

**Study of Anatomy of Inguinal Canal in Both Sex in Bihar**Vivekanand<sup>1</sup>, Rekha Sinha<sup>2</sup>, Amrita Kumari<sup>3</sup>, Birendra Kumar Sinha<sup>4</sup><sup>1</sup>Assistant Professor, Department of Anatomy, PMCH, Patna<sup>2</sup>Assistant Professor, Department of Anatomy, PMCH, Patna<sup>3</sup>Assistant Professor, Department of Anatomy, PMCH, Patna<sup>4</sup>Professor & Head, Department of Anatomy, PMCH, Patna

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Corresponding author: Rekha Sinha

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**Abstract:**

**Background and Objectives:** Inguinal canal is an oblique musculo-aponeurotic tunnel in lower part of anterior abdominal wall, situated just above and parallel to the medial half of inguinal ligament. Inguinal hernia is more common in low socio-economic group than others. Most of the people of Bihar comes under this group. The dimension and the content of inguinal canal in both sexes varies.

**Material and Method:** The anatomy of inguinal canal was studied in cadaver of both sexes in the Department of Anatomy, PMCH Patna (Bihar). Freshly embalmed bodies were used for purpose of dissection of inguinal canal. Both male and female bodies were dissected and superficial and deep inguinal rings and inguinal canal were studied.

**Conclusion:** In most cases muscular fibres of internal oblique strengthened the canal anteriorly, where deep inguinal ring was situated. The musculo aponeurotic fibres of transverses abdominis did not take part in formation of anterior wall.

**Keywords:** Inguinal Canal, transversalis fascia, spermatic cord.

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**Introduction**

Inguinal canal is an oblique musculoaponeurotic tunnel in lower part of anterior abdominal wall, situated just above and parallel to the medial half of inguinal ligament.

Size – 4-6cm (1.5 inches) in length (varies with age)  
1 cm apart Direction – Medially, Forward  
Downward

Extends - From deep inguinal ring to superficial inguinal ring. Sex difference -Male - Larger and well developed due to passage of spermatic cord and descent of testis. Female – Narrow due to passage of round ligament of uterus. The canal presents anterior and posterior wall, roof and floor, inlet and outlet.

Anterior wall – (i) Whole extent – Skin Superficial fascia. External oblique aponeurosis.

(ii) Lateral  $\frac{1}{3}$  -Inguinalfibres of internaloblique muscle.

Posterior –

(i) Whole extent – Fascia transversalis (It separates canal from extra peritoneal tissue and parietal peritoneum.

(ii) Medial half - Conjoint tendon (Falxinguinalis)

In front of fascia transversalis.

(iii) Middle 1/4– Reflected part of inguinal ligament.

(iv) Lateral 1/3- Interfoveolar ligament.

Roof – It is formed by arched fibres of internal oblique and transversus abdominis.

Floor – It is formed by grooved upper surface of inguinal ligament, posterior margin of which fuses with fascia transversalis and medially, by upper (abdominal)surface of lacunar ligament.

**Superficial Inguinal Ring (outlet)** – oblique triangular gap in External oblique aponeurosis.

Position- above and lateral to pubic crest .

1.25cm above pubic tubercle.

Base – pubic crest.

Apex - directed above and lateral, formed by convergence of two Crura.

Medial and Lateral side – medial and lateral margin of triangle called Superior and Inferior Crura

respectively, which meet laterally to form obtuse apex. Near the apex two crura are united by intercrural fibres. Superior crus is attached to pubis symphysis and inferior to pubic tubercle. Inferior crus is fixed most of the time.

Dimension – 2.5 cm long from apex to base  
1.25 cm broad at base

Margin - from the margin of ring, external spermatic fascia balloons over the spermatic cord.

**Deep Inguinal Ring (inlet)** – Oval (U-shaped) gap in fascia transversalis.

Position- 1.25cm above the mid inguinal point.

Above – arched fibres of transversalis abdominis.

Medially - interfoveolar ligament

Inferomedially – inferior epigastric vessels.

(branch of external iliac artery)

(guide to identify deep ring) Front and lateral – inguinal fibres of internal oblique

Margin - from the margin of deep ring, a tubular prolongation of internal spermatic fascia extends over the spermatic cord.

- 1) In fact the deep ring is not an opening, but is the neck of internal spermatic fascia. Entire content - Spermatic cord in male, or round ligament of uterus in females.
- 2) Partial content – Ilioinguinal nerve.

#### **Structures passing through the rings –**

**Superficial Inguinal Ring** – Male – spermatic cord, cremaster muscle and its nerve and vessels.

Ilio inguinal nerve.

Female – round ligament of uterus and its nerve and vessels.

Ilioinguinal nerve

#### **Deep Inguinal Ring –**

Male – spermatic cord

Female – round ligament of uterus

Ilio-inguinal nerve – It enters the canal through interval between external and internal oblique muscle about 2.5cm below and medial to anterior superior iliac spine and passage out through the superficial inguinal ring and pierce the external spermatic fascia and comes in front of it and descends to supply the skin of external genitalia and upper part of medial side of thigh. It is mixed nerve, carrying fibres from ventral rami of L1, but after piercing the internal oblique it conveys only sensory fibres.

- (i) Ductus (vas) deferens.

- (ii) Testicular and cremastic arteries.
- (iii) Artery of ductus deferens.
- (iv) Pampiniform plexus of veins.
- (v) Lymph vessels from the testis and ductus deferens.
- (vi) Genital branch of genitofemoral nerve.
- (vii) Plexus of sympathetic nerve around the artery of Ductus deferens.
- (viii) Testicular sympathetic plexus
- (ix) Loose connective tissue.

Remains of processus vaginalis

#### **Objectives**

Most of the people of Bihar comes under this group. The dimension and the content of inguinal canal in both sexes varies.

#### **Material and Method**

The anatomy of inguinal canal was studied in cadaver of both sexes in the Department of Anatomy, Patna Medical College and Hospital Patna (Bihar). Freshly embalmed bodies were used for purpose of dissection of inguinal canal. Both male and female bodies were dissected and superficial and deep inguinal rings and inguinal canal were studied. Study duration of Two Years. The dissection of inguinal canal was made stepwise. The circumference of superficial and deep inguinal ring and canal length was measured in mm. Position of body— The body must be supine with extension of lower limb. Incision - One transverse incision through the entire thickness of superficial fascia from anterior superior iliac spine to median plane. Another vertical incision from medial end of first incision in median line up to pubis symphysis.

The lower edge of incised skin was reflected downwards and laterally up to inguinal ligament. The superficial fascia was exposed. In the superficial fascia following structures was seen:- Superficial circumflex iliac vessel, running towards anterior superior iliac spine, Superficial epigastric vessel towards umbilicus. Superficial external pudendal vessel toward external genitalia. Terminal part of ilioinguinal nerve and iliohypogastric nerve.

- 1) Then superficial fascia was cut in the same way as skin incision.
- 2) The finger was insinuated between membrane layer of superficial fascia and external oblique as far as below the inguinal ligament where membrane layer blends with fascia lata of thigh.
- 3) The triangular opening was seen on lower medial side of external oblique aponeurosis, this was superficial inguinal ring.

A vertical incision was given from the pubic tubercle to the umbilicus through the whole thickness of the abdominal wall. Another vertical incision was also given from anterior superior iliac spine to the 12<sup>th</sup> rib, through whole thickness of the abdominal wall. The

upper ends of these two incisions were joined by a transverse incision passing from the skin to the peritoneum. Thus the posterior aspect of the abdomen was exposed. The spermatic cord was seen passing through the deep inguinal ring. The peritoneum was removed and margins of the deep inguinal ring were exposed by clean dissection, through which the spermatic cord was seen clearly.

## Results

The anatomy of the inguinal canal was studied in 30 cadavers in the departments of Anatomy in PMCH Patna. Out of the 30 cases, 20 were males and 10 were females.

**Table 1: Showing sex of the cadavers.**

Sex	No. of cadavers	Percentage
Male	20	66.66%
Female	10	33.33%
Total	30	100.00%

**Table 2: Showing the length of the inguinal canal in 30 cases.**

Maximum	Minimum	Average
40.5 mm	35 mm	37.75 mm

**Table 3: Scattered graph showing the length of the inguinal canal in 30 cases.**

Maximum	Minimum	Average
40.5 mm	35 mm	37.75 mm

**Table 4: Showing the diameter of spermatic cord in 20 cases**

Maximum	Minimum
6.3 mm	4.8 mm

**Table 5: Showing the diameter of the deep inguinal ring in 30 cases**

Longest diameter	Smallest diameter
13 mm	8.8 mm

**Table 6: Showing the distance from the base to apex of the superficial inguinal canal ring in 30 cases**

Longest distance	Smallest distance
26.1 mm	22.5 mm

## Discussion

The study of various structures of that canal was done, right from skin deep to peritoneum. The variations were also observed.

**The inguinal canal** – It is the passage between deep and superficial inguinal rings.

**Size** – 4cm long

**Axis** – parallel to and a little above inguinal ligament.

**Ant. wall** – skin, superficial fascia, external oblique abdominis and muscular fibres of internal oblique on the lateral third.

**Post wall** – reflected inguinal ligament, conjoint tendon and fascia transversalis separating it from extra peritoneal connective tissue and peritoneum.

**Superior** – arched fibres of internal oblique abdominis and transverses abdominis. Inferior – union of inguinal ligament and fascia transversalis. Medially by lacunar ligament. Mortan (1841) and Rontan [1] (1843) described the conjoint tendon first. Blood good (1919) found the conjoint tendon to be very variable. Edmund Andrens [2] (1928) found that only in 30 percent of the cases, the internal oblique contributed to the formation of a true tendinous structure. In 70 percent of the cases it

was not tendinous at all [3]. G.V. Foster (1936) was of opinion that the conjoint tendon was frequently absent and almost completely obliterated near its insertion. Fallis (1938) observed that the internal oblique arched on the rectus muscle, rather than through intermediary of a fibrous tendon. He was of opinion that the conjoint tendon was rudimentary. Anson and McVay [4] (1938) considered the conjoint tendon to be an artefact. He considered it to be nearly an area in the anterior lamina of the rectus sheath rendering more prominent than the surrounding tissue through its insertion into the bone. Chatterjee [5] (1950) also found much irregularity in the conjoint tendon. In the present series of cadavers, the conjoint tendon was found to be muscular in 20 percent it had a true tendinous structure in 80 percent. Mair [6] (1940) in his review of 45 cases of inguinal hernia found that conjoint tendon was inserted in the pubic tubercle only in 46 percent of the cases. In 20 percent it was within one and half inch from the pubic tubercle. In this series of observation on cadavers, the conjoint tendon was found to be inserted in the pubic tubercle in only 60 percent of the cases [7].

## Fascia Transversalis

**In Cadavers:** Anson and McVay (1938) described the fascia transversalis to be seemingly strong

enough, rare instances, it was not of uniform strength and thickness, but thick laterally and very thin medially. Anson and Zimmermann [8] (1938) found the fascia transversalis strongest in the inguinal region where it was an important constituent of posterior wall of the inguinal canal. In the triangular cleft existing between the transversus abdominis and inguinal ligament, it compensated for the deficiency in the transversus abdominis muscle. Foster (1936) also said that the fascia transversalis compensated for the deficiency in the transversus abdominis muscle. Carones [9] (1939) emphasised its importance in the same way. Lytle (1948) held that the fascia transversalis was of immense importance, as it formed the first and probably the most important line of defence against herniation.

#### inguinal ring:

**In cadavers (from in front):** Anson and McVay [10] (1938) found that the deep inguinal ring to be oval in shape when viewed from in front. It varied in shape in different subjects and was much larger in the males than in females [11]. It was situated in the transversalis fascia midway between the anterior superior iliac spine and the pubic symphysis and half inch above the inguinal ligament. From its circumference, a thin funnel-shaped membrane named the internal spermatic fascia was continued as a covering on the spermatic cord and testis. Avisse C et al [12] (2000 Feb.) found that no significant difference was found between early and new diagrams of the posterior anatomy of the inguinofemoral area from a laparoscopic point of view because anatomy is unique to each individual [13]. But new dangers can arise from new approaches, even if the anatomic structures are well known, so anatomic research is still useful. It provides information relative to new surgical techniques, new vision of structures known for centuries [14].

Thus, when the trunk rotates to the left, as the patient pulls sideways on a rope, the linea alba becomes convex to the left (Perry, 1966 and Valenti G et al [15], 1998) and the transverses and internal oblique fibres on the right side are presumably pulled away from the inguinal ligament.

#### Conclusion

In the posterior wall the fascia transversalis was found to be thicker in inguinal region. the conjoint tendon formed the posterior wall in almost all the cases and in few cases muscular fibres were also present. The reflected part of inguinal ligament also formed the posterior wall in more than 70% cases. They strengthened the superficial inguinal ring from posterior side. The superficial inguinal ring was found to be triangular in all cases. Its measurement in female was found to be smaller. The two crura of

superficial inguinal ring were aponeurotic and inter-crural fibres were less defined in case of females.

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