Short Report

The iliopubic tract: an important anatomical landmark in surgery

LAURENCE S. G. TEOH\(^1\), GUY HINGSTON\(^2\), SAAD AL-ALI\(^1\), BRENDA DAWSON\(^1\) AND JOHN A. WINDSOR\(^2\)

Departments of \(^1\) Anatomy and \(^2\) Surgery, Faculty of Medicine and Health Science, University of Auckland, Auckland, New Zealand

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ABSTRACT

A band of fascial thickening, termed the iliopubic tract, lies on the posterior aspect of the inguinal region and has been described in the surgical literature as playing an important role during herniorrhaphy. This study was undertaken to examine the gross and microscopic anatomy of the iliopubic tract in 12 cadavers. The results confirmed that the iliopubic tract can be readily identified as a thickening of the transversalis fascia running deep and parallel to the inguinal ligament. It attaches to the superomedial part of the pubic bone medially, but laterally its fibres fan out within the fascia transversalis and fascia iliaca without bony attachment to the iliac spines. In contrast to the inguinal ligament, the histological analysis of the iliopubic tract shows a high elastin to collagen ratio. The functional significance of this structure merits further study, but there is no doubt that it is important in many approaches to inguinal herniorrhaphy. For this reason it is considered that the iliopubic tract deserves greater emphasis in the anatomy teaching of the inguinal region.

Key words: Inguinal herniorrhaphy; transversalis fascia.

INTRODUCTION

The iliopubic tract (Thomson ligament) was first referred to as a band in the posterior inguinal region distinct from the inguinal ligament and is sometimes known as the deep crural arch (Nyhus, 1964; Rheault et al. 1965). Current anatomy textbooks give little or no emphasis to the iliopubic tract (Moore, 1992; McMinn, 1994; Salmons, 1995; Snell, 1995) despite its importance in the surgical repair of groin herniae. There is also no agreement regarding the lateral attachment of the iliopubic tract, it being said to arise from the anterior inferior iliac spine (Hollinshead, 1971), anterior superior iliac spine and iliac crest (Nyhus, 1964; Lichtenstein et al. 1990), anterior superior iliac spine and iliopectineal fascia (Spaw et al. 1991) or the iliopectineal line (Skandalakis et al. 1993).

While the iliopubic tract is given greater prominence in the surgical literature, there is still little consensus as to its structure and function or to its importance in the surgical repair of groin herniae. The iliopubic tract has been considered a thickening of the deep layer of the anterior abdominal wall (Skandalakis et al. 1989; Spaw et al. 1991; Condon, 1995), a thickening of the transversalis fascia (Nyhus, 1964) or the inferior part of the transversus abdominis muscle layer (Lichtenstein et al. 1990). Some of the standard surgical repairs of inguinal herniae are based on the iliopubic tract (Devlin et al. 1977; Rutledge, 1988; Bendavid 1995), while others discount it altogether (Lichtenstein et al. 1990). The advent of laparoscopic approaches to herniorrhaphy has recently heightened awareness of the importance of the iliopubic tract (Spaw et al. 1991; Arregui et al. 1993).

This study was undertaken to determine whether the iliopubic tract can be identified readily, whether it is a demonstrable thickening of the transversalis...
Fig. 1. Internal surface of the anterior abdominal wall (posterior approach) showing the iliopubic tract (IPT) as a thickening of the transversalis fascia (TF) after removal of the peritoneum. The white pointer indicates the lateral part of the iliopubic tract (LAT). The blue pointer indicates the iliopubic tract more medially (MED). The internal surface of the external oblique aponeurosis (EOA) is indicated.

Fig. 2. External surface of the anterior abdominal wall (anterior approach) showing the external surface of the middle part of the iliopubic tract (IPT). Skin, subcutaneous fat, Scarpa’s fascia and Camper’s fascia are removed. The external oblique aponeurosis (EOA) has been incised and the inguinal ligament (IL) is indicated. The iliopubic tract (IPT) is a distinct structure lying posterior to the inguinal ligament, and is shown to form the inferior part of the posterior wall of the inguinal canal. The superior (SUP) and inferior (INF) margins of the dissection and the spermatic cord (SC) are indicated.

Fig. 3. Low magnification light micrograph of the inguinal region taken perpendicular to the mid point of the inguinal ligament. All structures from the inguinal ligament/external oblique aponeurosis layer (IL/EOA) anteriorly, to the iliopubic tract/transversalis fascia layer (IPT/TF)
fascia, whether it is attached to the iliac spine and whether it has a different composition than the inguinal ligament.

MATERIALS AND METHODS

The iliopubic tract was examined in 12 cadavers (males 8, females 4, median age 73 y, range 60–95 y), 1 before and 11 within 1 y of embalming. The bodies were bequeathed under the terms of the Human Tissue Act (1964). The tract was exposed by anterior and posterior dissection of the abdominal wall. The skin, subcutaneous fat and the external oblique aponeurosis were incised on a line between the pubic tubercle and the anterior superior iliac spine. The spermatic cord or round ligament was mobilised, exposing the posterior wall (transversalis fascia) and the floor (iliopubic tract) of the inguinal canal. The iliopubic tract was also exposed in the preperitoneal plane by removing peritoneum and preperitoneal fat from the pubic tubercle to beyond the anterior iliac spines.

The width (from superior to inferior margins) of the iliopubic tract was measured in situ, at the point at which it passes anterior to the external iliac vessels and also at the point of intersection between the tract and an imaginary line perpendicular to the tract from the anterior superior iliac spine. The distance between the tract and the anterior superior iliac spine was also measured along the imaginary line described above.

Parasagittal sections of the abdominal wall anterior to the femoral artery were excised from each of the cadavers. The sections were either stained with haematoxylin and eosin or elastic van Gieson (EVG) for the detection of elastin fibres. The thicknesses of the transversalis fascia and the iliopubic tract were measured under lower power light microscopy using an eyepiece scale. The mean thickness values were obtained by the average of multiple measurements. The mean ratio of the thickness of the iliopubic tract and transversalis fascia was also calculated.

A morphometric analysis was used to measure the elastin to collagen ratio in the iliopubic tract and the inguinal ligament from the histological slides. This involved placing a transparency with 100 evenly spaced points in 10 rows on an enlarged colour plate of the slide. The number of points out of 100 falling on each constituent (collagen, elastin, and other) of the tissue was recorded. The elastin/collagen ratio was calculated from this.

RESULTS

The iliopubic tract was visible and palpable in all 12 cadavers when examined from both an anterior and posterior approach (Figs 1, 2). It was a discrete thickening of the transversalis fascia, running deep and parallel to the inguinal ligament, below which the fascia became the anterior portion of the femoral sheath. The medial origin of the tract arose from the medial part of the superior surface of the body of the pubic bone immediately posterior to the site of attachment of the lacunar ligament into the pubic bone at the pubic tubercle. The iliopubic tract was observed to extend along a line separated by an average distance of 19 mm (range 12–24 mm) from, but without direct attachment to, the anterior superior iliac spine. Its lateral edge extended in a fan-like manner within the transversalis fascia and fascia iliaca.

The mean width of the iliopubic tract, as measured in the cadavers, was 4.6 mm (range 3.5–7.0 mm) at the point overlying the femoral artery and was 5.3 mm adjacent to the anterior superior iliac spine. The mean thickness of the tract was 0.24 (range 0.18–0.3) mm and the thickness of the transversalis fascia was 0.12 (range 0.10–0.14) mm when measured microscopically. The ratio of the iliopubic tract to the transversalis fascia was 1.9 (range 1.4–2.5), indicating that the iliopubic tract was twice as thick as the transversalis fascia on either side of it.

The transversalis fascia with the iliopubic tract was a distinct layer histologically (Fig. 3) and of similar connective tissue composition (Fig. 4). The EVG stain demonstrated that the tract was rich in elastin fibres and that the fibres ran parallel and perpendicular to the long axis of the tract. In contrast, the inguinal ligament was considerably thicker than the iliopubic tract and contained an abundance of densely packed collagen fibres and relatively few elastin fibres (Figs 3, 5). The observation that the iliopubic tract contained relatively more elastin than the inguinal ligament was
confirmed quantitatively by morphometric analysis. The elastin/collagen ratio of the iliopubic tract was $1.7 \pm 0.42$ s.d. compared with $0.07 \pm 0.05$ s.d. for the inguinal ligament.

**DISCUSSION**

This study has confirmed that the iliopubic tract can be identified readily as a thickening of the transversalis fascia deep to the inguinal ligament. The lateral attachment of the tract is not to the iliac spines, as for the inguinal ligament, but it merges with the fascia overlying the iliacus muscle. The histological composition of the iliopubic tract is strikingly different from the inguinal ligament, being high in elastin relative to collagen.

The functional significance of the iliopubic tract has not been specifically addressed by this study. However, it is interesting to note that at the sites where structures enter and exit the abdominal cavity the inner investing layer of the abdominal wall, the transversalis fascia, appears to make a special contribution, for instance, the phreno-oesophageal membrane at the oesophageal hiatus (Bombeck et al. 1966), the investing fascia propria of the rectum (Church et al. 1987), and the transversalis fascia with the iliopubic tract bridging the myopectineal orifice (Wantz, 1991). These anatomical structures have all attracted significantly more attention from surgeons than anatomists.

A number of the more commonly performed surgical repairs of inguinal herniae incorporate the iliopubic tract. The Shouldice repair, widely acknowledged as the ‘gold standard’ technique, specifically utilises the iliopubic tract in the 2-layered repair of the posterior wall of the inguinal canal (Devlin et al. 1977; Bendavid, 1995; Lazorthes, 1995), although not all accounts refer to the tract (Obney, 1979). The posterior (preperitoneal) approach to repair of inguinal and femoral herniae closes the hernial defect by bringing the arch of the transversus abdominis aponeurosis to the iliopubic tract (Nyhus et al. 1960). The Cooper’s repair involves suturing Cooper’s (pectineal) ligament to the anterior femoral fascia, which, although not named, incorporates the iliopubic tract (Rutledge, 1988). The Lichtenstein repair recognises the existence of the iliopubic tract, but because it is considered to be of variable strength does not use it in the anterior ‘tension free’ mesh repair (Lichtenstein et al. 1990). The iliopubic tract has assumed greater importance to the surgeon since the development of the laparoscopic mesh repairs of groin herniae over the last 8 y (Spaw et al. 1991; Arregui et al. 1993). In contrast, the iliopubic tract has not been considered an important anatomical structure with all the commonly performed open surgical repairs, except the Shouldice repair. This anterior repair relies on the iliopubic tract to provide anchorage to the second line of sutures in the double-breasted plication of the transversalis fascia. The iliopubic tract is important during the laparoscopic approach to repair because it provides a visual and palpable landmark during the initial dissection of the peritoneum from the underlying structures. This exercise is usually effected with the expansion of a balloon inserted into the plane from an infraumbilical incision. The dissection can be observed and the anatomical landmarks confirmed by using a laparoscope within the balloon during the expansion. Groin anatomy from the preperitoneal perspective has not been routinely taught to medical students. As a result surgeons and surgeons in training are often not familiar with preperitoneal anatomy, which is based on the concept of the myopectineal orifice, transversely bisected by the iliopubic tract. Given the very notable trend towards laparoscopic hernia surgery, it would be reasonable to review whether medical students are taught groin anatomy in the most relevant way. The second reason for the importance of the iliopubic tract is that it provides a safe and constant structure onto which the mesh can be secured by staples (or tacks) until tissue ingrowth prevents the mesh from slipping.

This study has clarified the controversy regarding the lateral attachment of the iliopubic tract. It does not appear to attach via the fascia, as stated by other authors, into the anterior superior iliac spine and iliac crest (Nyhus, 1964; Lichtenstein et al. 1990) or to the iliopsoas line and iliopectineal fascia (Spaw et al. 1991; Skandalakis et al. 1993). In all the cadavers, the fibres of the iliopubic tract passed posteroinferiorly to the anterior superior iliac spine before splaying out in the layer of the transversalis fascia and iliacus muscle fascia. This is consistent with the iliopubic tract being a thickening of the transversalis fascial layer, which was more prominent medially. The apparent lack of consensus regarding the lateral attachment probably arises from the fact that it is not routinely exposed during the surgical repair of groin herniae.

In conclusion, the iliopubic tract is a readily defined thickening of the transversalis fascia, quite distinct from the inguinal ligament. The histological analysis of the iliopubic tract, which, to our knowledge has not been published before, highlights the high elastin content relative to collagen. The functional significance of this structure needs further study, but there is no doubt that it is important in many approaches to
the repair of inguinal herniae and should be given greater emphasis in teaching the anatomy of the inguinal region.

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REFERENCES


