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CONTENTS

Original Article

OBLIGATORY ALTERATIONS IN THE MORPHOLOGY OF MEDIAN NERVE: A SONOGRAPHIC STUDY IN ASYMPTOMATIC INDIVIDUALS

Vandana Lakra, Garima Sehgal, Jyoti Chopra, Anita Rani, Kaweri Dande
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ABSTRACT

Introduction: Median nerve is formed in axilla by contributions from medial and lateral cords of brachial plexus. It descends in the arm, forearm and then through carpal tunnel in close conjunction with flexor tendons of forearm. Carpal tunnel syndrome (CTS) is a common entrapment neuropathy. Median nerve cross sectional area (CSA) and ratio of nerve major axis to minor axis (flattening ratio) serve as potential diagnostic criteria for carpal tunnel syndrome. Median nerve cross sectional area and flattening ratio (FR) can be assessed by ultrasonography (US).

Aim of the study was to assess median nerve by US and tabulate mean values for CSA and FR in asymptomatic population. This would serve to limit the cut-off values that differentiate asymptomatic nerves from neuropathic nerves.

Material & Methods: Study was conducted in the Department of Anatomy, KGMU, Lucknow. Fifty randomly selected asymptomatic volunteers (undergraduate students: 30 males, 20 females) participated in the study. Sonography was performed to evaluate certain morphological dimensions of median nerve. Height, weight and wrist circumference of participants were also noted. Ultrasonography was performed using high frequency linear probe and observations were made at two pre-determined sites. Observations were recorded, tabulated and analyzed.

Results: Median nerve was easily observable at both sites. It was round in shape in forearm (Fo), and flattened as it reached the carpal tunnel (Ct). Among all 50 study subjects, at both sites, flattening was more on right side (FRFoRt-1.71; FRCtRt-3.08) than on left side (FRFoLt-1.66; FRCtLt-2.78). In right forearm, nerve was flatter in females (FRFoRt-1.77) as compared to males (FRFoRt-1.68). In left forearm, median nerve was slightly rounder in females (FRFoLt-1.65) as compared to males (FRFoLt-1.67). At the distal wrist crease on right side, increased flattening was observed in females (FRCtRt-3.30) as compared to males (FRCtRt-2.94), whereas on left side, at same site flattening was more in females (males FRCtLt-2.74; females FRCtLt-2.83).

Conclusion: Altered FR has both diagnostic as well as prognostic values in carpal tunnel syndrome. The database generated from the study will help in facilitating comparisons between normal, asymptomatic and pathological, asymptomatic individuals.

Keywords: Median nerve, ultrasound, carpal tunnel syndrome, cross sectional area, flattening ratio.

INTRODUCTION

Median nerve is an important nerve of upper limb. It is a mixed nerve, formed in axilla by contributions from medial and lateral cords of brachial plexus. The nerve descends in axilla in close proximity to third part of axillary artery, in the arm it crosses in front of brachial artery from lateral to medial side close to insertion of coracobrachialis, and then, descends to lie between

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brachialis and bicipital aponeurosis in the cubital fossa, it enters the forearm between two heads of pronator teres, and descends in forearm between flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP). Proximal to flexor retinaculum median nerve curves around the tendon of FDS and becomes superficial, lying between flexor carpi ulnaris (FCR) and palmaris longus (PL). The nerve courses through the carpal tunnel along with tendons of long flexors of the fingers and finally splits into digital branches and muscular branches [1]. The digital branches supply the skin of thumb, index, middle, and the radial side of ring finger, while the muscular branches supply thenar muscles and some lumbricals [2]. The nerve is nearly circular on cross-section in arm, but, as it courses along cubital fossa, forearm and carpal tunnel it undergoes alteration in shape [3]. To investigate this alteration, median nerve was assessed by high-resolution ultrasonography (HRUS). HRUS has become the principle diagnostic tool for evaluating peripheral neuropathies; it can assess all main peripheral nerves of upper limb [4]. Ultrasonography can assess median nerve cross-sectional area (CSA) and flattening ratio (FR) at forearm as well as carpal tunnel. Cross-sectional area of nerve decreases as the nerve courses distally, except at cubital fossa and distal wrist crease where it shows an abrupt increase. The Flattening ratio is defined as ratio of nerve's transverse axis to that of anteroposterior axis. This ratio serves as a biomarker and a potential diagnostic criterion for CTS [5]. In humans, carpal tunnel syndrome is the most common nerve entrapment. Ultrasound imaging technique is an addendum to electrodiagnostic tests for diagnosing CTS. CTS is accompanied by increase in median nerve CSA just proximal to tunnel and increased flattening in the distal tunnel.

Hence, median nerve CSA and shape changes along its course. Among different population groups the change may differ quantitatively; there is also a comparable difference in the change that is physiological from the change which is part of a pathology.

The study was planned to assess median nerve morphology by ultrasonography, and tabulate the mean values for CSA, FR and wrist-to-forearm ratio (WFR) in an asymptomatic population. The morphological assessment would help to limit cut-off values that differentiate asymptomatic nerves from neuropathic nerves.

MATERIAL AND METHODS

This descriptive, cross-sectional study was carried out in the Ultrasound laboratory of Department of Anatomy, King George's Medical University, Lucknow, UP, India after approval by ethical review board of the university. Written informed consent was obtained from all participants.

Study was conducted from October 2017 to July 2018, 50 randomly selected students of 1st year MBBS and BDS, 2017 batch (30 males, 20 females) were evaluated. Participants in the study were free of CTS symptoms such as pain, numbness, burning sensation, itching or discomfort in hand, wrist, upper extremity or weakness in any area of the median nerve distribution. None of the volunteers received any medication that could alter sensory or motor functions or gave history of any injury or surgery of upper extremity. Certain physical tests were also additionally performed for exclusion.

Height, weight and wrist circumference were noted. Height of the subjects was measured without shoes on stadiometer in centimetres (cm) with an accuracy of 0.1cm. Weight was measured (without shoes) on a weighing machine with an accuracy of 0.5 Kg. Bilateral wrist circumference was noted at distal wrist crease by a measuring tape (in cm).

Ultrasonography was performed on ***Esaote Europe My Lab 40*** with linear probe of frequency range 6-13MHz. Median nerve was identified using anatomical landmarks, and was studied at two pre-determined sites, firstly in mid-forearm (mid-point between elbow crease and distal crease); and secondly at distal wrist crease. Nerve was identified on the basis of its appearance as dark punctuate areas (fascicular pattern) with hyperechoic margin (perineurium) [4] and differentiated from surrounding muscles which presented with hypoechoic pattern interspersed with small hyperechoic foci.

The ultrasound measurements were made by two separate examiners. Median nerve was identifiable at two pre-defined sites. CSA was measured by ellipse formula after excluding the hyperechoic epineurium, transverse axis (ML diameter) and anteroposterior axis (AP diameter) of median nerve was measured by distance method at both sites in all male and female subjects and flattening ratio was calculated (Fig. 1-4).

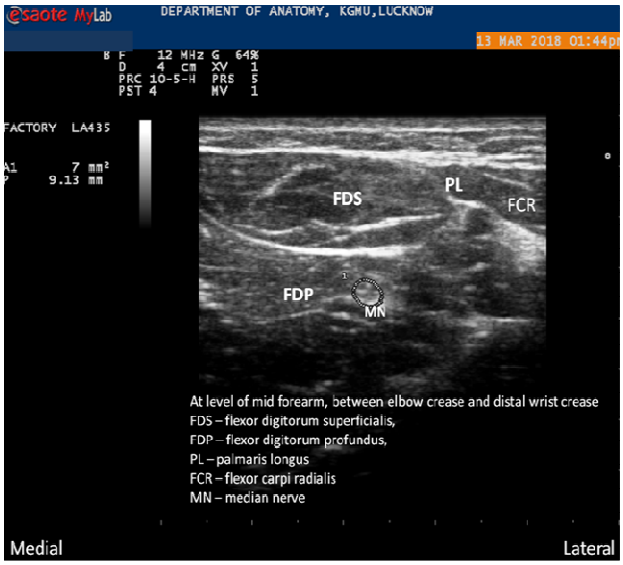

Fig. 1 A cross-sectional view of the median nerve at mid forearm showing CSA measurement by dotted line A 1 Cross sectional area, P perimeter

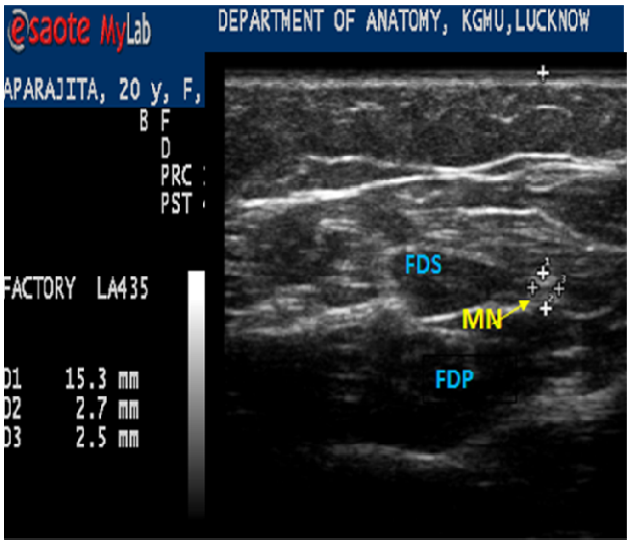

Fig. 2 Transverse scan of medial nerve at mid forearm showing measurements of major and minor axis MN-median nerve, FDS-flexor digitorum profounds D1 depth from skin D2-major axis, D3-minor axis

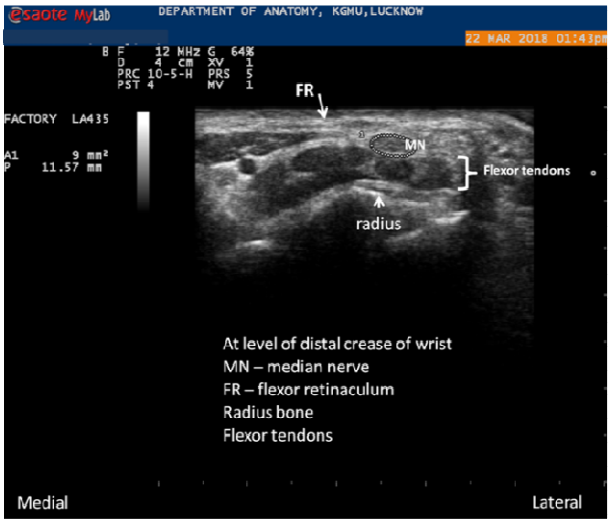

Fig. 3 Transverse scan at distal wrist crease showing mediannerve by dotted line, A1 is CSA and P is perimeter.

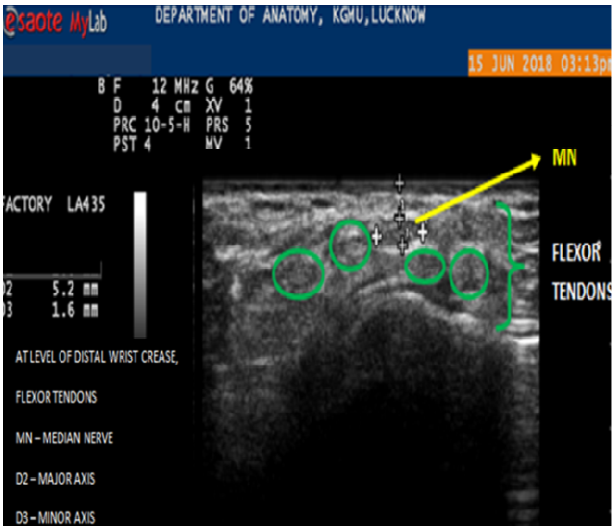

Fig. 4 Transverse scan at distal wrist crease showing median nerve major and minor axis measurement along with flexor tendons

During examination, upper limb was kept flexed at elbow, supinated and with wrist in neutral position. Median nerve was localized and traced longitudinally from mid-forearm to the level of distal crease (just proximal to proximal border of flexor retinaculum). At the wrist, nerve was differentiated from tendons on the basis of sonographic architecture and movement of tendons that accompanied the joint movement [4]. Measurements were made on a transverse scan; CSA was measured by the ellipsoid technique (inside the hyperechoic epineurium) (Fig. 1&3), transverse axis (ML diameter) and anteroposterior axis (AP diameter) of median nerve were measured by using distance method (Fig. 2 &4). The transducer was placed perpendicular to avoid any obliquity during measurement and probe was placed gently to avoid distortion of nerve. Transverse and AP diameters were used to calculate flattening ratio (major axis/minor axis), that provided information about changes in median nerve morphology and served as an index of nerve compression. Measurements were taken bilaterally, observations were recorded, tabulated and statistically analysed.

OBSERVATIONS AND RESULTS

The study was conducted on 50 asymptomatic volunteers (undergraduate students) in the Ultrasound Laboratory of Department of Anatomy, KGMU. Basic parameters like height, weight, and wrist circumference were also recorded.

The age ranged from 18 to 22 years for males (20.28 ± 2.83 years) and for females it was 18 to 21 years (19.75 ± 1.28 years). For the entire sample, mean value for height-166±8.71cms; weight-63.24±11.03kgs; and wrist circumference was 15.73±1.20cms.

At mid-forearm (MFA), overall mean cross sectional area was similar for both right and left median nerves (5.96±1.48mm²; 5.96±1.43mm²). CSA increased distally: at distal crease of wrist (DCW), RMN CSA measured 7.4±1.68mm² and LMN CSA measured 7.54±1.67mm². At DCW mean CSA of LMN was larger than mean CSA of RMN (Table 1).

Table 1: Median nerve CSA at mid-forearm and distal crease of wrist

Site	Number of extremities	CSA RMN (mm²)	CSA LMN (mm²)
Mid-forearm	100	5.96±1.48	5.96±1.43
Distal wrist crease	100	7.40±1.68	7.54±1.67

In Females, mean CSA MFA of LMN (5.85±1.39mm²) was greater than mean CSA MFA of RMN (5.6±1.73mm²). CSA increased distally: at distal crease of wrist; CSA DCW RMN was 7.5±2.12mm² and CSA DCW for LMN was 7.55±1.39mm² (Table 2). Though CSA at both sites was greater on left, the overall increase in CSA (CSA DCW- CSA MFA) was greater on right than on left side; 1.9 mm² (right) as compared to 1.7 mm² (left); degree of increase was 33.93% on right as compared to 30.36% on the left (Table 2).

Table 2: Mean CSA of right and left median nerve in Females (n=20)

Site	Number of extremities	CSA RMN (mm²)	CSA LMN (mm²)
Mid-forearm	40	5.6±1.73	5.85±1.39
Distal wrist crease	40	7.5±2.12	7.55±1.39

In males, at mid-forearm, mean CSA MFA of RMN (6.2±1.27 mm²**)** was greater than mean CSA MFA of LMN (6.03±1.47 mm²). CSA DCW RMN was 7.33±1.35mm² and CSA DCW LMN was7.53±1.85 mm². In contrast to females the increase was comparatively greater on left side; 1.5 mm² (left) as compared to 1.13 mm² (right); degree of increase was 24.88% on the right and 18.23% on the left (Table 3).

Table 3: Mean CSA of right and left median nerves in Males (n=30)

Site	Number of extremities	CSA RMN (mm²)	CSA LMN (mm²)
Mid-forearm	60	6.2±1.27	6.03±1.47
Distal wrist crease	60	7.33±1.35	7.53±1.85

CSA MFA was greater in males as compared to females on both sides; the difference was greater on right side than left. CSA DCW was bilaterally greater in females as compared to males; the difference being greater on right side (Table 4). The degree of increase

in CSA along its course from forearm to wrist was greater in females as compared to males (Table 4).

Table 4: Comparison of mean CSA of right and left median nerves among male and females

Site	Right		Left	
	Male (n=30)	Female (n=20)	Male (n=30)	Female (n=20)
Mid-Forearm CSA (mm^2)	6.20±1.27	5.60±1.73	6.03±1.47	5.85±1.39
Distal Wrist Crease CSA (mm^2)	7.33±1.35	7.50±2.12	7.53±1.85	7.55±1.39

At mid-forearm, MFA RMN ML diameter was 3.50±0.64mm and LMN ML diameter was 3.44±0.58mm. MFA AP diameter of RMN was 2.09±0.34 almost equivalent to AP diameter of LMN which was 2.10±0.27. At distal wrist crease, DCW ML diameter of RMN was 5.10±0.99 and for LMN was 4.94±0.92. DCW AP diameter of RMN was 1.73±0.38 and for LMN was 1.84±0.48. Therefore, the nerves were more flattened oval in shape on right than left side. The observations were indicative of greater alteration in shape of nerve on the right side than left (Table 5).

Table 5: Overall mean value of major and minor axis on cross-section of median nerve

Site	Right		Left	
	Major axis (mm)	Minor axis (mm)	Major axis (mm)	Minor axis (mm)
Mid-forearm	3.50±0.64	2.09±0.34	3.44±0.58	2.10±0.27
Distal crease	5.10±0.99	1.73±0.38	4.94±0.92	1.84±0.48

Flattening ratio (FR) was calculated as a ratio between the major axis and minor axis. MFA FR of RMN was 1.71±0.45 and MFA FR of LMN was 1.66±0.33. DCW FR of RMN was 3.08±0.92 and DCW FR of LMN was 2.78±0.66. Hence, at mid-forearm, left median nerve was rounder as compared to right median nerve; at the wrist right median nerve was transversely more oval as compared to left median nerve. Right median nerve displayed greater flattening at distal crease than left median nerve (Table 6).

Table 6: Overall mean values of flattening ratio of median nerve at mid-forearm and distal wrist crease

Site	Flattening Ratio	
	RMN	LMN
Mid-forearm	1.71±0.45	1.66±0.33
Distal crease	3.08±0.92	2.78±0.66

Among the 20 female subjects, at mid-forearm, MFA ML diameter of RMN was 3.46±0.59 and of LMN was 3.36±0.48 whereas MFA AP diameter of RMN was 2.03±0.34 and of LMN was 2.06±0.25. At distal wrist crease, DCW ML diameter of RMN was 5.33±1.00 and of LMN was 5.14±0.86 whereas DCW AP diameter of RMN was 1.67±0.31 and of LMN was 1.93±0.63. Observations revealed that at mid-forearm right nerve was wider and thinner as compared to left nerve (RMN-3.46±0.59mm; LMN-3.36±0.48mm). The increase in major axis from mid forearm to distal wrist crease indicated a change in shape from round at forearm to a transverse oval at the distal wrist crease. Increase in transverse axis of nerve along its course from MFA to DCW was 54.05% on the right side as compared to 52.98% on the left (Table 7).

Table 7: Right versus left limb major axis & minor axis of median nerve cross-section in females

Site	Number of limbs	Right		Left	
		Major axis (mm)	Minor axis (mm)	Major axis (mm)	Minor axis (mm)
Mid-forearm	40	3.46± 0.59	2.03± 0.34	3.36± 0.48	2.06± 0.25
Distal crease	40	5.33 ±1.00	1.67± 0.31	5.14± 0.86	1.93± 0.63

At mid-forearm, MFA FR of RMN was 1.77±0.57 and of LMN was 1.65±0.28. Evident flattening of nerves was documented as the nerve approached the distal crease of wrist. At distal crease of wrist, DCW FR of RMN was 3.30±0.91 and of LMN was 2.83±0.74. At MFA LMN (1.65±0.28) was rounder than RMN (1.77±0.57). Nerves flattened on both sides as they approached the distal wrist crease (DCW RMN 3.30±0.91; DCW LMN 2.83±0.74); the overall flattening observed in the right median nerve (DCW RMN FR - MFA RMN FR= 1.5) was more than left median nerve (DCW LMN FR - MFA LMN FR= 1.18) (Table 8).

Table 8: Mean value of flattening ratio of median nerve in females

Site	Right	Left
	Flattening ratio	Flattening ratio
Mid-forearm	1.77±0.57	1.65±0.28
Distal crease	3.30±0.91	2.83±0.74

In males at mid-forearm, MFA RMN ML diameter was 3.50±0.64 and LMN ML diameter was 3.44±0.58 whereas MFA RMN AP diameter was 2.09±0.34 and of LMN AP diameter was 2.10±0.27. At distal wrist crease, DCW RMN ML diameter was 4.96±0.97 and LMN ML diameter was 4.81±0.95 whereas DCW AP diameter of RMN was 1.77±0.43 and LMN AP diameter was 1.79±0.35. There was an increase in major axis from mid forearm (3.50±0.64) to distal crease (4.96±0.97) on the right side and also on left side (3.44±0.58 mm to 4.81±0.95).This was accompanied by a reduction in the minor axis from 2.09±0.34 to 1.77±0.43 on the right and from 2.10±0.27 to 1.79±0.35 on the left side**.** On both sides nerves elongated transversely, increase in transverse axis was 41.71% on the right and 39.83% on the left (Table 9).

Table 9: Right versus left limb major axis & minor axis of median nerve cross-section in males

Site	Number of limbs examined	Right		Left	
		Major axis (mm)	Minor axis (mm)	Major axis (mm)	Minor axis (mm)
Mid-forearm	60	3.50± 0.64	2.09± 0.34	3.44± 0.58	2.10± 0.27
Distal crease	60	4.96± 0.97	1.77± 0.43	4.81± 0.95	1.79± 0.35

At mid-forearm, MFA FR of RMN was 1.68±0.36 and of LMN was 1.67±0.36. At distal crease of wrist, DCW FR of RMN was 2.94±0.91 and of LMN was 2.74±0.61. It was observed that the nerve was rounder in forearm with a flattening ratio that was almost similar on right (1.68±0.36) and left (1.67±0.36) sides. Flattening of nerves were observed on both sides as they come closer to distal wrist crease (DCW RMN 2.94±0.91; DCW LMN 2.74±0.61); the overall flattening observed in right median nerve (DCW RMN FR – MFA RMN FR = 1.26) was more than left median nerve (DCW LMN FR – MFA LMN FR = 1.07) (Table 10).

Table 10: Mean value of flattening ratio of median nerve in males

Site	Flattening Ratio	
	Right	Left
Mid-forearm	1.68±0.36	1.67±0.36
Distal crease	2.94±0.91	2.74±0.61

For right median nerve, the mean value of RMN DCW was found to be 7.4±1.68 and RMN MFA was 5.96±1.48. The WFR RMN calculated was 1.30±0.38. For left median nerve, the mean value of LMN DCW was observed to be 7.54±1.67 and LMN MFA was 5.96±1.43. The WFR LMN calculated was 1.31±0.34 (Table 11).

Table 11: Overall mean value of wrist-to-forearm ratio (WFR) of median nerve (n=50)

DCW/ MFA	WFR (RMN)	DCW/ MFA	WFR (LMN)
7.4±1.68/ 5.96±1.48	1.30±0.38	7.54±1.67/ 5.96±1.43	1.31±0.34

In females (n=20), for right median nerve, the mean value of RMN DCW was 7.5±2.12 and RMN MFA was 5.6±1.73; the RMN WFR calculated was 1.42±0.49. For left median nerve, the mean value of LMN DCW was found to be 7.55±1.39 and LMN MFA was 5.85±1.39; the LMN WFR evaluated was 1.34±0.33 (Table 12).

Table 12: Mean value of wrist-to-forearm ratio (WFR) of median nerve in females

RMN		LMN	
DCW/ MFA	WFR	DCW/ MFA	WFR
7.5±2.12/ 5.6±1.73	1.42±0.49	7.55±1.39/ 5.85±1.39	1.34±0.33

In males (n=30), for right median nerve, the mean value of RMN DCW was observed to be 7.33±2.75 and RMN MFA was 6.20±2.53; the calculated RMN WFR was 1.21±1.12. For left median nerve, the mean value of LMN DCW was seen as 7.53±2.79 and LMN MFA was 6.03±2.50; the calculated LMN WFR was 1.29±1.15 (Table 13).

Table 13: Mean value of wrist-to-forearm ratio (WFR) of median nerve in males

RMN		LMN	
DCW/ MFA	WFR	DCW/ MFA	WFR
7.33±2.75/ 6.20±2.53	1.21±1.12	7.53±2.79/ 6.03±2.50	1.29±1.15

DISCUSSION

The carpal tunnel houses the median nerve along with the long flexor tendons. Any compression of the median nerve in the tunnel causing its entrapment results in carpal tunnel syndrome presenting with sensory and motor deficit along its distribution. Prevalence of CTS in the general population is 9.2% in women and 6% in men [6]. Patient's symptoms and positive testing helps to identify the cases. Till date electrophysiological study is an essential step in establishing the diagnosis. In forthcoming years, high-resolution ultrasonography shall enroute the clinical diagnosis of CTS. For assessment of CTS, high-resolution ultrasonography should become a complementary technique in addition to nerve conduction study.

Ultrasound is considered important for peripheral nerve evaluation and CTS diagnosis; it is fast and comfortable for patients. Furthermore, US can be used to not only diagnose CTS but also to detect underlying causal anatomical abnormalities. The measurement of CSA is the most-studied method for the diagnosis of CTS [7]. In the year 2004, Yesildag et al. (2004) documented that CSA of median nerve at the inlet level of the carpal tunnel has a sensitivity of 89% and specificity of 94.7% when the cut-off was set to 10.5 mm. These findings were studied on 86 patients with symptomatic CTS and 45 asymptomatic individuals [8]. Cartwright et al. (2009) studied 50 individuals (100 arms; 32 females, 18 males) for ultrasonographic reference values of normal median nerve. Median nerve CSA (mm^2) at distal wrist crease was 9.8 mm^2 and mid-forearm was 7.5 mm^2. The mean side-to-side difference was 1.2mm^2 [9]. Claes et al. (2010) studied 54 healthy control subjects (25 male and 29 female; mean age 41 years). Out of 98 wrists (52 right and 46 left- handed) that were finally accounted for CSA of median nerve was measured ultrasonographically, at the inlet of carpal tunnel (distal wrist crease was used as an external landmark). The mean CSA of right median nerve in males (n=25) and females (n=27) was found to be 10.2mm^2 and 8.4mm^2, respectively. The mean CSA of left median nerve for males (n=23) and females (n=23) was found to be 10.0mm^2 and 8.0mm^2, respectively [10]. Ulaşli et al. (2013) measured CSA at three levels of the carpal tunnel and suggested that a maximum CSA of >10 mm^2 is more sensitive for the US diagnosis of CTS. Among 95 wrists of 55 patients of CTS, CSA at carpal tunnel inlet was found to be 13.0±3.14mm^2 where as among 27 volunteers (48 wrists) CSA of median nerve was 8.98±1.83mm^2 [11].

We studied median nerve CSA at two sites, mid forearm and distal wrist crease. At mid-forearm, overall mean cross sectional area was similar for both right and left median nerves (5.96±1.48mm^2; 5.96 ±1.43mm^2). At mid-forearm, the mean value of median nerve CSA was in confirmation with Martinoli et al. (2002), Tagliafico et al. (2013) and Sugimoto et al. (2013) [12-14]. But, contrastingly in a study by Bathala et al. (2014), in Asian population, the mean values showed smaller CSA of median nerve [3]. In the present study, at distal crease of wrist, there is comprehensive increase in CSA of RMN and LMN and it measured 7.4±1.68mm^2 and 7.54±1.67mm^2, respectively. Mean CSA of left median nerve was larger than mean CSA of right median nerve. The mean CSA of right median nerve in males (n=30) and females (n=20) was observed to be 7.33±1.35mm^2 and 7.50±2.12mm^2, respectively. The mean CSA of left median nerve for males (n=30) and females (n=20) was noted to be 7.53±1.85mm^2 and 7.55±1.39mm^2, respectively.

Tai et al. (2012) systematically reviewed 28 articles on diagnostic test accuracy by ultrasonography for CTS. The cut-off values (8-14mm^2) provided in each article included were scrutinised for diagnostic accuracy. With cut-off value of 8mm^2 there was increase in sensitivity (94.3%), while the cut-off value increased to 14mm^2, the specificity was highest (96.5%). In these articles, there was proposal for cut-off value to be within range of 9-11mm^2. Authors proposed that CSA of median nerve at the inlet of carpal tunnel proved to be prime diagnostic criteria and the minimum value of 9mm^2 should be considered for diagnostic accuracy [15].

Wrist to forearm ratio is also a recommended measurement; however, authors differ in their views regarding its superiority over CSA, certain studies report that the wrist-to-forearm ratio was superior [16], whereas others contrarily believe it is not so [17]. Hobson-Webb et al. (2008) indicated that a wrist-to-forearm ratio ≥ 1.4 gave 100% sensitivity for diagnosing CTS, while using only the median nerve area at the wrist resulted in a sensitivity of 45–93%

[16]. Lange (2013) indicated that the optimal cut-off value for the wrist-to-forearm ratio for CTS was 1.6 [18]. The range for WFR for RMN was 1.18-1.33, and for LMN was 1.14-1.29. In the present study, the mean WFR for RMN was 1.24 and LMN 1.26 and in conformation to the values reported in previous studies. Hence, the findings are in acceptance with the view of taking WFR ≥1.4 as cut off in diagnosing CTS.

Bueno-Gracia et al. (2017) defined major and minor axis measurements that provided an indication of nerve's rounded structure. The ratio between these two parameters reaching value to 1 specifies a circle [19]. There is alteration in the morphology of nerve as it courses through the arm, forearm, wrist and carpal tunnel. Median nerve appears to be rounded while traversing through arm and mid-forearm and it undergoes an obligatory alteration in morphology as it approaches the carpal tunnel; where it was observed to acquire an elliptical configuration. Flattening ratio (major axis/ minor axis) has been proposed for establishing diagnosis of CTS. In the present study, at mid-forearm, mean FR of RMN was 1.71±0.45 and of LMN 1.66±0.33 depicted left median nerve to be rounder as compared to right. At distal wrist crease, comparison of mean FR of LMN (2.78±0.66) and RMN (3.08±0.92) indicated that the right median nerve was more flattened than the left nerve. Our findings for right median nerve were in conformation to that of Buchberger et al. (1991), and Duncan et al (1999), [20,21] whereas left median nerve observations were in conformation to the study by Nakamichi and Tachibana (2000) and Abe (2004) [22,23]. The values of major axis of right median nerve at distal crease in our study was in conjunction with Bueno-Gracia et al. (2017) and Nakamichi and Tachibana (2000) [19,22]. The study revealed major axis of left median nerve at distal crease, was higher than the value given by Abe (2004) and McCartney et al. (2007) [23,24]. The minor axis measured in the study population showed a lower value than that of Nakamichi and Tachibana (2000) [22].

In all our asymptomatic individuals of Indian population (n=50), the calculated cut-off values of CSA of RMN is 8.92mm² at mid-forearm and 10.76mm² at distal wrist crease. The calculated cut-off value of CSA of LMN is 8.82mm² at mid-forearm and 10.88mm² at distal wrist crease. In females, the evaluated cut-off value of CSA for RMN is 9.06mm² at mid-forearm and 11.74mm² at distal wrist crease and for LMN, 8.63mm² at mid-forearm and 10.33mm² at distal wrist crease. In males, the computed cut-off value of CSA for RMN is 8.74mm² at mid-forearm and 10.03mm² at distal wrist crease whereas for LMN is 8.97mm² at mid-forearm and 11.23mm² at distal wrist crease.

We also additionally observed that in female subjects, the increment in cross sectional area at wrist was 33.94% on the right as compared to 30.96% on the left. In comparison to this, the increment in cross sectional area at wrist was much lesser in males; it was 24.88% on the right and 18.23% on the left. On meticulous search for literature, we were not able to find any literature regarding increase in cross-sectional area or transverse axis at wrist for both sexes for any comparison.

The study described the normal CSAs of median nerve at mid forearm and distal wrist crease. As seen in our observations the CSA at distal crease was greater bilaterally in females as compared to male subjects. The increase in CSA as well as transverse axis was of a much greater degree than in males. This could be due to work related increased movements of flexion and extension at wrist (increasing the compressive forces in carpal tunnel) in females in contrast to male subjects.

It was seen that the nerve was round in morphology in the forearm and flattened on approaching the carpal tunnel. This obligatory alteration is related to passage of nerve through the confines of carpal tunnel in a restricted area. Changes in morphology of the nerve proximal to the inlet of tunnel are seen in asymptomatic normal nerves and are not necessarily part of nerve pathology. Exaggerations in these alterations define pathological changes and to differentiate this normal deviation in morphologic anatomy from pathology cut off values of flattening ratio and wrist forearm ratio can be helpful.

We compared our observations with previously defined cut-offs for abnormal nerves and our findings were in accordance, and within normal limits.

CONCLUSION

We conclude that median nerve morphology can be assessed ultrasonographically at mid-forearm and distal wrist crease and measurements can be taken. The morphology of nerve undergoes a normal alteration which is within clearly defined limits set by cut off values. Median nerve shape alters from minimally oval in forearm to obviously oval at distal wrist crease. Despite changes in morphology and morphometry the values remained within normal limits, hence the changes in morphometry were normal and

obligatory. Increase in flattening ratio confirmed that nerve displayed obvious flattening on reaching distal crease. A careful observation of the degree of changes in size and shape helps in differentiating normal phenomenon from compressive distortion.

Nerve CSA, Flattening ratio and Wrist forearm ratio of median nerve are the parameters which could be useful in assessing CTS. Side to side differences between RMN and LMN CSA <1mm² meant that nerve of either side could serve as a control during morphometry. Exaggeration of these morphological changes accompanies nerve pathologies. The degree of changes differs among males and females. We would like to propose that instead of having any common cut off, the percent change in CSA and transverse axis at the wrist, on individual basis is more relevant. Also comparison of this change between symptomatic and asymptomatic sites of the same individual, with the normal side serving as control, could be more informative and diagnostic.

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Original Article

ANATOMY IN ASYMPTOMATIC LUMBAR FACET JOINT ARTHROSIS

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ABSTRACT

Introduction: The facet joints are the only synovial joint of spine and undergo osteoarthritic changes referred to as facet joint arthrosis (FJA). The arthrosis is akin to arthritic changes in any other synovial joint of the body and may manifest as back pain or may remain asymptomatic throughout life. The causes for pain manifestation in FJA are manifold but there is paucity of literature in defining reasons to remain asymptomatic even with a deranged pathology at the joint. Thus the aim of the study was to assess the prevalence of asymptomatic FJA and define its relation with respect to age, gender and vertebral level on CT evaluation and discuss the pertinent anatomy around each spinal motion segment which prevents manifestation of pain.

Material & Methods: A total of 100 asymptomatic subjects were selected on basis of a low back pain questionnaire within age range of 20-70 years, reporting to radiology department for CT abdomen. The individuals were categorized as per the following age groups; 20-35yrs as young; 36-50 as middle and 51-70 as old age groups. All five lumbar vertebral levels with their facet joints were analysed for evidences of degenerative grades and their severity, in total selected subjects. The images obtained were further assessed on image analysis software for distribution as per the age-groups, gender and prevalence with respect to vertebral level.

Results: A total of 136 (27.2%) levels in 43(43%) spines were found to have FJA. The highest prevalence (43.3%) of asymptomatic FJA was observed in the middle age group with involvement of multiple spinal motion segments and with grade 4 severity.

Conclusion: Prevalence of severe grades of asymptomatic FJA in middle age group suggests the possible role of certain muscle groups in maintaining an appropriate posture in spite of on-going degenerative processes.

Keywords: Facet joint, asymptomatic, lumbar, synovial, arthrosis, low back pain, para-spinal muscles.

INTRODUCTION

Facet joints play a significant role in spinal biomechanics by contributing largely to rotational kinematics of the spine. The task is greater in terms of lumbar facet joints where the robust lumbar vertebrae bear the maximum weight of the body and also limit the spinal rotation due to fixed pelvis. The role of lumbar facet joints in rotational kinematics is variable, depending on the normal and deranged anatomy of the three components respective to a spinal motion segment. Each spinal motion segment includes the anteriorly placed intervertebral disc (IVD) and the posteriorly located two synovial facet joints (FJs), together referred to as the “tripod joint” [1,2]. Each spinal motion takes both compressive and rotational component of the load during postural alignment. The compressive load is borne by the anterior fibres of annulus fibrosus of the disc while the rotational component is distributed equally to the two FJs [1,3]. The mutual interplay of the disc and facet joint makes it debatable to define the prime event in degenerative cascade of the spine.

Many are of the view that disc is the prime component to undergo degeneration and manifests as radiating, debilitating low back pain in individuals [4].

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In a normal motion segment, the outermost fibres of annulus fibrosus (AF) are the first component to bear the load and rotational strain. These fibres are made up of concentric layers of collagen type I fibres and hold the gelatinous nucleus pulposus (NP) within, which is predominantly collagen type II fibres [5]. This arrangement of fibres peripherally and centrally provides the discs the capacity to bear the maximum strain during static and normal kinematic alignment of the spine. But during excessive weight/load bearing and abrupt kinematic changes there occurs tears within the AF, progressing to fraying and dehydration of the NP with eventual loss of the annular-nuclear distinction [6,7]. Horst and Brinckmann (1980) demonstrated that severely degenerated discs load asymmetrically under eccentric compressive conditions, reflecting the solid-like behaviour of degenerated discs in contrast to the fluid-like properties of healthy discs [8]. This solid -like disc distributes the load asymmetrically which eventually causes disrupted load distribution to the posterior component of the spine, the facet joints. Yang and King (1984) predicted a significant rise in facet joint loading pressure with increasing segmental degeneration using a finite element model of disc degeneration (DD) [9]. This thus suggests that the discs are the first to be involved in the degeneration of spine followed by degeneration of facet joints and gradually manifests as low back pain (LBP). However there have been cases with evidences of DD in otherwise asymptomatic individuals also and this has been debated with reference to avascular and aneural nature of the disc [10, 11]. This probably suggests that DD in itself is not the only source of pain but some other factor/ factors contribute towards patient symptomatology.

Secondly, the facetogenic theory suggests the facets joints to be the prime pain generator in the spinal degenerative cascade. These joints are typical diarthrodial joints which may be C or J shaped having structure similar to any other large synovial joint of the body. The fibrous capsule, articular cartilage, joint cavity with potential joint space of 2-4mm, filled with 1-2ml of joint fluid is the normal anatomy of the joint (Fig. 1) [12].

Fig.1: Normal facet joint on CT imaging

Owing to their postero-lateral location and structural anatomy these joints depend largely on the spine's response and are also able to alter the spines' response during conditions of mechanical load bearing. Due to normal process of ageing the joints undergo osteo-arthritic changes similar to any other synovial joint in the body [13]. The location of low threshold mechanoreceptors, nociceptor fibres in the fibrous capsule and surrounding structures it contributes largely to pain manifestation during the process of arthrosis. Also the release of inflammatory mediators in the joint cartilage has been appreciated during degenerative joint anatomy and all these reasons are sufficient enough to produce facetogenic pain [14]. Various epidemiological studies for pain associated with FJA have however provided conflicting results. An extensive work of Eubunks et al. (2007) has defined facet arthrosis as a universal finding in individuals as young as less than 20 years [15]. There have been studies where severe grade of arthrosis is evident in otherwise asymptomatic subjects [16, 17]. This once again suggests that the facet joint alone is insufficient to produce symptoms and clinical manifestations of LBP. Hence the term FJA is more of pathology at the FJ with cartilage destruction, osteophyte formation, decrease in joint space rather than a clinical entity, as the manifestation of pain occurs only after involvement of second component (IVD) of the spinal motion segment.

Throughout the whole spine, the lumbar region is better aligned to bear the mechanical load because of the larger size of the vertebral body, curvilinear shape of articular surface and more sagittal orientation of the lumbar facet joints [18]. The flexion-extension and rotational movements are restrained at the lumbar spine due to more sagittal orientation of the facet joints as compared to cervical and thoracic segments. This

in turn, acts as a protective mechanism to prevent extensive shear and torsional force component on the IVDs. Thus, in the lumbar region, it would be inappropriate to suggest that the disc degeneration is the prime event in the degenerative cascade. The present study is thus an attempt to detect the prevalence of lumbar facet arthrosis in otherwise healthy asymptomatic subjects with no other radiological or imaging evidences of disc degeneration at the lumbar vertebral levels.

Various studies on pathophysiology of LBP have documented either the disc or the facets as the source of pain but very few studies till date have discussed the reasons for subjects to remain asymptomatic even with on-going degenerative process at either of the spinal motion component. There might be some other anatomical factors that may contribute to maintain the spinal posture, stability and integrity of spinal biomechanics even with deranged anatomy of the facet joints. Keeping in view the consideration of evidences of asymptomatic FJA in lumbar region, the aim of the study was to define the prevalence of FJA in healthy, asymptomatic (for LBP) Indian population, its relation to age, gender and level of vertebral involvement and suggest probable causes or factors responsible to maintain an asymptomatic condition even with a deranged joint.

MATERIALS AND METHODS

The study was executed after necessary institutional ethical clearance letter was obtained. It was conducted at Santosh Medical College, Ghaziabad in collaboration with Safdurjung Hospital, New Delhi. The study was conducted on subjects reporting to radiology department for CT abdomen for diseases other than that of spine. Only subjects who gave a written informed consent were chosen for the study. The individuals were categorized as per the following age groups; 20-35 yrs as young; 36-50 as middle and 51-70 as old age groups. A modified Nordic low back pain questionnaire was provided to the subjects to categorize as asymptomatic and symptomatic for LBP [19]. It was a questionnaire designed to have a binary or multiple choice response. The first question in the series was designed to categorize the patient as symptomatic or asymptomatic followed by series of questions to eliminate the possibility of false positive response. Once categorized as per symptomatology, asymptomatic subjects were taken up for CT scan. The CT scan was performed on subjects in a standard protocol in supine position on Philips brilliance 40 (120kV 250mAsCT 8*2.5 slice collimation). The scans obtained from 100 asymptomatic subjects were taken for further interpretation on image analysis software (Philips DICOM viewer R3.0). Only those images with no evidences of disc degeneration were taken up for the study.

Any spine having FJA evidences at one or more than one vertebral level was taken as arthritic spine. Subsequently, selected subjects with no symptoms for LBP and positive evidences of degeneration at FJs were taken for further analysis. The facet joint morphology was re-assessed from L1-L5 motion segments to grade the severity of arthritic changes. The classification of Pathria et al. (1987) was used to categorize the disease severity from least severe as grade 1 (with joint space less than 2mm) and most severe as grade 4 (with complete ankylosis) [20] (Fig. 2). It has been documented earlier that the arthrosis is independent of side (right or left), thus any one side involvement and side with higher severity grade was taken as the grade for FJA [21]. The results for FJA presence and disease grades were computed with respect to gender, age groups and vertebral level. SPSS 19 was used for statistical computation. The confidence interval (CI) was set at 95% and p value less than 0.05 was taken as significant association.

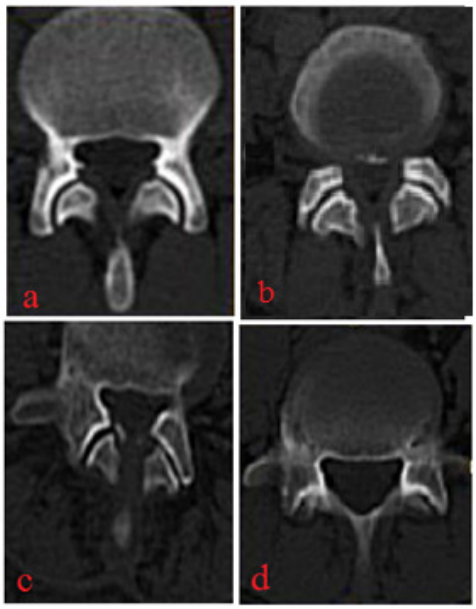

Fig. 2: Degenerative grades of FJA
a=grade 1(decreased joint space), b=grade 2 (hypersclerosis of joint margins), c=grade 3 (presence of osteophytes, d= grade 4 (complete ankylosis)

OBSERVATIONS AND RESULTS

From the questionnaire interpretation, 100 subjects with 44 males and 56 females were selected for the study. There was no statistically significant difference of age between genders (p>0.05, CI 95%). Out of 100, CT images of 43 (21 males & 22 females) spines; mean age 44.26±12.85 years; had osteo-arthritic changes at the FJs with no evidences of disc degeneration. These spines were categorized as arthritic spines and used for further analysis. The mean age for males and females was 46.24±12.4 years and 42.6±13.3 years respectively, with no statistically significant difference of age between the genders; p>0.05 at 95%CI.

The analysis at each spinal motion level for FJA was done for the selected 43 spines (215 spinal motion levels) and a high prevalence (63.2%) for FJA was observed in asymptomatic subjects. The results at each vertebral level suggest highest involvement of L4-L5 followed by L5-S1 level. The prevalence gradually decreased rostrally from L4-L5 and the results were statistically non-significant with respect to vertebral level (Table 1).

Table 1: FJA prevalence at different vertebral levels for asymptomatic subjects

Vertebral Level	FJA +ve (%)	FJA –ve (%)	P value
L5-S1	34 (15.8)	9(4.1)	0.39 NS
L4-L5	35(16.3)	8(3.8)	
L3-L4	26 (12.1)	17(7.9)	
L2-L3	22 (10.2)	21(9.8)	
L1-L2	19 (8.8)	24(11.2)	
TOTAL	**136 (63.2)**	**79 (36.8)**	

The presence of arthrosis was further analysed with respect to genders (Fig. 3). Females had a higher proportion of FJA at each vertebral level but the results were statistically non-significant between genders (p=0.964, CI 95%).

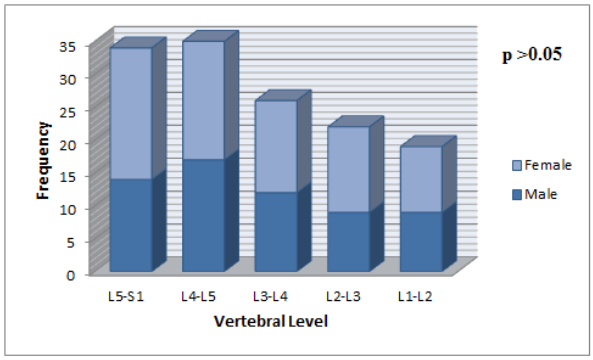

Fig. 3: Proportion of FJA cases between genders for asymptomatic subjects

The distribution of FJA positive cases as per the defined age groups was found to be statistically independent of age groups when considered at each vertebral level. Hence all the vertebral levels were studied in total with respect to age groups and it was observed that the highest prevalence was in the middle age group and was statistically highly significant (p<0.01 ,p=0.001) (Fig. 4). This suggests that degeneration of facet joints is dependent on the age of an individual, highest being at middle age groups, but still remaining asymptomatic.

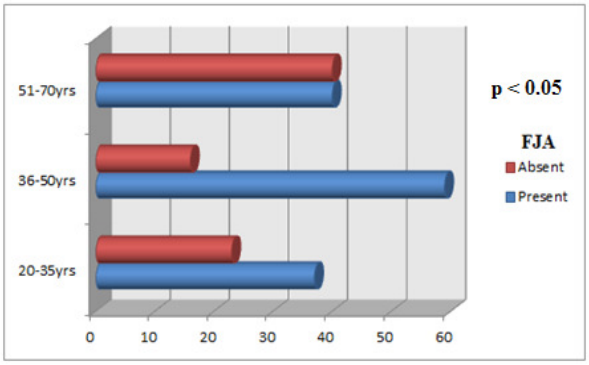

Fig. 4: Distribution of FJA cases in different age groups

Another observation was that even with multi-segmental involvement in one spine with most severe degenerative grades the patient remained asymptomatic (Fig. 5). The highest proportion was for grade 2 FJA at each vertebral level.

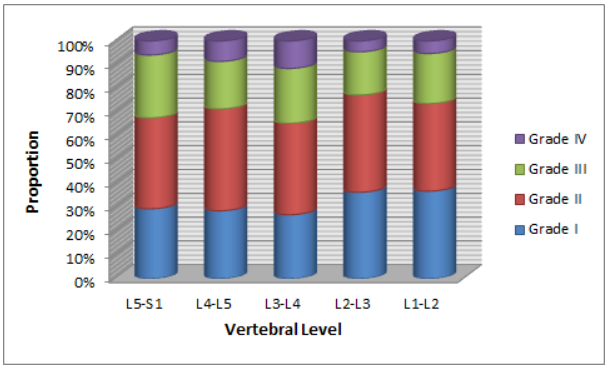

Fig. 5: Severity grades for FJA at different vertebral levels

DISCUSSION

A high prevalence 63.2%, of facet joint arthrosis, was seen in asymptomatic subjects and almost similar results have been reported by earlier researchers [1, 22]. The L4-L5 spinal motion level was most frequently affected in the present study and Eubanks et al. (2007) on 647 cadaveric lumbar spines also concluded with similar findings [15]. A high proportion of arthrosis at L4-L5 as compared to L5-S1 is explained by the fact that the large L5 vertebral body supported by strong osseo-ligamentous structures allow minimal rotational movements to occur at this level, preventing arthrosis. The fixed pelvis (sacral body) on which L5 rests spares L5-S1 segment from abrupt postural changes and subsequent degeneration [22]. Facet tropism, which may be a probable cause of degeneration, is defined as the angular asymmetry between the left and right facet joint orientation and is also commonly reported at L4-L5 level [23, 24].

The higher prevalence observed in females in the present study is explained by the fact that women have a higher body mass index which otherwise increases lumbar lordosis. The increase in lumbosacral angulations due to exaggerated lordosis consequently increases the load on the facet joints leading to their degeneration [25]. Also, higher prevalence in females is attributed to estrogen which has high chondro-destruction ability [26, 27]. Histological studies of facet articular cartilage have observed increase number of estrogen receptors in cases with FJA. The mechanical load bearing by the articular cartilage is equally distributed throughout the surface of the cartilage in a static spine but during kinematic flexion-extension movements increased load is borne by the superior and inferior poles of the cartilage. This is proved by various studies which have documented sparing of the central part of the cartilage, with majority degenerative changes occurring at the margins of the articular cartilage [28, 29].

A significant association between age groups and asymptomatic FJA was observed in the present study. Osteo-arthritis, in any synovial joint, is an age-related degenerative process, it follows logically that advanced arthritis might be associated with pain in older adults, and not in younger adults [30, 31]. A higher prevalence of asymptomatic FJA in middle age group suggests the possible role of para-spinal muscles in maintaining the structural integrity and functional stability even in presence of arthrosis. With ageing there occurs a reduction in muscle cell number, muscle twitch time and twitch force, decrease in sarcoplasmic reticulum volume and calcium pumping capacity thus patients in older age groups start presenting the pathology as a disease entity with manifestations of painful symptoms [32, 33]. The level of physical activity which usually decreases with age has also been stated as an important factor for decreased muscle mass. The role of physical activity is manifested by a study on tennis players where early and severe degeneration was observed without any clinical complaints [16]. The spinal musculatures not only provide structural support and prevent buckling of vertebral column but also provide proprioceptive feedback regarding the position of spine in space [17, 34]. With increasing age, there is decrease in paraspinal muscle mass which contributes significantly to FJA and also impaired spinal proprioception evident as chronic low back pain [34, 35].

The osteophyte formation in a facet joint is seen even in grade 2 type of disease. The mere presence of osteophytes is not suggestive of disease severity and neither is indicative of clinical symptoms. The formation of osteophytes is considered as a remodelling phenomenon and may or may not be seen even in severe cases of degeneration, thus their mere presence does not relate to disease severity [17, 36]. The location of osteophytes with or without disc involvement suggests some cases of asymptomatic arthrosis even with grade 4 variant. Intervertebral foramen is a tear drop shaped exit for the neurovascular structures. Unless there is decrease in height or width of IVF, there are hardly any chances of compression of structures passing through it. The height of the foramen is largely dependent on the discal height which was not affected in our study groups. The formation of osteophytes at the superior margin of the articular facet also spares the nerves which occupy the posterior upper part of the foramen.

CONCLUSION

The FJA is a pathological event which is evident even in younger age groups. It is independent of vertebral level and gender but dependent on age. The increased muscle mass and physical activity in middle age groups probably are the reasons for the subjects to remain asymptomatic even with most severe form of degenerative pathology at multiple spinal segments. The increased surface area of the articular surface of caudal lumbar vertebrae and specific site for osteophytes are also factors which spare the subject from having LBP.

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Original Article

UNUSUAL VARIATIONS IN PATH OF ACCESSORY SUBMANDIBULAR SALIVARY GLAND DUCT IN COMPARISON WITH MAIN SUBMANDIBULAR SALIVARY GLAND DUCT

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ABSTRACT

Introduction: The submandibular gland is located bilaterally in the submandibular triangle. The main submandibular duct or Wharton's duct, runs with lingual nerve to open in the sublingual papilla at the side of frenulum of the tongue. The aim of this study was to demonstrate the unusual variations of accessory submandibular duct in comparison with main submandibular salivary gland duct.

Material & Methods: Nineteen cadavers were dissected to study the submandibular salivary duct.

Results: 15.7% incidence of variations were observed. We found that one submandibular region was having unusual path of accessory duct, it emerged from superficial part of the gland and crossed the superficial surface of mylohyoid muscle and bifurcated into two branches. These bifurcated branches of duct pierced the mylohyoid muscle to pass between mylohyoid and hyoglossus muscle. One branch of bifurcated accessory duct opened through papilla in the floor of the mouth behind the lower incisor tooth and second branch of the bifurcated duct anastomosed with the main duct (Wharton's duct) to open in sublingual papilla. Wharton's duct of this side followed its normal path to open in the sublingual papilla. Two specimens of submandibular region was observed with duplication of submandibular duct in each submandibular gland. One was main duct and second was accessory duct. Both ducts emerged separately from the deep part of submandibular gland and ended independently into sublingual papilla.

Conclusion: Reporting of these variations are important for diagnostic imaging, anatomical teaching and to help surgeons while operating in this region.

Keywords: Submandibular gland, accessory submandibular duct, Wharton's duct, variation, sialography

INTRODUCTION

Submandibular salivary gland is irregular in shape and about the size of a walnut. It consists of a larger superficial and smaller deep part, continuous with each other around the posterior border of mylohyoid. It is a seromucous (but predominantly serous) gland [1,2]. The gland is drained by a single submandibular duct or Wharton's duct [2-4] is about 5 cm long. It begins from numerous tributaries in the superficial part of the gland a little behind the posterior border of the mylohyoid and then it traverses the deep part of the gland. It runs forwards between mylohyoid and hyloglossus to open in the floor of the mouth (linguogingival) on the summit of the sublingual papilla on each side of the frenulum of the tongue. The main function is to conduct the saliva to the oral cavity [1]. The duct lies between the lingual and hypoglossal nerve on hyoglossus muscle. The lingual nerve lies above the duct then crosses its lateral side and finally ascends medially winding round the lower border of

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the duct. [1,2].

The submandibular gland develops bilaterally during the 6th week of fetal life. Glands form solid diverticula in linguogingival sulcus that undergo branching morphogenesis, the whole tree-like structure later acquiring a lumen. The blind ends of the branches form acini. The edges of the linguogingival sulcus come together to form the elongating submandibular duct [5].

Sialography is a diagnostic procedure of choice for the detection of structural variations of submandibular gland and duct including trauma, inflammatory disorders and calculi [6,7]. Most of the accessory submandibular duct are detected incidentally during sialography [8-10].

The practice of dissection of cadaver is very important because it allows one to verify the possible existence of structural differences in the human body.

The purpose of the study was to describe the anatomical variation in unusual path of accessory submandibular duct.

MATERIALS AND METHODS

A total of 19 adult embalmed cadavers were dissected and studied during routine dissection classes for 1st year MBBS students in 2016-2018, in Anatomy department of Jaipur National University Institute for Medical Sciences and Research Centre, Jaipur, Rajasthan, India; Pandit Deendayal Upadhyay Medical College, Churu, Rajasthan, India and Varunarjun Medical College and Research Hospital, Shahjahanpur, Uttar Pradesh, India to determine the morphological features and anatomical variations in unusual path of accessory submandibular duct. The cadavers had no trace of scar, adhesions or signs of trauma or operation. The dissections were done bilaterally. Total 38 submandibular regions were dissected. Marginal mandibular incision were made from mastoid process to the chin and midline skin incision in neck from chin to the sternum was given to reflect the skin inferolaterally [11]. The submandibular gland, main submandibular duct or Wharton's duct and accessory submandibular duct were explored and examined for its emergence, course, unusual path and termination. The details of the variations were recorded and photographed.

OBSERVATIONS AND RESULTS

The present study was done on 19 cadavers, anatomical variation of accessory submandibular duct was found during routine dissection in 3 male cadavers i.e. total incidence was 15.7%. Two submandibular ducts (duplication of duct) were found in two cases (10.5%) and accessory submandibular duct with unusual path was found in one case (5.2%). Variations were in the disposition, location and unusual path of the multiple accessory submandibular ducts.

In one cadaver, submandibular gland of left side had two submandibular ducts, the disposition and location with unusual path of the accessory submandibular gland duct was that the accessory duct of the left submandibular gland had an external location. It emerged from the superficial part of the gland and crossed horizontally the superficial surface of mylohyoid muscle for about 1cm. Then it bifurcated into two branches. These two branches of bifurcated ducts pierced the mylohyoid muscle and passed deep to mylohyoid muscle (Fig. 1A).

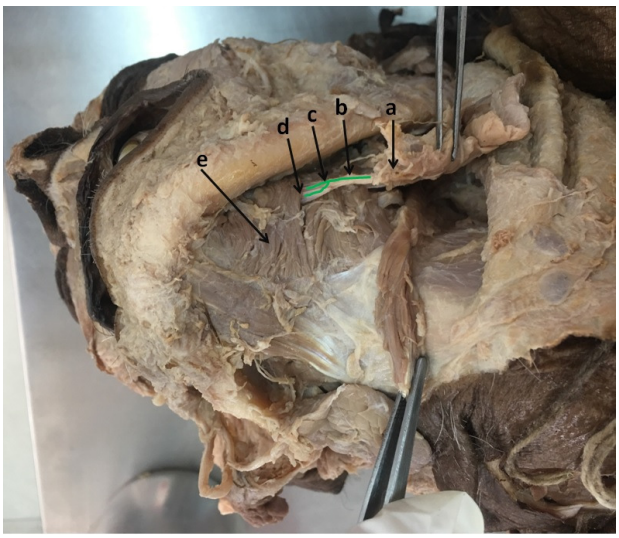

Fig. 1A: Photograph showing unusual path of the accessory submandibular duct (a) superficial part of the submandibular salivary gland (b) accessory submandibular duct (c) bifurcation of accessory submandibular duct (d) mylohyoid muscle pierced by bifurcated accessory submandibular duct (e) mylohyoid muscle.

These two bifurcated branches of accessory duct passed in the space between the hyoglossus muscle medially and the mylohyoid muscle laterally and had separate openings in to the oral cavity. One branch of the bifurcated accessory duct opened through a papilla

in the floor of the mouth behind the lower incisor tooth. Second branch of the bifurcated accessory duct joined the main duct (Wharton's duct) to open in left sublingual papilla on the left side of the lingual frenulum (Fig. 1B). The main duct (Wharton's duct) of this side (left side) was emerging from deep part of the gland and had normal path. Near its terminal part it was joined by the second branch of the accessory duct and opened at the same side (left side) of the sublingual papilla (Fig. 1B). The right submandibular duct of this cadaver appeared normal with suitable ending in the floor of the mouth.

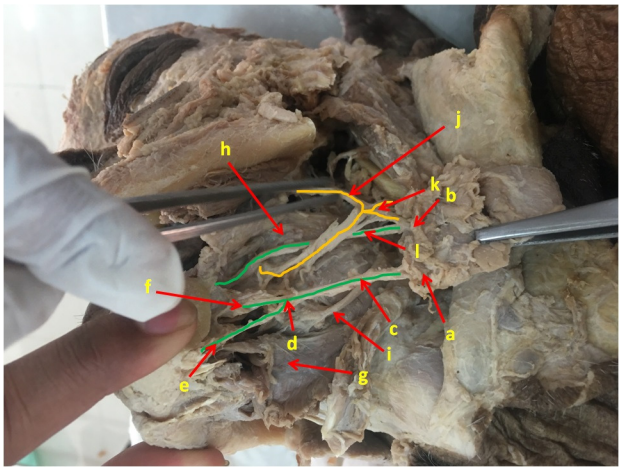

Fig. 1B: Photograph showing deep structures of photograph "A" after horizontal incision on mylohyoid muscle to reflect superolaterally and inferomedially. (a) superficial part of the submandibular gland (b) deep part of the submandibular gland (c) accessory submandibular duct from superficial part of gland (d) bifurcation of accessory submandibular duct (e) one branch of the bifurcated accessory duct opened through a papilla in the floor of the mouth behind the lower incisor tooth (f) second branch of the bifurcated accessory duct joined the main duct to open in left sublingual papilla (g) reflected part of mylohyoid muscle (h) hyoglossus muscle (i) hypoglossal nerve (j) lingual nerve (k) submandibular ganglion (l) main submandibular duct (Wharton's duct) from deep part of the gland.

In two cadavers, submandibular regions of right side had duplication of duct i.e. two submandibular ducts in a salivary gland. Location and opening of accessory duct was that in these two cases, anatomical variation was in the form of duplication of ducts, that one duct was main duct and second duct was accessory duct (Fig. 2). Both ducts emerged separately from the deep part of the gland. The two ducts were parallel in position and present in between the hyoglossus and mylohyoid muscle. The main duct was larger and inferior in position and accessory duct was slightly narrower and superior in position. Initially, ducts were between the lingual and hypoglossal nerve on hyoglossus muscle. The lingual nerve was above the duct, then it passed between two ducts and crossed lateral side of the inferior duct and finally ascends medially winding round the lower border of the duct (Fig. 2). The terminal part of ducts had independent opening into the floor of mouth in sublingual papilla on left side of frenulum of the tongue.

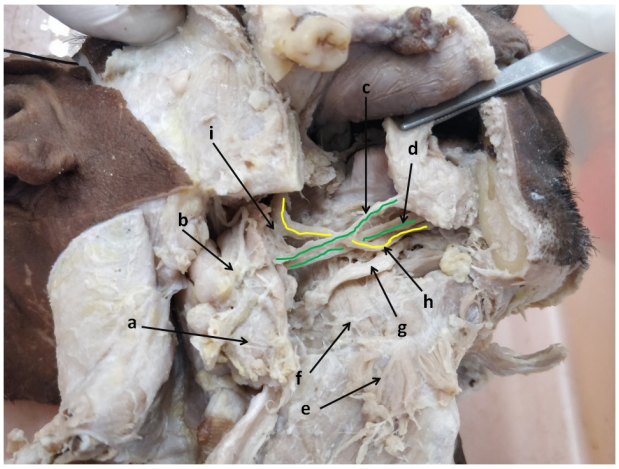

Fig. 2: Photograph showing a submandibular region of right side, having two submandibular ducts (a) superficial part of the submandibular gland (b) deep part of the submandibular gland (c) accessory submandibular duct from deep part of gland (d) main submandibular duct (Wharton's duct) from deep part of the gland (e) reflected part of mylohyoid muscle (f) hyoglossus muscle (g) hypoglossal nerve (h) lingual nerve (i) submandibular ganglion.

DISCUSSION

The submandibular gland develops bilaterally during the 6th week of fetal life as an endodermal outgrowth from the floor of the alveologingival groove [12]. The edge of the floor of the alveologingival groove gradually fuse together to form the submandibular duct, if the duct branches early or invaginates in two places it may lead in rare case for the formation of an accessory submandibular gland and duct [8-10]. Accessory submandibular ducts are usually smaller and run parallel to the main duct [10].

Waller (1934) described an embryo in which the submandibular duct opened into the pharynx near the isthmus of the fauces [13]. Rose (1932) described a case in which Wharton's duct bifurcate, with one end opening into the sublingual papilla and second end opening into the mouth opposite the second molar tooth [14]. Manzur-Villalobos et al. (2016) reported a cadaver in which an externally located right

submandibular duct anastomosed with the parotid duct and opened into the buccal mucosa adjacent to the second molar [15]. Humberto Ferreira-Arquez (2017) observed the excretory duct of the left submandibular gland had an external location that ascends and crosses vertically off the body of mandible, in its termination, it is divided in four ducts that had separate openings into the oral cavity upon a small papilla independently, opposite to the first and second lower molar crown [16].

In present study, an accessory duct of left submandibular gland had an external location (Fig. 1A.). The accessory duct was emerging from superficial part of the gland, then crossed the superficial surface of mylohyoid muscle and bifurcated. Then the ducts pierced mylohyoid muscle and passed deep to mylohyoid muscle (Fig. 1A). One branch of bifurcated duct was opening into a papilla in the floor of mouth behind the lower incisor tooth. Second branch of bifurcated duct anastomosed with the terminal part of main duct of same (left) side and then opened into sublingual papilla with the main duct (Fig. 1B). The main duct of this side had normal path and opened in sublingual papilla (Fig. 1B).

Using digital sialography and magnetic resonance imaging Gadodia et al. (2007) identified a unilateral submandibular duct duplication with a small duct of 2 cm in length passing close to the main submandibular duct and draining a small accessory gland [10].

Previous studies have also reported double duct of the submandibular gland [17-20]. The presence of double duct is important for treating bilateral dry eyes with a technique has been described in which severe keratoconjunctivitis sicca is managed by microvascular autologous submandibular gland transfer. In this operation, the Wharton's duct is transferred with the submandibular gland to the upper lateral conjunctival fornix to replace the lacrimal gland. One of the key elements of the operation is harvesting of an intact duct [20].

In our study, duplication of submandibular duct was found in two submandibular glands, both ducts emerged separately from the deep part of submandibular gland and ended independently into sublingual papilla (Fig. 2).

The presence of radiolucent stones or disease in accessory duct may be overlooked so, information regarding the possibility of additional ducts is essential for oral surgeons and radiologists. Therefore, it is important to know the different anatomical variation that can be present in the excretory duct of salivary glands, because these variations can confuse the real diagnosis for surgeons and to avoid any complication or laceration of the duct [21]. It is essential for radiologist to facilitate and assist in the diagnosis of these ducts by radiographic studies [18, 22]. These structural changes are called anatomical variations which may be present with no functional impairment in the individual. It is very important to report these finding so further studies can be initiated for such variation or anomaly.

CONCLUSION

The anatomical course of main submandibular duct or Wharton's duct are known but few conclusive reports on accessory submandibular duct and its unusual path are there. We found cases where accessory submandibular duct were present i.e. duplication of submandibular duct in two cases and unusual path of accessory submandibular duct in one case. Our study showed that the presence of accessory submandibular ducts are frequent. The morphological feature of the submandibular duct reported in the present case is divergent from those of the earlier reported cases.

These anatomical variations may be the cause of complications or reasons for injury during surgery. This study was done on the presence of accessory submandibular duct and its unusual path. It will provide a useful reference for clinical applications and surgical procedure in the floor of the mouth. A thorough anatomical knowledge of these variations is very useful for anatomists, ophthalmologists, oral and maxillofacial surgeons, plastic surgeons, otolaryngologists and radiologists.

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Original Article

NORMAL VARIANCE IN ULTRASOUND MEASURED RENAL DIMENSIONS WITH AGE, SEX AND BODY HABITUS IN A SPECIFIC POPULATION WITHOUT KNOWN RENAL DISEASE

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ABSTRACT

Introduction: Evaluation and follow-up of patients with renal diseases is commonly done by renal ultrasonography. Renal size is influenced by some factors such as age, height, weight, body mass index and ethnicity. The aim of this study was to evaluate the normal range of dimensions of kidney, like length, width, thickness & volume and its correlation with age, sex, height, weight and body mass index in population of eastern Odisha by Ultrasonography.

Material & Methods: Ultrasound was performed on 223 subjects. Initially the image was taken in supine and later in both lateral decubitus position. The measurements of kidney were taken from the freezed images in longitudinal axis and the transverse section obtained at the level of the renal hilum.

Results: In 63.68% cases the kidney length and in 81.17% cases, the kidney volume was larger on left side. A decline trend in all the measurements of parameters beyond 50 years was observed in the present study. However, the mean volume on both sides had a slight increasing trend in 61-70 years age group.

Keywords: Renal Ultrasonography, renal size, body mass index, kidney volume,

INTRODUCTION

The kidneys, one of the essential organs of body are part of the urinary system. It excrete the metabolic waste by filtering the plasma of the blood [1]. Renal function has close relation with renal size. Nephrological disorders like renal infections, inflammation and co-morbid conditions like hypertension and diabetes mellitus affect the renal size [2-5]. Chronic kidney diseases, renal growth, cysts can be associated with change in size and shape of kidney. Thus, it is imperative to establish the pattern of normal renal dimensions. Kidney volume is regarded as the most precise indicator of kidney size, which correlates best with the subject's height, weight and total body area [6,7]. Renal ultrasonography is currently used for the evaluation and follow-up of patients with renal diseases, which is a relatively inexpensive, quick, non-invasive and radiation-free imaging modality. Renal size is influenced by some factors such as age, gender, height, weight and ethnicity [8]. Renal length is most commonly used for quantitative measure of renal size for comparison with established standards [9]. The present study was conducted in the Department of Anatomy, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India from October 2011 to August 2013 after the approval from the ethical committee. It was conducted in collaboration with the Department of Radiodiagnosis. The aim of this study was to evaluate the normal range of dimensions of kidney and its correlation with age, sex, height, weight and body mass index in population of eastern Odisha in different age groups by ultrasonography.

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MATERIAL AND METHODS

Real time sonography was performed on 223 subjects and all measurements were taken by the same observer. Subjects having chronic hypertensive disease, diabetes mellitus, tuberculosis, malignancy of anywhere in body, chronic kidney disease, single or multiple renal cysts, unilateral kidney, malignancy of kidney and previous renal surgery were excluded from the study.

Initially the image was taken in supine and later in both lateral decubitus position. The measurements of kidney were taken from the freezed images in longitudinal axis and the transverse section obtained at the level of the renal hilum (Fig. 1).

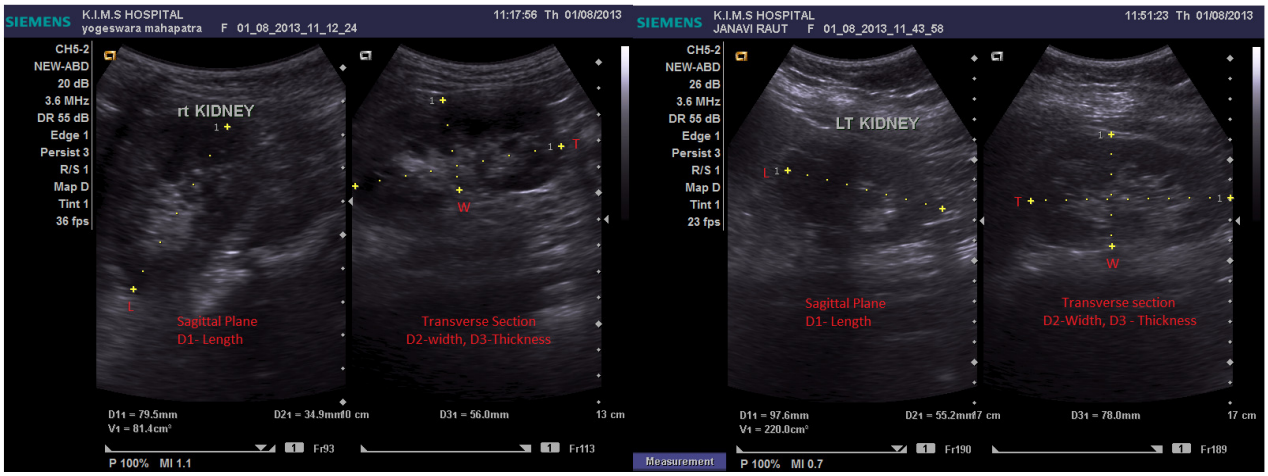


Fig. 1: Renal measurements at sonography

A standardized weighing machine was used to record the weight and an infant weighing scale for infants. Measurement of the standing height was taken by the measuring scale fixed to the wall.The supine lengths were measured on an infanto-meter in children below 2 years. Height was measured and rounded to the nearest 0.5 cm. Body Mass Index (BMI) was calculated as:

$$BMI\ (kg/m^2) = weight\ (kg)/\ [height\ (m)]^2$$

Parameters for Measurement of Kidney

Length: Maximum longitudinal kidney length measured in a sagittal plane by placing the electronic calipers on the outer edges of the caudal and cranial side.

Thickness: Maximum Antero-Posterior diameters of the Transverse Section.

Width (**Breadth):** Maximum distance between lateral and medial border of the transverse section.

Volume: The renal volume (cm^3) was calculated from length, breadth & thickness by ellipsoid formula as 0.523 × Length (in cm) × Width (in cm) × Thickness (in cm).

Ethics statement

The study protocol was approved by the ethics committee KIIT university, Bhubaneswar (Ref: KIIT-U/Exam/Evaluation/5752/11, Date11/11/2011). Written informed consent was obtained from all subjects.

RESULTS

Data analysis was done by using software SPSS 13 version. Table 1 presents age and sex wise distribution of subjects at interval of 10 years. The analysis of the parameters by ten years age group was done through an ANOVA and presented in Table 2 for right kidney. The mean length of right kidney was 94.4 ± 11.8 mm, the mean breadth was 41.2 ± 8 mm, the mean thickness was 46.2 ± 9.5 mm and the mean volume was 98.3 ± 38.2 cm^3 and significant statistically ($p = 0.000$). The mean right renal length, breadth, thickness and volume increased with age upto 50 years and after that there was a decline trend. The mean volume of right kidney showed slight increase trend between 61-70 years (Table 2, Fig. 2).

Table 1: Age and sex wise distribution of subjects

Age Group (Years)	Total Number	Sex			
		Male		Female	
		Number	%	Number	%
≤10	26	15	57.7	11	42.3
11 - 20	42	24	57.1	18	42.9
21 - 30	48	18	37.5	30	62.5
31 - 40	42	21	50.0	21	50.0
41- 50	28	14	50.0	14	50.0
51 - 60	18	4	22.2	14	77.8
61 - 70	19	9	47.4	10	52.6
Total	223	105	47.1	118	52.9

Table 2: Right renal dimensions distributed by age (grouped by decade of life)

Parameters	Age Group (years)	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	f & p Value
					Lower Bound	Upper Bound			
Length Right Kidney (mm)	≤10	26	75.208	11.679	70.491	79.925	55.3	97.7	21.270
	11 - 20	42	94.048	9.250	91.165	96.930	72.7	109.4	
	21 - 30	48	98.152	9.201	95.480	100.824	80.4	119.5	
	31 - 40	42	97.926	10.167	94.758	101.094	78.7	120.1	
	41- 50	28	99.043	8.600	95.708	102.378	84.4	122.7	0.000
	51 - 60	18	96.439	6.333	93.290	99.588	80.7	110.5	
	61 - 70	19	95.542	9.493	90.967	100.117	78.9	113.5	
	Total	223	94.413	11.801	92.855	95.970	55.3	122.7	
Breadth Right Kidney (mm)	≤10	26	30.462	5.182	28.369	32.555	21.9	43.1	14.527
	11 - 20	42	40.050	6.522	38.017	42.083	29.8	53.4	
	21 - 30	48	44.677	8.739	42.140	47.215	31.3	63.9	
	31 - 40	42	44.136	6.518	42.105	46.167	34.1	62.1	
	41- 50	28	41.882	7.071	39.140	44.624	32.1	57.6	0.000
	51 - 60	18	40.961	4.808	38.570	43.352	34.6	52.9	
	61 - 70	19	42.858	5.663	40.129	45.587	32.9	50.3	
	Total	223	41.240	7.978	40.188	42.293	21.9	63.9	

Parameters	Age Group (years)	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	f & p Value
					Lower Bound	Upper Bound			
Thickness Right Kidney (mm)	≤10	26	35.342	6.125	32.869	37.816	25.3	47.3	9.453
	11 - 20	42	44.826	9.127	41.982	47.670	31.9	73	
	21 - 30	48	48.863	8.641	46.353	51.372	34.2	62.9	
	31 - 40	42	48.648	8.980	45.849	51.446	36.2	73.9	
	41- 50	28	48.911	8.295	45.694	52.127	30.5	67.9	0.000
	51 - 60	18	44.861	10.758	39.511	50.211	32	64.8	
	61 - 70	19	49.479	7.143	46.036	52.922	38.9	61.9	
	Total	223	46.221	9.513	44.966	47.477	25.3	73.9	
Volume Right Kidney (cm^3)	≤10	26	43.723	16.633	37.004	50.441	20.3	76.9	16.330
	11 - 20	42	92.019	34.677	81.213	102.825	37	198.2	
	21 - 30	48	112.511	35.061	102.331	122.692	57.6	193	
	31 - 40	42	111.665	32.960	101.394	121.936	62.7	192.7	
	41- 50	28	109.434	35.694	95.593	123.275	58.9	196	0.000
	51 - 60	18	97.767	28.273	83.707	111.826	63.3	171.8	
	61 - 70	19	106.032	29.761	91.687	120.376	55.5	174.4	
	Total	223	98.344	38.166	93.307	103.380	20.3	198.2	

The mean left renal length was 97.4 ± 12mm, the mean breadth was 46.4 ± 7.6 mm, the mean thickness was 47.5 ± 8.2 mm & the mean volume was 115.8 ± 41.1 cm^3 and correlated statistically significant (p = 0.000). The mean length, breadth & volume increased up to 41-50 years age group and in thickness the increase was up to 51-60 years age group, after that there was a declining trend up to 70 years (Table 3, Fig. 3).

Table 3: Left renal dimensions distributed by age (grouped by decade of life)

Parameters	Age Group (years)	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum	f & p Value
					Lower Bound	Upper Bound			
Length Left Kidney (mm)	≤10	26	76.623	9.812	72.660	80.586	56.6	95.3	26.141
	11 - 20	42	96.864	9.901	93.779	99.950	69.5	121	
	21 - 30	48	101.719	8.642	99.209	104.228	82.2	120.7	
	31 - 40	42	100.783	9.815	97.725	103.842	78.1	121.9	
	41- 50	28	103.236	10.147	99.301	107.170	87.1	136.8	0.000

	51 - 60	18	99.494	5.312	96.853	102.136	89.2	111.1	
	61 - 70	19	97.458	9.556	92.852	102.064	81.4	118.5	
	Total	223	97.350	12.087	95.755	98.945	56.6	136.8	
Breadth Left Kidney (mm)	≤10	26	35.565	6.787	32.824	38.307	25.8	49.5	15.681
	11 - 20	42	45.388	7.678	42.996	47.781	30	58.7	
	21 - 30	48	49.152	5.798	47.468	50.836	39.4	61.6	
	31 - 40	42	48.688	6.968	46.517	50.859	38.5	69.1	
	41- 50	28	48.654	5.444	46.543	50.764	35.5	60.7	0.000
	51 - 60	18	46.356	5.333	43.703	49.008	38.4	56.5	
	61 - 70	19	48.074	5.118	45.607	50.540	37.6	55.7	
	Total	223	46.391	7.584	45.391	47.392	25.8	69.1	
Thickness Left Kidney (mm)	≤10	26	36.027	6.660	33.337	38.717	24.2	48.4	15.296
	11 - 20	42	46.348	7.686	43.953	48.743	34.9	66.9	
	21 - 30	48	51.260	7.304	49.140	53.381	38.2	73	
	31 - 40	42	49.593	6.154	47.675	51.511	33.1	67	
	41- 50	28	48.868	6.043	46.524	51.211	39.5	61	0.000
	51 - 60	18	49.722	8.171	45.659	53.785	40.8	64.4	
	61 - 70	19	47.837	6.838	44.541	51.133	37.4	62	
	Total	223	47.529	8.230	46.443	48.615	24.2	73	
Volume Left Kidney (cm^3)	≤10	26	53.377	22.242	44.393	62.360	20.9	97.1	19.845
	11 - 20	42	109.196	38.288	97.265	121.127	48.2	205.8	
	21 - 30	48	134.885	35.387	124.610	145.161	77.9	232.4	
	31 - 40	42	129.747	34.825	118.895	140.599	54	219	
	41- 50	28	128.268	28.100	117.372	139.164	87.8	211	0.000
	51 - 60	18	115.578	39.414	95.978	135.178	11.6	182.3	
	61 - 70	19	118.968	26.991	105.959	131.978	81.2	165.8	
	Total	223	115.830	41.113	110.405	121.256	11.6	232.4	

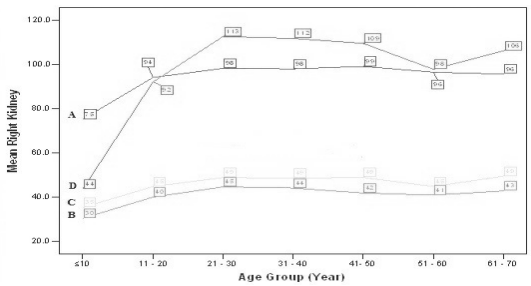


Fig. 2: Parameters of right kidney by age

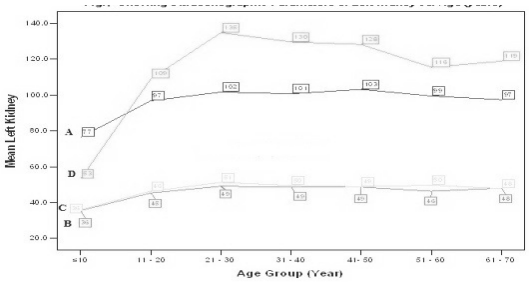


Fig. 3: Parameters of left kidney by age

A-Length of kidney B- Breadth of kidney C-Thickness of kidney D- Volume of kidney

The mean values of parameters of right and left kidneys were analysed respectively by sex along with significant values of 't' test (Table 4 & 5). It was found that all the parameters of male kidney were larger than female kidney on both sides (Fig. 4 & 5) and significant statistically except the length.

Table 4: Comparison of parameters of right kidney by sex

Group Statistics	Sex	N	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval for Mean		t Value	p Value
						Lower Bound	Upper Bound		
Length Right Kidney (mm)	Male	105	94.866	13.777	1.345	92.230	97.501	0.530	0.597
	Female	118	94.009	9.757	0.898	92.249	95.770		
Breadth Right Kidney (mm)	Male	105	42.624	8.821	0.861	40.937	44.311	2.437	0.016
	Female	118	40.009	6.953	0.640	38.755	41.264		
Thickness Right Kidney (mm)	Male	105	47.540	9.538	0.931	45.716	49.364	1.964	0.051
	Female	118	45.047	9.375	0.863	43.356	46.739		
Volume Right Kidney (cm^3)	Male	105	106.66	43.842	4.279	98.278	115.050	3.069	0.002
	Female	118	90.940	30.626	2.819	85.414	96.466		

Table 5: Comparison of parameters of left kidney by sex

Sex	Sex	N	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval for Mean		t Value	p Value
						Lower Bound	Upper Bound		
Length Left Kidney (mm)	Male	105	98.181	14.052	1.371	95.493	100.869	0.950	0.343
	Female	118	96.611	10.026	0.923	94.802	98.420		
Breadth Left Kidney (mm)	Male	105	47.437	8.699	0.849	45.773	49.101	1.920	0.056
	Female	118	45.461	6.325	0.582	44.320	46.602		
Thickness Left Kidney (mm)	Male	105	49.146	8.762	0.855	47.470	50.822	2.784	0.006
	Female	118	46.090	7.474	0.688	44.741	47.438		
Volume Left Kidney (cm^3)	Male	105	124.534	46.865	4.574	115.57	133.498	2.980	0.003
	Female	118	108.086	33.562	3.090	102.03	114.142		

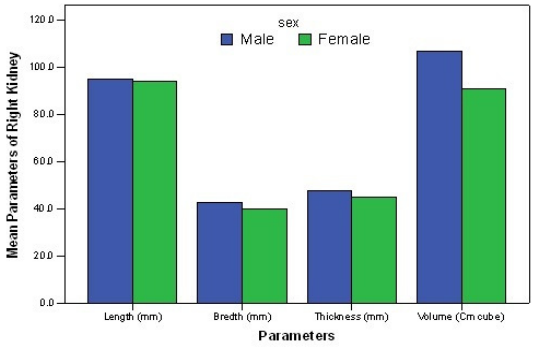


Fig. 4: Parameters of right kidney by sex

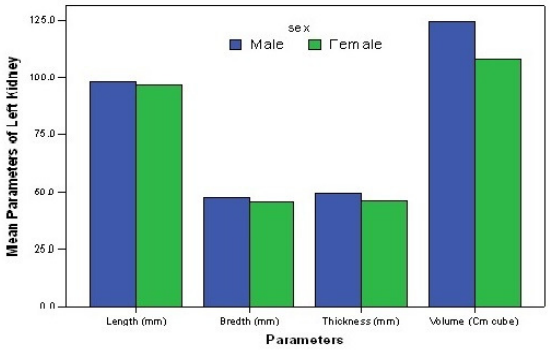


Fig. 5: Parameters of left kidney by sex

The mean parameters of kidney by different weight groups for right and left kidneys respectively were analysed which revealed that as the weight increases the parameters of kidney also increases and significant statistically (p = 0.000) (Table 6 & 7, Fig. 6 & 7).

Table 6: Relationship between right renal dimensions and individual's weight (kg)

Parameters	Weight Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f value	p value
				Lower Bound	Upper Bound		
Length Right Kidney (mm)	≤30	75.663	11.186	71.486	79.840	47.462	0.000
	31 - 40	89.944	7.878	86.828	93.061		
	41 - 50	95.732	5.683	94.063	97.401		
	51 - 60	96.401	8.647	94.308	98.495		
	61 - 70	103.021	7.304	100.472	105.569		
	>70	105.776	8.909	101.196	110.357		
	Total	94.413	11.801	92.855	95.970		
Breadth Right Kidney (mm)	≤30	30.710	4.866	28.893	32.527	33.340	0.000
	31 - 40	38.522	5.640	36.291	40.753		
	41 - 50	40.462	5.407	38.874	42.049		
	51 - 60	42.250	6.192	40.751	43.749		
	61 - 70	47.906	7.552	45.271	50.541		
	>70	48.924	6.524	45.569	52.278		
	Total	41.240	7.978	40.188	42.293		
Thickness Right	≤30	36.193	6.235	33.865	38.522	16.646	0.000
	31 - 40	43.974	8.549	40.592	47.356		

Parameters	Weight Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f value	p value
				Lower Bound	Upper Bound		
Kidney (mm)	41 - 50	43.660	7.540	41.446	45.874		
	51 - 60	49.518	7.946	47.594	51.441		
	61 - 70	52.085	10.927	48.273	55.898		
	>70	49.653	6.654	46.232	53.074		
	Total	46.221	9.513	44.966	47.477		
Volume Right Kidney (cm^3)	≤30	45.426	16.673	39.201	51.652	44.192	0.000
	31 - 40	81.041	22.883	71.988	90.093		
	41 - 50	90.480	22.108	83.989	96.971		
	51 - 60	107.858	29.862	100.629	115.086		
	61 - 70	132.432	33.838	120.625	144.239		
	>70	134.718	34.035	117.219	152.217		
	Total	98.344	38.166	93.307	103.380		

Table 7: Relationship between left renal dimensions and individual's weight (kg)

Parameters	Weight Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f value	p value
				Lower Bound	Upper Bound		
Length Left Kidney (mm)	≤30	77.883	10.458	73.978	81.788	42.406	0.000
	31 - 40	95.552	8.187	92.313	98.790		
	41 - 50	97.557	8.448	95.077	100.038		
	51 - 60	99.919	8.358	97.896	101.942		
	61 - 70	104.794	7.791	102.076	107.513		
	>70	108.824	9.759	103.806	113.841		
	Total	97.350	12.087	95.755	98.945		
Breadth Left Kidney (mm)	≤30	36.583	7.089	33.936	39.230	25.788	0.000
	31 - 40	43.496	7.332	40.596	46.397		
	41 - 50	45.906	4.528	44.577	47.236		
	51 - 60	48.400	6.203	46.898	49.902		
	61 - 70	50.765	6.347	48.550	52.979		
	>70	52.859	4.351	50.622	55.096		

Parameters	Weight Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f value	p value
				Lower Bound	Upper Bound		
	Total	46.391	7.584	45.391	47.392		
Thickness Left Kidney (mm)	≤30	36.603	6.444	34.197	39.009	22.226	0.000
	31 - 40	45.922	6.915	43.187	48.658		
	41 - 50	47.100	6.608	45.160	49.040		
	51 - 60	50.087	6.516	48.509	51.664		
	61 - 70	52.574	7.525	49.948	55.199		
	>70	50.224	6.961	46.644	53.803		
	Total	47.529	8.230	46.443	48.615		
Volume Left Kidney (cm^3)	≤30	56.820	23.353	48.099	65.540	37.387	0.000
	31 - 40	101.623	29.259	90.049	113.198		
	41 - 50	111.474	27.596	103.372	119.576		
	51 - 60	125.658	34.518	117.303	134.013		
	61 - 70	147.419	32.892	135.942	158.895		
	>70	152.088	28.449	137.461	166.715		
	Total	115.830	41.113	110.405	121.256		

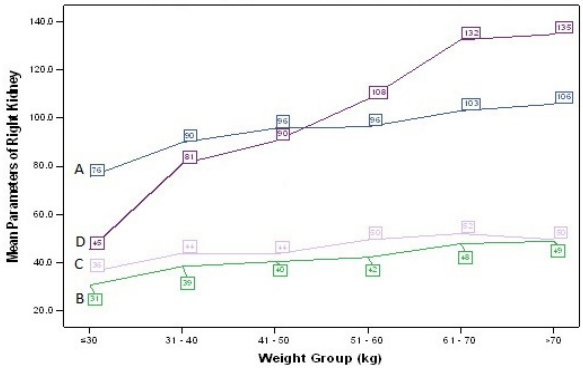


Fig. 6: Parameters of right kidney by weight

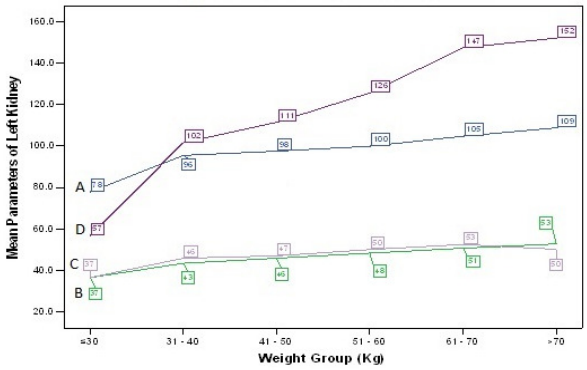


Fig. 7: Parameters of left kidney by weight

A-Length of kidney B- Breadth of kidney C-Thickness of kidney D- Volume of kidney

The mean of parameters of right and left kidney along with ANOVA results according to height was analysed (Table 8 & 9, Fig. 8 & 9) and it was seen that there was an increasing trend of the magnitude of parameters with height, which was statistically significant (p = 0.000).

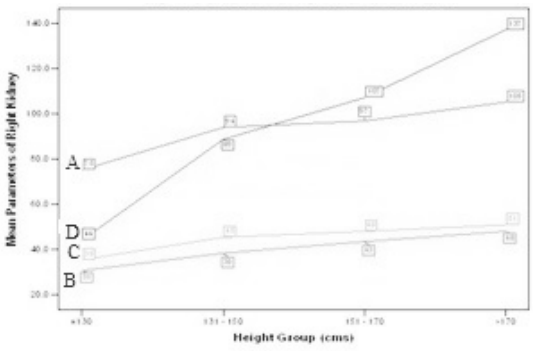
Table 8. Relationship between right renal dimensions and individual's height (cm)

Parameters	Height Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f & p Value
				Lower Bound	Upper Bound	
Length Right Kidney (mm)	≤130	75.104	11.558	70.333	79.875	
	131 - 150	93.917	8.609	91.521	96.314	
	151 - 170	96.743	9.195	95.108	98.377	48.671
	>170	105.076	7.479	101.672	108.481	
	Total	94.432	11.824	92.868	95.996	0.000
Breadth Right Kidney (mm)	≤130	30.620	5.388	28.396	32.844	
	131 - 150	38.390	5.897	36.749	40.032	
	151 - 170	43.476	6.777	42.271	44.680	37.723
	>170	47.990	7.626	44.519	51.462	
	Total	41.264	7.988	40.207	42.320	0.000
Thickness Right Kidney (mm)	≤130	35.408	6.113	32.885	37.931	
	131 - 150	45.398	8.242	43.104	47.693	
	151 - 170	48.002	9.251	46.357	49.646	17.003
	>170	50.867	8.280	47.098	54.636	
	Total	46.245	9.528	44.984	47.505	0.000
Volume Right Kidney (cm^3)	≤130	44.148	17.254	37.025	51.270	
	131 - 150	88.606	25.839	81.412	95.799	
	151 - 170	107.030	33.181	101.132	112.928	42.534
	>170	137.010	36.658	120.323	153.696	
	Total	98.469	38.206	93.416	103.523	0.000

Table 9. Relationship between left renal dimensions and individual's height (cm)

Parameters	Height Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f & p Value
				Lower Bound	Upper Bound	
Length Left Kidney (mm)	≤130	76.120	9.718	72.109	80.131	
	131 - 150	96.729	8.665	94.316	99.141	
	151 - 170	100.406	8.957	98.813	101.998	55.924
	>170	106.233	10.863	101.289	111.178	0.000

Parameters	Height Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f & p Value
				Lower Bound	Upper Bound	
	Total	97.361	12.113	95.759	98.963	
Breadth Left Kidney (mm)	≤130	35.612	6.338	32.996	38.228	
	131 - 150	45.656	5.952	43.999	47.313	
	151 - 170	48.360	6.450	47.213	49.506	29.571
	>170	49.871	7.499	46.458	53.285	
	Total	46.434	7.574	45.432	47.436	0.000
Thickness Left Kidney (mm)	≤130	35.924	6.759	33.134	38.714	
	131 - 150	46.227	6.687	44.365	48.089	
	151 - 170	50.048	7.080	48.790	51.307	29.889
	>170	50.000	7.354	46.652	53.348	
	Total	47.558	8.237	46.469	48.648	0.000
Volume Left Kidney (cm^3)	≤130	52.916	21.566	44.014	61.818	
	131 - 150	109.231	30.589	100.715	117.748	
	151 - 170	127.686	35.739	121.333	134.039	38.681
	>170	138.910	37.358	121.904	155.915	
	Total	116.005	41.123	110.566	121.444	0.000



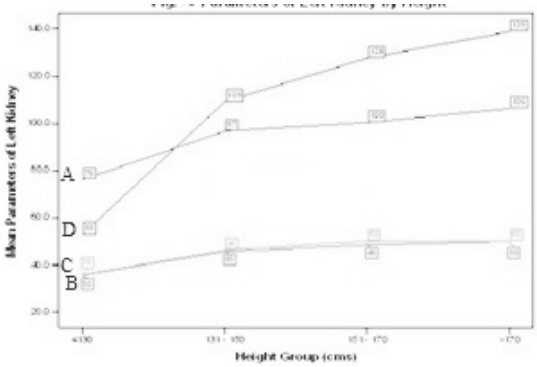


Fig. 8: Parameters of right kidney by height **Fig. 9: Parameters of left kidney by height**
A-Length of kidney B- Breadth of kidney C-Thickness of kidney D- Volume of kidney

The ANOVA results of the variation of parameters of kidney with the BMI, are represented in Table 10 and Fig. 10 for right kidney parameters and in Table 11 and Fig. 11 for left kidney parameters. The mean length, thickness, breadth and volume showed strong correlation with all the BMI groups and statistically significant (p = 0.000).

Table 10. Relationship between right renal dimensions and individual's BMI (kg/m²)

Parameters	BMI Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f value	p value
				Lower Bound	Upper Bound		
Length Right Kidney (mm)	≤ 15	77.921	10.144	73.988	81.855	18.280	0.000
	>15 & ≤ 17	88.927	11.354	84.341	93.513		
	>17 & ≤ 19	95.104	10.223	90.788	99.421		
	>19 & ≤ 21	95.474	9.648	92.302	98.645		
	>21 & ≤ 23	99.191	8.390	96.216	102.166		
	>23 & ≤ 25	97.871	9.327	94.616	101.125		
	>25 & ≤ 27	100.121	7.629	96.899	103.342		
	>27	102.863	8.454	98.358	107.367		
Breadth Right Kidney (mm)	≤ 15	32.118	4.518	30.366	33.870	12.319	0.000
	>15 & ≤ 17	37.831	6.846	35.065	40.596		
	>17 & ≤ 19	40.942	5.709	38.531	43.352		
	>19 & ≤ 21	40.603	7.227	38.227	42.978		
	>21 & ≤ 23	43.730	8.186	40.828	46.633		
	>23 & ≤ 25	44.812	5.537	42.880	46.744		
	>25 & ≤ 27	44.996	8.640	41.348	48.644		
	>27	46.350	7.329	42.444	50.256		
Thickness Right Kidney (mm)	≤ 15	39.854	7.988	36.756	42.951	6.921	0.000
	>15 & ≤ 17	41.231	7.856	38.058	44.404		
	>17 & ≤ 19	43.292	8.589	39.665	46.918		
	>19 & ≤ 21	46.184	9.350	43.111	49.258		
	>21 & ≤ 23	48.152	9.814	44.672	51.631		
	>23 & ≤ 25	52.353	8.980	49.220	55.486		
	>25 & ≤ 27	48.404	8.477	44.825	51.984		
	>27	49.669	7.317	45.770	53.568		
Volume Right Kidney (cm³)	≤ 15	53.443	19.847	45.747	61.138	15.825	0.000
	>15 & ≤ 17	75.332	28.459	63.837	86.826		
	>17 & ≤ 19	91.492	27.131	80.035	102.948		
	>19 & ≤ 21	100.912	38.346	88.308	113.516		
	>21 & ≤ 23	109.724	32.118	98.336	121.113		
	>23 & ≤ 25	122.168	32.250	110.916	133.421		
	>25 & ≤ 27	112.262	35.500	97.272	127.253		
	>27	123.518	31.499	106.733	140.302		

Table 11. Relationship between left renal dimensions and individual's BMI (kg/m²)

Parameters	BMI Groups	Mean	Std. Deviation	95% Confidence Interval for Mean		f value	p value
				Lower Bound	Upper Bound		
Length Left Kidney (mm)	≤ 15	82.029	12.214	77.293	86.765	14.890	0.000
	>15 & ≤ 17	90.065	11.306	85.499	94.632		
	>17 & ≤ 19	99.613	8.730	95.926	103.299		
	>19 & ≤ 21	99.482	11.181	95.807	103.157		
	>21 & ≤ 23	100.303	10.736	96.496	104.110		
	>23 &≤ 25	102.409	7.637	99.744	105.074		
	>25 & ≤ 27	101.858	6.089	99.287	104.429		
	>27	103.944	10.882	98.145	109.742		
Breadth Left Kidney (mm)	≤ 15	38.086	6.748	35.469	40.702	10.919	0.000
	>15 & ≤ 17	42.200	7.994	38.971	45.429		
	>17 & ≤ 19	46.521	7.736	43.254	49.787		
	>19 & ≤ 21	47.226	7.014	44.921	49.532		
	>21 & ≤ 23	48.818	6.354	46.565	51.071		
	>23 & ≤ 25	48.629	5.111	46.846	50.413		
	>25 & ≤ 27	50.346	5.136	48.177	52.514		
	>27	49.869	6.510	46.400	53.338		
Thickness Left Kidney (mm)	≤ 15	39.846	6.618	37.280	42.413	7.408	0.000
	>15 & ≤ 17	43.750	8.163	40.453	47.047		
	>17 & ≤ 19	49.392	7.972	46.026	52.758		
	>19 & ≤ 21	48.274	9.604	45.117	51.430		
	>21 & ≤ 23	47.488	5.885	45.401	49.575		
	>23 & ≤ 25	51.044	6.348	48.829	53.259		
	>25 & ≤ 27	50.704	7.366	47.594	53.815		
	>27	50.400	6.864	46.743	54.057		
Volume Left Kidney (cm³)	≤ 15	67.060	24.616	57.515	76.605	13.675	0.000
	>15 & ≤ 17	90.221	32.452	77.113	103.329		
	>17 & ≤ 19	122.376	39.343	105.763	138.989		
	>19 & ≤ 21	121.896	43.036	107.750	136.041		
	>21 & ≤ 23	122.888	34.926	110.504	135.272		
	>23 & ≤ 25	130.973	31.497	119.983	141.963		
	>25 & ≤ 27	137.967	34.519	123.390	152.543		
	>27	138.633	30.155	122.564	154.702		

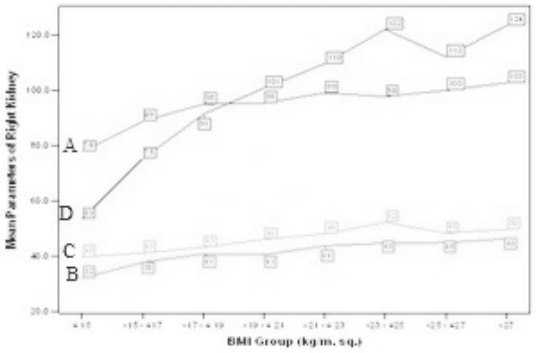


Fig. 10: Parameters of right kidney vs BMI

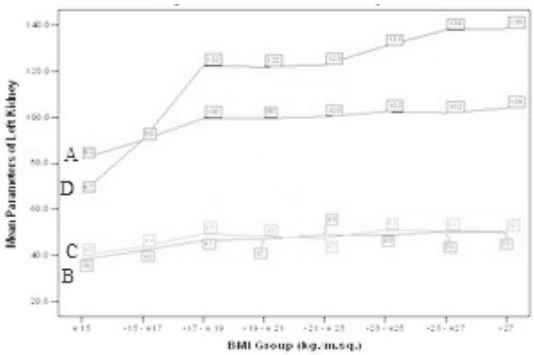


Fig. 11: Parameters of left kidney vs BMI

A-Length of kidney B- Breadth of kidney C-Thickness of kidney D- Volume of kidney

DISCUSSION

Ultrasonographic renal size is one of the easily reproducible parameter and provides rough indication of the renal function. Therapeutic decisions are frequently based on the size of the kidney. A small kidney size is an indication of irreversible chronic renal failure. Hence, it is important that the method of measuring the organ should accurate and precise. One could start with an ultrasonographic measurement of renal length and reserve MR imaging as a second-level method in case of uncertainty. When the renal length is 10 cm or longer, one would be 'safe' to start certain treatment or can perform certain procedure. Since the estimation of renal volume requires measurement of three dimensions of the kidney, the error increases in geometric proportion while calculating the volume. Hence it is simpler to use renal length as a yardstick for comparing renal growth with body growth [10,11].

Investigators studying intra- and inter-observer variations in renal length and volume measurements with USG have found comparable or slightly better repeatability. For example, Emamian et al. [12] found a relative SD of the difference of 4%–5% for renal length and of 14%–17% for renal volume in adults.

In the present study in 63.68%, the left kidney length was larger than right side. The kidney volume in the present study was 98.3±38.1 cm^3 on right side and 115.8±41.1 cm^3 on left side. This study correlate with the study of Raza et al. (2011) [11] and Arooj et al. (2011) [13]. The kidney volumes in the study by Emamian et al. (1993) [12] were larger than this study, may be due to larger habitus of the western population. In the present study, the kidney volume was found to be larger on left side in 81.17%, right side in 18.39% and equal in 0.45%. Study by Dinkel et al. (1985) found renal volume to be greater on the left in 51.7%, on the right in 29.5% and of equal size in 18.8% [14]. In the present study, the left kidney was significantly larger than the right (Table 12), which was similar to the results of many studies like Oyuela Carrasco et al. (2009) [15], Fernandes et al. (2002) [16], Dinkel et al. (1985) [14], Gavela et al. (2006) [17]. This difference could be explained by the fact that the liver being bigger than the spleen, for which the right kidney has less space to grow. Another possible explanation is related to the shorter length of the left renal artery, which increases blood flow to the left kidney which in turn increases the volume and size of the left kidney [12].

Table – 12 Correlation of parameters of right and left kidney in different studies

	Parameters	Present Study (2017)	Mujahid et al. (2011) [11]	Arooj et al. (2011) [13]	Buchholz et al. (2000) [2]
Right Kidney	Length (mm)	94.4±11.8	101.6±8.9	97±7.9	104±9
	Breadth (mm)	41.2±7.9	42.7±7.1	38±5.2	42±7
	Thickness (mm)	46.2±9.5		38±5.7	
	Volume (cm^3)	98.3±38.1	99.8±37.2	71.5±18.8	
Left Kidney	Length (mm)	97.3±12.0	102.7±9.2	99±9.6	105±9
	Breadth (mm)	46.3±7.6	47.6±7	44±5.9	48±7
	Thickness (mm)	47.5±82.2		43±7.9	
	Volume (cm^3)	115.8±41.1	124.4±41.3	93.6±27.6	

In the present study, there was sharp increase in measurements of parameters till the age of 20 years and slight increase up to 30 years and thereafter, it remained stable beyond 30 years up to 50 years. The above analysis leads us to formulate the hypothesis that the parameters of kidney might have attained its full growth by the age of 11-20 years and corroborates with the findings of Buchholz et al. (2000) [2]. Han and Babcock modelled renal growth according to two separate linear models—one from birth to age 1 year and another from age 1–18 years. Their model estimates growth to be 0.15 cm per month in the first year and 0.27 cm per year thereafter [18]. A decline in trend in all the measurements of parameters beyond 50 years was observed in the present study similar to study by Reshaid and Fattah (2014) [19]. However, the mean volume on both sides had a slight increasing trend in the age group 61-70 years, which may be due to relaxation of the abdominal wall with advancing age, so that the kidneys are squeezed less in older persons.

In the present study, it was found that all the parameters of kidney in male were larger than female on both sides and differed statistically significantly. This corroborates with the result by Raza et al. (2011) [11], Emamian et al. (1993) [12], Arooj et al. (2011) [13], Hekmatnia and Yaraghi (2004) [7], Oyuela Carrasco et al. (2009) [15], Fernandes et al. (2002) [16], Gao et al. (2011) [20], Mustafa and Ahmed (2017) [21]. In this present study, all the parameters of kidney correlates well with height, weight and BMI and are statistically significant (p=0.000). However, best correlation was found with height and weight. Raza et al. (2011) also showed a significant positive relationship of the subject's height and weight with renal volume and renal length in both genders [11]. This finding is very much in line with the studies of many workers such as Emamian et al. (1993) [12], Gavela et al. (2006) [17], Buchholz et al. (2000) [2]' Fernandes et al. (2002) [16] and Oyuela Carrasco et al. (2009) [15]. However Reshaid and Fattah (2014) observed that renal length of the two sides correlate in a significantly positive manner with weight and BMI, and weakly with height [19], in contrast to other studies in adults where the strength of this association has been significantly greater with height [12,15,20].

The data in the present study show that the mean values obtained for the dimensions of both kidneys was similar to the study done by Raza et al. (2011) [11], Buchholz et al. (2000) [2] and Zeb et al. (2012) [22] as the population under these studies, belonged to South East Asia. The mean values were below those found in European studies. It is known that the Westerners are taller and bigger compared to Asians [13]. The organs of Asians are generally accepted to be smaller than that of Westerners [23].

CONCLUSION

In this study in all age groups the ultrasonographic mean dimensions of right kidney were length 94.4 ± 11.8 mm, breadth 41.2 ± 7.9mm, thickness 46.2 ± 9.5 mm and volume 98.3 ± 38.2 cm^3 and the mean measurements of left kidney were length 97.4 ± 12.1 mm, breadth 46.4 ± 7.6mm, thickness 47.5 ± 8.2 mm and volume115.8 ± 41.1cm^3.The parameters were

smaller than previously reported, is probably a reflection of the relatively small body size of South East Asians than western population. Left kidney was larger than Right kidney. Kidneys were significantly larger in male than female. All the measurements of parameters of both right and left kidney correlated significantly with age, height, weight and BMI. Maximum growth period noted in this study was up to 20years of age. Thereafter, there was minimal growth up to 50 years. Slight decline in trend in all the measurements of parameters beyond 50 years was observed.

Conflict of Interest: None

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Original Article

A STUDY ON CEPHALIC INDEX OF ADULT NORTH INDIAN POPULATION

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ABSTRACT

Introduction: Cephalic index is the percentage of head breadth to head length. The index is calculated from measurement of the diameters of head (head length and head breadth). When applied to living individuals it is known as cephalic index, and when referring to dry skulls, the cranial index. This index is used as a useful anthropological tool for analysis of racial and sexual differences in a population. The present study was done to find out Cephalic Index and to study sexual dimorphism in adult North Indian population. Objective of the study was to calculate the cephalic index and to find out that the present study group belongs to which category in the classification of skull based on cephalic index and to study the sexual dimorphism in respect to cephalic index.

Material & Methods: The present study comprised of 200 medical students of age group between 18 yrs. to 25 yrs. of S.N. Medical College, Agra, not having any significant disease or deformity that could have affected the general or the bony growth.

Two anthropometric parameters; head length and head breadth were recorded in centimeters by using spreading caliper. With these recorded data, cephalic index was calculated for males and females separately as well as combined.

Results: Mean Cephalic Index was significantly higher (p=0.03124) in females (79.350 ± 5.7157) as compared to males (77.715 ± 4.9102).

Conclusion: There was a statistically significant difference in the mean of the cephalic indices of male and female students (p=0.03124). The mean cephalic index of combined population in this study was 78.533 ± 5.3776 which states that the dominant head shape among North Indians is Mesaticephalic.

Keywords: Head length, head breadth, anthropology, spreading caliper.

INTRODUCTION

Cephalic index (CI) also called as cranial index or Index of breadth is one of the important parameter that helps to differentiate between different human races. The cephalic index was defined by Swedish professor of Anatomy Anders Retzius (1796–1860) and first used in physical anthropology to classify ancient human remains found in Europe [1]. The measures used by Retzius, when applied to living individuals are known as cephalic index, and when referring to dry skulls, the cranial index [1].

The cephalic index is calculated by multiplying the head breadth with 100 and dividing it with the head length. It is very useful anthropologically to find out racial and sexual differences [2]. The relevant data on cephalic index of a population is very much essential and useful in designing various orthopaedic and physiotherapic equipments of head and face like cranial remodeling band (helmet), head phones, goggles etc. by formulating standard sizes [3]. Also standardized cephalometric records are useful in anatomy, forensic medicine, pediatrics, plastic surgery, oral surgeries and dentistry etc. [4] and enable diagnostic comparison between patients and the normal population [5]. The dolicocephalic people have otitis media less often than brachycephalics [6]. It is

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also reported that individual with Alpert's syndrome are hyperbrachycephalic [7].

Regarding, the effect of racial, ethnic and geographical factors on head dimensions the present study was done to determine the cephalic index of adult population, to find out the dominant head type and to study sexual dimorphism in North Indian students of age group 18 to 25 years of S. N. Medical College, Agra, Uttar Pradesh, India. The observations and findings of present study will provide a platform for similar cephalometric studies done on various communities, castes, races of particular geographic zones.

MATERIALS AND METHODS

The present study comprised of 200 medical students of age group 18-25 years of S.N. Medical College, Agra, Uttar Pradesh from North India. Age above 18 yrs has been chosen for the reason that by this age there is almost completion of skeletal growth. The subjects chosen were medical students because of easy availability in medical college. The subjects chosen were apparently healthy and without any visible spinal or cranial deformity. Any subject with congenital or acquired cranial, spinal or bone deformity i.e. scoliosis, kyphosis, etc. were excluded from the study.

Two anthropometric data (head length and head breadth) was taken in centimetres and to an accuracy of 0.10 cm, with the subject sitting in chair, in relaxed condition and the head in anatomical position. Prior informed consent in writing was taken from each subject. Head length was measured as the straight distance between glabella and the opisthocranion, using blunt ended spreading caliper. Head breadth was measured as the maximum biparietal diameter and is the distance between the most lateral points of the parietal bones i.e. between two parietal eminences.

All these measurements were recorded three times to minimize subjective errors, and then their mean was taken as standard. All data were entered on MS excel sheet and the data were analyzed in PRIMER and SPSS version 22 for Windows statistical software package (IBM SPSS Statistics 22). Quantitative data were summarized in form of mean and SD (Standard Deviation). Then the percentage of head breadth to head length was calculated separately for male and female population as well as in combination of both males and females. The difference and relationships were deemed statistically significant when $p < 0.05$. Mean ± SD values of all variables were obtained, and $p < 0.05$ was considered to be significant.

OBSERVATIONS AND RESULTS

Cephalic Index is the percentage of head breadth to head length in any skull. The index is calculated from measurement of the diameters of the skull.

$$\text{Cephalic index} = \frac{\text{Head breadth} \times 100}{\text{Head length}}$$

Skulls can be classified into four categories on the basis of cephalic index [8] i.e. Dolichocephalic in which cephalic index is below 75 (in Australians), Mesaticephalic with cephalic index between 75- 79.9 (in Indians, Europeans), Brachicephalic having index between 80- 84.9 (in Chinese, Japanese) and Hyperbrachicephalic with index between 85.0- 89.99 (in Fars males, Iran).

The mean Cephalic Index for males was 77.715 with SD 4.9102, and mean Cephalic Index for females was 79.350 with SD 5.7157. Mean Cephalic Index was significantly higher (p value 0.03124) in females as compared to males. The mean Cephalic Index of combined males and females subjects was 78.533 with SD 5.3776 (Table 1, Fig. 1).

As per Cephalic Index, it was concluded that the present study population belongs to Mesaticephalic (index between 75 - 79.9 found in Indians, Europeans) category.

Table 1: Comparison of mean Head length, mean Head breadth & mean Cephalic Index between males, females & combined population

Sex	No.	HL±SD	HB±SD	Mean Cephalic Index ± SD	p value
Male	100	18.630± 0.7356	14.458± 0.7511	77.715± 4.9102	0.03124 S
Female	100	17.361± 0.6923	13.763± 0.7797	79.350± 5.7157	
Combined	200	17.995± 0.9551	14.110± 0.8393	78.533± 5.3776	

(HL= Head length, HB= Head breadth, SD= Std. deviation, p= probability, S= Significant)

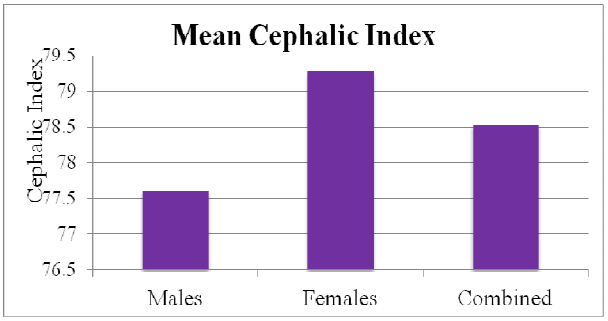

Fig. 1: Comparison of Cephalic Index between males, females and combined population

DISCUSSION

The present study is based on the measurement of the Cephalic index on the living population. On the basis of cephalic index head shapes were grouped into four categories, i.e. Dolicocephalic (from the ancient Greek Kephale, head and dolikhos, long and thin), Brachicephalic (short and broad), Mesocephalic (intermediate length and width) and Hyperbrachicephalic (very short and broad) [8].

The mean Cephalic index of males was 77.715 ± 4.9102. This finding was slightly higher than Bhils study with 76.98 [9]. But lower than males from Manipal with 77.92 [10], Barelas with 79.80 [11] and Gujarati males with 80.42 [2] of Indian group.

The mean Cephalic index of Indian females in present study was 79.350 ± 5.7157. This finding was lower than Nakashima (1986) study in Kyushu with 87 [12], a study on native Fars group with 85 in north of Iran [13], Turkman group 82.8 in North of Iran [4], Shah and Jadhav (2004) from India with 81.20 [2], Manipal females with 80.85 [10]. But higher than study in Tehran- center of Iran with 75 [14], in Croatia with 79.23 [15], Ijaw (78.24) and Igbo (76.83) tribes community [16], Baysela state, Nigeria with 72.24 [17].

The mean cephalic index of this study (combined population) was 78.533 ± 5.3776 which states that the dominant head shape among North Indians is Mesaticephalic which was lower than Shah and Jadhav study (2004) in India with 80.42 [2], Bhargava and Kher's study (1961) in Berelas of Central India 79.80 [11], study on Manipal population with 78.92±6.31 [10], Chile (80.42) by del Sol, Fars males with 84.8 [13], study in Port Harcourt, Nigeria with 79.80 [18]. But the Cephalic index was higher when compared to Abolhasanzadeh and Farahani study (2003) in Tehran–Iran with 75 [14], Bhargav and Kher (1961) for Bhils of Central India 76.98 [11] and study by Eroje et al. (2010) for Ogbia of Nigeria with 72.96 [17].

This shows that there is tendency towards brachycephalisation. Comparing previous records of cephalic index with recent work proves tendency towards "brachycephalisation" that is an evidence of continuous growth of brain more in the lateral direction [2]. Also, in tropical zones head form is longer (dolichocephalic), but in temperate zones the head form is more round (mesocephalic or brachycephalic) [19]. Since India is partly in temperate and tropical zone, the present classification shows tendency to brachycephalization from dolicocephalic.

CONCLUSION

The present study has shown the usefulness of cephalic index as a parameter for differentiation of sex in North Indian population and that the dominant head shape among North Indians is Mesaticephalic. Methods used in the study for measuring the parameters are noninvasive, non-time consuming and non-expensive, which do not need any specialized training hence, can be used by anyone.

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Original Article

THORACIC VERTEBRAL BODY MORPHOMETRY WITH ITS CLINICAL IMPLICATIONS

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ABSTRACT

Introduction: Vertebral body morphometry is required for designing of customised bone grafts and implants for various spinal procedures. The literature review revealed number of studies focussing on the morphometry of pedicles and spinous processes of vertebrae. However there is paucity of literature for the complete dimensions of thoracic vertebral bodies. The aim of the present study was thus, to collect baseline morphometric data of thoracic vertebra in Eastern belt of Uttar Pradesh.

Material & Methods: One hundred and fifty typical thoracic vertebrae of undetermined age and gender were selected for the study. Parameters namely anteroposterior diameter, width, anterior height, posterior height, superior transverse diameter and inferior transverse diameter of vertebral body were measured using a digital Vernier calliper. Data was analysed statistically using SPSS 19 software

Results: The mean values for anterior height, posterior height, superior transverse diameter, inferior transverse diameter, width and anteroposterior diameter were 17.06±1.52 mm, 18.13±1.64 mm, 25.32±2.32 mm, 26.97±2.40 mm, 23.52±2.77 mm and 19.95±3.81 mm respectively..

Conclusion: Study highlights the importance of collecting morphometric data for a specific population due to diversity in geographical factors affecting morphometry.

Keywords: Thoracic vertebra, morphometry, anterior thoracic fusion, anterior height, posterior height, vertebral body width.

INTRODUCTION

The adult vertebral column is a curved linkage of 33 individual bones or vertebrae stacked one above the other in caudal cranial direction. The column protects the underlying spinal cord along with their meninges and nutrition providing intricate vasculature. The column also provides stability with limited mobility and the surface for muscular attachments [1].

Surgical procedures on the vertebral column are commonly performed for various spinal and vertebral column diseases. Anterior thoracic fusion is performed in operative treatment of osteomyelitis, fractures and various malignancies involving thoracic vertebral bodies, degenerative diseases and for correction of scoliosis [2]. It is a procedure where a surgeon applies bone grafts between two vertebral elements initiating a biological reaction inciting bone growth further this aids in healing. It is believed that pathologies like spondylolisthesis and disc abnormalities respond better when operated anteriorly [3,4]. The advantage of anterior approach is that it allows excellent view and accessibility to thoracic spine, intervertebral discs and even nerve roots. This procedure helps in relieving compression from neural elements and attains maximum spinal stability. Other advantages are direct access to lesion with minimal per operative bleed. Also the devices used for fixation have the advantage of being short segment permitting acceptable mobility [5].

The prognostic outcomes of anterior thoracic fusion procedures can be improved by designing bone grafts and appropriate implants customized as per the morphometric data of an individual/population as this

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is racial, gender and region specific.

Kunkel et al. (2011) in their study on German population studied the height of intervertebral discs at all thoracic spinal levels and emphasized that vertebral height dimensions can be a good predictor of disc height at that specific level [6]. The disc height measurements are invariably used during disc arthroplasty procedures. This further highlights the significance of obtaining vertebral body dimensions as predictors for disc disease.

The literature published till date has focussed on dimensions of thoracic spine and pedicle measurement [6-8]. There is very little literature citing the racial differences within the vertebral body measurements [8]. The present study is thus an attempt to define the morphometry of thoracic vertebral body in the studied population, this would aid in collecting an important database for regional population (Eastern belt of Uttar Pradesh).

MATERIALS AND METHODS

One hundred and fifty undamaged typical human thoracic vertebrae were selected for the study. The vertebrae were obtained from the bone bank of the Department of Anatomy, Heritage Institute of Medical Sciences, Varanasi, UP, India. The vertebrae were of undetermined gender and age and each of them was assigned a specific number. To study the morphometry, the following measurements were taken using a Vernier calliper [9,10].

The following parameters were recorded in a proforma:

1. Anterior height of the body (AHV_B): It is the vertical distance between superior and inferior borders of vertebral body in the midsagittal plane anteriorly (Fig. 1A).
2. Vertebral body width (WV_B): It is the minimum transverse distance across the waist of vertebral body (Fig. 1A).
3. Posterior height of the body (PHV_B): It is the vertical distance between superior and inferior borders of vertebral body in the midsagittal plane posteriorly (Fig. 1B).
4. Anteroposterior diameter of the vertebral body (APV_B): It is the length between anterior border and posterior border of the superior surface of vertebral body in midline (Fig.1C).
5. Superior transverse diameter of the vertebral body (TD_SV_B): It is the maximum transverse diameter of the vertebral body at the superior surface (Fig. 1C).
6. Inferior transverse diameter of the vertebral body (TD_IV_B): It is the maximum transverse diameter of the vertebral body at the inferior surface (Fig. 1D).

The data analysis was done using SPSS 19 software and the results were compared accordingly. The level of significance was noted at $p < 0.05$ at 95% confidence interval.

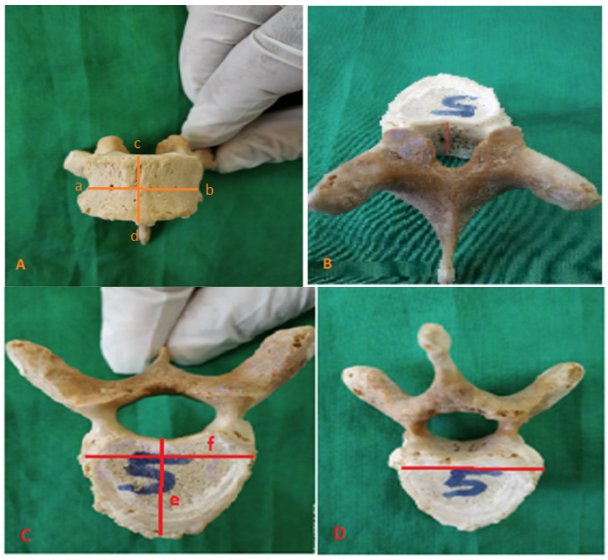

Fig. 1: Photograph showing morphometric measurements taken in the present study. A: ab= vertebral body width (WV_B), cd=anterior height (AHV_B), B: posterior height (PHV_B), C: anteroposterior diameter of vertebral body (e) and superior transverse diameter (f), D: inferior transverse diameter (TD_IV_B)

RESULTS

The observations for all parameters were assessed and are represented graphically as under. The values for anterior and posterior heights provided a range of 13.2-20.5mm and 14.0-23.0 mm respectively, the mean and standard deviation were analysed (Fig. 2A). The superior and inferior transverse diameter of the vertebral body gave a mean range of 22.0-29.6 mm and 24.0-31.0 mm respectively, which are graphically represented in Fig. 2B. The vertebral body width (mean range 18.0-28.0mm) and antero-posterior diameter of vertebral body (mean range 13.0-27.0mm) are represented in Fig 2C. The means of all the parameters were compared with that of other population groups (Fig. 3).

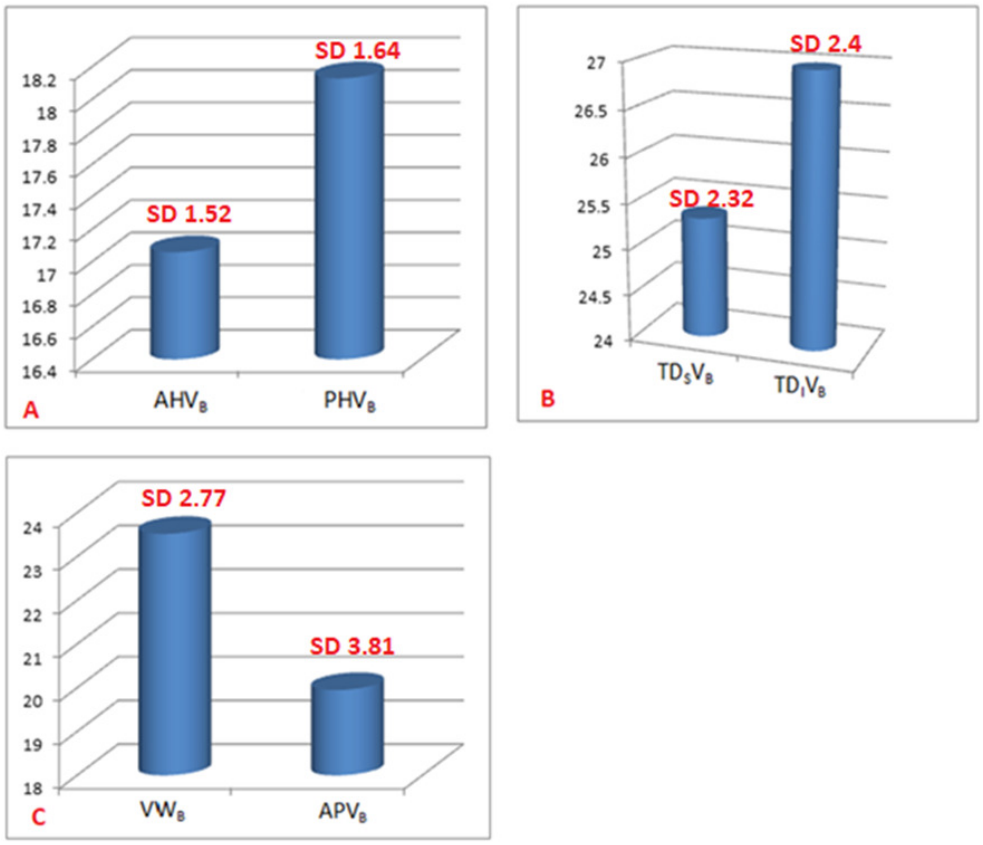

Fig. 2: Graph showing mean values of various parameters in mm with standard deviations
A: anterior (AHV_B) & posterior height (PHV_B) of vertebrae B: superior (TD_SV_B) & inferior transverse diameter of the vertebral body (TD_IV_B) C: vertebral body width (VW_B) & anteroposterior diameter of the vertebral body (APV_B)

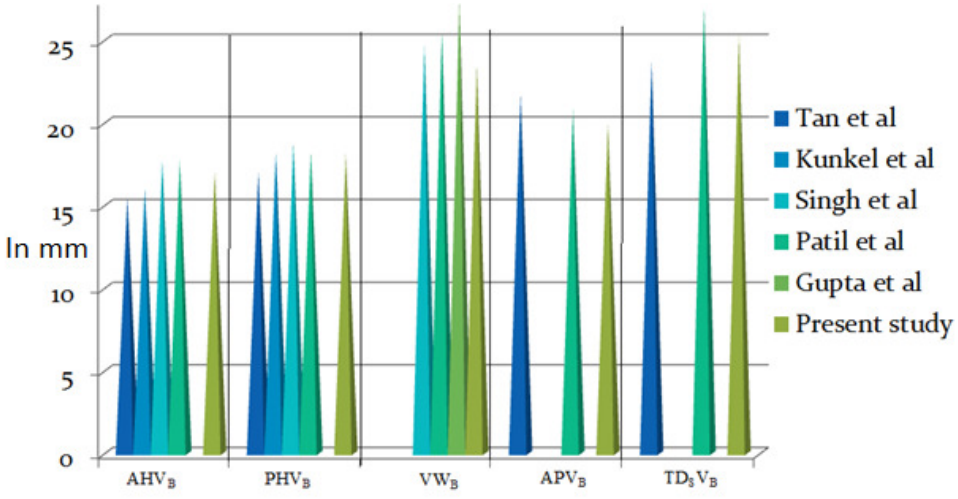

Fig. 3: Mean values of parameters compared between different population groups

DISCUSSION

Morphology of vertebral column is affected externally by mechanical and environmental factors and internally by genetic, metabolic and hormonal factors. All these influence its ability to react to varying magnitudes of weight bearing and are much modified by occupation, locomotion and posture.

While comparing morphometric data of thoracic vertebrae of our study with that of other racial groups, it was observed that mean values of anterior vertebral height, posterior vertebral height, antero posterior diameter and superior transverse diameter were statistically significant with respect to the present study ($p<0.05$). As per the study by Kunkel et al. (2011) on German population, their values for anterior height and posterior height were greater [6] than those from our study. Their study was primarily based on measurement of dimensions of intervertebral discs so other dimensions of body could not be extracted from their study. Comparison of the present study population with those of Chinese origin provided higher values for most of the morphometric data (AHV_B, PHV_B, TD_SV_B and APV_B) [9] (Fig. 3).

Regional comparison within Indian origin populations were also done. It was observed that there is minimal non-significant variation in vertebral body morphometry as per regional distribution. A study in Northern region conducted by Singh and Srivastava (2011) revealed higher values for anterior height, posterior height and antero-posterior diameter [8] than that of our study. Similar study on western Indian population also reported values that were greater than our study [10], though in both the studies the p value was found to be statistically non-significant with that of present study (Fig. 3). The present sample was obtained from the eastern part of Uttar Pradesh.

Vertebral body width is the only parameter which was significantly variable between various population groups. Both racial (between population groups of different origin) and regional (different parts within India) differences were observed in this variable of vertebral morphometry, as has been observed by earlier researchers also [7-10]. During designing of implants for spinal instrumentation this particular variable (VW) should be taken into consideration for better post-operative prognosis.

Findings from present study highlight that morphometric data varies within population groups. Hence, spinal implants required for anterior thoracic fusion procedures need to be customised according to specific population for which a complete database is necessary. Such customisation will be instrumental in improving outcome after operative interventions. Hence it is imperative to measure the vertebral body dimensions and build an extensive database for a specific population.

CONCLUSION

This study highlights the significance of collecting baseline data for vertebral body morphometry of thoracic vertebra for different population groups as there are diverse ethnic and environmental factors modifying the vertebral morphometry.

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Original Article

A STUDY OF CORRELATION BETWEEN STATURE AND ARM SPAN OF NORTH INDIAN POPULATION

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ABSTRACT

Introduction: Age, sex and stature are primary characteristics for identification of an individual. Stature has a definite and proportional biological relationship with each and every part of human body i.e. head, neck, trunk and extremities.

Material & Methods: The present study comprised of 300 medical students belonging to North India of age group between 18 yrs. to 25 yrs. of S.N. Medical College, Agra. The two anthropometric parameters, arm span and stature were used to calculate mean, standard deviation and Pearson's correlation coefficient.

Results: The Pearson's correlation coefficient was found to be 0.9171 and p value was calculated to be <0.00001 thus, showing a significant positive correlation between the stature and arm span for the North Indian population.

Conclusion: The correlation between arm span and the stature in adult males and females, was found to be an accurate predictor of stature. Thus it becomes an important anthropologic tool for the scientists in limb reconstruction surgeries. In mass disasters like train accidents, earthquakes, etc. and where the subject is in highly decomposed, fragmentary and mutilated form, it can be helpful in determining the identity of an individual.

Keywords: Arm Span, stature, anthropology.

INTRODUCTION

Measurement of body size such as height and weight are required for assessment of growth and nutritional status of an individual [1]. Stature is an important clinical parameter in risk stratification and to identify an unknown cadaver [1], patients with deformity of limbs or amputation [2] or cadaver where limb is absent or mutated or decomposed or animal attacked or mass disaster [3].

Identification of disproportionate growth abnormalities in individuals, disease like skeletal dysplasia, in medicolegal cases, or spinal deformities caused by accidents, or formed by surgical procedures [4]. Among the assessment of various other anthropometric measures, including knee height, height of spine, face breadth [5], sitting height and demi span, the various studies indicate that arm span has the strongest correlation with standing height [6,7].

Here, we have made an effort to find out correlation between arm span and height in North Indian population. The data and statistics derived from our study can be of importance in various medical fields like forensic, anthropologic studies and archaeologists as well. The aim of the study was to determine the stature from arm span in both the sexes in North Indian population and to find a correlation between stature and arm span and derive a regression equation for stature from arm span.

MATERIALS AND METHODS

The study comprised of 300 medical students between 18 yrs. to 25 yrs. of age group who were apparently healthy of SN Medical College, Agra. The

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lower age limit of 18 yrs. was chosen as by this age the skeletal maturity is almost completed. The study excluded subjects having any spinal or bone deformity e.g. scoliosis, kyphosis, arthritis etc. An informed written consent was taken from the subjects prior to the study.

In this study, the body height was measured as the perpendicular distance between the top of the head and the bottom of the feet. It was measured using stadiometer to the nearest 0.1 centimetres in bare feet with the students standing upright against stadiometer. The students had their feet together and moved back until their heels touched the bottom of the stadiometer. Their buttocks and upper part of their back were in contact with the stadiometer, but their head did not touch the stadiometer. The student's head were in horizontal plane. The vertex was the highest point on their head, to lie in the Frankfort plane to align their head properly [8].

As arm span is the anthropometric measurement of the length from the tip of the middle finger of left and right hands when raised parallel to the ground at shoulder height at 180 degrees angle. It was measured using a calibrated steel tape to the nearest 0.1 centimetres in bare feet on a level concrete floor with their upper backs, buttocks and heels against the wall providing support. The student's head were also in the Frankfort plane and the arms outstretched at right angles to the body with palms facing forwards. The measurements were taken from middle fingertip of one side to middle fingertip of other side, with the tape passing in front of clavicles (Fig. 1) [9].

Fig. 1: Photograph showing the method used for measurement of arm span

Body height and arm span of each subject were taken thrice and then their average was calculated. Thereafter, the mean height and mean of arm span was calculated for all the students. The standard deviation and p value were calculated, eventually the regression equation was calculated using SPSS software, version 22.

OBSERVATIONS

In a sample (N) of 300 students, mean stature was taken as standard to be 164.86 cm, with standard deviation of 8.78 cm, and mean arm span was taken as standard 169.41cm, with standard deviation of 10.79 cm (Table 1).

A regression equation is given as: **Y = bX + a**

The regression formula was calculated using SPSS software version 22 using arm span of the subjects and was given as: **Y = 0.75X + 37.63**

Y is the height of subject that is to be calculated, is the dependent variable. X is the arm span of the subject, an independent variable, values of b, the slope and a is intercept in the graph are 0.75 and 37.63 respectively.

Now, by applying regression statistics, in the derived formula above, the stature of subject (Y) was calculated by applying the value of arm span (X) as 169.41cm (Table 1).

Height of subject (Y) = 37.63 + (0.75 x 169.41) =164.85 cm, and correlation coefficient (r) between arm span and height is 0.92 (Table 1), while the coefficient of determination (R^2) is 0.85 using SPSS software, version 22.

Table 1: Relationship of arm span and stature

Values	Arm Span	Stature
Sample (N)	300	300
Maximum (cm)	195.00	186.80
Minimum (cm)	142.00	142.00
Mean value (cm)	169.41	164.86
Standard deviation	10.79	8.72
Standard error	0.62	0.51
Pearson's correlation coefficient	0.92	
p- value	0.0001 (significant)	

The relation between arm span and stature is shown in scattered diagram (Fig. 2), where x axis shows arm span drawn against y axis depicting stature, which shows that the stature and arm span are strongly correlated and they show positive correlation, i.e. in individuals whose arm span are greater, Stature is also found to be large, and vice-versa. The R^2 =0.850, which means that 85.0% of the total variation in arm span was explained by the linear relation with mean stature.

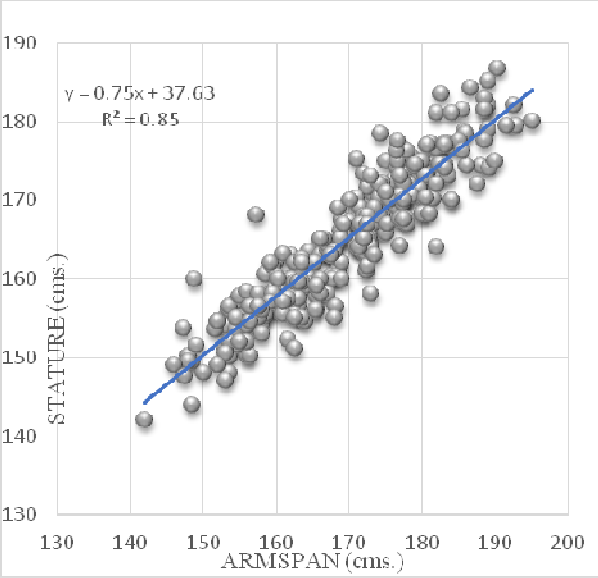

Fig. 2: Graph showing the linear relation between arm span and stature

DISCUSSION

When the accurate measurement for stature is unobtainable, it is computed using other surrogates [10]. Arm span is the most widely used one. Estimation of stature using various physical measurements has been attempted by many authors. Present study was compared with various previous studies (Table 2). Chumlea et al. (1985) estimated stature from knee height [11.The one variable that proved to be consistently reliable in estimating stature was the arm span. Shah et al. (2013) performed a cross sectional study on 150 MBBS students in one of the medical college of Ahmedabad. Statistical analysis of the data obtained showed strong and significant correlation of 0.9313 between height and arm span [1]. Patel et al. (2012) did work on 273 subjects, showing correlation between stature and five parameters i.e. arm span, hand length, hand breadth, foot length and foot breadth at different degrees, where arm span showed the highest correlation with stature (r=0.908) [12]. Alam et al. (2016) did a study on 124 students in Uttar Pradesh, India. The correlation between stature and arm span was positive and significant (r=0.798, p<0.05) [9]. Body height correlates well with the arm span so it can be used as a reliable marker for stature estimation using regression equation. Nadankutty et al. (2014) did work on 315 subjects of Malaysia and found correlation to be 0.920 between arm span and height, which was strong and positive correlation [2].

Table 2: Comparison of present study with the previous studies done at different parts of Asia

Authors	Mean height (cm)	Mean arm span (cm)	Pearson correlation coefficient (r)	p value
Shah et al. in Gujarat (2013) [1]	168.23 ± 9.38	169.92 ± 10.46	0.9313	<0.0001
Patel et al. in Bhavnagar (2012) [12]	164.59 ± 9.19	167.28 ± 10.73	0.9080	<0.0001
Alam et al. in east UP (2016) [9]	167.59 ± 10.38	168.67 ± 11.78	0.7980	<0.0001
Nadankutty et al. in Malaysia (2014) [2]	163.25 ± 8.68	165.87 ± 10.91	0.9200	<0.0001
Present study in North India (2018)	164.86 ± 8.78	169.41 ± 10.79	0.9222	<0.0001

CONCLUSION

In the present study, a significant positive correlation was observed between arm span and stature in 300 North Indian students of age group between 18-25 yrs. and the estimated stature from arm span was almost equal to their measured mean stature i.e. 164.8560 cm using the derived regression equation which is Y=0.75X + 37.63.

The height was strongly correlated with arm span as p value is <0.0001. The finding of the present study indicate that the arm span can be used to accurately predict stature of an individual of North Indians.

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Original Article

SONOMAMMOGRAPHIC EVALUATION OF BREAST MASSES

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ABSTRACT

Introduction: Sonomammography is an ideal, noninvasive, painless and accurate procedure used to detect and evaluate breast masses. In this study, detection evaluation and characterization of breast masses was done with ultrasound for a period of seven months from March 2017 to September 2017.

Material & Methods: 106 patients from Department of Surgery and Obstetrics & Gynaecology were screened by clinical and ultrasound examination. Histological confirmation was done by fine needle as piration cytology and excision biopsy.

Results: On examination, the distribution of lesions were fibroadenoma, fibrocystic disease, mastitis, breast cyst, abscess, galactocele, fat necrosis, lipoma, papilloma, invasive ductal carcinoma and invasive lobular carcinoma.

Conclusion: Sonomammography is a powerful tool to evaluate breast masses as it is less affected by tissue density. It improves the visualization of tumours in radio dense breasts and as well as improves the specificity of mammography when used in conjunction.

Keywords: Mammography, fine needle aspiration cytology, fibroadenoma, fibrocystic disease.

INTRODUCTION

Definitive diagnosis of breast lesions without resort to formal biopsy is highly desirable both for patient and clinicians and thus avoids unnecessary breast surgeries in benign conditions [1]. The failure of mammography as a definitive diagnostic technique is usually due to problems associated with breast density [2] which leads to false positive diagnosis. Meticulous ultrasound including all the four quadrants of breast, nipple areola complex, axilla helps in diagnosing all the breast lesions, focal asymmetric densities and palpable abnormalities with 98% sensitivity [3], only disadvantage being that early nature of breast malignancy i.e. microcalcification cannot be detected by sonomammography.

MATERIALS AND METHODS

The present study was conducted in the Department of Radiodiagnosis, Rama Medical College Hospital and Research Centre, Kanpur, Uttar Pradesh, India. Patients under study were referred from Department of Surgery and Obstetrics & Gynaecology and evaluated by clinical and ultrasound examination.

Patient evaluation was done clinically and by radiological evaluation. Detailed clinical history was taken along with general and local examination. High resolution real time sonography of breast was also done. Patients were divided into different age groups i.e. 10-20, 21-30, 31-40, 41-50, 51-60 and 61-70 years. Lumps was seen in all patients and scanning was done with 7-10n MHZ Transducer on Siemens Accuson X 300 Premium Edition and Voluson P8. Sonographic examination of inner quadrants of breast was done in supine position and outer quadrants was done in decubitus and ipsilateral position with raised

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arms. Color doppler and Power doppler was used to determine vascularity [4].

Histopathological confirmation was done in all patients.

OBSERVATIONS AND RESULTS

Maximum number of patients with breast masses were seen in the age group 31-40 years followed by 41-50 and 51-60 years (Fig. 1).

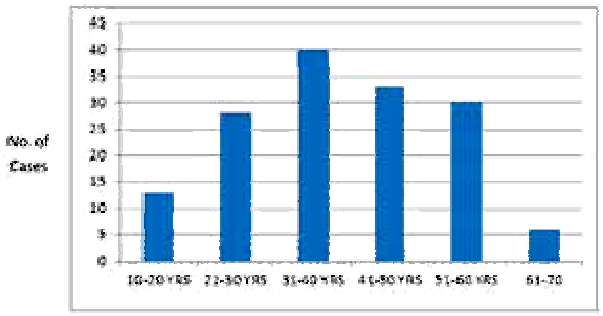

Fig. 1: Bar diagram showing number of cases in different age groups

Lesions of breast were detected in 89 cases, indeterminate in 4 and normal finding on USG was seen in 13 cases. Nature of lesion was divided into various types as observed in ultrasound. Of these maximum cases were of fibroadenoma (28.1%) followed by fibrocystic disease of breast (21.4%) (Table 1, Fig. 2-7)).

Table 1: Ultrasonic characterization of breast lesions (n=89)

Nature of lesion	No. of cases (%)
Fibroadenoma	25 (28.1)
Fibrocystic disease of breast.	19 (21.4)
Mastitis	10(11.3)
Breast cyst	6 (6.7)
Breast abscess	4 (4.4)
Fat Necrosis	3 (3.3)
Lipoma	2 (2.2)
Papilloma	2 (2.2)
Invasive Ductal Carcinoma	14 (15.8)
Invasive Lobular Carcinoma	4 (4.6)

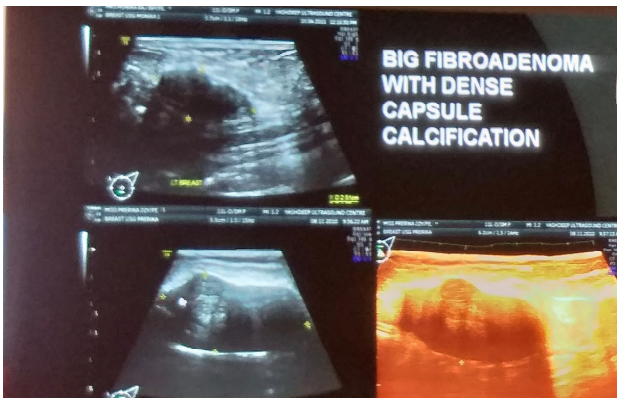

Fig. 2: Fibroadenoma with smooth margin (benign) with regular walls on USG

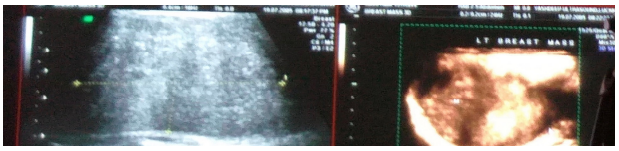

Fig. 3: Big Fibroadenoma with shadowing on USG

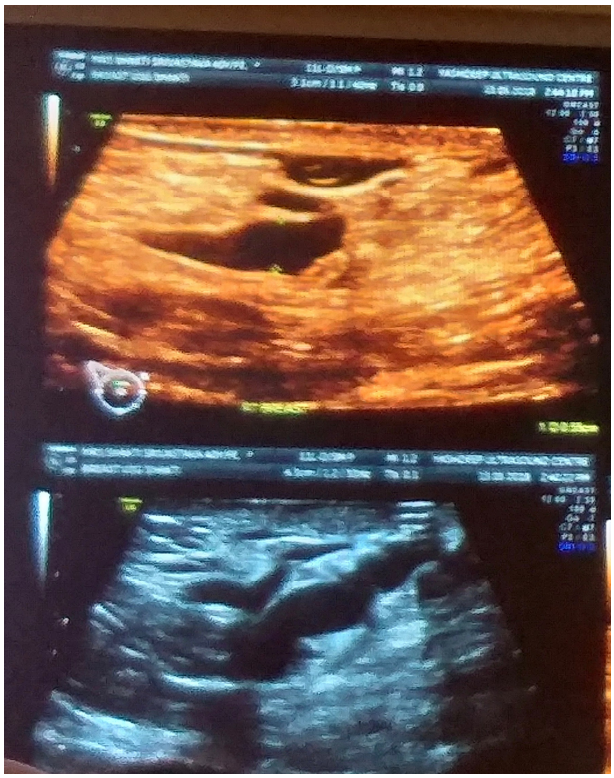

Fig. 4: Breast cyst (anechoic mass with thin walls) on USG

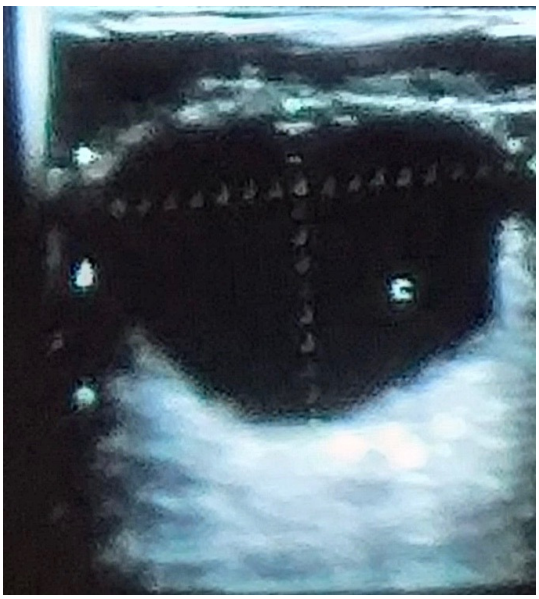

Fig. 5: Duct ectasia with dilated duct and irregular walls on USG

Fig. 6: Intraductal papilloma (small papillomatus growth in the duct) on USG

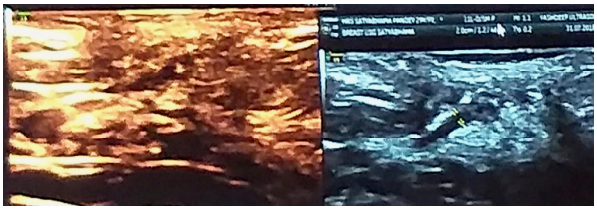

Fig. 7: Invasive lobular carcinoma (big irregular hetero-genous mass distorting the breast architecture)

Histopathological evaluation was also done and the lesions were categorized as benign, indeterminate and malignant of which benign were observed in maximum number of cases (Table 2).

Table 2: Histopathological categorization of lesion detected on USG examination (n=89)

Nature of lesion	No. of cases (%)
Benign	66 (74.15)
Indeterminate	4 (4.49)
Malignant	19 (21.32)

DISCUSSION

In our study, 106 patients with complaints of breast lumps were assessed. Mostly patients presented with clinical features of heaviness, lumpiness /actual lumps/swelling, pain, nipple discharge or retraction and combination of these complaints. Out of 106 patients, lesions were detected in 91 patients on ultrasound examination, while 11 patients were normal on clinical and ultrasound examination and 4 patients were with undetermined lesions on USG.

Benign breast disease comprised of fibroadenoma, fibrocystic disease, breast abscess, breast cyst, lipoma, trauma and haematoma. In fibrocystic diease, patient presented with pain in both breasts which was continuous /cyclical. USG revealed abundant fibrous tissue and cysts of varying size, thick glands and hypoechoic surrounding gives a mottled and spongy appearance to the breast. It is usually seen in young women. Sometimes found as incidental mass on ultrasound; it is usually homogenous, well defined, hypoechoic, ellipsoid, width more than height and may even show posterior enhancement. It may also present with foci of calcifications within. Fibroadenoma can be multiple / solitary. The calcifications within a fibroadenoma are coarse and may show posterior acoustic shadowing. Complex fibroadenomas have a higher incidence of transformation into breast cancer. On Color doppler evaluation, mostly lesions presented with mild/ absent vascularity [5,6]. Cases with breast abscess were seen in lactating females except one which presented post trauma which may be due to infected haematoma. Patients having breast cysts showed either simple or complex cystic features on USG.

On USG, simple cysts presented as completely anechoic lesion, with a thin echogenic capsule, posterior acoustic enhancement, and thin clear edge shadow. Complex cysts showed internal echoes, septations or thick irregular walls. Sometimes, it may appear as hypoechoic or solid echogenic lesion,

depends on its contents. On Color Doppler, mostly lesions present with increased peripheral vascularity.

Lipomas are fatty tumours in the breast parenchyma and appear uniformly ecogenic to heterogenous or completely anechoic masses. We found well defined oval echogenic mass, mildly compressible on probe pressure and did not show any significant vascularity. Lesions due to trauma or hematoma were found to be varied in appearance, grossly echogenic to completely anechoic in texture with a history of trauma.

Malignant breast lesions presented with irregular mass with heterogenous echoes surrounded by halo retrotumour shadowing in 40% cases, tumour nidus is small, irregular and poorly reflective, internal echo may be small in sub centimeter tumour, beam attenuation observed in 70% cases [7].

Characterstic/diagnostic features of malignant masses found were spiculations, angular margins, shadowing, calcifications, branch pattern, microlobulation and duct extension.

Papillomas in the breast may be intracystic or intraductal. They are difficult to differentiate from papillary carcinomas only on sonography and a FNAC/biopsy is required for confirmation. In our study, most of the patients with clinical complaint of bloody nipple discharge were turned out to be intraductal and intracystic papillomas/papillary carcinoma [8]. On USG, it presented as a complex cystic lesion with an intracystic, solid, polypoidal echogenic mass of varying sizes. On CD & PD, lesions presented with increased vascularity within solid echogenic component. Invasive ductal carcinoma presented with irregular ill-defined micro lobulated heterogenous mass with indistinct margins. These lesions were taller than their width in dimensions [9]. Invasive lobular carcinoma is the second most common breast malignancy and maybe seen in elderly women. Appearances are variable ranging from architectural distortion with shadowing. In our scans, ill-defined heterogenous hypoechoic lesions with areas of architectural distortions were observed.

Fat necrosis is a common entity. However, may pose difficulty to clinicians and sonologists. Fat necrosis may result from accidental trauma, after surgery or radiation therapy. The sonographic features of fat necrosis are varied and depend on the degree of fibrosis.

Axillary lymphadenopathy in normal breast on USG is an incidental finding. USG may some extent differentiate between benign and metastatic lymph nodes by presence of a fatty hilum which is absent in metastatic lymph nodes.

CONCLUSION

Sonomammography is a very dynamic and powerful tool for the evaluation of breast lumps. It very well differentiates between solid and cystic masses. It is good for assessment in non-palpable masses, assesses disease spread and aging, metastatic spread, USG guided FNAC, cheaper, having no radiation, good for assessing vascularity of lesion. Hence USG should be used as the primary investigation or in conjunction with X-ray mammography for the evaluation and characterization of the breast lumps.

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Original Article

MORPHOMETRIC ANALYSIS OF FORAMEN MAGNUM IN NORTH INDIAN POPULATION

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ABSTRACT

Introduction: Foramen magnum is a large opening located in the occipital bone of the skull. The morphometric analysis of foramen magnum is clinically and surgically important because vital structures passing through it may suffer compression such as in cases of achondroplasia, brain herniation and meningiomas.

Objectives: To study morphometric analysis of foramen magnum in dry human skulls and to measure its antero-posterior diameter, transverse diameter and foramen magnum index.

Material & Methods: 100 dried human skulls of unknown age and sex were obtained from Department of Anatomy, Rama Medical College and GSVM Medical College, Kanpur, Uttar Pradesh, India. Deformed samples were excluded. Different parameters were measured with the help of Vernier caliper.

Results: The mean antero-posterior diameter of foramen magnum was 33.79mm. The maximum antero-posterior diameter of foramen magnum was 40mm and minimum antero-posterior diameter was 28.2mm.The mean transverse diameter of foramen magnum was 28.30mm.The maximum transverse diameter of foramen magnum was 36mm and minimum transverse diameter was 21.5mm.The mean index of foramen magnum was 84.14mm.

Conclusion: The morphometric analysis of foramen magnum and its variation is important not only for anatomists but also important to the anesthetists, neurosurgeons, orthopedicians and radiologists ; while planning and performing cranio-vertebral junction procedures.

Keywords: Antero-posterior diameter, transverse diameter, foramen magnum index

INTRODUCTION

The posterior part of cranial base is largely occupied by occipital bone. Its most prominent feature is foramen magnum. It is the largest bony foramen in the base of skull. It lies in antero-median position and leads into the posterior cranial fossa. It is oval and wider behind with its greater diameter being antero-posterior diameter [1]. Foramen magnum provides a wide communication between posterior cranial fossa and the vertebral canal. The major structure passing through this large foramen are lower end of medulla oblongata with meninges, vertebral arteries, spinal accessory nerve, anterior and posterior spinal arteries, apical ligament of dens and tectorial membrane. Anteriorly, the margin of foramen magnum is slightly overlapped by the occipital condyles, which articulate with the first cervical vertebra to form atlanto-occipital joint [1]. In the midline, the anterior margin of the foramen magnum is called basion and the posterior margin is called opisthion [2]. Foramen magnum is surrounded by different parts of the occipital bone. The squamous part lies behind and above, basilar part in front and a condylar part on either side [3].

Diameters of foramen magnum have been reported to be about 35mm antero-posterior and 30mm transverse [4]. Dimensions of foramen magnum differ in each individual skull. Depending on the dimensions there are various types of shapes of foramen magnum. It can be oval, egg shaped, rounded, tetragonal, pentagonal, hexagonal and

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irregular [5]. Most common shape observed is oval shape. The importance of variations in shape is due to its effects on the vital structures passing through it. Its shape also plays an important role in deciding various surgical approaches in this region. Dimensions of the foramen magnum has clinical as well as surgical importance because the vital structures that pass through it may get compressed in various conditions such as foramen magnum stenosis, achondroplasia, foramen magnum brain herniation and foramen magnum meningiomas. These may result into life-threatening respiratory complications [6]. The knowledge of diameters of foramen magnum is needed to determine some malformations such as Arnold Chiari syndrome, in which there is expansion of transverse diameter [7].

The abnormalities of the cranio-vertebral junction can be congenital [8]. The progress in the neuroimaging techniques to diagnose cranio-vertebral abnormalities accurately has increased interest and scope for cranio-vertebral surgeries. Such surgeries are a challenging task for the neurosurgeons, because of the close relation of vascular and neural structures to foramen magnum. Advances in skull base surgeries such as 'far lateral transcondylar approach' have improved the better and wider access of surgical exposure leading to successful surgeries. To perform such surgeries, prior analysis of the morphometric dimensions of foramen magnum is essential [9]. The diameters of the foramen magnum are greater in male than female hence the study about foramen magnum dimensions can be used in the field of forensic medicine to determine sex in the medico legal conditions as in aircrafts injuries and war fare injuries [10].

The morphometric analysis of foramen magnum and its variation is important not only for anatomists but also important to the anesthetists, neurosurgeons, orthopedicians, radiologists, while planning and performing cranio-vertebral junction procedures [11].

The dimensions of the foramen magnum are clinically and surgically important because the vital structures that pass through it may suffer compression in case of foramen magnum achondroplasia , foramen magnum brain herniation, foramen magnum meningiomas [11].

MATERIALS AND METHODS

100 dried human skulls of unknown age and sex were obtained from Department of Anatomy, Rama Medical College & GSVM Medical College, Kanpur, Uttar Pradesh, India. Deformed samples were excluded.

The different parameters measured with the help of Vernier caliper were:

Foramen magnum length or Antero-posterior diameter: It was measured from basion which is the median point on the anterior margin of the foramen magnum to opisthion which is the median point on the posterior margin of the foramen magnum (Fig. 1).

Foramen magnum width or Transverse diameter: It was measured between two points of the foramen magnum on most laterally placed margins (Fig. 2).

Foramen magnum index (FM index): It was calculated by Foramen magnum width X 100/ Foramen magnum length.

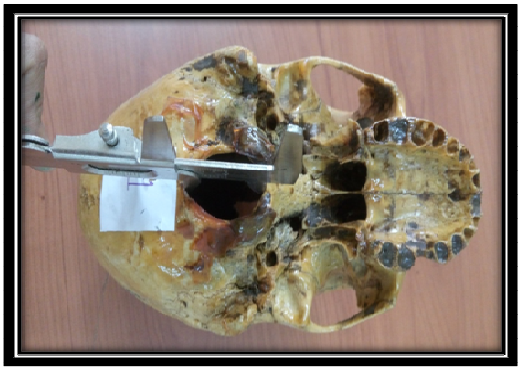

Fig. 1: Photograph showing measurement of antero-posterior diameter of foramen magnum

Fig. 2: Photograph showing measurement of transverse diameter of foramen magnum

OBSERVATIONS AND RESULTS

The various measurements of foramen magnum were made in 100 dried human skulls of unknown age and sex. The mean antero-posterior diameter of foramen magnum measured in our study was 33.79 mm. The maximum antero-posterior diameter of foramen magnum was 40mm and minimum antero-posterior diameter of foramen magnum was 28.2mm. The mean transverse diameter of foramen magnum was 28.30 mm. The maximum transverse diameter of foramen magnum was 36mm and minimum transverse diameter of foramen magnum was 21.5mm.The mean index of foramen magnum was 84.14mm (Table 1).

Table 1: Showing analysis of different parameters of skulls

Parameter	Number of skulls (100)
Mean antero-posterior diameter (mm)	33.79
Mean transverse diameter (mm)	28.30
Mean foramen magnum index	84.14

DISCUSSION

The morphometric analysis and shapes of foramen magnum were studied in 100 dried human skulls.

Antero-posterior diameter and Transverse diameter:

In present study, mean antero-posterior diameter of foramen magnum in 100 dried human skulls was found to be 33.79mm. The maximum antero-posterior diameter was 40mm and minimum antero-posterior diameter was 28.2mm. The mean transverse diameter was found to be 28.30mm. The maximum transverse diameter was 36mm and minimum transverse diameter was 21.5mm. Rajkumar et al. (2017) studied 298 dried human skulls of unknown sex and found that the mean antero-posterior diameter of foramen magnum was 33.98±2.75mm. The mean transverse diameter of foramen magnum was 28.16±2.15mm [12]. Sampada et al. (2017) studied 78 dried human skulls and found that the mean antero-posterior diameter was 34.84±2.32mm while the mean transverse diameter was 29.39±1.73mm [13]. Rohinidevi and Vimala (2016) studied 38 dried human skulls found that the mean antero-posterior diameter was 34.80mm. The maximum antero-posterior diameter was 42.18mm and minimum antero-posterior diameter was 31.10mm. The mean transverse diameter was 28.5mm. The maximum transverse diameter was 32.10mm and minimum transverse diameter was 25.20mm [14]. Sharma et al. (2015) studied 50 dried skulls of unknown sex and observed mean antero-posterior and transverse diameters of the foramen magnum as 38.75mm and 33.44 mm respectively [15]. Muralidhar et al. (2014) studied on 150 dried human skulls of known sex and found that the mean antero-posterior and transverse diameters of foramen magnum in males were 33.40mm and 26.70mm respectively. The mean antero-posterior and transverse diameter of foramen magnum in females were 33.6mm and 28.00mm respectively [16]. Jain et al. (2013) studied on 68 dried human skulls of known sex, found that the mean antero-posterior and transverse diameters of foramen magnum in males were 36.9mm and 31.5mm respectively. The mean antero-posterior and transverse diameter of foramen magnum in females were 32.9mm and 29.5mm respectively [17].

The findings of present study are nearly similar to that of Rajkumar et al. (2017) [12], Rohinidevi and Vimala (2016) [14], Sharma et al. (2015) [15] but different from Muralidhar et al. (2014) [16], Jain et al. (2013) [17].

Foramen magnum index:

In present study the mean index of the foramen magnum was 84.14.

Rajkumar et al. (2017) found the mean value of foramen magnum index 83.14±6.33 on 298 dry adult human crania of unknown sex [12]. Singh et al. (2017) found mean value of foramen magnum index as 84.65±6.32 in 100 dried human skulls of unknown sex [18]. Vinutha and Shubha (2016) found that the mean FM index of male skull bones was 82.54 ± 10.49, whereas in case of female skull bones, it was 83.52 ± 8.93 [19]. Kumar et al. (2015) found that the foramen magnum index was higher in females (89.01±6.84mm) compared to males (81.75±5.99mm) [10]. Sharma et al. (2015) found that the mean value of foramen magnum index was 87.68 on 50 dried human skulls [15]. The data obtained from the present study was compared with the data reported by other authors. After comparison, we observed that our findings were almost similar to that of Singh et al. [18] while different to Sharma et al. (2015) [15] and Kumar et al. (2015) [10].

CONCLUSION

The mean anteroposterior diameter of foramen magnum was 33.79mm and the mean transverse diameter was 28.30mm. These parameters should be taken during craniovertebral and cervical spine surgical procedures. The knowledge of dimensions of the foramen magnum is also helpful in determination of malformations like Arnold Chiari syndrome and in transcondylar approach to make a safe occipital condyles resection. The morphometric analysis of foramen magnum and its variation is important not only for anatomist but also important to the anesthetists, neurosurgeons, orthopedicians and radiologists while planning and performing cranio-vertebral junction procedures .

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Original Article

A CADAVERIC STUDY ON THE ANATOMICAL VARIATIONS OF THE MUSCULOCUTANEOUS NERVE IN RELATION WITH MEDIAN NERVE AND CORACOBRACHIALIS MUSCLE

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ABSTRACT

Introduction: Musculocutaneous nerve is derived from the lateral cord of brachial plexus and supplies the muscles of the arm. Initially the nerve accompanies the lateral side of third part of axillary artery and then pierces the coracobrachialis muscle after supplying it, passes downwards and laterally in between biceps brachii and brachialis sending branches to both and continues as lateral cutaneous nerve of the forearm. Variations of musculocutaneous nerve is important for surgeons, orthopedic surgeons and traumatologists, so a detailed cadaveric study of musculocutaneous nerve was done to observe the variations.

Material & Methods: Musculocutaneous nerve was studied in 50 human cadavers (30 males and 20 females) of age group 40-60 years at Department of Anatomy, Subharti Medical College, Meerut, India.

Results: Musculocutaneous nerve was present in all the cases and was piercing the coracobrachialis muscle. In 4% of the cases, the nerve was rejoining the median nerve after piercing the coracobrachialis.

Keywords: Musculocutaneous nerve, median nerve, coracobrachialis.

INTRODUCTION

Variations in the terminal branches of the cords of brachial plexus are common and reported in literature. Variations of musculocutaneous nerve and its branches have been reported previously. The musculocutaneous nerve may be found absent in some studies. Some authors observed that the musculocutaneous nerve do not pierce the coracobrachialis [1-3].

The musculocutaneous nerve may be found absent in some studies [1, 4-7]. Some authors also observed that the musculocutaneous nerve joins the median nerve after piercing coracobrachialis muscle [1, 7-9]. So, a detailed study was done for the observation of variations of musculocutaneous nerve in human cadavers.

MATERIALS AND METHODS

Hundred upper Limbs (Rt-50 Lt-50) from fifty embalmed human cadavers (30 males and 20 females) of age group 40-60 years were dissected and observed for a period of four year. The pectoral region, axilla, arm and forearm region were dissected to observe the cords of brachial plexus and the variations of musculocutaneous nerve were observed.

OBSERVATIONS AND RESULTS

The musculocutaneous nerve was present in all the limbs. In all the cases, musculocutaneous nerve was originating from lateral cord and was piercing the coracobrachialis muscle. In two cases, musculocutaneous nerve was observed to join the median nerve after piercing coracobrachialis muscle on both the sides (4% of cases). The lateral root of median nerve from the lateral cord was small in both the cases (Fig. 1&2).

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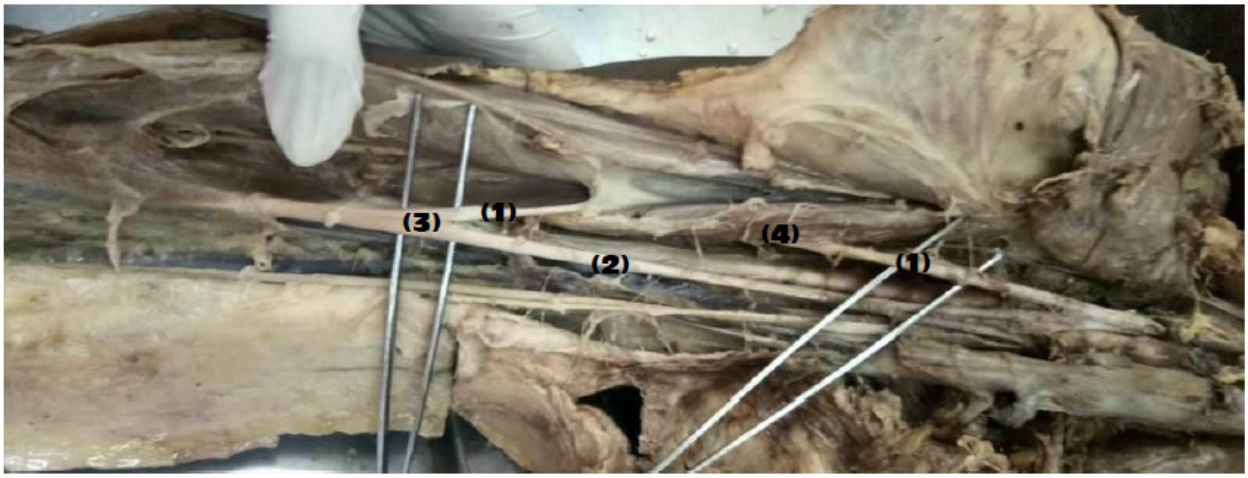

Fig. 1 : Photograph showing joining of Musculocutenous Nerve with Median Nerve after piercing Coracobrachialis Muscle (Right Limb).
(1). Musculocutenous Nerve (2). Median Nerve (3). Joining of Musculocutenous Nerve & Median Nerve
(4). Coracobrachialis Muscle

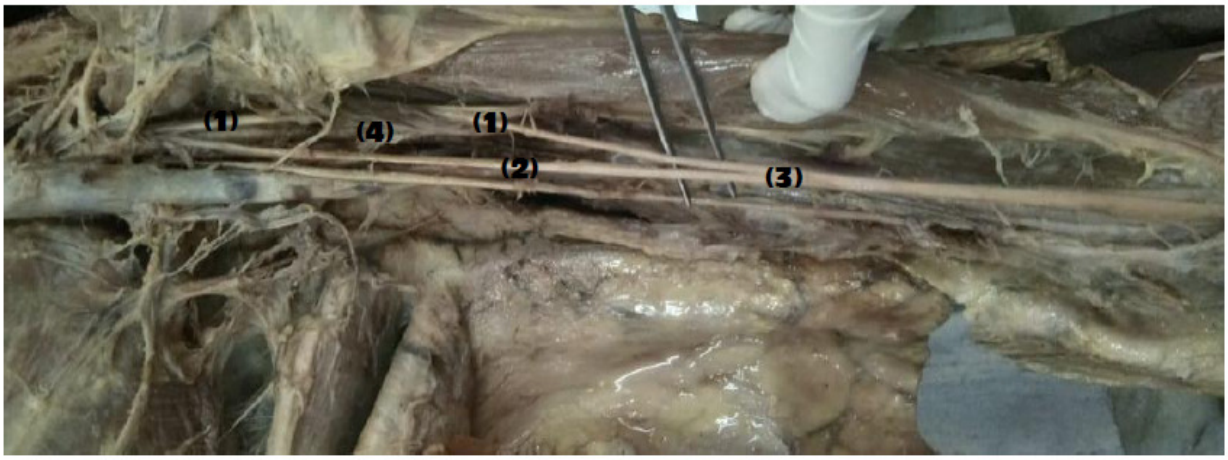

Fig. 2 : Photograph showing joining of Musculocutenous Nerve with Median Nerve after piercing Coracobrachialis Muscle (Left Limb).
(1). Musculocutenous Nerve (2). Median Nerve (3). Joining of Musculocutenous Nerve & Median Nerve
(4). Coracobrachialis Muscle

DISCUSSION

The musculocutaneous nerve arises from lateral cord of brachial plexus, innervates the muscles of the arm and pierces the coracobrachialis muscle and continues as lateral cutaneous nerve of the forearm [10]. The musculocutaneous nerve has frequent variations. It may run behind coracobrachialis or adhere for some distance to the median nerve and pass behind biceps. Another variation in which the musculocutaneous nerve did not pierce the coracobrachialis (Table 1) but rather pass between it and the biceps, and in some

cases the nerve split, one part going superficial to the muscle and the other through the muscle [11]. Prasada and Chaudhary (2001) reported two cases of absent musculocutaneous nerve from lateral cord of brachial plexus [4].

Ihunwo et al. (1997) reported a case of the bilateral absence of the musculocutaneous nerve from the lateral cord of the brachial plexus [5] (Table 2). But in our study the musculocutaneous nerve was present in all the cases. The musculocutaneous nerve was rejoining the median nerve after piercing coracobrachialis muscle was reported by Joshi et al. (2008) in one case [8] and in 3.125% of cases reported by Bhattarai and Poudel (2009) [9] (Table 3). But in our study we observed the joining of musculocutaneous nerve with median nerve after piercing coracobrachialis muscle in 4% of the cases bilaterally. Iwata (1960) explained on the embryological basis that the brachial plexus appeared as a single radicular cone in the upper limb, which was divided into ventral and dorsal segments.

The ventral segments gave roots to the median and ulnar nerve. The musculocutaneous nerve arose from the median nerve [12] Jamuna and Amudha (2011) reported three cases of absent musculocutaneous nerve unilaterally and in 2% of limbs the nerve was rejoining median nerve after piercing coracobrachialis [1] (Table 2,3).

But in our study in all the cases musculocutaneous nerve was present. Nakatani et al. (1997) and Le Minor (1990) observed the absence of the musculocutaneous nerve from the lateral cord of the brachial plexus [6,7] (Table 2). Nayak et al. (2006) reported that in one limb, the musculocutaneous nerve had a low origin and that the nerve was not piercing the coracobrachialis [2]. In present study, the musculocutaneous nerve was present in all the cases and was found to pierce the coracobrachialis muscle. Chitra (2007) observed in two cases that the musculocutaneous nerve did not pierced the coracobrachialis [3]. Thakur et al. (2015) observed musculocutaneous nerve not piercing coracobrachialis in 7.5% cases [13] and Babu et al. (2016) in 4% of the cases [14].

Table 1: Comparison of studies on musculocutaneous nerve not piercing coracobrachialis

Authors	Percentage of cases observed
Jamuna & Amudha (2011) [1]	6%
Nayak et al. (2006) [2]	1.66%
Chitra (2007) [3]	4%
Present study (2018)	0%

Table 2: Comparison of studies on absence of musculocutaneous nerve

Authors	Percentage of cases observed
Prasada & Chaudhary (2001) [4]	3% (Bilaterally)
Ihunwo et al. (1997) [5]	1% (Bilaterally)
Jamuna & Amudha (2011) [1]	2% (Bilaterally)
Nakatani et al. (1997) [6]	1% (Unilaterally)
Le Minor (1990) [7]	1% (Unilaterally)
Present study (2018)	0%

Table 3: Comparison of studies on rejoining of musculocutaneous nerve with median nerve after piercing coracobrachialis muscle

Authors	Percentage of cases observed
Joshi et al. (2008) [8]	1%
Bhattarai & Poudel (2009) [9]	3.125%
Jamuna & Amudha (2011) [1]	2%
Le Minor (1990) [7]	3%
Present study (2018)	4%

CONCLUSION

Variations of musculocutaneous nerve are common and the knowledge of these variations are important for surgeons. It can be concluded from the present

study that variations are not uncommon in musculocutaneous nerve and in our study in 4% of the cases, the musculocutaneous nerve were found to rejoin the median nerve after piercing coracobrachialis.

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Original Article

MORPHOLOGICAL STUDY OF VARIATIONS IN FORAMEN TRANSVERSARIUM OF ATLAS VERTEBRA

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ABSTRACT

Introduction: Foramen transversarium are the characteristic bony feature of the cervical vertebrae. They are located on the transverse process of cervical vertebrae through which second part of vertebral artery passes along with vertebral venous and sympathetic plexus. Their variations are common with regard to size, shape, incomplete, duplicated and may even absent.

Material & Methods: Two hundred foramen transversarium of one hundred atlas vertebrae were examined for morphological variations.

Results: Out of hundred atlas vertebrae examined, foramen transversarium was present in all. Absence of costal element was noticed in four atlas vertebrae. Four atlas vertebrae showed incomplete bilateral foramen transversarium while four showed unilateral duplicated foramen transversarium.

Conclusion: The increasing incidence of neck injuries and related syndromes necessitates the study of bony variations of the atlas vertebra and its foramen transversarium. The second part of vertebral artery is prone to be damaged during neck surgeries and posterior cervical injuries due to incomplete formation of the foramen transversarium, hence the knowledge of such variations is important for surgeons, otorhinolaryngologists, neurologists, orthopedicians, radiologists and physicians.

Keywords: Foramen transversarium, atlas vertebrae, vertebral artery.

INTRODUCTION

Atlas, the first cervical vertebra supports the globe of the head and hence its name. It differs from other cervical vertebrae in lacking a body; and spine, with large lateral mass on both sides, and the two transverse processes are widest apart relative to other cervical vertebrae [1].

The second part of the vertebral artery passes through foramen transversarium of C6–C1 along with vertebral venous plexus and sympathetic plexus, it then enters the foramen magnum and joins with the corresponding vertebral artery to form basilar artery [1]. The atlas vertebra differs in structure from other cervical vertebrae and variations of this vertebrae are common. In the past, various studies has been conducted by many authors on the variations in size, shape, absence, incomplete [2-5] or duplicated foramen transversarium [6-8].

Such variations in the foramen transversarium may cause compression of vertebral artery during manipulation of cervical spine surgery, excessive exercise of the neck, physiotherapy and this may result in vertebro-basilar ischemia which may lead to common symptoms like migrane, vertigo, diplopia, shoulder pain, neck pain and sometime cerebro-vascular incidents [8]. Hence, the knowledge of variation of foramen transversarium of atlas vertebrae is important for physicians, surgeons, orthopedicians, neurologists and physiotherapists [5].

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MATERIALS AND METHODS

One hundred atlas vertebrae of unknown sex of North Indian population were studied in the Department of Anatomy, Subharti Medical College, Meerut, Uttar Pradesh, India. Foramen transversarium were studied for presence, absence, incomplete and duplication in one hundred atlas vertebra.

OBSERVATIONS AND RESULTS

Out of one hundred atlas vertebrae examined, foramen transversarium were present in all of the vertebrae. Foramen transversarium was present in all the cases (100%) i.e. complete in 92%, in 4% incomplete and in 4% of cases double foramen transversarium was present (Table 1). In four atlas vertebrae (4%), costal vertebrae showed incomplete foramen transversarium bilaterally. In four vertebrae (4%), duplication of foramen transversarium were present unilaterally (Fig. 1&2).

Table 1: Incidence of occurrence of various types of foramen transversarium

Types of Foramen Transversarium	Number Observed	Incidence
Complete	92	92%
Incomplete	4	4%
Double	4	4%
Absent	0	0%

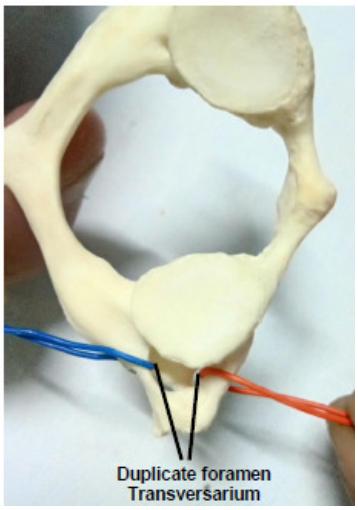

Fig. 1: Photograph showing unilateral duplicate foramen transversarium

Fig. 2: Photograph showing incomplete foramen transversarium

DISCUSSION

Variations of atlas vertebrae is common [1], many authors have observed different variations of atlas vertebrae like deficient anterior arch, deficient posterior arch, retroarticular foramen, accessory foramen, duplicated, incomplete or absent foramen transversarium [2-8] (Table 2 & 3). Zambare and Reddy (2011) studied fifty atlas vertebrae and found complete in 4% of cases and incomplete ring of foramen in 12% cases [9]. Chauhan and Khanna (2013) studied fifty atlas vertebrae and found absence of costal element in seven vertebrae [4]. Taitz and Nathan (1986) reported absence of the transverse foramen at C4 and C6 vertebrae [6]. Vasudeva and Kumar (1995) reported unilateral absence of foramen transversarium on the left side of atlas [10]. Nayak (2007) observed bilateral absence of foramen transversarium [11]. But in present study, foramen transversarium were present in all the cases. Aziz and Morgan (2018) observed 7% incomplete and 17.7% double foramen transversarium [8]. Sethi et al. (2014) observed 97% complete, 2% incomplete and 1% absent foramen transversarium of atlas vertebrae [5]. Karau and Odula (2013) observed 7.8% incomplete foramen transversarium [2]. Hasan et al. (2001) observed 8.60% double foramen transversarium [7]. Gupta et al. (2013) observed 8.57% incomplete foramen transversarium [3]. But in present study we observed that foramen transversarium was present in all the cases i.e. complete in 92%, in 4% incomplete and in 4% of cases double foramen transversarium was present.

Table 2: Comparison of findings on foramen transversarium of present study with previous studies

Authors	Population	Absent Foramen Trans-versarium	Incomplete Foramen Trans-versarium
Karau and Odula (2013) [2]	Kenyans	0	7.8%
Gupta et al. (2013) [3]	Indians	-	8.57%
Chauhan and Khanna (2013) [4]	Indians	-	10%
Sethi et al. (2014) [5]	Indians	2%	2%
Present Study (2018)	Indians	0%	4%

Table 3: Prevalence of double transverse foramina in different study population

Authors	Population	Prevalence of double foramina
Taitz and Nathan (1986) [6]	Indians	7%
Hasan et al. (2001) [7]	Roaman	8.60%
Karau and Odula (2013) [2]	Kenyans	3.90%
Aziz & Morgan (2018) [8]	Egyptian	17.70%
Present Study (2018)	Indians	4%

CONCLUSION

It can be concluded from the present study that variations are not uncommon in foramen transverserium of atlas vertebrae. Anatomical variations of atlas vertebrae especially in the bony bridges embracing the vertebral artery and first cervical nerve is common which may be responsible for various neurological disturbances. Knowledge of such variations is important for physicians, otorhinolaryngologists, neurologists and orthpaedicians.

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Original Article

CT SCAN BASED EVALUATION OF SPLENIC INDEX IN PATIENTS FROM LUCKNOW AND ADJOINING AREAS

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ABSTRACT

Introduction: The Indian subcontinent is an endemic zone for diseases like malaria and filaria which alter the size of spleen to a variable extent. In order to identify and examine the spleen accurately, the modes of investigation that are at our disposal are Ultrasonography, Computerised Tomography, Magnetic Resonance Imaging and Radionuclide Scan. Linear dimensions are of limited use as a guide to normal splenic size on CT because the spleen is irregular in shape and is obliquely oriented within the left upper quadrant. A more accurate approach to the assessment of splenic size is the splenic index. Sufficient and reliable data for its normal values are lacking. The objective of the present study was to generate normative data of splenic index which could be used as a research and clinical tool.

Material & Methods: It was an open randomized study carried out on 80 adults between 20 to 70 years of age. Spleen was identified in each transverse, coronal and sagittal section image of helical CT scan.

Results: The average splenic index, calculated as a product of the three measured linear dimensions of spleen i.e. length, breadth and thickness, in males was 369.89 cm^3 and in females 298.61 cm^3. The mean splenic index was calculated as 342.62 cm^3.

Conclusion: The results can be used for evaluating patients with suspected splenomegaly, in certain clinical situations where objective measurement of splenic dimensions and comparison with normal values is required, and in drafting of government policies and programs related to malaria and filaria control where these normal values of splenic index help by identifying populations more susceptible to such infections.

Keywords: Spleen, splenomegaly, splenic index, computerised tomography.

INTRODUCTION

Spleen is an ovoid, purplish organ, about the size and shape of one's fist, located in the superolateral part of the left hypochondrium of the abdomen [1]. The size and weight of spleen vary with age and sex. It can also vary slightly in the same individual under different conditions [2]. Usually, the spleen is not palpable in adults [3]. In majority of cases, if its lower edge can be palpated, it is enlarged about three times its normal size [1]. So, palpation is not a reliable method for determination of spleen size [4]. Normally crescentic spleen appearing somewhat spherical and its extension anterior to the aorta or below the right hepatic lobe or rib cage are further clues to splenomegaly.

In order to identify and examine the spleen accurately, we usually have to rely on certain investigations. The modes of investigation generally used are Ultrasonography, Computerised Tomography, Magnetic Resonance Imaging and Radionuclide Scan [5].

Ultrasonography is most commonly used in routine practice for examining spleen but this method can be inaccurate since the contour of spleen is variable. It is difficult to scan the entire spleen completely in one

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sitting due to bone, bowel gas or left kidney intervening between the ultrasound probe and spleen. Therefore, Computerised Tomography is considered to be more reliable than Ultrasonography as far as examination of spleen is considered [5].

Diagnosing a large number of diseases incorporates the assessment of splenic size as this organ gets enlarged to a variable extent in a variety of disorders [6]. Many observers while studying spleen generally rely on their personal experience in order to judge the splenic volume.

The spleen measures 12 to 15 cm in length, 4 to 8 cm in width, and 3 to 4 cm in thickness [7]. These measurements are of limited use as a guide to normal splenic size on CT due to the spleen's irregular shape and oblique orientation within the left upper quadrant,

A more accurate approach to the assessment of splenic volume is the splenic index. Splenic Index [SI] is a research tool. It is a volumetric index and is used as an indicator in surveillance of malaria.

A high splenic index is generally of no concern. A low splenic index indicates a compromised immune system. This is usually an indication that the spleen is not producing an adequate amount of lymphocytes leading to a weakened immune system. Consequently, susceptibility to infections like malaria and filaria is increased. Thus, the SI is used as an indicator for immunity against malaria and filarial infection. Population having high SI is considered less susceptible or immune to such kind of parasitic infections [8].

In the Indian population, calculation of the normal splenic index becomes difficult since in endemic diseases like malaria and filaria, a variable change in the size of spleen is seen.

MATERIALS AND METHODS

The present study was conducted in the Department of Anatomy in collaboration with the Department of Radiodiagnosis at Era's Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, India. Patients were recruited from the Radiodiagnosis department. Inclusion criteria was adults between 20 to 70 years of age [9]. Exclusion criteria were abnormal appearance of spleen on CT scan, diagnosed cases of pathologies involving the spleen, where the entire length of the spleen could not be properly documented, fever at least four weeks prior to the scan and pregnancy.

Informed consent was taken. Medical history of all subjects was reviewed. Spleen was identified in each transverse, coronal and sagittal section image of helical CT scan. CT was performed on SIEMENS SOMATOM FORCE, 384 slice machine, by a single observer.

For maximum length of spleen, craniocaudal length was measured from the most superior margin to the most inferior margin of the spleen in coronal section image [10]. Maximum width and thickness were measured on the transverse section images. Width was measured as the greatest overall dimension. Thickness was measured as the perpendicular distance between the hilum and the outer convex surface of the spleen (Fig. 1) [10].

The Splenic Index (SI) was calculated as: **SI = length x width x thickness (cm)**

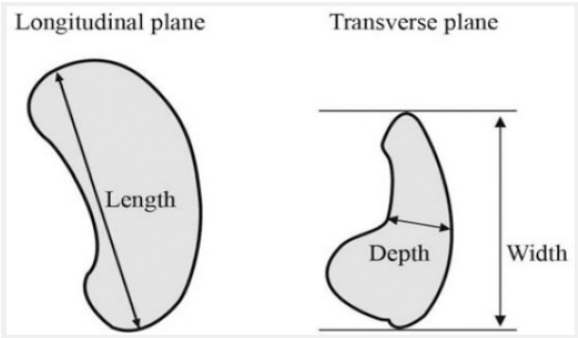

Fig. 1: Method of measuring the linear dimensions of spleen

OBSERVATIONS

In the present study, a total of 80 participants were recruited aged between 20 to 70 years and was divided into five groups (Table 1). Out of these, 54 were males (67.5%) and 26 females (32.5%).

Table 1: Age-wise demographic profile of the study population

Age (years)	No.	%
20-30	15	18.8
31-40	14	17.5
41-50	27	33.8
51-60	13	16.3
>60	11	13.8
Mean Age±SD	45.11±14.12 (20-75)	

A significant association was found between age and splenic parameters. There was a steady increase in the splenic index till the beginning of 4th decade of life. Thereafter, with advancing age, there was a significant reduction in the mean value of splenic index (Fig. 2).

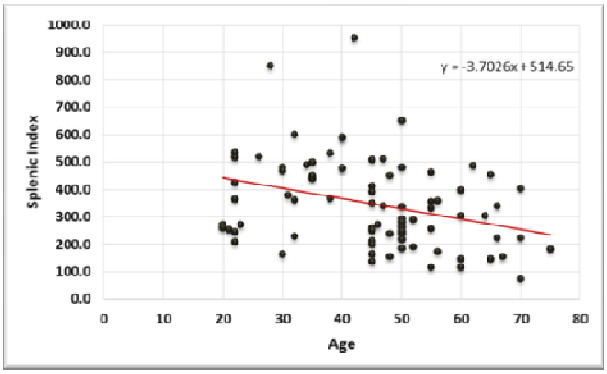

Fig. 2: Graph showing correlation of age with splenic index

The average length of spleen in males, measured craniocaudally, was 9.69 cm and in females, it was 9.29 cm, average of the two being 9.57 cm. The average width was measured as 8.85 cm in males and 8.22 cm in females, average of the two being 8.65 cm. The average thickness of spleen in both males and females was 4.06 cm.

The average splenic index was calculated as a product of the three measured linear dimensions of spleen i.e., length, width and thickness. In males, it came out to be 369.89 cm³ while in females, it was 298.61 cm³. The mean splenic index was calculated as 342.62 cm³ (Fig. 3).

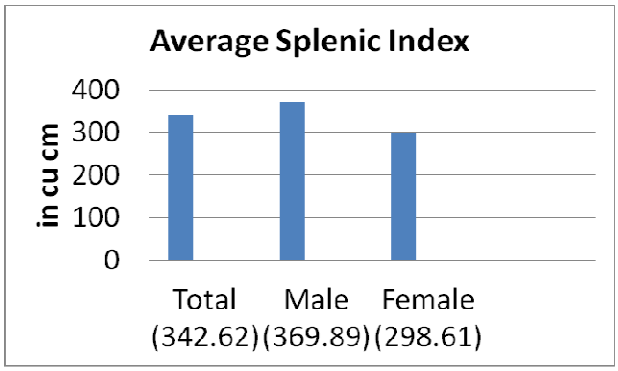

Fig. 3: Bar diagram showing average splenic index of the study population

DISCUSSION

We found that gender did not affect the splenic index, however a significant association was found between age and splenic parameters. There was a steady increase in the splenic index till the beginning of 4th decade of life. Thereafter, with advancing age, there was a significant reduction in the mean value of splenic index.

The splenic index did not show significant sexual difference though female had a lesser value (male 369.89 cu cm and female 298.61 cu cm, $p<0.160$).

Strijk et al. (1987) had measured the splenic index and gave a mean value of 449 on European population [11] which is considerably higher than the value we got in our study i.e. 342.62 cm³.

Grissom and Shintr (1998) calculated his upper normal value as 425-450 cm³ (20) which again is more than what we have found. They calculated the splenic index by multiplying the greatest anteroposterior, transverse and length of the spleen. This is usually by CT measurements although MRI or USG could also be used [12].

Jong et al. (2009) defined the upper limit of normal for splenic index as 725 cm³. They found a mean value of 395 ±163 cm³ for splenic index in their study on 111 subjects [13]. This again was more than our finding. The normal value of splenic index is around 480 cm³ [13].

So, we found that the splenic index of Indian adult population residing in the area of our study lies below the range given for European and American population and it is much less than the normal value of splenic index which is 480. This makes them much more susceptible to infections like malaria and filaria.

We also found that splenic index, when calculated as the product of splenic length, width and thickness, is a simple and rapid procedure. This is especially helpful when we are defining splenic size in vivo. The splenic index is also a needful tool to assess splenomegaly.

Before diagnosing splenomegaly, it is necessary to know the normal value of splenic index. This value becomes even more important in context of the Indian subcontinent because this region is an endemic zone of infections like malaria and filaria.

CONCLUSION

The aim of this work was to determine the normal splenic index in North Indian adult population and compare it with the published data.

The results provide a normal value of splenic index for a part of the population and hence suggest that a lower cut off value is needed for making a diagnosis of splenomegaly. Splenic index can be used for evaluating patients with suspected enlargement of spleen. The findings can also be helpful in certain clinical situations where splenic dimensions and comparison with normal values is required. The Splenic index can also be used in drafting of government policies and programs related to malaria and filaria control where normal values of splenic index may help in identifying populations susceptible to infections.

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Original Article

ESTIMATION OF STATURE FROM HAND LENGTH

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ABSTRACT

Introduction: Estimation of stature from hand length is considered as an important parameter in medico-legal and forensic examinations. When highly decomposed and mutilated dead bodies with fragmentary remains are brought for postmortem examination, it becomes difficult to identify the deceased. Therefore, an attempt has been made in this study to derive a linear regression equation for estimation of stature from the length of hand.

Material & Methods: The present study was conducted on 506 medical students (255 males and 251 females) of age group 18-25 years, at Index Medical College Hospital and Research Center, Indore. The measurements were taken by using standard anthropometric instruments.

Results: The observed data was subjected to statistical analysis. The 't' test applied for correlation coefficient. The value of 't' was found to be statistically significant. Simple linear regression equation derived was used for estimation of height.

Conclusion: It was concluded that the hand length provides good reliability in estimation of stature in forensic examinations and in medico-legal cases and the correlation between present parameters would be helpful in medico-legal cases for identification of individuals.

Regression equation derived can be of help in artificial limb centers for construction of prosthesis required in cases of amputations following gangrene, trauma, frostbite etc.

Keywords: Anthropometry, hand length, stature.

INTRODUCTION

Various factors such as nutritional status, environment, age, race and gender affects human growth [1]. The stature prediction occupies relatively a central position in the anthropological research and in identification necessitated by medico-legal experts [2]. Whenever the body is recovered in mutilated or fragmented state, the problem of identification of the person is difficult even by the most experienced forensic experts. The mutilation of dead body is done by a criminal who wants to destroy all the traces of identity and to facilitate the disposal of dead body [3]. Height is fundamental to assess growth, nutrition, calculating body surface area and predicting pulmonary function in childhood [4]. The following study was conducted to estimate the stature from hand length and to find out the correlation between hand length with the stature of the individuals of different sex.

Ascertaining sex and estimation of stature from incomplete skeletal and decomposing bodies is a recurring theme in physical anthropology and forensic science. This has become useful in recent times due to mass disasters like train and plane accidents, mass suicide, tsunamis, forest fires, earthquakes and cyclones. Identification in forensic investigation, the relationship between different body parts especially the limbs is being used to establish sex and stature. Specifically hand and foot have been used by many investigators to determine sex and to estimate stature.

Stature estimation of an individual from skeletal material, mutilated, amputated limbs and parts of limb

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has obvious significance in personal identification in events of murders, accidents or natural disasters mainly concerning with forensic identification analysis. Estimation of stature from hand, finger and phalangeal length has been reported by many authors [5-8].

MATERIAL AND METHODS

The present study was conducted on 506 medical students including 255 males and 251 females of age group 18-25 years old, at Index Medical College Hospital and Research Center, Indore between August 2012 to July 2013. The subjects were selected irrespective of their caste, religion, dietary habits and socio-economic status. The subjects were apparently healthy and without any craniofacial deformity.

Parameters for measurement

Height of the individual- Height was taken from the vertex of subject to the standing surface, bare footed by Standard flexible measuring steel tape (Fig. 1a,b).

Hand Length– was measured from the distal crease of wrist joint to the tip of middle finger, on the palmar surface when dorsal surface of hand rested over the table by using Vernier Caliper (0-200 mm) (Fig. 1c).

All the measurements were taken in millimeters (mm).

Fig. 1: Photographs showing: a. Flexible measuring steel tape**; b.** Measurement of height**; c.** Measurement of hand length.

The calculations was done using regression formula.

Regression: It is used to express the functional relationship between two variables. In the most basic form of this technique (simple linear regression), the value of one variable (X) e.g. age or diameter is used to predict the value of the other variable (Y) e.g. diameter. In simple linear regression equation, X is an independent variant and y is a dependent variant**.** It is particularly useful in generating curves for various diameter parameters.

Simple Linear Regression

The relationship between two variables may be one of functional dependence of one on the other. That is, the magnitude of one of the variables (the ***dependent variable***) is assumed to be determined by i.e., is a function of the magnitude of the second variable (the ***independent variable***). The independent variable is also called the "predictor" or "regressor" variable and dependent variable the "response" or "criterion" variable. The term "dependent" does not imply a cause-and-effect relationship between the two variables.

The simple linear regression equation:

$Y = a + bX$

X = Independent variable

Y = Dependent variable

Where a = Intercept, b = Slope

Such a dependent relationship ($Y = a + bX$) is termed as regression, the term simple regression refers to the fact that only two variables are being considered. The regression coefficient intercept (a), generally represent the background value of the dependent variable (Y) and thus, intercept has the same units as of Y, the dependent variable. The regression coefficient (b), generally called slope, expresses what change in Y is associated, on the average, with a unit change in X. The units of b are the units of Y divided by the units of X.

OBSERVATIONS AND RESULTS

Total 506 medical students including 255 males and 251 females of age group between 18 - 25 years old were included in this study.

The total height (Mean ± SD) in males was 1709.05 ± 113.39 mm. Right hand length (Mean ± SD)

was 193.19 ± 10.34 and left hand length (Mean ± SD) was 193.49 ± 10.28 in males. The total height (Mean ± SD) in females was 1533.74 ± 205.44 mm. Right hand length (Mean ± SD) was 178.11 ± 9.55 mm and left hand length was 177.84 ± 9.82 mm in females (Fig. 2).

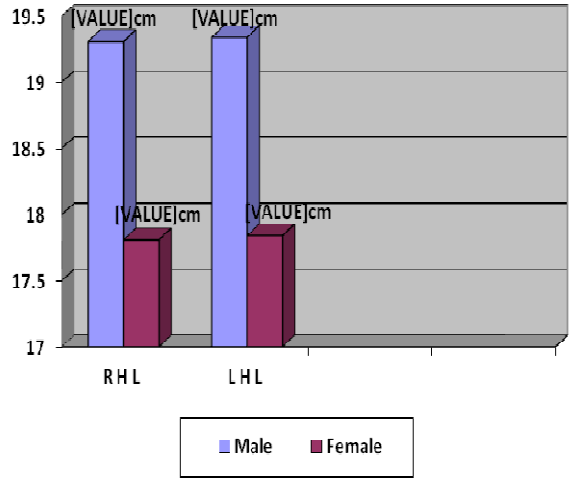

Fig. 2: Bar diagram showing right hand length (RHL) and left hand length of male and female

Regression analysis was done for various parameters and total height versus right and left hand length for both male and female (Tables 1-4). The value of 't' was found to be statistically significant.

Regression equation formula for males:

Height of male = 940.0 + 3.9805 X right hand length of male

Height of male = 974.1 + 3.7981 x left hand length of male

Regression equation formula for females:

Height of female = 948.42 + 3.4442 x right hand length of female

Height of female = 968.95 + 3.3339 x left hand length of female

Table 1: Regression analysis of various parameters in male & female

Parameter	Sex	Coefficient	SE coefficient	t	p
Constant	Male	508.4	158.3	3.21	0.001
	Female	726.01	95.48	7.60	0.000
Right hand length (mm)	Male	4.890	2.985	1.64	0.103
	Female	1.032	1.624	0.64	0.525
Left hand length (mm)	Male	-4.137	2.994	-1.38	0.168
	Female	0.810	1.571	0.52	0.607

Table 2: Regression analysis of total height (mm) versus right and left hand length (mm) in male & female

Parameter	Sex	Coefficient	SE coefficient	T	P
Constant	Male	940.0	124.3	7.56	0.000
	Female	948.42	58.66	16.17	0.000
Right hand length (mm)	Male	3.9805	0.6427	6.19	0.000
	Female	3.4442	0.3289	10.47	0.000
Left hand length (mm)	Male	3.7981	0.6509	5.83	0.000
	Female	3.3339	0.3204	10.41	0.000

Table 3: Correlation of total height in relation to other parameter in male & female

Parameter	Sex	Pearson correlation	p value
Right hand length and total height	Male	0.632	0.000
	Female	0.553	0.000
Left hand length and total height	Male	0.620	0.000
	Female	0.551	0.000

Table 4: Regression analysis of total height versus other parameters in both males and females combined

Parameter	Co-efficient	SE coefficient	t	p	Significance	
Constant	252.40	43.33	5.83	0.000	P<.001	High significance
Right hand length	0.980	1.058	0.93	0.355	P>.05	Non significance
Left hand length	0.765	1.043	0.73	0.464	P>.05	Non significance

DISCUSSION

The present study of estimation of stature from hand length in 506 cases (255 males, 251 females), age group ranging from 18 – 25 years were compared with other studies. The various measurements include estimation of total height, right and left hand length. The findings of present study i.e. the mean value of the right hand length 19.31 ± 1.03 cm and left hand length 19.34 ± 1.02 cm in males correlates with that of previous studies [2,9-12] (Table 5).

Table 5: Comparison of hand length in males of present study with previous studies

S. No.	Authors	Sex	Sample Size	Side	Mean	SD
1.	Ilayperuma et al. (2009) [9]	Male	140	- -	19.01	0.86
2.	Sunil et al. (2005) [10]	Male	75	Rt.	19.6	1.3
				Lt.	19.5	1.2
3.	Oommen et al. (2005) [11]	Male	50	Rt.	19.06	.737
				Lt.	19.06	.719
4.	Danborno & Elukpo (2008) [12]	Male	250	Rt.	19.85	0.86
				Lt.	19.93	0.93
5.	Jasuja & Singh (2004) [2]	Male	30	Rt.	19.80	0.73
				Lt.	19.79	0.76
6.	Present study (2013)	Male	255	Rt.	19.31	1.03
				Lt.	19.34	1.02

The findings of present study i.e. the mean value of the right hand length 17.81 ± 0.96 cm and left hand length 17.78 ± 0.98 cm in females correlates with that of previous studies [2,9,11] while slightly differ from other studies [10,12] (Table 6).

Table 6: Comparison of hand length in females of present study with previous studies

S. No.	Authors	Sex	Sample Size	Side	Mean	SD
1.	Ilayperuma et al. (2009) [9]	Female	118	- -	17.62	0.93
2.	Sunil et al. (2005) [10]	Female	75	Rt.	18.1	1.0
				Lt.	18.1	1.0
3.	Oommen et al. (2005) [11]	Female	50	Rt.	17.32	0.89
				Lt.	17.24	0.87
4.	Danborno & Elukpo (2008) [12]	Female	150	Rt.	18.51	0.66
				Lt.	18.52	0.77
5.	Jasuja & Singh (2004) [2]	Female	30	Rt.	17.51	0.81
				Lt.	17.47	0.80
6.	Present study (2013)	Female	251	Rt.	17.81	0.96
				Lt.	17.78	0.98

CONCLUSION

It was concluded that the hand length provides good reliability in estimation of stature in forensic examinations and in medico legal cases and the correlation between present parameters can be helpful in medico-legal cases for identification of individuals.

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Original Article

TO STUDY THE CORRELATION BETWEEN PLACENTAL THICKNESS AND AMNIOTIC FLUID INDEX IN THIRD TRIMESTER OF UNCOMPLICATED PREGNANCY IN INDIAN FEMALES

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ABSTRACT

Introduction: Placenta is the most important temporary organ during pregnancy. Healthy placenta is utmost needed for a healthy baby. Ultrasonography is the preferred modality for antenatal evaluation of placenta. Amniotic fluid plays a major role in fetal growth and development and for adequate amniotic fluid volume, a normally developed placenta is required. Thus, Placental parameters may indirectly affect the amniotic fluid volume which plays a crucial role for fetal development.

Material & Methods: One hundred (100) antenatal cases were recruited for the present study. Those women who were with uncomplicated, singleton pregnancy of more than 26 weeks and gave their written informed consent, were taken as subjects. Thickness of the placenta was measured at the level of cord insertion. Amniotic Fluid Index (AFI) was obtained by adding the vertical lengths of deepest fluid pockets in four uterine quadrants**.**

Results: The mean placental thickness in third trimester was found as 3.90±1.1cm and mean AFI as 125.20±38.5.

Conclusion: A linear but inverse correlation was observed between placental thickness and amniotic fluid index.

Keywords: Placenta, placental thickness, amniotic fluid.

INTRODUCTION

During pregnancy, the most important temporary organ is placenta. It is formed during pregnancy in the lining of the uterus. It is an organ fundamentally of fetal origin. When fully formed it has an average diameter of 15cm and thickness of about 3cm. The primary function of placenta is to permit substances dissolved in the blood of mother to diffuse into the blood of fetus and vice versa [1]. Thus, this has been emphasized that normal development of placenta is crucial for normal growth of the fetus, however, still the placenta is one of the least understood and most understudied organ in the human body. For centuries, while the anatomy of other organs has been studied in detail by ultrasonography, the placenta has often been ignored.

Amniotic fluid plays a major role in fetal growth and development. Initially, some amniotic fluid is secreted by amniotic cells; most is derived from maternal tissue and interstitial fluid by diffusion across the amniochorionic membrane from the decidua parietalis. Later, there is diffusion of fluid through the chorionic plate from blood in the intervillous space of the placenta. The volume of amniotic fluid normally increases slowly, reaching approximately 30ml at 10 weeks, 350ml at 20weeks, and 700 to 1000ml by 37weeks [2].

Therefore, for adequate amniotic fluid volume, a normally developed placenta is required. Thus, placental parameters may indirectly affect the amniotic fluid volume which plays a crucial role for fetal development.

Ultrasonography is the modality of choice for antenatal evaluation of placenta as well as exact determination of amniotic fluid. Thus, this study is

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meant for providing a baseline data of placental thickness and placental volume and their effect on amniotic fluid index in third trimester of normal pregnancy.

MATERIALS AND METHODS

This study was conducted in the Department of Anatomy, King George's Medical University, Lucknow in collaboration with Department of Obstetrics and Gynaecology, Queen Mary's Hospital, King George's Medical University, Lucknow. One hundred (100) antenatal cases were recruited for the present study. Recruited patients were divided into four groups according to gestational age (Table 1). Those women who were with uncomplicated, singleton pregnancy of more than 26 weeks and gave their written informed consent, were taken as subjects. All cases of fetal congenital anomaly, Placental anomaly, maternal medical diseases, maternal gynecological diseases and maternal obstetrical diseases which can cause oligohydramnios or polyhydramnios were excluded from the study. The gestational age was confirmed by previous ultrasonography reports of first trimester. All ultrasound examinations were performed on model LOGIQ^{TM} α 200 ultrasound machine and on L&T Medical, Sonata (version 3.1) machine, with a curvilinear 3.5 –MHz transducer. The placenta was identified as a hyper-echoic area separated from fetus by a hypo-echoic area of amniotic fluid.

Thickness (T) of Placenta

The probe was moved all over the localized placenta and the level of cord insertion was identified over the fetal surface. A straight line was drawn from the level of cord insertion up to the maternal surface of the placenta and thus thickness was measured [3] (Fig.1).

Amniotic Fluid Index (AFI)

AFI was obtained by adding the vertical lengths of deepest fluid pockets in four uterine quadrants**.** Those pockets were considered for AFI in which no fetal part or cord were seen. Fetus was also seen for the presence of any major congenital anomaly [3] (Fig. 2).

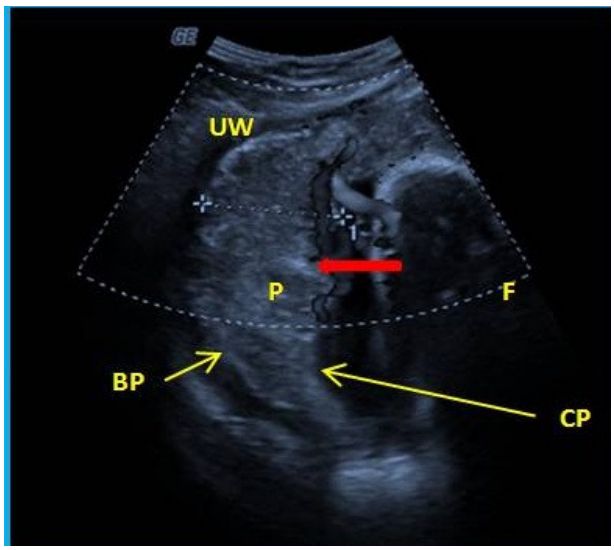

Fig 1: Measurement of placental thickness in USG

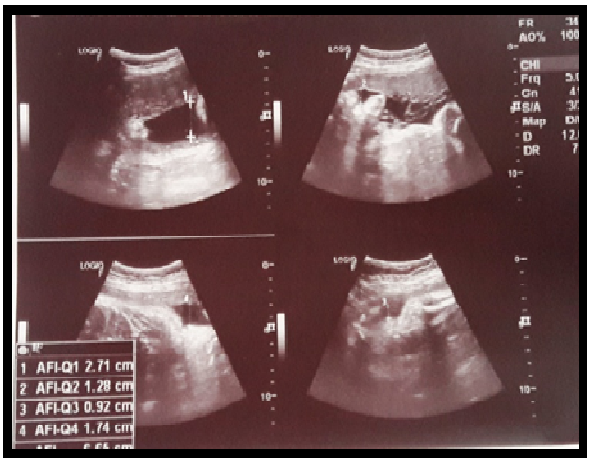

Fig 2: Measurement of Amniotic fluid index in USG

Ultrasound images were recorded and stored. Data were transferred on an excel sheet. Data were analyzed using statistical software package, STATA 11.2 and the difference was considered to be significant if 'p' value was found to be <0.05.

OBSERVATIONS AND RESULTS

The mean placental thickness in third trimester was found as 3.90±1.1cm and mean AFI as 125.20±38.5. It was observed that as the placental thickness increases with gestational age, the volume of amniotic fluid decreases. However, in the last gestational group,

i.e., 38^{+}-42 weeks, the mean of placental thickness as well as amniotic fluid index both were observed to be decreased (Table 1).

Table 1: Correlation of placental thickness (T) with Amniotic fluid index (AFI)

Gestational age (wks)	Thickness (cm) Mean±S.D.	Amniotic fluid index (mm) Mean±S.D.
26 – 30 (n=21)	3.56±0.8	144.50± 45.5
30^{+}– 34 (n=26)	4.01±1.2	134.18± 32.0
34^{+} - 38 (n=41)	4.05±1.3	119.52± 35.5
38^{+}- 42 (n=12)	3.73±0.8	91.41± 19.7
Total (n=100)	3.90±1.1	125.20± 38.5

(n=number of patients, AFI = 125.5-.07*PT, p = 0.983)

On applying regression analysis, it was observed that there is a linear correlation between placental thickness and amniotic fluid index. The analysis yielded following equation:

$$AFI = 125.5 – 0.7 * PT$$

Where AFI is amniotic fluid index, PT is placental thickness. According to above equation, if placental thickness increases by one unit, amniotic fluid index decreases by 0.7 units. The p-value was >0.05, therefore the correlation was not significant.

DISCUSSION

Normally the placental morphology varies considerably during its short life span. Alterations in placenta as part of “Ageing” phenomenon are probably a part of maturation process and go hand in hand with continued growth of placenta. Placenta grows till 37th week and as a result immature villi are seen even till term [4]. Hence, in the study on placenta, Fox (1975), has stressed the importance of analyzing the placental pathology quantitatively and has stated that the importance of the lesions could be realized only when assessed in relation of fetal growth and maturation [5]. The thickness of the placenta may give indirect information on the foeto-placental ratio. It may give an indication of the amount of substances (nutrients, gases) that is exchanged between the foetus and the mother. Thin placenta may be due to intrauterine growth retardation, placental infarction and pregnancy with essential hypertension and pre-eclampsia [6].

In this study, we observed that the thickness of placenta increases as the pregnancy advances. However, beyond a certain limit (38 weeks in our study), the mean placental thickness starts decreasing though the placental growth is still occurring by increasing the surface area. It was suggested that raised amniotic pressure in hydramnios compressed the placenta and intervillous space [7, 8]. However, to what extent this reason could be applied for explanation of decrease in placental thickness even after decrease in AFI in normal pregnancies is to be investigated. Thus, a further research and investigation is needed on a large population to answer the above queries.

Gupta et al. (2018) studied association of placental thickness and amniotic fluid volume in cases of oligohydramnios and observed a non-significant correlation between the two parameters [9].

Akgunduz et al. (2014) evaluated the correlation between placental thickness and amniotic fluid index in cases of normal pregnancies and in polyhydramnios. They observed that the placental thickness was significantly lower in the patients with polyhydramnios compared to the patients in the control group and suggested a possible inverse ratio between the two [10]. Similar observations were made in our study, i.e., an increase in placental thickness will lead to decrease in AFI.

CONCLUSION

In normal pregnancies, though there is a correlation between placental thickness and AFI, but it is not a statistically significant one. Statistically significant decrease in placental thickness with increase in AFI can occur only when AFI crosses a certain limit as in hydramnios.

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Case Report

ACCESSORY THYROID GLAND WITH DUAL BLOOD SUPPLY: A RARE VARIATION

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ABSTRACT

A rare congenital anomaly of thyroid gland due to developmental defect is accessory or ectopic thyroid gland. Ectopic thyroid refers to the presence of thyroid tissue in locations other than the normal in anterior neck region between the second and fourth tracheal cartilages. Abnormal organogenesis of the thyroid gland leads to morphological variations, such as thyroid dysgenesis, hypoplasia, hemiagenesis and agenesis. The ectopic or accessory thyroid being the most common form of thyroid dysgenesis. Here, we are presenting a case with the accessory thyroid tissue with dual blood supply observed during a routine dissection of a female cadaveric body. The accessory thyroid tissue was in the form of an oval structure about 1.5cm x 3 cm was situated in the midline 2cm above the normally located thyroid gland which was supplied by a branch of lingual artery as well as superior thyroid artery. The accessory thyroid tissue could be asymptomatic or it could present with any disorder affecting the main thyroid gland including malignancy. The significance of this case is to show an anatomical variation in the form of developmental defect during the organogenesis of thyroid along with its clinical implications. Thus, this report highlights the importance of knowing and understanding the normal anatomy of thyroid as well as the anatomical variant that could be immensely beneficial while diagnosing thyroid disorders or carrying out surgical procedures involving thyroid.

Keywords: Accessory thyroid gland, superior thyroid artery, lingual artery, variation.

INTRODUCTION

The thyroid gland is brownish –red endocrine gland situated anteriorly in the lower neck level with the C5-T1.The gland consist of right and left lobe connected by a narrow isthmus. It weighs about 25gm and each lobe measures about 5cmX3cmX2cm and isthmus 1.25cmX1.25cm.The thyroid gland is slightly heavier in female and enlarged during menstruation and pregnancy. The thyroid gland is supplied by the superior and inferior thyroid arteries. The superior thyroid, lingual, and facial arteries arise from anterior surface of external carotid artery and the inferior thyroid artery is a branch of thyrocervical trunk (which arises from subclavian artery) [1]. The thyroid gland is a highly vascularized endocrine gland that frequently present with varied range of morphological anomalies [2]. Ectopic thyroid tissue is rare but may be found around the course of the thyroglossal duct due to arrest of migration along the line of descent or laterally in the neck, sometimes small detached masses of thyroid tissue may occur above the lobes or isthmus as accessory thyroid glands. Ectopic thyroid has a gender predisposition with male to female ratio of 1:4 [3-6]. Like other great vessels of neck, the external carotid artery and its branches have numerous variations and their exploration is more than interesting for a better anatomical knowledge of neck. These variations pose a dangerous situation during surgeries like thyroidectomy, laryngectomy facio-maxillary surgeries, tonsillectomy, glossectomy and other neck surgeries. It is important for the elevation of various cutaneous and myocutaneous flaps for plastic and reconstructive surgeries of the head, neck and face, which depend on the external carotid artery for their blood supply [7].

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CASE REPORT

A rare congenital anomaly, accessory thyroid gland was found 2cm above the superior border of hypertrophic, normally located thyroid gland which was having dual blood supply in a 60 years old female cadaver during routine dissection in the Department of Anatomy, King George's Medical University, Lucknow, Uttar Pradesh, India. The history of the individual and the cause of death was not known. The topographic details of thyroid and accessory thyroid was examined by casual dissection and photographed. The accessory thyroid gland was 2.5x1.5cm in size. As thyroid gland was supplied by superior and inferior thyroid arteries. The superior thyroid artery gives a branch to the accessory thyroid gland and a descending branch of lingual artery also supplied the accessory thyroid gland (Fig. 1).

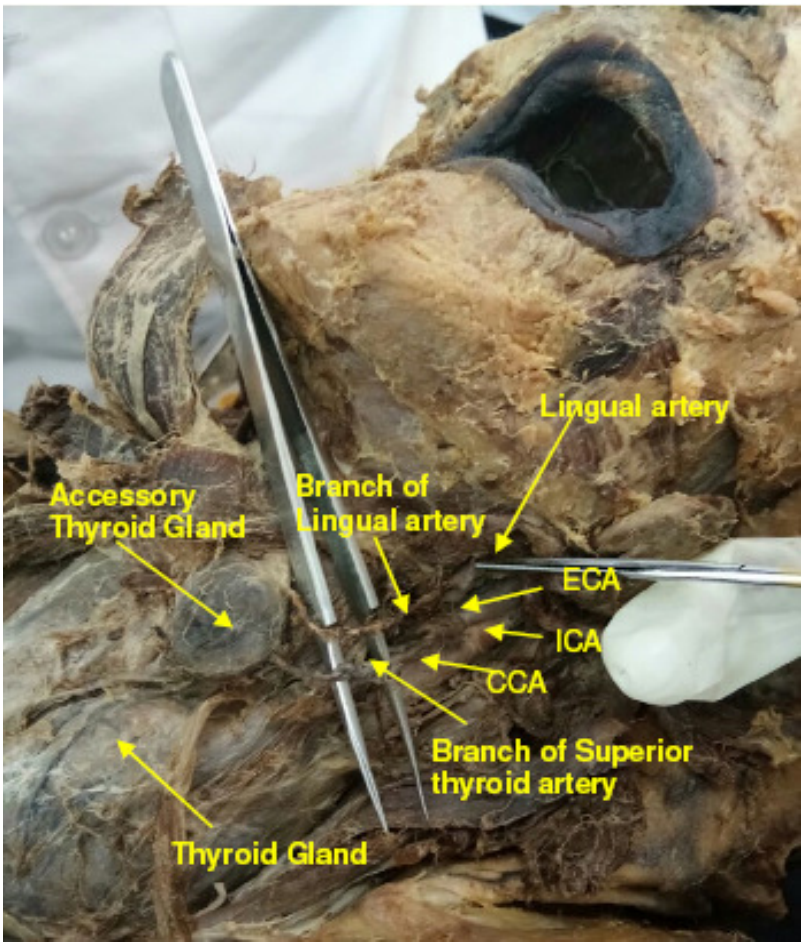

Fig. 1: Photograph showing thyroid and accessory thyroid glands supplied by branches of lingual artery and superior thyroid arteries (ECA-external carotid artery, ICA-internal carotid artery, CCA-common carotid artery)

DISCUSSION

Ranade et al (2008) noted an accessory thyroid tissue with absent isthmus in 1 case on male cadaver [8]. Nikumbh et al. (2015) found multiple thyroid anomalies like agenesis/absent isthmus with left pyramidal lobe and accessory lobe in between two lateral lobes with levator glandulae thyroidae in their case report [9]. Sawant et al. (2018) presented a case of dual thyroid in the form of ectopic or accessory thyroid tissue along with normal location thyroid found during a routine

dissection of a female cadaveric body, situated in the midline near the hyoid bone. It was located 10.2cm superior to a normally located thyroid gland and consistent with the track of the thyroglossal duct [10]. In our case same findings were noted as an accessory thyroid lobe present 2cm above normally placed thyroid with dual blood supply.

The thorough knowledge of anatomical variations of the thyroid gland is important as it is relevant in different types of thyroidectomy and tracheotomy. The risk of damage to parathyroid gland, recurrent laryngeal nerve and hematoma due to vascular damage can be minimized by the knowledge of anatomical variation of the thyroid gland [11]. Base of foramen caecum is the most common location for the ectopic thyroid present as a mass in the dorsum of the tongue referred as lingual thyroid. Most of the variations of the thyroid gland are due to a partial persistence of the median or thyroglossal duct [12].

Ectopic thyroid is the most common cause of congenital hypothyroidism in infants [13]. It is the most frequent form of thyroid dysgenesis, accounting for 48-61% of the cases [14]. The majority of patients with ectopic thyroid are asymptomatic, while some cases are detected incidentally. Epidemiologically, ectopic thyroid tissue is a sporadic embryological deformity that is usually noticed during autopsy and that has a prevalence of up to 10% [15].

CONCLUSION

The knowledge of variation in the thyroid gland and its blood supply is important for surgical procedures in the neck region such as radical neck dissection, catheterization, reconstruction of aneurysm, and interventional radiology. These variations pose a dangerous situation during various neck surgeries. In this case report, we have presented a photographic evidence of ectopic thyroid gland and its dual blood supply in the anterior neck in a female cadaver along with a brief review summarizing important facts of normally located thyroid gland and ectopic thyroid.

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ABSTRACTS

ABSTRACTS

AWARD SESSION

DR. VARSHA KATIRA GOLD MEDAL

OBLIGATORY ALTERATIONS IN MORPHOLOGY OF MEDIAN NERVE: A SONOGRAPHIC STUDY IN ASYMPTOMATIC INDIVIDUALS

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Introduction: Median nerve is formed in axilla by contributions from medial and lateral cords of brachial plexus. It descends in the arm, forearm and passes through carpal tunnel in close conjunction with flexor tendons of forearm. Median nerve cross sectional area (CSA) and flattening ratio (FR) can be assessed by ultrasonography (US). Flattening ratio is the ratio of transverse axis to the anteroposterior axis and serves as a potential diagnostic criterion for carpal tunnel syndrome (CTS).

Aims and Objectives: To assess median nerve by US and tabulate mean values for CSA and FR in asymptomatic population which would serve to limit the cutoff values that differentiate normal nerves from neuropathic nerves.

Material and Methods: The **S**tudy was conducted in Department Of Anatomy, KGMU, Lucknow, and included 50 randomly selected undergraduate students (30 males, 20 females). Height, weight, and wrist circumference were noted. Ultrasonography was performed using high frequency linear probe, and observations were made at two pre-determined sites. Observations were recorded, tabulated and analyzed.

Results: Median nerve was easily observable at both sites. It was round in shape in forearm, and flattened as it reached the carpal tunnel. On the right side nerves were rounder in forearm in males (FRFoRt-1.68) as compared to females (FRFoRt-1.77). At both sites, flattening was more on right side (FRFoRt-1.71; FRCtRt-3.08) than on left side (FRFoLt-1.66; FRCtLt-2.78) among all 50 study subjects. Increased flattening was observed in females (FRCtRt-3.30) as compared to males (FRCtRt-2.94). In left forearm median nerve was slightly more rounder in females (FRFoLt-1.66) as compared to males (FRFoLt-1.69), whereas FR was similar in both(males FRCtLt-2.83; females FRCtLt-2.83).

Conclusion: Study will help in generating database for facilitating comparisons between symptomatic (CTS) and asymptomatic individuals. Altered FR has both diagnostic as well as prognostic values in carpal tunnel syndrome

DR. O.P. KHANDURI MEMORIAL GOLD MEDAL

TOXIC CHANGES INDUCED BY ADMINISTRATION OF ASPIRIN IN CEREBRUM OF DEVELOPING MICE

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Introduction: Aspirin, a non-steroidal anti-inflammatory drug having antipyretic, analgesic and anti-inflammatory actions. It is also used in prevention of myocardial infarction. The antithrombotic effectiveness of aspirin is related to its inhibition of the cyclooxygenase (COX) enzyme that metabolizes arachidonic acid to a variety of prostanoids, including thromboxane A2. With the inhibition of platelet COX-1 activity, there is a decrease in platelet aggregation, leading to a reduced thromboembolic potential and a commensurate prolonged bleeding time. Thus, it is not surprising that the major risks associated with aspirin relate to bleeding complications.

Aims and Objectives: Looking at very few and inconclusive reports about the teratogenicity of aspirin and histopathological changes induced by it in the cerebrum of developing embryo, the present study has been undertaken.

Material and Methods: Aspirin was given to pregnant mice in the dose of 100mg/kg body weight and the cerebrum of 19th day fetus was studied for any microscopic changes.

Results: The treated cerebral cortex shows marked pathological changes when compared to the control cerebrum. The cortex shows edematous changes resulting in spongiform appearance. The six layers of the cortex are poorly visualized. Vast areas of degeneration and necrosis of pyramidal cells are seen and there are large vacuolar spaces in the cortical areas.

Conclusion: Aspirin has toxic effects on cerebrum of developing embryo so should be used with caution in pregnancy.

ARIATIONS IN INFERIOR PHRENIC ARTERY ORIGIN: ANGIOGRAPHIC ANALYSIS OF MISPLACED AND DISPLACED ARTERIES

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Introduction: The inferior phrenic arteries (IPAs) are arteries of small calibre that usually arise from the right and/or left anterior contour of abdominal aorta as collateral branches and supply the diaphragm. They frequently display variations in their origin, whereby, they may be direct branches of celiac artery through a common trunk or independently from its right or left side; or may be given off as a branch from left gastric, hepatic, superior mesenteric, spermatic, or adrenal arteries. Pathologic conditions like hemoptysis, bleeding due to trauma or surgery, and bleeding caused by Mallory-Weiss tear or gastro-esophageal cancer are related to the IPAs. IPAs also constitute an important source of extrahepatic collateral supply to hepatocellular carcinoma (HCC).

Aims and Objectives: Purpose of present study was to observe the origin of IPAs with reference to the site and level, and find the prevalence of variations.

Material and Methods: CT angiograms of 100 subjects (53 males and 47 females) were retrospectively reviewed to determine the site and level of origin of right and left inferior phrenic arteries.

Results: Results revealed that variations in origin of inferior phrenic artery are not exceptional. Site of origin was variant in 52% subjects and level of origin variations were seen in 14.5%. Arteries were classified into two groups according to the type and pattern of variation.

Conclusion: Origin of inferior phrenic may differ widely. Inferior phrenic artery originated from arteries other than aorta in majority. We additionally report caudal migration of inferior phrenic of aortic origin and uniquely classify them as displaced arteries. Knowledge

of variations in origin is important prior to surgical interventions and interventional radiological procedures and is therefore important for the clinicians, radiologists and surgeons.

ANATOMY ACTS OF UNION OF INDIA IN NEED OF INEVITABLE AMENDMENTS: ADVOCATING COMPREHENSIVE UNIFORM ANATOMY ACT

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Introduction: Dissection of Cadavers is the of core teaching and learning Anatomy. Anatomy Act provides legal ambit to medical educationist for the procurement of cadavers. Anatomy Act in India is a state act and which ensures provision of unclaimed /donated bodies for Medical Education and research. Rapid expansion of medical education, reorganization of states and changing socio cultural scenario has necessitated an urgent need of review of this act across various states. Suitable amendments addressing the current disparities and deficiencies are long overdue.

Material and Methods: The methodology included three components namely:

- Comparison of various Anatomy Acts clause by clause obtained by various sources to identify disparities.
- Feedback from the end users i.e. anatomic fraternity, obtained via a validated questionnaire.
- Formulation of comprehensive model Anatomy Act.

Results: Various acts studied showed discrepancies in purpose of the act, roles and duties of stake holders, regulation for body donation, procedure to handle unclaimed bodies, disposal of dead bodies etc. None of the acts defines a donor and neither addresses the issue of transport of anatomical material. Only ten states have a clause for body donation. Acts of only six states have been amended over last 50 years. Three states denied having an act.

Conclusion: The whole exercise of review of acts and extensive feedback received from end-users culminated in drafting of a comprehensive model Anatomy act, which has incorporated best of provisions of various Anatomy Acts and some modifications and inclusions as suggested by anatomic fraternity and found wanting after review.

ABSTRACTS

ORAL PRESENTATION

MORPHOLOGICAL STUDY OF OPTIC CANAL IN HUMAN SKULLS

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Introduction: Optic canal lies between the roots of a lesser wing and medially, the sphenoid body, descends a little anterolaterally, containing optic nerve, ophthalmic artery and meninges. The optic canal connects the orbit to the middle cranial fossa. Duplication of optic canal is very rare anomaly. This anomaly is ascribed to ossification process of duramater between the optic nerve and ophthalmic artery.

Aims and Objectives: To know about the incidence of one of the rare anomaly i.e.duplication of optic canal in dried human skulls.

Material & Methods: A total of 30 skulls in the Department of Anatomy, SRMS IMS Bareilly were included in the study. The dried skull bones were studied for the presence of unilateral/bilateral duplication of optic canal.

Results: Out of 30 human adult skulls, we observed bilateral duplication of optic canal in two skulls and unilateral duplication in one skull.

Conclusion: It is important to know the significance of the double optic canal during interventional procedures of optic canal and surrounding regions especially during endoscopic tumor removal and optic nerve compression.

MORPHOMETRIC STUDY OF TYPICAL HUMAN THORACIC VERTEBRAL BODY IN NORTH INDIAN POPULATION

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Introduction: Vertebral column plays a key role in transmission of body weight, protection of spinal cord and attachment of muscles. The dimensions of vertebra vary with racial and environmental factors. With the advent of anterior approach invarious surgical techniques for stabilisation of vertebral column, , neural decompression and spinal instrumentation, it is imperative to measure various dimensions of vertebral body .Most of the previous literature available is on pedicles.

Aims and Objectives: To measure various parameters of thoracic vertebra in North Indian population.

Material and Methods: Seventy five typical thoracic vertebras of unknown sex and age were selected for the study. Eight parameters namely width, anteroposterior diameter, superior transverse diameter, inferior transverse diameter, anterior height, posterior height, right lateral and left lateral height of vertebral body were measured using a vernier calliper.

Results: The width of vertebral body ranged from 18-28 mm with a mean of 23.52 mm. The anteroposterior distance of the vertebral body in typical thoracic vertebrae ranged from 13-27 mm with a mean of 19.95mm. The superior transeverse diameter ranged from 22-29.6 mm with a mean of 25.32 mm. The inferior trasverse diameter ranged from 24-31 mm with a mean of 26.97 mm. Anterior height (mid sagittal) of body ranged from 13.2-20.5 mm with a mean of 17.06 mm. The posterior height ranged from 14-23 mm with mean of 18.13 mm. The right and left. Lateral height of the body ranged from 14 - 20 mm with a mean of 17.01 mm.

Conclusion: This study provides normative data for vertebral body in North Indian population. This can be used as a baseline and reference during spinal surgery instrumentation and designing of implants.

MORPHOMETRIC STUDY OF MAXILLARY AIR SINUSES USING COMPUTED TOMOGRAPHY

Singh Pankaj, Gupta Girish Shashi, Kumar Vinod

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Introduction: The maxillary sinus is a pyramid shaped pneumatic space with its base adjacent to the nasal wall and apex pointing to the zygoma. It is the largest bilateral air sinus located in the body of the maxilla and opens in the middle nasal meatus of the nasal cavity with single or multiple openings. The dimensions of maxillary sinuses are particularly significant when considering endoscopic sinus surgery

Aims & Objectives: This study is to compare the size and volume of the maxillary sinus between males & females by CT scan.

Materials and Methods: Cranial computerized tomographic images (CT) of 200 normal subjects between the age groups of 18 and 80 years were observed in this study. The height, width, and depth of the maxillary sinuses were measured with Philips Brilliance 16 CT. The statistical analysis for sex and age comparison for all the parameters was done.

Results: It will be presented at the time of power point presentation.

Conclusion: CT measurements of maxillary sinuses may be beneficial to support gender determination in forensic medicine; however, with fairly low-accuracy rate (less than 70%). We advise that the depth, the width, and the height of the maxillary sinuses together with other bones can be used for gender determination when the complete skeleton is not available. This information can also be useful for ENT surgeons while performing surgery in this region.

MORPHOMETRIC STUDY OF MASTOID PARAMETERS FOR SEXING INDIAN SKULLS

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Aims and Objectives: The aim of this study is to determine sexual dimorphism of skull by multivariate analysis of anthropometric data and to assess the reliability of the mastoid's morphometric parameters in determining the gender.

Material and Methods: The sex of the skulls was established on the basis of gross appearance by comparing external features on dry skulls using digital Vernier calliper for measurement and images were taken with help of digital camera. Inclusion criteria were Adult dry skulls of both sexes without destruction of the mastoid bone in the region of the cranio-metric points. The skulls with atrophied, decomposed and deformed mastoid process, all juvenile and senile skulls were excluded from study.

Three craniometric points were identified in dry skulls as follows:

- Porion(po)- upper most lateral point of external acoustic meatus
- Mastoidale(ma)- most inferior point of mastoid process
- Asterion (as) - meeting point of three posterior skull sutures that is, lambdoid, occipitomastoid and parietomastoid.

These points were selected to compute area of study and these craniometric points were marked by single investigator to avoid intra-observer error. A triangle was made using these three points on the skull on both sides. Measurements of the dimensions of the sides of the mastoid triangle were carried out using digital Vernier caliper. If any of these points were found damaged, they were removed from the study. The mastoid triangle area was calculated using Heron's formula with side of triangle a.

Conclusion: It was observed that mean mastoid parameters was more in skulls of male individuals as compared to skulls of female individuals irrespective of race or region in manual method.

EVALUATION OF DIFFERENT TECHNIQUES OF EXTRACTION AND CLEANING OF BONES FROM HUMAN CADAVERS

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Introduction: The present study was carried out to evaluate the different techniques for extraction and cleaning of bone specimen from human cadavers.

Aims and Objectives: Aim of the present study was to evaluate the least time consuming and practical method to procure bones from embalmed cadavers and wet specimen in the department

Material and Methods: Skull, long bones, and other bones from embalmed preserved cadaver were obtained and cleaned. In present study, we applied 4 different methods for preparing the bone specimen.

Results: In present study, we observed that boiling followed by burial of embalmed specimen is ideal procedure for extracting bone specimen of skull and long bones.

Conclusions: Preparation of bone specimen from embalmed cadaver is a time saving technique for many medical institutions and self-prepared specimens are of good quality.

A STUDY OF SUPERIOR ORBITAL FISSURE IN NORTH INDIAN DRY SKULLS

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Introduction: Superior orbital fissure (SOF) which is situated in the middle cranial fossa is a very complex region as the structures passing through this region provide afferent and efferent information for the visual system. Detailed knowledge of the SOF is also required for the resection of the sphenoid bone, anterior clinoid process, and the superolateral part of the orbital roof.

Aims and Objectives: The aim of the present study is to assess the morphometry of SOF which is useful for general orientation and approach to the middle cranial fossa and orbit.

Material and Methods: The present study includes 50 dry adult fully ossified human skulls from the Anthropology Museum of Department of Anatomy, GSVM Medical College, Kanpur. All the measurements were done by digital vernier calliper. The data was statistically analysed.

Result: The mean distance from the superomedial to the superolateral edge was measured as 17.64±2.09 mm on the right side and 17.41±2.99 mm on the left side and from the superolateral

to the inferior edge as20.25±1.85 mm on the right side and 20.04±2.13 mm on the left side. The mean distance from the superomedial to inferior edge of the fissure was measured as 7.01±1.13 mm on the right side and 7.18±1.10 mm on the left side.

MORPHOMETRIC STUDY OF FORAMEN MAGNUM IN NORTH INDIANS POPULATION

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Introduction: The morphometric evaluation of foramen magnum is clinically interesting because of its relation with its contents. These vital structures that pass through it may suffer compression in cases of achondroplasia, foramen magnum brain herniation and atlanto-occipital fusion. The aim of the present study was to conduct a morphometric analysis of foramen magnum.

Materials and Methods: Completely ossified 50 adult human dry skulls of unknown age and sex were taken from the Department of Anatomy of KGMU, U.P, Lucknow, were used for the study. All the 50 cranial bases were visually assessed for foramen magnum shape classification. Each foramen magnum was classified into one of the four shapes, oval, round, irregular, tetragonal, pentagonal and hexagonal. The antero-posterior and transverse diameters were measured using a digital vernier caliper graded upto 0.01mm. Observations made were tabulated and photographed.

Results: The average anteroposterior length of foramen magnum was 33.50 mm and the transverse diameter was 26.49 mm. When the foramen magnum index was > 1.2, the foramen was found to be ovoid, 48.7% of skulls studied exhibited an ovoid foramen magnum. The foramen magnum shapes were determined as an oval in 50 %of cases, round shape in 20%, tetragonal in 6%, irregular in 16%, hexagonal in 6% and pentagonal in 2% of the cases. **Conclusion:** Detailed morphometric analysis will help in the planning of surgical intervention involving the skull base. This study will be useful for the anatomist, neurosurgeon, radiologist and orthopaedic surgeon

LUMBAR HERNIA THROUGH AN ILIAC CREST BONE GRAFT

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Introduction: The most common source for autologous bone graft in orthopedics is the iliac crest. It may be harvested from the anterior or the posterior iliac crest. Reported complications include arterial injury, nerve injury, ureteral injury, ileus, hematoma, pelvic instability, fracture, and herniation. Herniation through an iliac crest defect is a very rare but major complication of this procedure.

Case report: We present two cases of right lumbar incisional hernia repair using prosthetic mesh which was fixed to iliac bone with corkscrew. A 38 years female presented with complain of swelling in right flank since 1 year associated with dull aching pain. She has history of femur fracture for which iliac bone grafting was done 3 years back. A 65-year-old female presented with swelling in the left lumbar region for six years. She was operated on six years back, during which a bone graft was taken from her left iliac crest for a knee replacement. The patient also had dull aching pain at the site of the hernia.

Conclusion: The incidence of lumbar hernia after iliac crest bone graft harvesting is estimated to be 5% to 9 %.This disease is unique for its anatomic specialty and for its rarity, since most surgeons do not have exposure to such a problem.So Surgery is recommended secondary to the 25% risk of incarceration and 10% risk of strangulation with lumbar hernias.

STUDY OF EPIPTERIC BONE AND ITS ANATOMICAL VARIATIONS IN NORTH INDIAN POPULATION

Sudha Supriya , Singh AK, Singh Nishtha, Pandey Krishna, Singh Badal, Anand Mamta, Singh Harvendra, Singh Kalyani

Moti Lal Nehru Medical College Allahabad

Introduction: Epipteric bone is a sutural bone occasionally present at the pterion or junction of the parietal, frontal, greater wings of sphenoid and squamous portion of the temporal bone. Epipteric bone also called pterion ossicles.This variation of pterion which contained unusual epipteric bone may lead to surgical pit fall in cranial surgery.

Aim and Objectives: To study the incidence of epipteric bones and its variations in region of pterion in human dry skull in north Indian population.

Material & Methods: Total 50 crania that were examined belong to anatomy department of Motilal Nehru Medical College Allahabad. They were examined meticulously for presence of epipteric bone, its morphology and morphometry.

Results: Out of 50 crania 7 were excluded on the basis of broken pterion region and 3 on the basis of fused suture. Among 40 crania epipteric bone was found in pterion region of 9 skulls. 4 different shape of epipteric bones were also found i.e. circular, irregular, triangular, quadrangular.

Conclusion: Anatomical knowledge of epipteric bones at the site of pterion is important as they may be confused for fractures. Also presence of epipteric bones may lead to complications in making burr holes at the pterion during neurosurgery. Epipteric bone knowledge is essential for anthropologist, radiology reporting, and skigram of skull in head injury.

COMMUNICATION BETWEEN THE MUSCULOCUTANEOUS AND THE MEDIAN NERVE: A CASE REPORT

Parul Saxena, Archana Sharma, G.L.Nigam

Introduction: The brachial plexus is an involute anatomical structure. The median and musculocutaneous nerves are functionally the most important terminal branches of brachial plexus. The median nerve is formed by medial and lateral roots from the medial and lateral cords respectively. And the musculocutaneous nerve is a branch of lateral cord and it innervates the muscles of flexor compartment of the arm and continuous as the lateral cutaneous nerve of forearm, without any communication with median or any other nerve.

Case report: The present report describes a case of variation observed in a 70 year old male cadaver during the routine dissection. The branches of brachial plexus were dissected carefully and the variation from the normal pattern was noted. The musculocutaneous nerve accompanies the lateral side of the third part of the axillary artery and pierces the coracobrachialis muscle, which it supplies. Along the course, it gives a communicating branch to the median nerve in the middle of arm, approximately 10 cm distal

to its formation. This communicating branch runs medially downwards and unites with the lateral aspect of the median nerve.

Conclusion: The variations in brachial plexus should be taken very seriously while the surgery of shoulder joint, axilla or the arm has to be performed as these nerves are more liable to be injured. And these communicating branches may give rise to a pattern of weakness that makes the diagnosis difficult. So it is extremely important to have an awareness of these variations.

MORPHOMETRIC ANALYSIS OF VARIATIONS IN FORAMINA OF MIDDLE CRANIAL FOSSA IN DRY SKULLS

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Introduction: An irregular depression in the middle of inner surface of base of skull that is middle cranial fossa ,is bounded infront by sphenoid bone, anterior clinoid process and behind by petrous temporal bone and dorsum sellae. The foramina in middle cranial fossa are mostly situated between intracranial and extracranial structures.

Aims & Objectives: To study the morphometric variations of foramina of middle cranial fossa in North Indian skulls.

Material and Methods: This study included 50 dry skull bones irrespective of age and sex from department of Anatomy, KGMU, Lucknow**.** The study was done using measuring ruler, digital vernier caliper and marker.

Results: Of the 50 human dry skulls, we observed the mean length of foramen ovale on the right and left sides was 5.86mm and 4.98mm and width was 3.87mm and 4.12mm.we observed bony septa and spur with in foramina .Foramina spinosum was absent in 1% of skulls and confluence with foramen ovale observed in 2% skulls. The mean diameter of foramen spinosum was 1.87mm and 2.03mm on right and left side, asymmetry was found in 2%of skulls. The mean vertical diameter of Foramen rotundum was 3.36mm and 4.01mm in right and left side. Foramen Vesalius was found in 7 skulls 14% of skulls.

Conclusion: Our study results help the clinicians and neurosurgeons before planning a neuro surgery. The knowledge of foramina is great guide to anaesthetics for administration of drugs in surgery involving mandibular nerve.

BILATERAL ANATOMICAL VARIATION IN THE ORIGIN AND BRANCHING PATTERN OF EXTERNAL CAROTID ARTERY

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Introduction: The external carotid artery is a principal artery in the head and neck .It begins in the carotid triangle at the level of upper border of thyroid cartilage opposite the disc between the third and fourth cervical vertebrae .As the artery ascends, it passes deep to the posterior belly of digastric and stylohyoid muscle ,giving eight named branches ;The superiorthyroid, lingual and facial arteries arise from its anterior surface, the occipital and posterior auricular arteries arise from its posterior surface and the ascending pharyngeal artery arises from its medial surface and two terminal branches maxillary and superficial temporal behind the neck of mandible.It necessitates accurate interpretation of its radiological images while planning surgical steps during the exploration of head and neck such as carotid endarterectomy, aneurysm repair, carotid angiogram, radical dissection of lymph nodes and carotid artery catheterization.High variability of carotid arterial systemsuch as early bifurcation, trifurcation, quadrifurcation and short common stem in the Kenyan population has been reported.

Aims and Objectives: to study the variation in the origin and branching pattern of external carotid artery and report any deflection from the normal branching pattern.

Material and Methods: A total of eight adult human formalin embalmed cadavers (5 males and 3 females) during first year MBBSUG's dissection in the academic year 2017 at Department of Anatomy, KGMU, Lucknow, UP was dissected as per normal standards of Cunningham.

The sternocleidomastoid muscle and body of mandible were removed and the external carotid artery and its branches were exposed.

Results: Variant pattern was observed in one cadaver in which there was a common linguo facial trunk on right side while on left side high origin of external carotid artery is present at the level of hyoid bone and also lingual artery arose from the common carotid artery just before its bifurcation instead ECA. Rest cadavers were having conventional pattern of branching of ECA on both the sides.

Conclusion: ECA shows high frequency of variation in branching pattern which may lead to inadvertent injury and cause confusion in interpretation of angiograms. Preoperative evaluation is recommended.

ANATOMICAL STUDY OF CANTHAL INDEX (MORPHOMETRICAL STUDY)

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Introduction: Anthropometry is the hallmark technique for biological anthropometry and has become increasingly important in health assessment across this century.

Aims and Objectives: The objective of the study is to correlate Anthropometric dimension related to Inner canthal distance (ICD), Outer canthal distance (OCD) and Canthal index (CI).

Material and Methods: The outer and inner Canthal measurements of the Nepalese were observed in 300 normal male and female as compared to 150 males and 150 females of age 17 – 25 years.The inner and outer Canthal distances were measured by using a digital sliding calliper graduated in millimetres. The Canthal index was calculated by ICD/OCD *100.

Results: There was statistically significant difference in ICD among (31.98+ 2.3) females and (34.25 + 2.96) males ($P < 0.001$). We found statistically significant difference in the OCD among 95.54+3.5 females and males 96.98+4.07 ($P < 0.001$) and also there was significance difference in mean CI among 33.48 +2.32 females and males 35.43 + 3.24 ($P < 0.001$) respectively.

Conclusion: This work has generated normative values for Canthal dimensions of Nepalese. This would be of benefit not only to Anthropometrist, the Maxillofacial and Plastic surgeons, but also to the Orthodontist and Dysmorphologis.

A STUDY OF NASAL INDEX IN ADULT HUMAN DRY SKULLS OF NORTH INDIAN POPULATION

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Introduction: Nasal Index is very useful in anthropology and it is one of the clinical anthropometric parameters recognized in nasal surgical and medical management. Nasal index is the most common nasal parameter which may be related to regional and climatic differences.

Aims & Objectives: The present study is designed to provide a normative data of Nasal Index and to classify their nose type and the comparison of the data with other studies, so that it would be further useful as an essential tool to the researchers, clinicians, rhinoplastic and facial reconstructive surgeons and forensic experts related to this field.

Material and Methods: The study is conducted on 100 Human Dry Skulls of North Indian Population in Department of Anatomy, SN Medical College, Agra. The measurements were taken using Digital Vernier Caliper. Nasal Index is calculated by measuring Nasal Height and Nasal Width in order to determine the Nasal type.

Results: In the present study, Mean Nasal Height is 49.96±3.07 whereas Mean Nasal Width is 24.65±1.64.Mean Nasal Index is calculated as 49.31± 2.01.

Conclusion: The findings of our study suggest that according to the Nasal Index, the studied population belongs to mesorrhine type.

THE STUDY OF CORRELATION BETWEEN HAND LENGTH AND THE STATURE OF NORTH INDIAN POPULATION

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Introduction: Height or Stature estimation is central dogma in anthropometric measurement. The human hand, the most used and versatile part of the body is of great scientific importance to investigators in the field of anthropometry, forensic pathology, orthopedic surgery and ergonomics. It aids in personal identification of an individual. It is believed that standards for identifying stature differ from population to population and the method for one population may not be applicable for another population.

Aims & Objectives: The aim of the present study was to find correlation between hand length and Stature in human adults, as it is found to be an accurate predictor of stature.

Material and Methods: The present study comprised of 300 medical students, of age group between 18 yrs. to 25 yrs. of S.N. Medical College, Agra. The two anthropometric parameters, hand length and stature were used to calculate mean, standard deviation and Pearson's correlation coefficient, thus regression equation was developed.

Results: Pearson's correlation coefficient was found to be 0.7755 and p value was <0.0001, which was highly significant thus, showing a positive strong correlation between the stature &hand length for North Indian population.

Conclusion: The findings of present study suggest that hand length can be successfully used for stature reconstruction by using the developed regression equation.

DETERMINATION OF SEX BY THE MEASUREMENT OF DIAMETER OF ACETABULUM AND LENGTH OF PUBIC PART OF HIP BONE

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Introduction: Determination of sex in living is not difficult but it poses difficulty in highly decomposed bodies and determination of sex becomes further problematic when the body has been reduced to skeleton and especially when only limited number of bone are available for examination and more so when they are in fragment state. In past several workers have worked on the topic of sex determination from different bones and in the light of the existing scientific knowledge it can be said safely that the sexing can be done with much reasonable degree of accuracy.

Material and Methods: The present study was carried out in the department anatomy FHMC Tundla Firozabad .and subjects studied also included the cadavers coming to the department for postmortem examination. All the cases studied in the present series come from the population of west U.P .the hip bones of the two sexes were considered separately.

Results: In this study we observed diameter of acetabulum of hip bones in two sexes and the related statistical calculations. The diameter of acetabulum of hip bone in males ranges from 4.8 to 5.9 cm and in females 4.1 to 5.1 cm. with a mean value of 6.01 cm and 4.61 cm in males and females. Length of pubic part of hip bones in two sexes also related statistical calculations. The length of pubic part of hip bone in males ranges between 4.5- 5.8 and in females between 5.0-6.4, with a mean value of 5.19 and 5.77 in males and females, respectively.

Conclusion: We conclude that the acetabulum is longer in males and its diameter is approximate equal to the distance from its anterior margin to the pubis symphysis. But length of pubic part of hip bone in males is shorter than females.

MORPHOMETRIC & MORPHOLOGICAL ANALYSIS OF SACRAL HIATUS

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Introduction: Sacral hiatus is an opening at the caudal end of sacral canal, which is formed due to failure of fusion of laminae of the 5th (or sometimes 4th) sacral vertebra or lower end of median sacral crest. The sacral hiatus exhibits many variations at the level of apex and base. Understanding of these variations may improve the success of caudal epidural anaesthesia. This study was done to have the detailed knowledge of sacral hiatus for optimal access into sacral epidural space.

Aims & Objectives: Morphometric & morphological analysis of the sacral hiatus.

Materials and Methods: The present study was conducted in the Department of Anatomy, Integral Institute of Medical College, Lucknow and Saraswati Medical College Unnao. 130 dry human sacra were measured by a digital vernier caliper. The shape of sacral hiatus was also determined.

Results: Will be presented at the time of power point presentation.

Conclusion: The sacral hiatus transmits fifth sacral and coccygeal nerves. The efficient and accurate caudal block depends upon the degree and extent of variations in sacral hiatus especially at the levels of apex & base. The caudal anesthesia is given through sacral hiatus for various purposes hence the morphometrical study of variations in sacral hiatus is of great relevance.

STUDY OF CEPHALIC INDEX IN RURAL AREA OF LUCKNOW REGION

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Introduction: Variety of metric and non-metric measurements access the ethnic and sex differences of skull. The non-ethnic measurements are more subjective, and the actual measurements like cephalic indices provide a metric recording of size, proportions of cranial features. Cephalic indices play a crucial role in comparison of cephalic morphometry between parents, offspring and siblings and provide information on inheritance pattern.

Aims & Objectives: To measure the cephalic index as it provides information on inheritance pattern and also contributes in age and sex determination of individuals

Material & Methods: The present study was performed on 100 participants of rural area of Lucknow region and anthropometric points were measured by using spreading, sliding calliper.

Result: The present study showed the head of most of the participants were mesocephalic.

Conclusion: In the present study most of the crania in both sexes were mesocephalic.

ANATOMICAL VARIATION OF FISSURES AND LOBES OF LUNG: A CADAVERIC STUDY

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Introduction: The knowledge of anatomical variations alerts the surgeons to the potential problem that might be encountered during surgical intervention. The variations of fissures and lobes of lungs have been described by many research workers on CT scans, whereas there are fewer studies done on gross anatomical specimens.

Material and Methods: Present study was done in Dept of Anatomy, GMC Haldwani (UK). 30 embalmed cadavers were included for the study. The lungs, of right and left side were removed from thoracic cavity and individual lungs were examined for fissures and lobes.

Results: 9 (30%) out of 30 left lungs showed incomplete oblique fissures. 8 (26.67%) out of 30 right lungs showed incomplete transverse fissure but oblique fissure was complete, and 2 (6.67%) of the right lung incomplete oblique and transverse fissure was found. In one (3.33%) of the right lung one accessory lobe and one accessory fissure was present. comparative analysis of present work with data in literature suggest that different studies performed on radiological images reported greater prevalence of incomplete or absence of pulmonary fissure as compared to present cadaveric study. Therefore our findings with regards to fissures and lobes are different from many image studies but similar with some.

Conclusion: Variation of lung anatomy is important for cardiothoracic surgeons, radiologists for interpreting x-rays, CT scans and MRI and also it is of academic interest to all medical personal.

A STUDY OF MYOCARDIAL BRIDGES IN NORTH INDIAN POPULATION

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Introduction: Myocardial bridges are a benign condition in which a coronary artery submerges into the myocardium and after a short intra mural course again appears sub-epicardially. The association between myocardial infarction and myocardial bridges has increased their clinical relevance.

Aims & Objectives: The aim of present study was to see the incidence, number and location of myocardial bridges in North Indian population.

Material & Methods: The present study was carried out on 50 adult human hearts of both sexes which were collected from Forensic Department of King George's Medical University, U.P. Lucknow. The hearts were washed and fixed in 10% formalin for 2-5days then examined for the presence of myocardial bridges in respect of their number and location.

Results: In the present study, the incidence of myocardial bridges was seen in 26 (52.2%) hearts. There was 1 bridge in a heart in majority but some of hearts had more than 1 bridge. Among these 26(52.2%) bridges were present in left anterior descending artery, 5(10%) bridges in marginal artery, 3 (6%) bridges in diagonal artery & 1(2%) bridges in posterior inter-ventricular artery. In majority, myocardial bridges were present in left anterior descending artery, at the middle one third.

Conclusion: It is a benign condition, so early diagnosis & treatment is important due to complication associated with myocardial bridges.

SCAPHOID MORPHOMETRY AND DISTRIBUTION OF ITS NUTRIENT FORAMINA

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Introduction: Scaphoid is boat shaped bone of proximal carpal row connecting it with distal row of carpals. It is the most commonly fractured bone at the wrist due to its morphological and vascular features. Morphometric data of scaphoid gives insight into its structural details required for its reconstruction and estimating the

length of screws used for its fixation study of its vascular foramen will give clues regarding its blood supply.

Materials and Methods: Study was done on 50 Scaphoid bones (32 Right and 18 Left). Scaphoids were taken from the Department of Anatomy, MLN Medical College, Allahabad. Measurements were taken with the help of vernier calliper and thread, hand lens was used to observe the number of nutrient foramina, excel spreadsheet was used to calculate data.

Results: Following morphometric details were found in our study average length of scaphoid on Right side was 22. 738 and 21.867 on the left side, average circumference of waist on the Right and Left side was 30.423 and 29.982 respectively and average number of nutrient foramina on the Right and Left side was 8.366 and 5.082 respectively.

Conclusion: All measurements were higher on right side as compared to Left side except for secondary height of tubercle. We can infer that right side scaphoid is sturdier and tubercle is tilted more in right side.

MORPHOMETRIC STUDY OF STYLOID PROCESS AND ITS CLINICAL IMPLICATIONS

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Introduction: The styloid process of temporal bone is a slender, pointed, bony projection from the inferior aspect of petrous temporal bone. Its length varies from few millimetres to an average of 2.5 cm. An elongated styloid process can compress neurovascular structures in its surroundings, hence, study of morphometric parameters of styloid process is of paramount importance.

Aims and Objectives: Aim of study was to observe various parameters of styloid processand discuss clinical relevance of changes in morphometry of styloid process.

Material and Methods: Study was conducted on 25 dried skulls with an intact styloid process, obtained from the osteology laboratory, Department of Anatomy KGMU, U.P, Lucknow. Variables studied included; length of styloid process,interstyloid distance at tip and base, thickness at base, and distance between styloid process and stylomastoid foramen (StSf Dist.). All measurements were made using digital vernier callipers (±0.06). The observations were tabulated and analysed accordingly.

Results: Mean length of styloid process was 17.7mm and 18.3 mm on right and left sides. Average interstyloid distance at base and tip was 74.6mm & 62.6 mm respectively. Thickness (at base) was 3.2 mm on right side and 3.8 mm on left side. St Sf Dist. was 3.74mm on right side and 3.43mm on left side.

Conclusion: Neurovascular structures in close proximity may undergo compression due to variations in anatomy of styloid process. The data may be useful for surgeons, radiologists, anaesthetists and anatomists for academic interest.

MORPHOMETRIC ANATOMY OF HYPOGLOSSAL NERVE IN RELATION TO ITS APPLICATION IN HEAD AND NECK SURGERIES: A CADAVERIC STUDY

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Introduction: Morphometry of hypoglossal nerve is important as it has been seen that it is a commonly damaged cranial nerve in head and neck surgeries including surgeries for resection of submandibular gland tumor. It has also been seen that it is also damaged due to malpositioning of neck during surgery. Soa detailed understanding of the anatomy of hypoglossal nerve in relation to various landmarks and surrounding structures is important to reduce the procedural complications and therefore the risk of nerve damage can be prevented.

Aims & Objectives: The current study aims to determine the distance between hypoglossal nerve and various landmarks including bifurcation of carotid arteries (CCA), external carotid artery (ECA), internal carotid artery (ICA), posterior belly of digastric muscle (PBD), mid-point of the body of hyoid bone (BHB), angle and base of mandible and tip of mastoid process (TMP). It also aims at measuring the vertical extent of the loop of hypoglossal nerve from PBD.

Material & Methods: The study was carried out in the neckregion of 4 preserved cadavers (total 8 sides i.e. 4 right and 4 left) from the Department of Anatomy, KGMU, Lucknow. Dissection of the neck region was done as per standard guidelines. Hypogossal nerve and its relation to various landmarks were measured with the help of thread and scale.

Results: The average distance between the origin of descendens hyoglossi (DH) and CCA was found out to be 3.5cm. Distance from CCA to ECA (till the origin of DH) was 2.5cm and to ICA (till the origin of DH) was 2.6cm. The distance from TMP to loop of hypoglossal nerve (LHN) was 6.5cm. Extent of LHN to the tendon of PBD just above it was 1.5cm and from mid-point of BHB to LHN was 3.2cm. Distance between LHN to the angle and base of mandible was 3.7cm and 3.0cm respectively.

Conclusion: The required knowledge about the morphometry of hypoglossal will help to decrease the procedural complications during surgery and the risk of damage to the 12th cranial nerve.

MORPHOMETRIC AND TOPOGRAPHIC STUDY OF FORAMEN OVALE IN INDIAN SKULLS

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Introduction: An anatomical study was undertaken to note the shape of the foramen ovale (FO) presence or absence of canalis innominatus. The FO is present in the posterior part of the greater wing of the sphenoid. The important structures which pass through it are the mandibular nerve, the accessory meningeal artery, the lesser superficial petrosal nerve and the emissary vein. This is the one of the important foramina which is situated at the transition zone between the intracranial and the extracranial structures. The FO opens into the infratemporal fossa, through its other opening on the lateral surface of the greater wing.

Aims and Objectives: In our study we carried out to find out the variations in shape, bony growth & divisions of FO in available dry human skulls.

Materials and Methods: 50 dry adult human skulls were studied with regard to observe their size, shape, presence or absence and any duplication/multiplications of foramen ovale.

Results: Out of 150 observed, foramen ovale and foramen spinosum were present in all skulls studied. Foramen ovale was not duplicated in any of skulls studied, while duplication of foramen spinosum was observed in six skulls. The mean maximum dimension of foramen ovale was 7.53±1.75 mm on right side and 7.41±1.53 mm on left side.

Conclusion: Foramen ovale and foramen spinosum showed variability in size and shape. This study can be of great surgical importance to clinicians in invasive procedures such as percutaneous trigeminal rizotomy in trigeminal neuralgia.

A MORPHOMETRIC AND MORPHOLOGIC STUDY OF FORAMEN OVALE IN INDIAN POPULATION

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Introduction: The internal surface of cranial base is divided into three distinct fossae, the anterior, middle and posterior cranial fossae. In the floor of the middle cranial fossa, the sphenoid bone yields numerous openings or foramina that transmit vital neural and vascular structures. Recognition of the variants related to these foramina is important for understanding the complex regional neurovascular anatomy. Foramen Ovale (2 to 4 mm long) lies medial to the foramen spinosum and lateral to the foramen lacerum It transmits the mandibular division of the trigeminal nerve, the lesser petrosal nerve, the accessory meningeal branch of the maxillary artery and an emissary vein.

Aim and Objectives: To conduct an observational study on the variations of foramina of middle cranial fossa regarding their metric and non-metric parameters in adult dry human skulls and to compare the observations with those of previous studies.

Materials and Methods: 150 Adult non-pathological dry human skulls were obtained from preserved sets of bones of unknown age and sex as from Department of Anatomy, Era's Lucknow Medical College and Hospital and Department of Anatomy, King George's Medical University, Lucknow. The Foramen Ovale was identified and its non-metric features were analyzed. Metric parameters were collected in the form of antero-posterior diameter (APD), transverse diameter (TD) and distance from midline (MLD) on both sides. Descriptive statistics (mean, minimum, maximum and standard deviation) were evaluated for all the parameters collected.

Results: Most common shape noted was transversely oval on both sides. Mean of TD, APD and MLD for Foramen Ovale were 5.9mm, 4.0 mm and 213mm on right side and 5.8mm, 4.0 mm and 21.4 mm on left side.

Conclusion: Primarily, the morphologic variations of Foramen Ovale in the form of accessory foramen and presence of bony bar / bony plate are common. Secondarily, this study will provide a baseline data as well as frequency of related variations in our population for a safer approach by the surgeons.

MORPHOMETRIC PARAMETERS OF AXIS VERTEBRAE: AN AID IN BETTER CERVICAL SPINE SURGERY

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Introduction: Axis vertebrae, the second cervical vertebrae have a complex morphology and it also exhibit many variability. Many neurovascular structure lies around it. So a good knowledge of its morphology and variations is must for surgeries around the axis vertebrae.

Aims and objectives: The aim is to evaluate various morphometric dimensions of axis vertebrae and to compare with the available data.

Material and methods: 30 dried axis vertebrae of north Indian human population were taken for the study available in Department of Anatomy, King George's Medical University. Vernier caliper was used for measuring various dimensions. The dimensions were measured in millimeters. Parameters measured were the centre of the posterior surface of the body to tip of transverse process on both sides; the total length of axis (tip of the dens to centre point on lower border of the body); and length of dens (tip of dens to upper border of the body). Any variation in bifurcation of spine and superior articulating facet was also observed carefully.

Result: Mean length of axis vertebrae was found to be 35.1mm, mean length of odontoid process was found to be 11.8 mm and mean distance of tip of transverse process from the center of posterior surface of body was found to be 26.7mm on right side and 27.4mm on left side. Shape of superior articulating facet was oval in 15 vertebrae circular in 12 vertebrae and triangular in 3vertebrae and spine was symmetrically bifurcated in 20 vertebrae asymmetrically bifurcated in 9 vertebrae and no bifurcation was seen in 1vertebrae.

Conclusion: These data may help surgeons of various fields to work accurately around axis vertebrae.

STUDY OF ANATOMICAL VARIATIONS OF PLANTARIS MUSCLES IN CADAVERS

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Introduction: The plantaris muscle consists of a small, thin muscle belly, and a long thin tendon. The aim of this study was to identify the agenesis and the variations of its origin and insertion.

Aims and Objectives: Accurate anatomical knowledge of plantaris muscle is an important tool for the clinical diagnosis of muscle rupture and interpretation of MRI scan.

Materials and Methods: The present study was conducted by the Department of Anatomy, TSM Medical College & Hospital, Lucknow. The plantaris muscle was dissected in 15 adult embalmed cadavers (30 lower limbs), 4 females and 11 males; the average age of the cadavers was between 40-70 years.

Result: In our present study mean length of the muscle belly was 7.59 cm, mean girth of muscle belly was 0.42 cm and mean length of the tendon was 32.37 cm. Agenesis of plantaris was observed bilaterally in a male cadaver, with the incidence of 6.66%.

Conclusion: Earlier it was thought that the plantaris muscle is vestigial and degenerating structure. Recent studies revealed that it can be used as a autograft material in plastic & reconstructive surgeries.

MORPHOMETRIC STUDY OF PATELLA- AN AID IN KNEE ARTHROPLASTY

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Introduction: The patella, also known as the knee cap, is a thick, circular-triangular bone, which articulates with femur and covers the anterior surface of knee joint. Patella is the largest sesamoid bone embedded in tendon of quadriceps femoris. The anatomical knowledge of patellar dimensions can be useful in knee implant designs and certain surgical procedures like patellar resurfacing for knee arthroplasty.

Aims and Objectives: the objective of the present study was to study various patellar dimensions. Patella were also classified on basis of the dimensions of articular facets.The impact of the findings obtained were further discussed with the implants used or designed.

Material and Methods: 50 (25 of right side and 25 of left side) dry patella were obtained from the department of Anatomy KGMU-U. P, Lucknow. Morphometry of patella was measured using a digital Vernier Calliper. Various dimensions of patella i.e.height (linear distance between superior border and apex), thickness (linear distance between anterior surface and median ridge on posterior surface), width (linear distance between medial and lateral border), and width of medial and lateral articular facets were recorded.

Results: the mean height,width,thickness of patella,width of medial and lateral articular facets of right were 37.5,38.58,19,18.6,23.5 mm respectively and that of left side were 38.24,38.48,18.5,18.5,22.9 mm respectively.

Conclusion: Morphometric data presented in this study is beneficial for orthopedicians in designing patellar implants for procedures involving knee in north Indian population.

GALLBLADDER VOLUME IN ADULTS AND ITS RELATIONSHIP TO AGE, SEX, BODY MASS INDEX AND GALLSTONES

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Introduction: The role of a large gallbladder volume with regard to a predisposition for gallstones is unknown. It is possible that an increase in gallbladder volume could result in impaired gallbladder motility and bile stasis. **Aims and Objectives:** We looked for factors affecting gallbladder volume in a random population in the north India population.

Material and Methods: To assess the relationship between gallbladder volume and gallstones,60 subjects was studied in the Department of Anatomy in collaboration with Department of Surgery at KGMU U.P,Lucknow Age, sex, body mass index, and gallbladder volume were collected for each subject. A linear regression analysis was performed to look for significant variables.

Results: The overall adjusted prevalence of cholelithiasis was 13.9% in our population. On linear regression analysis, two variables (age and surface area) were found to be independently correlated with gallbladder volume. Gallbladder volume was significantly increased in subjects over 60 years (p 0.001). There was a positive correlation between gallbladder volume and body mass index (r = 0.33, p 0.001). In this study, the presence or absence of gallstones did not significantly affect the gallbladder volume.

Conclusions: We report that there is dilatation of the gallbladder with age and with an increase in body mass index. Whether this could represent risk factors for the occurrence of gallstone remains uncertain?

AN ANATOMICAL STUDY OF DISTAL END OF ULNA AMONG NORTH INDIAN POPULATION

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Introduction: The anatomical study of the distal end of ulna can help to understand various movements around wrist joint. Also provide knowledge of pattern of injury occurring at distal radio ulnar joint. Wrist joint connects hand and forearm and plays pioneer role for movement of upper limb. Detailed knowledge of distal end of ulna can help physician to improve diagnosis, skill and treatment related to wrist injury.

Aims and Objectives: The aim is to evaluate size of styloid process and seat (articular surface of the head of ulna).

Material and Methods: 30 dried human ulna of north Indian population available in department of Anatomy King George's Medical University was studied. The dimensions were measured with Vernier's caliper in millimeter and statically analyzed.

Results: Out of 30 dried human ulna, 15 were right sided and 15 were left sided. Mean length of styloid processes were 7.95mm for right side and 13.42 mm for left side. Mean length of seats were7.98 mm and 8.02 mm respectively.

Conclusion: Dimensions of distal end of ulna play an important role in anatomy of wrist joint. Any variations can produce clinical conditions such as ulnar impaction syndrome etc.

ANATOMICAL STUDY OF PROXIMAL FEMORAL COMPONENT FOR DESIGNING OF HIP PROSTHESES

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Introduction: Knowledge of the anatomy of proximal femoral component especially correlation between femoral neck shaft angle to femoral neck length is a prerequisite for complete understanding of the mechanics of the hip joint and serves as a basis for the treatment of pathological condition of the hip and femur. The femoral neck length is approximately 5 cm long and connects the head to shaft atan average angle of 135. This angle facilitates movements at the hip joint, enabling the limb to swing clear of the pelvis.

Aims & Objectives: The current study aims to find the relation between femoral neck- shaft angle to its neck length.

Material & Methods: A total of 100 adult dry femur (62 left and 38 right) were collected randomly from the Department of Anatomy, King George's Medical University, Lucknow. After labelling the bones with number, long axis of shaft and axis of neck was drawn. Femoral neck shaft angle, femoral neck length and femoral length were measured by goniometer, sliding calipers and osteometric board respectively.

Results: Neck shaft angle of femur was found to be132.06◦, neck length 32.76mm and total length of femur 42.14cm.

Conclusion: The required size of the length of the neck can be determined to design prostheses for the restoration of normal neck-shaft angle.

OSSIFICATION OF SCAPHOID: A RADIOGRAPHIC STUDY AT A TERTIARY HEALTH CARE CENTRE

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Introduction: There are eight carpal bones in each wrist which are arranged asfour bones each in proximal and distal rows viz. In the proximal row, Scaphoid, Lunate, Triquetrum and Pisiform are present from lateral to medial side. In distal row, Trapezium, Trapezoid, Capitate and Hamate are present from lateral to medial side.Scaphoid is boat shaped bone. It is fifth carpal bone to ossify.Its ossification center normally appears at the age of 6 years but may appear from four to seven years of age.

Aims & Objectives: To see the centre of ossification of Scaphoid bone in subjects belonging to indigenous population of North India.

Material & Methods: A total 50 subjects of birth to eighteen years of age who had given their written informed consent for wrist radiography in the Department of Radiodiagnosis, included in this study and reviewed for appearance of centre of ossification of Scaphoid bone andits variations. This study had been done in the Department of Anatomy, King George's Medical University UP, Lucknow, in collaboration with the Department of Forensic Medicine and Toxicology, and Department of Radiodiagnosis, King George's Medical University UP, Lucknow.

Results: All the subjects were divided into 18 groups. In group five (4-5 years) out of 6 males, 2 showed appearance of ossification center of Scaphoid, while in the same group one female was present but ossification center of scaphoid has not appeared. In group sixth (5-6 years) one female was present but showed no ossification center of scaphoid.In group ninth (8-9 years), one female subject of 9 years showed absence of ossification center. It is also a case of delayed ossification.

Conclusion: Scaphoid appeared at normal age (4-7 years) in 98% subjects, 2% subjects (only female) showed delayed ossification at the age of 9 years.

Medico-legal significance in deciding criminal responsibility of a child under Sec. 127-130 of Indian Railway Act, 1890 n Sec. 82 IPC.

HISTOLOGICAL CHRONOLOGY IN HUMAN FOETAL URETER

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Introduction: Foetal ureter is developed by ureteric bud shows many developmental changes. Normal histology of the fetal ureter at various stages of development was studied to get insight into the morphology of fetal ureter.It is necessity for correlation with increase in gestational age and pathological changes for normal functioning ofurinary system in fetal life.

Aims & objective: our aim is to find normal developmental histology of foetal ureter in chronological order

Material & Methods: Histological findings of 70 normal human fetal ureters were noted with respect to the age. The histology was studied by using H & E and Masson's trichome stain.

Results: Chronological foetal ureteral histology is different from adult. Unlike in adult ureter, irregular star shaped lumen shows multiple epithelial layer with circularly arranged single muscular layer and thin lamina propria surrounded by connective tissue. Vascularization increases with age in lamina propria and division of muscular layer as inner longitudinal and outer circular layer occurs. Development of translational epithelium in lumen. Later on, the lumen changes to star shaped by multiple mucosal folds with increased vascularization in outer connective tissue layer.

Conclusion: The present study will be helpful in understanding the normal histological architecture of Foetalureter and add to the existing knowledge regarding its development, its relation with gestational age and pathogenesis.

HISTOPATHOLOGICAL AND HISTOMORPHOMETRIC STUDIES ON THE EFFECTS OF OLANZAPINE ON KIDNEY: AN EXPERIMENTAL STUDY IN ALBINO RATS

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Introduction: Olanzapine, a widely used atypical antipsychotic agent is known to cause nephrotoxic effects after prolonged use.

Aims and Objectives: To find out detailed histopathological and histomorphometric information which might through light on the mechanism of toxicity of olanzapine

Material and Methods: 12 albino rats were divided into equal number of experimental and control groups i.e. 6 each. Experimental rats received olanzapine, 4mg/kg, intraperitoneally for 6 weeks. Kidney tissue was processed for H/E stain.

Results: Extensive degenerative changes with generalized edema were observed as histopathological findings. Histomorphometry showed shrinkage of Bowman's capsule and glomeruli.

Conclusion: Degeneration of kidney due to prolonged use of olanzapine is confirmed which might be due to direct effect on the organ or indirect effect due to toxicities on other organs.

COMPARISON OF EPIDERMAL THICKNESS IN DIFFERENT REGIONS OF SKIN

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Introduction: During 4^{th}-6^{th} week of gestation, under the influence of notochord neuralation proceeds which leads to differentiation of ectoderm into surface ectoderm and neural ectoderm. The further development of epidermis takes place from the surface ectoderm.**Aims and Objectives:**sequential changes in development of epidermis of human fetal skin and to identify the growth pattern in thickness of epidermis in 26-30 weeks of gestation of fetuses in skin from abdominal region, interscapular region, palm region and scalp region.**Material and Methods:** We conducted a study on 5 stillborn/I.u.d human fetuses of 26-30 weeks of gestational age. Sample was procured from different regions (abdomen, interscapular, palm and scalp) and processed by paraffin embedding method. Staining was done with haematoxylin and eosin. Slides

were examined under microscope (high and low power). Measurement of epidermal thickness of different regions was noted.

Results: Mean epidermal thickness of abdomen was 27.82 µm, mean epidermal thickness of interscapular region was 147.1 µm, mean epidermal thickness of palm was 177.2 µm and mean epidermal thickness of scalp was 28.76 µm.

Conclusion: The mean epidermal thickness varied in different regions of fetal skin. The most notable change noticed was the epidermal thickness of scalp was less than epidermal thickness of interscapular and palm region and also epidermal thickness of palm was more than epidermal thickness of interscapular region.

HISTOLOGICAL ALTERATION IN THE CA1 REGION OF HIPPOCAMPUS OF MALE ALBINO RATS EXPOSED TO PYRETHROID BASED MOSQUITO VAPORIZERS AND PROTECTIVE ROLE OF TURMERIC

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Introduction: Poor memory, lower retention and slow recall are common problems in today's stressful and competitive world. Hippocampus the brain area is mainly concerned with learning and memory. Pyrethroids are most widely used class of insecticides worldwide. The commonly available liquid mosquito repellent vaporizers contain derivatives of pyrethroids as mosquito repellent. The hippocampus is the most affected region in rats exposed to mosquito repellent**.** Extensive studies demonstrated the protective action of turmeric in almost all the disorders of the body. It is known to possess neuro-protective properties.

Aims & Objectives: Present study was carried out to investigate the effect of sub-chronic whole body inhalation of mosquito vaporizer on histology of CA1 region of hippocampus and protective role of turmeric. The results were compared with control group.

Material & Methods: A total of eighteen male albino wistar rats were used for the study. They were randomly divided into group I, II and III, each group contained six rats. Group II animals were exposed to mosquito vaporizer for eight hours daily for 90 days and group III animals received turmeric per orally along with exposure. Rats were sacrificed and hippocampus was processed for histological assessment.

Results: Histological examination of the CA1 region of hippocampus showed marked neurotoxicity in exposed group rats. This toxicity was less in turmeric treated group.

Conclusion: The assessment suggests that inhalation of pyrethroid based mosquito vaporizer fumes have neurotoxic effects which may be avoided to some extent by turmeric.

STUDY ON MORPHOLOGICAL CHANGES AFTER EXPOSURE TO ACETAMIPRID INSECTICIDE IN CHICK EMBRYOS

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Introduction: Humans have used insecticides since ancient times. Pesticides are widely used in food production systems and in agriculture sectors of some of the countries because of their increased food demands.

Aims and Objectives: The use of acetamiprid is increasing, it is necessary to identify its possible adverse effects on animals.

Material and Methods: Present study was carried out in the Department of Anatomy Govt. Medical College, Ambedkar Nagar and Govt. Medical College Budaun U.P. on 270 fertile eggs of white leghorn chicken obtained from government poultry farm after taking permission from animal ethical committee. Chicken eggs exposed to Acetamiprid with doses of 10µg, 20µg, and 50µg in a volume of 10µl, 20µl and 50µl respectively and control same as test group. The embryos were terminated on 20th day, egg shell broken with a scalpel and embryos removed. Morphological changes observed and recorded.

Results: The results show that experimental group had comparatively more cases of morphological changes and growth retardation, limbs defects and Ectopia Viscerale as compared to controls.

Conclusion: In conclusion, acetamiprid was demonstrated to be teratogenic in chick embryos producing morphological changes and comparatively higher doses proved more toxic and also caused many developmental defects.

CYTOGENETIC STUDY OF MISCARRIAGES FROM COUPLES WITH RECURRENT MISCARRIAGES

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Introduction: Parental carriers of structural chromosomal rearrangements are associated with recurrent pregnancy loss. Its incidence varies from 0.08-0.3% in the normal population.

Aims and Objectives: In our study we carried out a cytogenetic analysis of 50 couples (100 individuals) by G banding technique and aimed to establish balanced translocation as one of the etiological factors of recurrent pregnancy loss in Lucknow region of Uttar Pradesh.

Material and Methods: Subjects were analysed by karyotyping using G banding technique by peripheral blood. Karyogram were prepared by cytovision software after the processing of the samples. At least 20 metaphases were analyzed per patient.

Results: Balanced translocation was present in 10 (10%) individuals. Out of which 8 were females and 2 were males.

Conclusion: The carrier status of balanced translocation is associated with recurrent miscarriage. An apparently balanced translocation may produce a clinical phenotype by gene disruption or altered expression of genes in or around the breakpoint region.

A CYTOMORPHOMETRIC ANALYSIS OF EXFOLIATED BUCCAL CELLS IN TOBACCO CHEWERS

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Introduction: Buccal epithelial cells are the very first barrier found in the oral mucosa exposed to smokeless tobacco. Exfoliated oral

epithelial cells are therefore identified as an ideal target site for early genotoxic events induced by carcinogenic agents entering the body through inhalation or ingestion. A cytomorphometric analysis of these cells is thus a quantitative method to assess the influence of smokeless tobacco on the buccal mucosa.

Aims and Objectives: To study the oral mucosa of subjects by exfoliative cytology and to assess the cytological and nuclear changes therein for early detection of oral lesions thus helping in better treatment and prognosis.

Material and Methods: A buccal smear was prepared by scraping the buccal mucosa with a wooden spatula; the slides were stained with Papanicolaou stain. Photomicrographs were obtained at 40X magnification for individual unfolded cells with a clear outline. Fifty cells per slide were analysed for CA, NA, and NA/CA (N/C) ratio using Leica 1000 software.

Results: Cytomorphometry in Control group revealed the measurements as follows: cellular diameter was 49.51µm SD 7.308; nuclear diameter was 8.83µm SD 1.096 and nuclear cytoplasmic ratio was 0.182µm SD .034. In Tobacco chewers cellular diameter was43.52µm SD 1.922; nuclear diameter was 7.77µm SD 0.762 and nuclear cytoplasmic ratio was 0.179 SD 0.018.

Conclusion: Oral exfoliative cytology is now widely accepted as an addition to clinical acumen and an adjuvent to biopsy. Our study thus elucidates the importance of early recognition of cellular alterations for identification of individuals who require early intervention even in the absence of visible changes of mucosal surface.

CHROMOSOMAL ABNORMALITY IS LESS LIKELY IF COUPLES HAVE PREVIOUS LIVE BIRTHS

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Introduction: Cytogenetic studies revealed that 50-60% of cases with recurrent abortions are due to genetic cause in the form of chromosomal aberrations. Available citations are very less to discuss the genetic abnormalities on the basis of previous live birth among couples with repeated abortions. Our study revealed the difference in occurrence of chromosomal anomalies of these cases in north Indian population.

Aims and Objectives: This study was conducted to find out the difference in occurrence of abnormal chromosomal pattern in couples related to number of prior live births.

Material and Methods: 86 couples with history of repeated pregnancy loss were included during the period of July 2013 to June 2014 to study chromosomal analysis from peripheral blood lymphocytes. Karyogram were prepared according to standard cytogenetic methods using G-banding technique.

Results: Total number of abnormal case was 9 (10.46%) with finding of 7 (15.2%) abnormal karyogram among 46 couples having '0' parity, 26 couples with parity '1' showed abnormality in 2 (7.7%) cases only. No abnormal case was detected among 14 couples who had two previous live births. Numerical abnormality was seen with mosaic pattern in 4 (4.7%) couples and structural abnormality was detected in 5 (5.8%) couples having isochromosome and translocations.

Conclusion: Finding of more number of chromosomal anomalies in cases with zero or 1 parity suggest to include this factor of "number of previous live births" along with other factors to obtain cytogenetically abnormal findings in the study population.

CONGENITAL (ANATOMICAL) MALFORMATIONS LEADING TO INFERTILITY AND ADVERSE PREGNANCY OUTCOMES

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Introduction: Congenital uterine anomalies are the most common malformations of the female reproductive tract which results from the incomplete fusion of mullerian ducts and are associated with recurrent pregnancy loss, pre term labour, abnormal fetal presentation and infertility. Septate uterus (most common) is assosciated with poorest reproductive outcome with pregnancy loss of more than 60% and fetal survival rates as low as 6%-28%.

Material and Methods: A retrospective study was done in 403 women suffering from primary infertility , recurrent pregnancy losses and poor pregnancy outcomes in form of Low birth wt fetuses, preterm birth , abnormal presentations stillbitths and sometimes dysmorphogenesis.w omen with infertility , recurrent pregnancy losses , premature deliveries were screened for uterine anomalies and compared to the women with similar presentations , primary modality used was routine 2d ultrasound , those found with anomalies were further evaluated by 3d ultrasound , transvaginal scans hysteroscopy and MRI.

Results: It was found that presence of uterine anomaly was associated with primary infertility, recurrent abortions < 12 wks ($p<0.01$), preterm births < 34 wks ($p<0.01$), ptb < 37 wks ($p<0.01$), premature rupture of membranes and malpresentations.

Conclusion: Women with anatomical uterine malformation are at risk of infertility and poor pregnancy outcome. Highlighting at risk women/ families can reduce the risk and promote early intervention.

CYTOGENETIC ANALYSIS OF TURNER SYNDROME

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Introduction: Turner syndrome is the most common female sex chromosomal abnormality with different studies quoting an incidence varying from 1 in 2000 to 1 in 2,500 of live birth. The most common type of abnormality observed is '45, X' (partial or complete) in approximately 80% of affected case. The main characteristics of turner syndrome are short stature, gonadal dysgenesis, primary amenorrhea, webbed neck and widely spaced nipples.

Aims and Objectives: To describe the role of chromosomal study by Karyotyping and FISH techniques for diagnosis of turner syndrome

Case Description: We have studied two post natal cases using peripheral blood and four prenatal cases using amniotic fluid and chorionic villi samples (CVS). A newborn baby (case 1) was referred with webbed neck, wide spaced nipples and long philtrum and another 14-year-old girl (case 2) with short stature, low set ears, webbed neck and no secondary sexual characteristics for

chromosomal analysis. Two CVS and two amniotic fluids samples were referred with a strong suspicion for Turner syndrome based on soft markers.

Material and Methods: Chromosomal analyses of these cases were carried out by using standard GTG banding and FISH technique.

Results: Karyotype analysis revealed mos 45,X[80 %] / 46,XX[20%] in case 1 whereas in case 2 only 45,X cell line was present. FISH analysis was also performed for both cases on the same peripheral blood sample using CEP X/Y probe. Case1; showed 80% cells with single green signals, which authenticate the presence of second cell line and case 2 showed only 45,X cell line. All four prenatal cases showed complete monosomy X in all cells observed by both FISH and Karyotyping methods.

Conclusion: Early recognition of Turner syndrome and timely investigations should be helpful. Karyotyping is definitely helpful in the evaluation of short stature and FISH study is essential to detect low level mosaicism with normal X chromosome in such patients for the appropriate counseling.

A CT STUDY OF VARIATIONS IN PORTAL VENOUS SYSTEM IN NORTH INDIAN POPULATION

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Introduction: Portal vein is formed by convergence of superior mesenteric and splenic veins posterior to neck of pancreas at the level of second lumbar vertebra. It is nearly 8 cm in length, courses obliquely to the right and anterior to IVC. Main portal vein (MPV) divides into two branches-left (supplying segments II, III, and IV) and right supplying segments V, VI, VII and VIII. It provides about 75% of hepatic blood flow and carries venous blood from the gastrointestinal tract to the liver for metabolic processing.

Variants in portal vein anatomy are frequent and of utmost importance prior to surgical planning or interventional radiological procedures.

Aims & Objectives: Aim of present study was to review variant portal venous anatomy inNorth Indian population.

Material & Methods: Study was conducted on imaging data generated from 50 patients who underwent abdominal CT examination for medical or surgical indication in the Department of Radiodiagnosis, K.G Medical University.

Result: Most common formative tributaries were superior mesenteric and splenic veins (78%) followed by splenic vein and common mesenteric vein (14%) and lastly superior mesenteric, splenic and inferior mesenteric veins in 8% subjects. Type I branching pattern was observed in 80% subjects followed by Type II in 14%and Type III in 6% subjects.

Conclusion: Portal vein variants are frequent and are recognizable on CT examination. These variations should be described precisely before graft procurement in liver transplantation, hepatic tumour resection, and placement of transjugular intrahepatic portosystemic shunts and for accurate tumour localization.

A CROSS SECTIONAL STUDY OF LONG BONE AND VERTEBRAL COLUMN IN MALE PATIENTS WITH HYPERTHYROIDISM

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Introduction: Osteopenia, osteoporosis and osteoporosis-related fractures are usually found related to postmenopausal females or elderly women, but these problems also occur in men .With the increasing size of our ageing population and the improving longevity of men, osteoporosis in men will soon become an even greater burden to society and healthcare systems worldwide. Thyroid disorders are among the leading causes of secondary osteoporosis. Untreated hyperthyroidism has been associated with a decreased bone mineral density (BMD) and an increased fracture risk. Thus, hyperthyroidism is considered as a major risk factor for osteoporosis. Besides, most of the studies hyperthyroidism and osteoporosis are focused on female population, whereas the relationship between hyperthyroidism and bone health has been studied in very few studies in male population. The present study was aimed to investigate the association between hyperthyroidism and bone health status in men aged 20 -60 yrs.

Aims and Objectives: The main objective of this study was to evaluate the changes in long bone and vertebras due to increased thyroid hormones.

Material and Methods: A total of seventy seven newly diagnosed male hyperthyroid patients and thirty male euthyroid subjects were included in the current study. Thyroid hormones and vitamin D were estimated with Enzyme Linked Immunosorbent Assay (ELISA) method. Serum calcium was estimated by Arsenazo III method. Dual electron X-ray absorptiometry (DXA) technique was used to measure the BMD at the femoral neck and lumbar vertebrae.

Results: Results of the present study showed that serum calcium level was significantly high in group I hyperthyroid patients (10.3±1.13mg/dl) as compared to group II euthyroid subjects (8.8±0.79 mg/dl) with $p<0.01$. Vitamin D level (22.59±15.4 ng/dl vs 51.82±17.66 ng/dl, $P<0.01$) and BMD level of male hyperthyroid patients at femoral neck was significantly low compare to male euthyroid subjects (0.863±0.22 g/cm^2 vs0.915±0.85 g/cm^2, $p<0.01$). Further, BMD level of male hyperthyroid patients at lumbar vertebrae was significantly low compare to male euthyroid subjects (0.910±0.12 g/cm^2 vs 0.939±0.10g/cm^2, $p<0.05$). There was an insignificant difference in findings of 'x' ray in both groups.

Conclusion: Findings of the current study suggest that increased level of thyroid hormones may interrupt the bone health of male subjects suffering with hyperthyroidism as higher level of thyroid hormones are associated with increase level of serum calcium and decrease level of vitamin D. Moreover, low BMD at lumbar vertebra as well as femoral neck indicate the decrease in strength of vertebra and long bones which in turn increase the susceptibility of fracture in this population. Therefore, it is suggested that BMD, serum calcium and vitamin D should be evaluated especially in newly diagnosed hyperthyroidism male patients to decrease the risk of fracture.

COMPUTERIZED TOMOGRAPHIC (CT) EVALUATION OF RENAL VASCULATURE IN ADULT NORTH INDIAN POPULATION

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Introduction: Anatomical variations of the renal veins are less frequent than the renal arteries. The frequency of multiple renal arteries ranges from 9% to 76%, with an average of 30%. Multiple renal veins are the most common and are seen in about 15-30% of the population. Laparoscopic nephrectomy for donor kidney harvesting has become the preferred surgical technique worldwide in renal transplant programme. Damage to renal veins during the procedure can be potentially life-threatening; therefore a prior knowledge of renal venous drainage system is essential for renal transplant surgeons.

Aims and Objectives: The aim of the present study was to observe the prevalence of anatomical variations of the renal veins and study the length and diameter in normal adult North Indian population to establish a standard reference value.

Material & Methods: CT scan of 86 normal adult (17 males and 69 females; mean age of 43.7 years), who were voluntary prospective kidney donors, were evaluated for the presence of anatomical variations of the renal veins and the diameter and length of renal veins was recorded.

Results: Each kidney was drained by single renal vein in 74.4% cases. Additional renal vein was present in 22 (25.9%) cases. Sixteen (23.2%) of the 69 females had an additional renal vein and in six of the 17 males (35.3%) of males additional renal vein was present. In all the 22 cases the additional renal vein was found to be draining the right kidney. In 2 of the 22 (9.1%) cases (one male and female each) the right kidney was drained by 3 renal veins. Circumaortic renal vein was seen in 5 (4 females& 1 male) cases on the left side

The mean length of main right and left renal vein was 29.3 mm and 24.0 mm respectively. The mean diameter of right vein was 10.3 mm and 10.6 mm respectively

Conclusion: In the present study the prevalence of additional renal vein was 25.9%. Additional renal veins were present exclusively on the right side. Circumaortic renal vein was present on the left side.

MORPHOMETRY OF FOURTH VENTRICLE IN NORMAL HUMAN BRAIN IN RELATION TO AGE AND GENDER: A CT STUDY

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Introduction: Ageing in human brain is associated with a decrease in size of brain tissue, increase in cerebrospinal fluid volume and enlargement of ventricles. Fourth ventricle is affected in posterior cranial fossa tumours and ventricular disorders as well as in ageing. Therefore, accurate measurement of the fourth ventricle will help the surgeons in diagnosis and decision making.

Aims & Objectives: We measured fourth ventricle with an aim to provide a database of normal ventricular dimensions in healthy brains of North Indian population.

Material & Methods: This study was jointly conducted by Department of Anatomy and Department of Radiodiagnosis, King George's Medical University, Lucknow. 100 radiologically normal axial CT scans of head region of patients were thoroughly analyzed using Radiant DICOM Viewer Software. Study subjects were categorized into V groups as per age: 18-30years, 31-40years, 41-50years, 51-60years and above 60years. Maximum antero-posterior and transverse diameters of fourth ventricle were measured.

Results: Antero-posterior diameter (height) of fourth ventricle (APD4) ranged from 4.8-14.3mm (mean=8.58±1.50mm). Transverse diameter (width) of fourth ventricle (TsD4) ranged from 9.8-20.2mm (mean=12.39±1.6 mm). There was a statistically significant increase in both the diameters with age.TsD4 was greater than APD4 for all ages. Mean fourth ventricle dimensions were greater in males (APD4=8.77mm; TsD4=12.83mm) than females (APD4=8.39mm; TsD4=11.93mm) which was statistically significant for TsD4 but not for APD4**.**

Conclusion: Study provides reference range for the normal values of the dimensions of fourth ventricle in male and female in north Indian population. It would help clinicians in differentiating normal ageing from pathological ventricular enlargement.

MEASUREMENT OF ANGLE OF MANDIBLE FROM DRY BONES AND ORTHOPANTOMOGRAM IN NORTH INDIAN POPULATION

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Introduction: The mandible also known as jawbone is the largest and only movable bone of face except ear ossicles. It forms the inferior part of the facial skeleton which helps in chewing, speech and facial expressions. It develops from the first pharyngeal arch. The body of the mandible is curved and has a pair of rami which project upwards from the posterior end of the body. Angle of Mandible is the posteroinferior angle present at the junction of lower part of ramus and body of mandible.

Aims & Objectives: Present study was done to determine mandibular angle using dry bones and Orthopantomogram in north Indian population.

Material & Methods: The study was conducted at the Department of Anatomy, King George's Medical University, Lucknow, Uttar Pradesh, India using 50 dry bones and 50 Orthopantomograms. The angle was carefully measured using basic geometrical instruments on dry bones and by using free trial version of Klonk Image Measurement Tool on Orthopantomogram.

Results: The average value of angle of mandible as per findings of 50 Orthopantomograms was 121.32° for right side and 124.52° for left side. In each and every case either the angle of mandible was equal to or greater on the left side.

Conclusion: Angle of mandible show changes which may be attributed to physiologic function of the mandible. It also varies in male and female similar to the case of left and right side.

ANATOMICAL STUDY OF ANGULATION OF CLIVUS FOR VARIOUS ENDOSCOPIC SURGICAL APPROACHES

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Introduction: The Clivus represents a vital bony landmark for neurosurgeons and ENT surgeons. It is one of the challenging surgical areas because of complicated anatomy and angular disposition with anterior cranial fossa anteriorly and Cranio vertebral junction posteriorly.

Aims & Objectives: The present study deals with the different vital angular values of clival disposition which are needed for various endoscopic surgical approaches.

Material & Methods: The study was conducted on normal 49 CT scans of Head region available in the Department of Anatomy in G.S.V.M. Medical College, Kanpur. The angle of clivus with imaginary line drawn between anterior cranial fossa and posterior clinoid process, basion and opisthion, basion and axis vertebra were measured with a Dicom Viewer software. The Welcher's Basal angle between lines joining nasion, anterior clinoid process and basion along the plane of clivus was also measured. The data was statistically analysed.

Result: The mean angle of clivus with imaginary line drawn between anterior cranial fossa and posterior clinoid process was 118.44 +/- 6.88 degrees, basion and opisthion was 123.15+/_ 7.6 degrees, basion and axis vertebra was 154.78 +/- 9.64 degrees. The Welcher's Basal angle was 125.9 +/- 4.35degrees.

Conclusion: The surgical importance of these angles will be discussed in conference.

INCIDENCE OF CONUS ARTERY AND ITS VARIANT THIRD CORONARY ARTERY: A CONVENTIONAL CORONARY ANGIOGRAPHIC STUDY

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Introduction: Normally the heart is supplied by two coronary arteries right and left. Conus artery is the branch of right coronary artery which supplies right ventricular outflow tract. One of the important variant of conus artery is the third coronary artery. Third coronary artery is actually the conus artery which arises directly from anterior aortic sinus (right aortic sinus) instead of being a branch from right coronary artery. Several studies had suggested that conus artery is an important source of collateral circulation through a vascular anastomotic bridge (Circle of Vieussens) between the right and left coronary arteries.

Aims and Objectives: The study was done to evaluate the variations in the origin and number of conus artery.

Material and Methods: Study was conducted in the Department of Anatomy in collaboration with the Department of Cardiology, K.G.M.U. Lucknow, in which coronary angiograms of 100 patients (81 males and 19 females) of different age groups were collected and evaluated.

Results: Conus artery was branch of right coronary artery in 93.0% cases. In 6.0% cases conus artery arose directly from anterior aortic sinus (AAS) and in 1% case it was not visualized.

Conclusion: The present study will add up in the data of origin of conus artery and its variant which is required for the diagnostic and therapeutic interventional procedures.

A RADIOLOGIC STUDY OF ACCESSORY OSSICLES AND SESAMOID BONES AROUND THE METATARSALS AND PHALANGES OF THE FOOT

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Introduction: Sesamoid bones are small rounded bones embedded within tendons or muscles. Accessory bones are formed from failed union of secondary osscificationcentres with primary bone masses. Immense variation is seen in the skeletal framework of the foot due to these additional elements. In general, these additional bones improve the overall function of the foot. However, they may cause complications in certain pathologic and traumatic conditions. It is also essential to distinguish them from fractures. Skiagrams of feet provide us with a good understanding of the anatomy of these bones.

Aims & Objectives: This study aims at studying the incidence and features of accessory ossicles and sesamoid bones around the metatarsals and phalanges of the foot using radiographs.

Material & Methods: Anteroposterior, lateral and oblique skiagrams of the feet of 120 (60 male and 60 female) adult subjects were obtained (of which 68 were of right side and 52 of left side) from the Department of Physical Medicine & Rehabilitation, King George's Medical University. They were studied for the presence and features of accessory ossicles and sesamoid bones. The bones considered were the hallucal, lesser metatarsal and interphalangeal sesamoids, osintermetatarseum and osvesalianum.

Results: Accessory skeletal elements were found in the feet of 65% of the subjects of which 52.6% were female and 79.5% had at least one of the bones under study. The bones with their incidence in the study sample in descending order are: hallucal sesamoids (100%), interphalangeal sesamoid (39.2%), lesser metatarsal sesamoids (23.3%) of which the most common was the fifth metatarsal sesamoid (22.5%), osvesalianum (3.3%) and osintermetatarseum (1.7%). 31.7% of the subjects had more than one accessory skeletal element in the foot and 40.8% had biphalangeal fifth toes.

Conclusion: The accessory ossicles and sesamoid bones of the foot have varying incidence and proper knowledge of their anatomy will ensure better diagnosis and treatment of conditions associated with them and will prevent confusing them with fractures.

SIGNIFICANCE OF SACRAL INDEX IN ESTIMATION OF SEX IN NORTH INDIAN POPULATION

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Introduction: For the assessment of sexual dimorphism of human skeleton, pelvis has been used with great accuracy, by the anthropologists or forensic experts. Sacrum, being an integral part of pelvis, has therefore gained importance. Among the various parameters of sacrum, sacral index is the most reliable one.

Aims and Objectives: To determine the significance of sacral index in estimation of sex in North Indian population.

Material and Methods: 35 dry human sacrum bones were obtained from the Department of Anatomy, KGMU, Lucknow, out of which 32 were used for study which were free of deformity. The bones were first separated as male and female on the basis of their gross features. Maximum length and breadth of sacra were measured using digital sliding Vernier calliper and sacral index was calculated by the formula:

Sacral index=max breadth x100/max length of sacrum.

Results: Mean sacral index was significantly higher in females (109.52) as compared to the males (92.37). Sex determination done on the basis of gross features was comparable to that done by calculation of sacral index, except in five sacral bones. Out of five, four sacra were more curved forwards (female feature) while their sacral indices were much lesser (male feature).One sacrum had a uniform curvature (male feature) while its sacral index was >105(female feature).The same sacrum also had only 3 dorsal and ventral foramina, which was a unique variation.

Conclusion: Sacral index is a reliable criterion for sex determination, useful for anatomical, medicolegal and anthropological purposes.

BODY DONATION AFTER DEATH: A SURVEY AMONG MEDICAL STUDENTS

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Aims and Objectives: The aim of this study was to determine the awareness, perception and attitude regarding body donation after death among medical, paramedical and nursing students.

Materials and Methods: A cross sectional study was conducted among 100 MBBS students (Male: Female=59:41), 100 Paramedical students (Male: Female=47:53) and 100 Nursing students (Male: Female=22:78) of Hind Institute of Medical Sciences, Barabanki U.P. India. The duration of study was from April 2018 to June 2018. The sample size of 300 participants was collected by simple random sampling.

Results: In our study most of the students (82%) were aware about body donation. Majority of the students (59.33%) were not willing to donate the body after death. Few (23.67%) were willing to donate but was prevented by their family members for body donation. There were also students (55%) who like to promote their family members for body donation.

Conclusion: Though modern medical students are aware of importance of body donation but are not willing to donate by various reasons.

A CROSS-SECTIONAL STUDY ON LEVEL OF AWARENESS ABOUT MEDICAL ETHICS AMONG JUNIOR DOCTORS

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Introduction: The practice of medicine is bound by ethics and there are well established ethical frameworks i.e. "Code of medical ethics of India" and a regulatory body like "Medical council of India". The doctors need to follow certain norms while dealing with patients and his/her relatives. But failure to do so advertently or inadvertently, may lead to patient dissatisfaction and/or litigation in the court of law. Considering this lack of awareness about medical ethics and the importance of its proper implementation for improving doctor-patient relationships, this study was conducted.

Aims & Objectives: To check the level of awareness about medical ethics among 100 junior doctors of Subharti Hospital, Meerut.

Material and Methods: The sample size was keptas 100 junior doctors viz. 43 Interns and 57 Postgraduate (PGs) students (both clinical and non-clinical). They were asked to fill the Consent form prior to the study and then, weregiven questionnaires to attempt. The sampling technique used for the study was of purposive type.

Results: It was observed that29.8%PGs and 2.3% Interns were unaware of the basis for "International Code of Medical Ethics" (statistically significant); 80.7% PGs and 74.4% Interns were aware of the practice of writing generic names of drugsin prescription; 54.4% PGs and 67.4% Interns were unaware about the points to be covered while taking "Informed Consent"; 40.4% PGs and 62.8% Interns were unaware of "Medical negligence" with p-value= 0.043 (statistically significant).

Conclusion: PG students have more knowledge about the components of medical ethics which are to be followed during their everyday clinical practice than Interns who have more of theoretical knowledge. Thus, there is a need to refresh their knowledge about medical ethics.

A STUDY OF MET GUIDELINE IMPLEMENTATION IN POORLY PERFORMING MEDICAL STUDENTS

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Introduction: MET guideline is a compulsory directive of MCI which has to be implemented in medical education training program in all medical college in the country.

Aims and Objectives: The present study was conducted to improve the performance of poor scoring medical students.

Material and Methods: 24 Students were selected on the basis of poor score between September to March from 1st year M.B.B.S. batch (2017-2018), T.S.M. Medical College & Hospital, Lucknow. They were exposed to MET guidelines like group dynamics, PBL, SDL, group discussion etc. Their performance was observed in successive examinations.

Result: It is an ongoing study. Result will be discussed in conference.

Conclusion: Marked improvement was seen in performance of students.

MORPHOMETRIC STUDY OF FRONTAL HORNS OF LATERAL VENTRICLES OF THE BRAIN BY COMPUTED TOMOGRAPHY

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Introduction: Morphometric analysis of lateral ventricles of brain is important for evaluating changes due to growth, ageing, intrinsic and extrinsic pathologies. The present study was done to provide more information regarding size of frontal horns of lateral ventricles of the brain in normal western UP population.

Aim & Objectives: The objectives of the present study were, firstly measurement of the dimensions of frontal horns of lateral ventricles and secondly to compare the data with reference to gender and side in different age groups.

Material & Methods: The present study was carried from May 2014 to September 2015 on 200 patients [100 males and 100 females] in the age group of 10-80 years. GE OPTIMA CT 660 was used for obtaining the scans.

Results: With regard to side and gender, the length of frontal horn of right side has the range between 23.0-35.0mm and 23.0-36.0mm on the left side .In males, the morphometric measurements were more as compared to females. The length of frontal horn is more on left side than the right side in both the sexes with an insignificant increase in the size as the age increases.

Conclusion: The measurements of the frontal horns of lateral ventricles were more on the left side in both sexes and also more in males. This study may be useful while diagnosing visual disturbances, hydrocephalus, schizophrenia and psychotic disorders.

CORRELATION BETWEEN FOOT LENGTH AND EAR LENGTH OF SECOND AND THIRD TRIMESTER FETUSES AND ITS CLINICAL SIGNIFICANCE

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Introduction: Footlength has been used as a predictor of gestational age in human fetuses because this data can be obtained from ultrsonographic examination, and it is particularly useful when other parameters do not accurately predict gestaional age (for example in fetuses with hydrocephalus, anencephaly and short limb dysplasia).

Several authors have evaluated ear length during the second trimester, showing a correlation between ear length and gestational age as well as ear length and biperital diameter.

Aims and Objectives: To determine the gestational age with the help of ear length in second and third trimester fetuses. To correlate the growth pattern of foot length and ear length of second and third trimester fetuses.

Material and Methods: Study was conducted on 103 aborted or stillborn fetuses obtained from obstetrics & gynaecology dept. BRD Medical College Gorakhpur. LMP was noted for calculation of gestational age. Foetal foot length and ear length were measured with the help of digital vernier caliper.

Result: Approximately twofold increase in foot length and ear length are seen in 3rd trimester as compared to 2nd trimester. Linear association of foot length with earlength in different gestational age are found.

Conclusion: The data provided in our study for foot length and ear length could be beneficial for the clinicians not only for the assessment of gestational age of the foetus but also will help them for early diagnosis of trisomy 21.

POSTERIOR CONDYLAR FORAMINA OF OCCIPITAL BONE: MORPHOLOGICAL VARIATIONS AND THEIR CLINICAL IMPLICATIONS

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Introduction: The condylar fossa lies immediately posterior to occipital condyle and may contain a posterior condylar canal for an emissary vein from the sigmoid sinus. Opening of this canal is known as posterior condylar foramen**.** Anatomical variations of the posterior condylar foramina are important during the treatment of dural arteriovenous fistula.

Aims & Objectives: To study the morphological variations of posterior condylar foramina in North Indian skulls.

Material & Methods: This study included 50 dry skull bones irrespective of age and sex from department of Anatomy, KGMU, Lucknow**.** The study was done by naked eye examination carefully and by passing the probe in the foramen.

Results: Of the 50 human dry skulls, we observed posterior condylar foramina in 47 skulls (bilaterally 27, unilaterally 20). The presence of bilateral posterior condylar foramina was noted in 27 skulls (54%) and unilateral foramina in 20 (left 10, right 10) skulls (40%) and foramen was absent in 3 (6%) skulls.

Conclusion: Our study gives basic knowledge to the clinicians and surgeons before planning a surgery in the occipital condylar regions.

ABSTRACTS

POSTER PRESENTATION

VARIATION IN THE LEVEL OF BIFURCATION OF THE SCIATIC NERVE – A CASE REPORT

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Introduction: Sciatic nerve is the thickest nerve in the body, about 2cm broad. It is the main continuation of the sacral plexus. It enters the gluteal region through the greater sciatic foramen below the piriformis, runs downwards between the greater trochanter and the ischial tuberosity, and enters the back of the thigh at the lower border of the gluteus maximus. It does not give any branches in the gluteal region.

At the back of thigh the nerve is crossed superficially by the long head of biceps femoris, and close to the upper angle of popliteal fossa it divides in to tibial and common peroneal nerves.

Case Report: Variation in the level of bifurcation of the Sciatic nerve was observed during routine dissection of a 50 year old male cadaver in department of anatomy, Banaras Hindu University, Varanasi, U.P. On right side the Sciatic nerve divided in the gluteal region in to tibial and common peroneal nerves. While on left side it was observed that the Sciatic nerve gave its two terminal branches in the upper part of thigh. Bilateral variation in the level of bifurcation of the Sciatic nerve was found in the cadaver.

Conclusion: The sciatic nerve is the most frequently injured nerve. The anatomical variations of the level at which the sciatic nerve divides is considered important by clinicians, radiologists, surgeons and orthopedicians etc.

A CASE REPORT- VARIATION IN THE FORMATION OF ANATOMICAL SNUFF BOX

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Introduction: Anatomical snuff box is a triangular hollow visible on the lateral aspect of the wrist when the thumb is fully extended. This space is bounded laterally by the tendons of abductor pollicis longus and extensor pollicis brevis; medially by the tendon of extensor pollicis longus. The radial artery passes obliquely, crossed by all the 3 extensor tendons.

Case Report: During routine dissection of a male cadaver for undergraduate course, it was found that on the left side, all the extensor tendons forming the boundary of snuff box were passing above the extensor retinaculum. Abductor pollicis longus had 3 tendons inserting on the radial side of base of first metacarpal. Extensor pollicis brevis also had 3 tendons; 2 lateral tendons were inserted on radial side of base of first metacarpal while 1 medial tendon was inserting on the dorsal aspect of base of proximal phalanx. Insertion of extensor pollicis longus was at its usual site. On the right side, insertion of all the 3 extensor tendons forming the snuff box were passing deep to the extensor retinaculum with normal insertion.

Conclusion: The presence of multiple tendons of the abductor pollicis longus is clinically relevant, as it can lead to the development of de Quervain's syndrome, which is caused by stenosing tenosynovitis. Detailed knowledge of these variations will aid during tendon reconstructive surgery.

OSSIFICATION OF SUPERIOR TRANSVERSE SCAPULAR LIGAMENT: A POSSIBLE CAUSE OF SUPRASCAPULAR NERVE ENTRAPMENT SYNDROME

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Introduction: Superior transverse scapular ligament (STSL) is attached laterally to the root of coracoid process and medially to the limit of the notch, converts the suprascapular notch into osseofibrous suprascapular foramen which transmits suprascapular nerve while the suprascapular vessels usually pass above the ligament. Superior transverse scapular ligament may ossify partially or completely which may be one of the risk factor of suprascapular nerve entrapment neuropathy.

Aims & Objectives: Ossified STSL is one of the important predisposing factors for the suprascapular neuropathy. Hence, looking for incidence of ossification of STSL is important.

Material and Methods: The present study was carried out in the Department of Anatomy, Government Medical College, Pali and AIIMS, Jodhpur among 74 dried scapulae (37 each of right and left side) irrespective of age and sex.

Result: Complete ossification of STSL was observed in two scapulae and both of them were of the left side (2.7%) and partial ossification in only one scapula of right side (1.3%).

Conclusion: The present study indicates that complete ossification of STSL on left side and partial ossification on right side. The excessive movement of the shoulder exerts traction on the suprascapular nerve which leads to its compression against the ossified STSL, is more commonly seen in athletes. Precise knowledge of ossification will help the clinicians in the diagnosis and treatment of idiopathic suprascapular neropathy.

A CASE REPORT OF ABERRANT RENAL ARTERY IN CADAVER

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Introduction: The renal arteries arise laterally from the abdominal aorta below the superior mesenteric artery at the level of L1/L2. Near the renal hilum, each artery divides into anterior and posterior divisions and these divide into segmental arteries supplying the renal vascular segments. Variations in the number, source, branching and course of the renal arteries are commonly observed. A single renal artery to each kidney is found in approximately 70% individuals and accessory and aberrant renal arteries are present in 30% individuals. Accessory renal arteries usually arise from the aorta above or below the main renal artery and follow it to the hilum whereas aberrant renal arteries supply the kidney without entering its hilum.

Case Report: During routine dissection classes for undergraduate students a rare case of aberrant renal arteries arising bilaterally from the abdominal aorta was observed. Both the right and left aberrant renal arteries originated at the level of lower border of L3 vertebra, inferior to the origin of normal renal arteries. Both aberrant arteries entered the kidney at the anterior surface of their respective lower poles. Both arteries gave off no further branches in their extrarenal course. The right aberrant renal artery was crossed by the IVC superiorly.

Conclusion: Anatomical knowledge of the variations in the renal vascular supply may be important for abdominal imaging studies and surgical operations involving renal transplants. Presence of aberrant or accessory renal arteries may also be associated with other underlying renal pathological conditions.

VARIATION IN EXTENSOR INDICIS TENDON- A CASE REPORT

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Introduction: Extensor indicis muscle is one of the deep muscles of extensor group of the forearm. It originates from the posterior surface of the shaft of ulna below the origin of Extensor pollicis longus and also from the interosseous membrane. It is inserted on to the dorsum of middle and distal phalanges of index finger, through dorsal digital expansion.

Case Report: During the routine dissection classes for undergraduate medical students in an adult male cadaverof age approx. 35-40 years fixed in 10% formalin, it was observed that the extensor indicis muscle showed two tendons passing underneath extensor retinaculum in both the upper limbs. In the left hand the Extensor Indicis showed two tendon i.e. medial and lateral tendons. The medial tendon inserts deep to the tendon of extensor digitorum muscle for index finger. In lateral tendon some fibres are inserted on the head of the 2nd metacarpal whereas some fibres are inserted on the radial side of extensor digitorum for index finger. In the right hand two tendons are shown where the fibres run deep to the extensor digitorum for index finger and are inserted on the lateral and medial side of dorsal digital expansion.

Conclusion: Muscle of extensor compartment of forearm may show diverse variation which could be helpful to surgeons in utilizing the extra tendon for graft.

STUDY OF CEPHALIC INDEX IN NORTH INDIAN POPULATION

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Introduction: Population of a region can be classified by evaluation of cephalic index. The cephalic index is the ratio of the maximum breadth of head to its maximum length. Cephalic index is very useful anthropologically to find out racial difference and it plays a crucial role in comparison of cephalic morphometry between parents, offspring and siblings and provides information on inheritance pattern. In this study we evaluated cephalic index of North Indian Region.

Aims & Objectives: The study and comparison of CI and Head shape in population of North Indian region and its comparison with other Indian and Foreign studies.

Materials & Methods: This exploratory study was carried out with 150 (82 male & 68 female) medical students of Era University, Lucknow, India. The Cephalic Index was measured using Hrdlicka's Method.

Results: Most common head shape found was Dolichocephalic. Mean Cephalic Index for male student was 74.07±5.17 and for female student was 75.85±5.11. Mean cephalic index irrespective of gender was found to be 74.88±5.20.

Conclusion: The result of present study shows that majority of male of north Indian region are dolichocephalic or mesocephalic and female are mesocephalic. Cephalic index of the female is 2-3 point higher than the male in north Indian population. This study will also help orthodontists, plastic surgeons and anthropologists in Cranio-facial reconstruction.

THE DERMATOGLYPHIC STUDY OF FINGER TIP PATTERNS IN SUBJECTS WITH CARCINOMA BREAST

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Introduction: The scientific study of the pattern of epidermal ridges is known as Dermatoglyphics. The ridge patterns on the distal phalanges of the fingertips are divided into three groups: Arches, Loops and Whorls. The most common pattern on the fingertip is the loop pattern. Whenever there is any abnormality in the genetic makeup of parents it is inherited to the children and is reacted in dermatoglyphic pattern. Breast cancer is second most common cancer amongst Indian women; and an increasing trend in its incidence has been observed in most of metropolitan cities. The present study was designed to study the quantitative dermatoglyphic pattern of finger tips in breast cancer patients and compared same parameters in the control group.

Aims and Objectives: To identify the dermatoglyphic pattern in subjects with carcinoma breast and compare it with control group.

Material and Methods: The subjects included 45 female patients of breast cancer diagnosed histopathologically and 45 healthy females as controls. The dermatoglyphic prints were taken by the "INK METHOD". Chi-square test was used for analysis and to find the significance of frequencies of fingertip pattern between cases and controls.

Results: The results of the study indicated that the arches in breast cancer cases were 13.3% whereas in controls it was 2.2%. The total percentage of whorls in cases present was 71.1% whereas in control it was 84.4% and the total percentage of loops in cases was 91.1% whereas in controls it was 84.4%.

Conclusion: Arches in the right hand were significantly ($p=0.04$) higher among cases (0.18±0.49) than controls (0.02±0.14). However, Arches in left hand were ($p>0.05$) higher among cases (0.20±0.45) than controls (0.13±0.34) but it was statistically insignificant.

THE STUDY OF ANATOMICAL VARIATIONS IN BRACHIAL ARTERY

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Introduction: The brachial artery is the major artery of the upper limb. It begins as a continuation of the axillary artery at the distal (inferior) border of the tendon of teres major muscle and ends at the level of the neck of the radius by dividing into radial and ulnar arteries

Aims & Objectives: To evaluate the prevalence of anatomical variations of brachial artery, its origin, length, course, branches, and the measurement of the point of origin of branches of the brachial artery.

Material and Methods: We dissected 50 upper limbs of both sexes from embalmed adult human cadaver used for undergraduate dissection from the department of Anatomy, Era University Lucknow. And we observed its origin, length, course, branches, and the measurement of the point of origin of branches of the brachial artery.

Results: There were 34% cadavers in which the length of brachial artery varies within the range 8.0 – 9.9 inch. Among 60% cadavers the length of brachial artery varies within the range 10.0 –11.9 inches. The length of brachial artery varies within the range 12.0 – 13.9 inches in remaining 6% cadavers.

Conclusions: The length of brachial artery makes almost normal curve with mean 10.95 inch and SD of 0.95. This information is helpful to estimate length and pattern of brachial artery in living human beings to treat diseases relating to circulatory system. No anomalies were seen in the present study.

TO STUDY THE GROSS ANATOMICAL VARIATIONS IN LEVEL OF DIVISION OF SCIATIC NERVE

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Introduction: The Sciatic nerve is the widest nerve of the body, consists of two components namely tibial and common peroneal components, derived from the lumbosacral plexus from the ventral rami of L4 to S3 spinal nerves. The Sciatic nerve usually enters the gluteal region under the piriformis muscle. It divides into tibial (TN) and common peroneal nerve (CPN), at superior angle of popliteal fossa.

Aims and Objectives: To study the gross anatomical variations in level of division of sciatic nerve.

Materials and Methods: 56 lower extremities from 28 formalin fixed cadavers were used for this study.. Gluteal regions and the posterior aspect of thigh on both sides were dissected to expose the sciatic nerve. Variations in level of division of sciatic nerve were observed.

Results: 50 lower limbs (89%) showed normal anatomy of sciatic nerve and. 6 regions (10%) showed variations in different level of division of the sciatic nerve, of which 4 regions (6%) showed division in pelvic region,1(1%) lower limb in gluteal region ,1(1%)lower limb in mid thigh and 50(89%) lower limbs showed division in popliteal fossa.

Conclusion: A proper knowledge about the variations of sciatic nerve is must for medical professionals during posterior hip surgeries, sciatic nerve decompression, total hip replacement, sciatic nerve injury during deep intramuscular gluteal injections and failed sciatic nerve block during anaesthetic procedure.

THE MORPHOMETRIC ANALYSIS OF PTERION IN NORTH INDIAN POPULATION

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Introduction: Pterion is defined as an H-shaped small circular area formed at the junction of four bones: Frontal, Parietal, Temporal and Sphenoid on Norma lateralis of the skull.

Aims and Objectives: To study various types of pterion, the variation of pterion according to the side of skull, Compare the data with those of previous studies in same or different populations.

Materials and Methods: A 35 dry adult human skulls of unknown sex without any gross pathology or abnormality were taken for the study.

Results: Sphenoparietal was the commonest type of pterion observed on both the sides. Second most common type of pterion found in our study was stellate type. Stellate type of pterion was present only on right side of skull.

Conclusion: The accomplishments of this study contribute to anatomical variations of the pterion, which are of interest to anthropologists, forensic pathologists and surgeons. This topic of study deserves further investigation in other populations from different geographical areas.

THE STUDY OF NUTRIENT FORAMEN IN THE ARM AND FOREARM BONES OF ADULTS

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Introduction: Nutrient foramen is an opening into the bone shaft which gives passage to the blood vessels of the medullary cavity of a bone, for its nourishment and growth. It has been suggested that the direction of the nutrient foramina is determined by the growing end of the bone, which is supposed to grow at least twice as fast as the non-growing end.

Aim and Objectives: To determine the number of nutrient foramen in upper long bones**.**

Material and Methods: Total 114 long bones of arm and forearm irrespective to sex and age, the material was collected for our study from department of Anatomy, ELMC, Lucknow, Hand lens, Hypodermic needle (26 gauge), Nutrient foramen was observed in all bones by the naked eye and then with the help of hand lens.

Results: In humerus (37 bones) 97.4% bones have single nutrient foramen and only (1 bone) 2.6% bone has double nutrient foramen. While in case of radius (38 bones) 100% bones have single nutrient foramen. And all ulna (38 bones) 100% bones have single nutrient foramen**.**

Conclusion: Total one hundred fourteen long bones of upper limb i.e. thirty eight each of the Humerus, Radius and ulna was taken from Department of Anatomy, Era's Lucknow Medical College Lucknow, and was studied for the number of Nutrient foramen. It was found that double nutrient foramen was found in one case of humerus, and all the radius and ulna show only one nutrient foramen.

THE MORPHOLOGICAL ANALYSIS OF FORAMEN MAGNUM IN HUMAN SKULL

Mishra Sushma

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Introduction: Foramen magnum is a Latin word meaning largest aperture in the skull. Foramen magnum is an important landmark in the posterior part of cranial base which is largely formed by occipital bone. Variations of the shape of foramen magnum have got diagnostic, clinical and radiological importance. It contains lower end of the medulla oblongata, meninges, vertebral arteries and spinal accessory nerve, apical ligament of dens and tectorial membrane pass through it to attach to the internal basiocciput. The importance of variations in shape is due to its effect on the vital structures passing through it. A number of variations in the shape of foramen magnum occur i.e. oval, circular, rectangular, hexagonal, and irregular shapes.

Aim and Objectives: The aim of this research work was to document and analyze the foramen magnum shapes of foramen magnum of dried human skulls.

Material and Methods: We studied 70 dried human skulls and measurements were done by using digital Vernier calipers. The shapes of foramen magnum were observed by visual identifications.

The antero-posterior diameter (□) is the distance between Basion and Opisthion. The transverse diameter (□) was measured from the point of maximum concavity on the right margin to the maximum concavity on the left margin. The data were analyzed and presented as mean ± SD. The foramen Index was calculated as the average of the transverse diameter and the antero-posterior diameter.

Results: The various shapes of foramen magnum were oval (47.1%), circular (22.9%), rectangular (12.9%), irregular (7.1%), triangular (7.1%), hexagonal (1.4%) and quadrangular (1.4%).The incidence of various shapes of foramen magnum in male and female skulls was statistically significant (p value = 0.001).

Conclusion: The most common shape of foramen magnum i.e. 33% was oval shape. The oval shape foramen magnum was more common in females whereas circular shape foramen magnum was mostly found in male skull. We also found that the antero-posterior diameter is greater than transverse diameter i.e. 3.4cm and 2.8cm respectively.

THE MORPHOLOGICAL STUDY OF SUPRASCAPULAR NOTCH AND ITS VARIATIONS

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Introduction: The Suprascapular notch is situated in the lateral part of the superior border of the scapula, just adjacent to the base of Coracoid process. The notch is bridged by the superior transverse scapular ligament (STSL) which some time ossifies and is attached laterally to the root of the coracoid process and medially to the limit of the notch. A number of variations occur in the shape of suprascapular notch, from a discrete notch to "J" shaped, "V" shaped , "U" shaped or "O" shaped (i.e. as a complete foramen).

Aims and Objectives: To study morphological and morphometric variations of suprascapular notch of north Indian population.

Material and Methods: We studied 140 dried scapula bone and measurements of SSN were done using digital vernier calipers. We used the Rengachary classification for this study.

Results: The results of our study were: J-shaped -28%, U-shaped-26%, V-shaped -15%, Partial-ossification-7%, Indentation-10%, Absent-9%, Complete ossification- 2%.

Conclusion: Type IV supra scapular notch was found to be the most prevalent type amongst all shapes. We also found that the characteristics of the scapula (dimensions) are related to the characteristics of the supra scapular notch (type and dimensions) and there was a distinct difference between right and left side of scapula.

THE STUDY OF CORRELATION BETWEEN FEMUR LENGTH AND BODY STATURE

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Introduction: The relationship between bones and height is used in assessing growth in normal individuals, as well as in people with specific stature. This is an important parameter as it provides estimation of height of a person in the living state

Aims & Objectives: To study the correlation between femur length and body stature of human body.

Material and Methods: Non stretchable measuring tape.Stature (*S*) was measured while the participant was in a standing posture, barefoot& without a hat.

Subject were made to stand with both feet in close contact to each other; head of the subject w rested without any strain in the eye- ear plane also known as Frankfurt plane.

Results: Total number of cases was 137 out of which there were 72 males and 65 female. The average height of the male was 170.17±7.36 and height of female was 158.35±5.33. The p value was found to be significant in cases of height of individuals 0.0001. Femur length of male and female was highly significant. Its p-value is 0.0001

Conclusion: More than half of cases were below 20 years of age (59.9%). Percentage of male and female was 52.6% and 47.4% respectively. Height was significantly ($p<0.01$) higher among males compared to females. Femur length was significantly ($p=0.001$) higher among males (42.50±3.81) compared to females (39.77±2.67).

VARIATION OF THE MUSCULOCUTANEOUS NERVE –A CASE REPORT

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Introduction: Musculocutaneous nerve is the branch of the lateral cord of brachial plexus. It pierces the coracobrachialis muscle and emerges between the biceps brachii and brachialis muscles and then continues as the lateral cutaneous nerve of the forearm..

Case Report: Variation in the origin, course, branching pattern, termination and the connection of the musculocutaneous nerve is not uncommon. These variations have a clinical significance during surgical procedure. During routine dissection of male cadaver we observed the communication between the median nerve and musculocutaneous nerve.

Conclusion: Variations of musculocutaneous nerve had been reported previously and the present study is the additional one. The Knowledge of variations is important for surgeon. A communicating branch is prone to the damage during the surgical procedure of the upper limb.

THORACOMPHALOPAGUS CONJOINED TWINS: A CASE REPORT

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Introduction: These are identical twins whose bodies are joined in utero. Thoracopagus (joined at chest) being the most common type incidence 40%.Omphalopagus (joined at abdomen) incidence 34%.Thoracomphalopagus (usually found joined at both thorax & abdomen) incidence is 74%. Twinning occurs in approximately 1 of every 87 live births. Monozygotic twins account for 1/3rd of twin births. Conjoined twins account for 1% of monozygotic twins. The incidence is 1 per 50,000 births and 1 per 200,000 live births. The stillbirth rate is 40-60%. 75% of the live borns die within 24 hrs. More common among females fetus, ratio M:F = 3:1.

Case report: The specimen of thoracomphalopagus conjoined twin had been received from private hospital, Khatima (U.K). Delivered by 25 yrs female 8 months of pregnancy (G_1P_0).On examination no FHS was found USG showed twins with no cardiac activity. No previous ultrasonography was done. Twins females were delivered by LSCS. After ethical approval specimen was brought to anatomy department for the purpose of dissection and study. Female monoygotic twins were found to be joined from their ventral aspect of lower thoracic as well upper abdominal region with single umblical cord.

Conclusion: Most of the cases of thoracomphalopagus not suitable for surgical separation as cardiac fusion is absolute contraindication for separation unless two cardiac donor available. Outcome depends on extent of fusion. Fused liver can be separated as liver can regenerate.

THE CORRELATION OF ENLARGED YOLK SAC WITH SPONTANEOUS ABORTION- AN ULTRASONOGRAPHIC STUDY

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Introduction: The yolk sac is the first extra embryonic structure that becomes sonographically visible within the gestational sac. The yolk sac is a round structure that is made up of an anechoic center bordered by a regular well-defined echogenic rim. It is usually 2-5 mm in diameter. The yolk sac appears at 6 weeks, thereafter increases in size; attains its maximum diameter at 10 weeks and then it starts decreasing in size. It disappears at 12 weeks.

Aims and Objectives: To measure the inner diameter of yolk sac using Transvaginal sonography and correlate it with the pregnancy outcome.

Material and Methods: An observational study was performed on 72 pregnant females of gestational age of 6 to 12 weeks at Era's Lucknow Medical College & Hospital, Lucknow. Yolk sac inner diameter was measured by Transvaginal sonography and its correlation with spontaneous abortion was observed.

Results: Yolk sac was not visualised in two cases (2.78%). Out of 70 cases, in 62 cases yolk sacs (88.57%) were in the normal range of diameter and in 7 cases (10%) the yolk sac were abnormally enlarged in size. The mean yolk sac diameter was 3.7±1.8 mm. The diameter of the largest yolk sac was 8.96 mm. All the cases in which yolk sac was enlarged in size resulted into spontaneous abortion.

Conclusion: The enlarged size of yolk sac has a significant correlation with the spontaneous abortion.

MRI STUDY OF MIDSAGITTAL DIAMETER OF LUMBAR SPINE IN NORTH INDIAN POPULATION

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Introduction: The knowledge of anatomical variations in lumbar spine might help in understanding the etiology as well as pathology of low back pain.

It is well established that the morphometric data varies within different sex, race and regions. The clinical significance of these variations and differences in morphometric assessment of lumbar spine has been reported in the past from several countries.

Aim and Objectives: The present study was carried out with an aim to study the normal anatomy of lumbar spine by magnetic resonance imaging in North Indian population.

Materials and Methods: Present study was carried out in Department of Anatomy in collaboration with Department of Radio diagnosis Era's Lucknow Medical College & Hospital, Lucknow. 130 Subjects in the age group of 20-70 yrs were included

Results: Assessment of Midsagittal diameter of canal from L1-L2 to L4-L5 showed the diameters ranging 0.95cm to 2.19cm. Mean diameters of canal at L1-L2, L2-L3, L3-L4, L4-L5 were 1.37cm ±0.23cm, 1.36cm ±0.18cm, 1.37cm ±0.19cm and 1.36cm ±0.20 cm respectively.

Conclusion: The antero-posterior/midsagittal diameter of canal was comparitively smaller. Amongst the 130 subjects studied the canal was narrowest at L4-L5 (0.95cm) and widest at L1-L2 (2.19cm). In both males and females the antero-posterior diameter of canal was widest at L1-L2 level 2.19cm and 2.01 cm respectively.

STUDY ON BELIEFS, KNOWLEDGE AND ACTIONS ON ORGAN DONATION AMONG UNDERGRADUATE MEDICAL STUDENTS

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Introduction: Organ donation is defined as the removal of tissues from the human body, from a living or dead person, for the purpose of transplantation as a treatment. Organ transplantation is the most preferred treatment for many of the end stage organ disease as it offers a better quality of life and has a better long term survival benefits. Statistics show that annual deaths are approximately 500,000 because of non-availability of organs. According to a study, India ranked second in the world in live related kidney transplants but only 40 in the total number of transplants. In India, there is a great need for human organs as there is critical shortage of the same for transplantation. The shortage in organ supply is due to lack of awareness and correct knowledge among public, myths and misconceptions surrounding organ donation due to religious and culture barriers leading to hesitancy in donation of human organs.

Aim: The purpose of this study was to understand the awareness, attitude and knowledge about organ donation among medical students.

Materials and Methods: A cross sectional study was conducted among 600 undergraduate medical students of Hind Institute of Medical Sciences, Barabanki, Uttar Pradesh, India. A structured questionnaire was used to assess perception towards organ donation. A convenient sampling method was employed and all students who consented orally and were willing to participate by filling the questionnaire were enrolled into the study.

Results: Questionnaires were answered by all the 600 students. Out of 600 students, 195(32.5%) were male and 405(67.5%) were female. The mean age of the students was 20.73 years (range from 18 to 27 years). The standard deviation (SD) was 1.7605. About 99% of the students were aware of organ donation out of which 77.5% were willing to donate their organs. We found that most of the students 93.5% had perception that organ donation save someone's life. In the study about 81% of the students said that their religion

allows for organ donation whereas the remaining of the students had no idea regarding religious view about organ donation.

Conclusion: This study shows that awareness on organ donation among undergraduate medical students is high. Students are also aware of body donation & organ donations are different. Most of the students are willing to donate their organs to save the life of needy people. Few students are unwilling to donate their organs because of psychological anxiety. Some students also believe that donated organ could be misuse, abused or misappropriated. Students like to promote their family members, relatives, colleagues & friends for organ donation. Students believe that the measures like monetary benefit, giving awards & free health treatment for donor family by government would be more effective in promoting organ donation.

HISTOLOGICAL CHANGES OF GALL BLADDER MUCOSA: CORRELATION WITH VARIOUS TYPES OF CHOLELITHIASIS

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Introduction: The gallbladder is a hollow, pear-shaped organ that stores and concentrates bile. Histologically, the gallbladder consists of three layers: mucosa, muscularis externa, and adventitia or serosa.

Aims and Objectives: To investigate the histological changes of gall bladder mucosa in relation to different gallstones whether it was cholesterol, pigment or mixed stone.

Material and Methods: This study was done in the Department of Anatomy in association with the Department of Pathology and the Department of Surgery, SRMSIMS, Bareilly. A total number of 104 specimens were selected from gallbladders after cholecystectomy with clinical and histopathological diagnosis of chronic calculus cholecystitis. Paraffin sections were stained with haematoxylin and eosin to demonstrate the general histology. The gallbladders were divided into groups depending on the type of gallstones found; cholesterol, pigment or mixed stones.

Results: The histological changes like epithelial ulceration and antral metaplasia were found to be more obvious in gall bladders with cholesterol stones, whereas mucosal hyperplasia and muscular hypertrophy were more prominent in gallbladder with pigment stones.

Conclusion: Gallstones are accompanied by major changes in the gallbladder epithelium. These changes were clearer in gallbladder mucosa with cholesterol stones may be due to the large size stones leading to more irritation to the mucosa.

CORRELATION OF SINGH INDEX WITH FEMORAL GEOMETRY AND BODY MASS INDEX FOR EVALUATING OSTEOPOROSIS

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Introduction: Osteoporosis is a disease of bone that leads to an increased risk of fracture. The upper end of the femur is a common site for osteoporosis. The Singh index is commonly used to assess & is based on the radiological appearance of the trabecular bone structure of the proximal femur on a radiograph. Body mass index & proximal femoral morphometry are important determinants of fracture risk. People with low body mass index are more likely to develop osteoporosis than people who are overweight.

Aim & Objectives: The aim of the study is to correlate the Singh index with femoral geometry & body mass index for evaluation of Osteoporosis.

Material & Methods: The study was conducted on 60 pelvis radiographs of post menopausal women who were age between 45-60 years in the department of radiology, SGT Medical College Gurugram. Baseline values are recorded for all women, including age, weight, height & any additional disease. Body mass index was calculated as weight (kilograms) divided by the square of height (meters). To determine the Singh index (Six point scale from grade VI to I) & morphometric measurements (HAL, FAL, HW, FW, TW, Q angle) the AP radiographs of the pelvic region including hip joint was taken. . Karl Spearman's & Pearson correlation coefficient was used to analyze the parameters under study.

Result: The result shows that Singh index is correlated significantly with hip axis length, femoral neck diameter, trochanteric width using Spearman's correlation test. As the osteoporosis level was being increased, these parameters were being reduced. If Singh index is correlated with BMI there was no a significant relationship between the Singh index and BMI ($p>0.005$). There is a strong positive correlations were found between BMI & the TW, FW, HW.

Conclusion: The present study concluded that there is relation between proximal femoral morphometry & BMI of the population. Simple radiograph hip geometry measurements are useful in the evaluation of osteoporosis.

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