Journal of Cardiovascular Disease Research
ISSN: 0975-3583, 0976-2833 VOL13, ISSUE 05, 2022

ORIGINAL RESEARCH

MORPHOMETRIC ANALYSIS OF INGUINAL REGION- A CADAVERIC STUDY

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ABSTRACT

Context: The existence of spectrum of variations in the anatomy of inguinal region and of inguinal hernia has been reported by many investigators and some acceptable conclusions used to be drawn at the end of every decade, but the subject about anatomy of the inguinal canal still remains inconclusive.

Hence, an attempt has been made to study the anatomy of inguinal canal in cadavers.

Objective: To study the morphometric data on inguinal canal of the cadavers, for a better concept on the anatomy of inguinal region. Though it's well explained in literature, still it is challenging for surgeons in each cases of inguinal hernia.

Methods

Design & setting: The present study was done in 100 cadavers obtained from the Department of Anatomy, Mahatma Gandhi Medical College and Research Institute, Pondicherry.

Dissection of cadavers was done and different parameters: like shape and sizes of inguinal rings SIR, length of IC and IL, DIR in relation to ASIS, IL and inferior epigastric artery to DIR were noted. Data obtained was subjected to student's t-test.

Main outcome Measures: There is no significant difference in the parameters taken on two sides of cadaver. But there is difference amongst the cadavers.

Result: The data obtained were compared bilaterally however; there was no significant difference observed.

Conclusion: The Anatomy of inguinal regions was studied.

No significant differences were observed in the inguinal region of both sides in cadavers.

An attempt has been made to analyse the perimeters of inguinal rings in the present study.

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INTRODUCTION

The inguinal canal is a short, narrow, diagonal passage in the lower anterior abdominal wall measuring approximately 4 cm in length, bounded by three muscles, the external and internal oblique and transverses abdominis. The inguinal canal has openings at either end, the deep and superficial inguinal rings. The deep inguinal ring is an oval gap in the transversalis fascia and lies 1.25 cm superior to the mid inguinal point, lateral to the inferior epigastric vessels. The superficial inguinal ring is a triangular opening in the aponeurosis of the external oblique muscle lying lateral to pubic turcle.[1]

Humans have been adapted to the upright posture and changed from quadripedal to bipedal locomotion. So human beings upright posture causes the gravitational force to pass down to the lower abdominal wall, but the inguinal canal is not designed for it. So this leads to weakening of the transversalis fascia and the development of inguinal hernia. Inguino-scrotal swellings constitute 96% of hernias, in which indirect hernia out number direct hernias by 2:1 ratio. Right sided inguinal hernias are more common[2-3], probably due to late descent of right testis. The prevalence of inguinal hernias is clearly age dependent. The recent study shows the risk for a male to have an inguinal hernia is 18%.The inguinal hernia is more frequent in male irrespective of all ages[2-3] Even though several techniques have been described for the treatment of inguinal hernia, [4] it is still represent a permanent surgical challenge in each case.[5] Congenital inguinal hernia affects approximately 1% to 3% of the general population and are considered the most frequent surgical condition in children of all ages, in which indirect hernia is most common.[6]

The inguinal canal provides roomy passage for the manifestation of every possible malformation.[7]

Many factors have been described, such as critically affected muscular and aponeurotic element of inguinal canal, additional secondary opening of deep inguinal ring, persistent peritoneal process, congenital variation in conjoint tendon and aberrations in the composition of collagen fibres in transversalis fascial layer of posterior wall of the inguinal canal, as attributes for genesis of inguinal hernia.[8]

The existence of spectrum of variations in the anatomy of inguinal region and of inguinal hernia has been reported by many investigators and some acceptable conclusions used to be drawn at the end of every decade, but the subject about anatomy of the inguinal canal still remains inconclusive.

Hence, an attempt has been made to study the anatomy of inguinal canal in cadavers.

AIM

To studythe anatomy of inguinal region of cadavers and report anatomical variations of inguinal region if present.

To study the contents of inguinal canal.

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MATERIALS AND METHODS

The present study was done 100 cadavers obtained from the Department of Anatomy, Mahatma Gandhi Medical College and Research Institute, Pondicherry.

Dissection of inguinal canal in Cadavers

The inguinal canals of well-preserved hundred adult male cadavers were dissected. Vertical incision was made from umbilicus to pubic symphysis;a second horizontal incision was made from the midpoint this to the mid axillary line. Lower flap of the skin was reflected from the mid line to mid axillary line towards the iliac crest. The transverse section was made through the entire thickness of the superficial fascia. The fatty and membranous layers were and latter separated from the aponeurosis of external oblique muscle deep to it until a point is reached just inferior to the inguinal ligament where the membranous layer fuses with the fascia -lata of the thigh. This layer was then excised to expose the external oblique muscle, then the distance between anterior superior iliac spine to pubic tubercle (ASIS – PT) was measured to ascertain the length of inguinal ligament. The superficial inguinal ring was identified just superolateral to the pubic tubercle. The measurements of ring were taken.

The external oblique muscle was reflected from the lateral margin of the rectus sheath towards the mid axillary line, to identify the attachment, orientation and formation of conjoint tendonby the internal oblique muscle. Later internal oblique was reflectedwith careful dissection to observe itsanatomical relation with transverses abdominis muscle. The deep ring was identified as an oval deficiency in fascia transversalis. Horizontal and vertical diameter of the deep ring was measured.The length of the inguinal canal was measured from the deep ring to superficial ring. The other measurement from anterior superior iliac spine to DIR and from IL to DIR (Vertical) was measured. The relation of the inferior epigastric artery with DIR was observed. The content of inguinal canal was explored to rule out the any abnormal content. All the measurements were made with **VernierCalipers**on both sides.

All the sampleswere subjected to the following five parameters and data so obtained were analysed for statistical significance using **student's t-test.**

- The distance between the ASIS to PT
- The sides of the superficial triangle
- The length of the inguinal canal
- The diameters of the deep inguinal ring
- Distance between the ASIS to DIR
- Distance between the DIR to inguinal ligament

Analyses of above parameters were carried out on both sides in cadavers.

OBSERVATION

Anterior wall:

In the present study 100 cadavers were dissected, the anterior wall of inguinal canal was formed by aponeurosis of external oblique muscle in all bilaterally. In 63 cadavers lateral 1/3 of canal was formed by fleshy fibres of internal oblique muscle on both sides.

Posterior wall:

The posterior wall of the inguinal canal was formed by the fascia transversalis throughout and medial 1/3 by conjoint tendon. In 22 cases the conjoint tendon appeared tough and in remaining cadavers it was weak and glistening.

Roof: The roof was formed by the arched fibres of internal oblique and transversalis muscle in all cadavers. In about 11 cases (10%), the internal oblique fibres were highly arched close to DIR (Fig.1).

Floor: It was formed by the curved fibres of the inguinal ligament and medially by lacunar ligament. In one specimen (3.33%) an additional extension of thick and tuff fibrous band was observed extending from PT part of inguinal ligament to the fascia on the medial side of thigh (Fig.2).

Inferior epigastric artery: In all cadavers irrespective of side, the relation of inferior epigastric artery was found to be medial to DIR. (Fig.3).

Contents: Normal contents were observed,

Inguinal rings: Location, shape and diameters of SIR and DIR were observed; the measurements were taken and compared with those of the patients with inguinal hernia (Fig.4, 5&6).

Analysis of various parameters of inguinal canal measured is represented in tables 1- 5.

Table 1: Length of Inguinal ligament	
No. of sample	100
Range (cm)	12-13.1
Mean (cm)	12
SD	0.31
p value	0.99

Table 2: Length of Inguinal canal	
No. Of sample	100
Range (cm)	4-5.7
Mean (cm)	4.9
SD	0.46
p value	<0.0001

Table 3: Perimeter of Superficial Inguinal Ring	
No. of sample	100
Range (cm)	5.6-6.8
Mean (cm)	6.2
SD	0.35

Table 4: Perimeter of Deep Inguinal Ring	
No. of sample	100
Range (cm)	3.58 - 6.17
Mean (cm)	4.6
SD	0.56

Table 5: Mean distance from the ASIS to DIR	
No. of sample	100
Range (cm)	6 – 7.5
Mean (cm)	6.89
SD	0.36
p Value	<0.0001

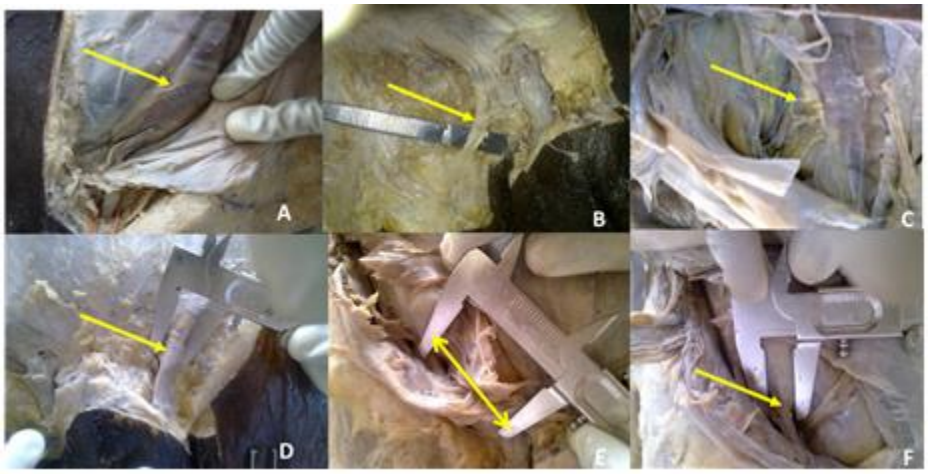

Fig.A. High arched fibres of internal oblique muscle. (Left side)
Fig.B. Inguinal ligament extensions to medial side of thigh. (Right side)
Fig.C Deep inguinal ring with inferior epigastric artery. (Right side)
Fig.D. Superficial inguinal ring base.(Left side)
Fig.E. Deep inguinal ring to superficial inguinal ring (inguinal canal) (Right side)
Fig.F. Measurement of diameter of deep inguinal ring. (Horizontal)(Right side)

DISCUSSION

The inguinal canal is four centimetres in length, it is placed obliquely extending from deep inguinal ring to superficial inguinal ring. DIR is placed 1.5 cm above the mid inguinal point and lies immediately lateral to the inferior epigastric artery. Superficial inguinal ring is deficiency in the aponeurosis of the external oblique muscle it is triangular in shape, situated just above and medial to the pubic tubercle. The base of the ring is formed by the pubic tubercle. Its margins are sewn together at the apex by the inter-crural fibres.

According to the findings of Lytle[9], the length of the inguinal ligament is 12-14 cm. In the present study the length of the inguinal ligament ranges between 12-13cms with the mean average of 12.6 ± 0.31cms.

Hollinshead[10]described that the length superficial inguinal ring from apex to base as 2.5cm and base as 1.5cm. In present study the mean length was observed as 2.03 cm from apex to base and base as1.3 cm. The difference in variations may be due to racial.

The shape of the deep ring has been described as oval[11].The perimeter of deep inguinal ring was found to be 4.6 ± 0.6 cm on the right side and 4.5 ± 0.5 cm on the left side.

According to Peri[11]the distance of deep inguinal ring from inguinal ligament varies from 1.5 cm to 2 cm [11]. In present study it was observed as 1.3 ± 0.1 cm and 1.3±0.1 cm in right and left side of the cadavers respectively.

The mean distance between the ASIS – DIR in was measured as 6.2 ± 0.8 cm by Sreedharan[12]. Present study has shown the distance as of 6.8 ± 0.8 cm on right side and 6.9 ± 0.3 cm on left side of cadaver. While reviewing the literature on the morphometric data on the inguinal canal,

there were no report on the measurement of the perimeter of the deep inguinal ring and superficial inguinal ring and their correlation. In the present study perimeter area of the superficial and deep inguinal rings in adult and patients with inguinal hernia were calculated and the result were analysed and was found to be highly significant p value.

CONCLUSION

The Anatomy of inguinal regions was studied.
No significant differences were observed in the inguinal region of both sides in cadavers
An attempt has been made to analyse the perimeters of inguinal rings in the present study.

REFERENCES

1. Gray's Anatomy 39th Edi 2009, Susan Standring: Elsevier Churchill Livingstone, London: 1104-12.
2. Venturelli M, Francisco, Uherek P, Fernando, Cifuentes V, Claudio et al. Inguinal hernia: Current concepts. Cuad. cir. (Valdivia), 2007; 21(1):43-51.
3. Ghoroubi J, Imanzadeh F, Askarpour S, Sayyari AA, Ahadi MMS, Javaherizadeh H. Ten years study of inguinal hernia in children J Surg Pak. 2008;13:173–174.
4. Nagem RG, Silva AL. Comparison between the shouldice and modified by the Berliner falciparum-lichtenstein in the inguinal hernia repair. Rev Col Bras Cir. 2007; 34(5):331-5.
5. Gac PE, Uherek FP, Del Pozo ML, Oropesa AVC, Rocco ER. Inguinal hernia: a continuing challenge. Journal of surgery. 2001; 15(1):96-106.
6. Cox JA. Inguinal hernia of childhood. SurgClin North Am. 1985; 65(5):1331-42.
7. Chandler S B. Studies on inguinal region, inguinal canal. Anat Rec 1950; 107: 93 - 102.
8. Greenberg G A. Abdominal wall and inguinal hernia Surgery, 1985; 2nd edi U.S.A; 2: 1623-25.
9. Lytle WJ. Inguinal anatomy. Journal of Anatomy, 1979; 128(3): 581-94.
10. Hollinshead WH, Anatomy for surgeons: the thorax, abdomen, and pelvis, 2nd edition, Hoeber–Harper Press, New York, 1971: 457.
11. Peri G, Farina F, Marciano V, Ridola C, Diana G, Arcara M, Guercio G, Sommariva V. Clinical and anatomic features of the inguinal canal during hernia. Italian journal of anatomy and embryology, 101(2):69-80.
12. Sreedharan V. Koliyadan,Govindraj Narayan, Premini B, Surface Marking of the Deep Inguinal Ring. Clinical Anatomy. 2004; 17: 554–7.