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Pre-Peritoneal Fascia/Fat – Laparoscopic Anatomy during Total Extra-Peritoneal Hernioplasty

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Abstract

Contrary to traditional concept, anatomy of the preperitoneal tissues of groin is complex and new technological advancements provide new vision of morphology and structures known for centuries. Use of the excellent perspective, lighting and magnification under laparoscopy during the total extra-peritoneal (TEP) inguinal hernioplasty (N=30) revealed presence of a well-defined pre-peritoneal fascia covering the so-called pre-peritoneal fat which was also a definite fibro-fatty layer of variable thickness. In 83% of cases, the pre-peritoneal fascia was single thin membranous layer while in 17%, it consisted of double layers both of which were thin membranous in nature. The pre-peritoneal fascia was quite distinct from the transversalis fascia in terms of not only its anatomic disposition but also its neurovascular supply, and there was an easily fissile avascular plane in between them, suggestive of different embryological origins of the two fascias. Internal spermatic fascia was consistently formed by the pre-peritoneal fascia, along with formation of a secondary internal ring at the level of the primary internal ring in the Transversalis fascia. Extensive fine neurovascular communications were consistently present among the three layers of the pre-peritoneal fascia, the pre-peritoneal fat and the parietal peritoneum, indicating their common embryological origin from the same somites. Pre-peritoneal fat formed a sizable cord lipoma in 20% of cases. Unhurried step-by-step judicious dissection in appropriate anatomical planes with keen observation, preferably under high definition endovision is the key to the continued research in the laparoscopic anatomy and is highly recommended to facilitate the surgical procedure with ease and safety.

Keywords: Total extraperitoneal hernioplasty, TEP, TEPP, Transversalis fascia, surgical inguinal anatomy, laparoscopic inguinal anatomy

Introduction

Sound knowledge of the live surgical anatomy of the extra-peritoneal tissues is of paramount importance in the era of laparoscopic minimal access surgery of anterior abdominal wall hernias where all the surgical work is carried out with precision in a limited closed space, and the surgeon with stereotyped knowledge of only classical anatomy of the inguinal region often lands up in difficulties during laparoscopic inguinal hernioplasty, possibly

not due to technical error or lack of experience but due to the poorly understood fascial arrangements and its variations as has been emphasized by Arregui (1997)[1]. Moreover, the living surgical anatomy of the pre-peritoneal fat/fascia was rarely ever reported in the past, and only one study, to the best of the author's knowledge, is reported in the English literature by Arregui (1997)[1] who commented that there remains not only little understanding but also little interest in the laparoscopic surgical anatomy of the preperitoneal fascia/fat and fascia transversalis among the practicing surgeons. As Lange (2002)[2] rightly commented that anatomy of the preperitoneal tissues of groin is complex, and Avisse et al (2000)[3] emphasized that new surgical technique provides new vision of structures known for centuries, the author utilized the excellent perspective, lighting and magnification to carefully study the live surgical anatomical dispositions of the pre-peritoneal fascia/fat during the laparoscopic total extra-peritoneal (TEP) inguinal hernioplasty.

Materials and Methods

After Institutional Ethics Committee clearance, a study was performed prospectively in Jawaharlal Nehru Medical College & Hospital, A.M. University, Aligarh from April, 2011 to August, 2013 in adult patients with uncomplicated primary inguinal hernia who underwent laparoscopic hernioplasty through the total extra-peritoneal approach. Patients with age less than 18 years, severe co-morbid disease (ASA grade III – V), previous lower abdominal surgery and complicated or recurrent hernia were not included in the study. The author followed the previously reported surgical technique of the total extra-peritoneal (TEP) inguinal hernioplasty.[4] High Definition Endovision was used in most of the cases, and instant documentation was done, usually with video recording.

Results

Thirty TEP Hernioplasties were carried out in 25 patients by the author over a period of 3 years. All patients were males. Inguinal hernia was indirect 27, direct 3, bilateral 5, and unilateral 20. Overall mean age of patients was 49.7 ± 17.6 yrs.

During 25 operations (83.3%), a diaphanous pre-peritoneal fascia (PPF) was observed which was distinct from the Transversalis fascia (TF) the detail of which is being reported separately. Mean age of these patients was 48.2 ± 11.9 Yrs. The diaphanous pre-peritoneal fascia consisted of an outer membranous layer and an inner fatty/fibrofatty layer just outside the parietal peritoneum (Figure 1-3). Pre-peritoneal fat was minimally fatty in 12, moderately fatty in 10, & excessively fatty in 3 cases. In 5 operations (16.7%), the pre-peritoneal fascia was found really double layer, & both the layers were membranous albeit thin in nature, enclosing minimal amount of fatty/fibrofatty tissues (Figure 1G-H); and there was also present a significant fibro-fatty layer between this double-layer pre-peritoneal fascia and the parietal peritoneum. Mean age of these patients was 49.9 ± 17.8 yrs.

In 27 cases of indirect inguinal hernia, the pre-peritoneal fascia/fat was clearly seen entering the deep inguinal ring formed by the Transversalis fascia, and covering the hernial sac and the cord structures inside the inguinal canal as the internal spermatic fascia (Figure 3E-F). The pre-peritoneal fascia/fat was found quite separate and distinct from the Transversalis fascia, with an easily feasible avascular plane in between them (Figure 2). The neurovascular supplies of the pre-peritoneal fascia/fat which had practically little/no communication with those of the Transversalis fascia, had extensive fine connections with those of the parietal peritoneum, making the dissection of the hernial sac rather difficult and bloody (Figure 3G-H).

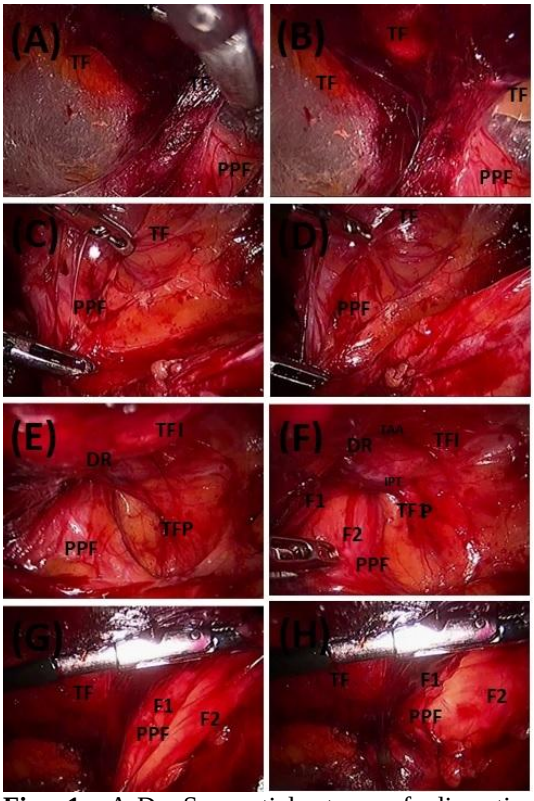

Fig. 1: A-D, Sequential steps of dissection in avascular plane between preperitoneal fascia (PPF) and Transversalis fascia (TF) during TEP hernioplasty on right side in one patient with indirect inguinal hernia; E-H, Dissection of indirect hernial sac from vas deferens (V) and gonadal vessels (GV) by teasing out PPF; TFI, Transversalis fascia in inguinal region; TFP, Transversalis fascia in pelvic region; DR, deep inguinal ring; TAA, transversus aponeurotic arch; IPT, iliopubic tract; Outer layer (F1) and inner layer (F2) of double-layer PPF covering the indirect hernial sac and cord structures.

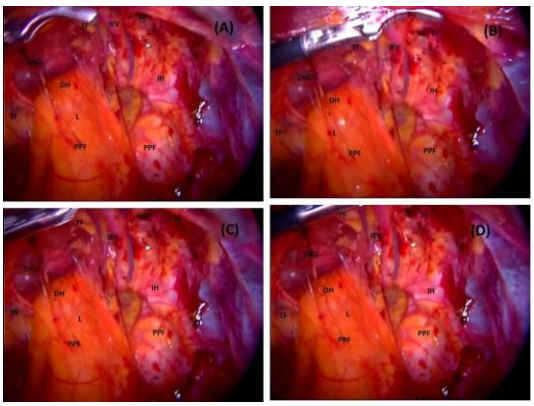

Fig. 2: A-D, Presence of both direct and indirect inguinal hernia after bloodless dissection in the easily fissile avascular plane between preperitoneal fascia (PPF) and Transversalis fascia (TF) during TEP hernioplasty on right side in another patient; TF is seen clearly to cover the direct hernial defect (DHD), deep inferior epigastric vessels and adjacent areas of the inguinal region, and TF is seen distinctly separate from diaphanous PPF which covers direct hernial sac (DH) along with a sort of lipoma (L) as well as indirect hernial sac (IH) along with minimal preperitoneal fat.

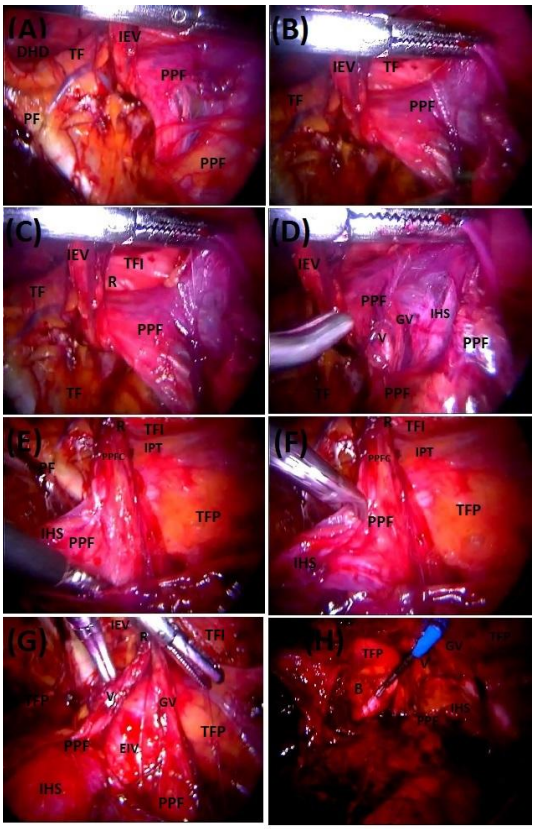

Fig. 3: A, Direct hernial sac reduced fully from the direct hernial defect (DHD) with visualization of thin pectineal fascia (PF) covering corona mortis over pectineal ligament , and Transversalis fascia (TFI) covering direct hernial defect (DHD), deep inferior epigastric vessels and adjacent areas of the inguinal region (IPT refers to iliopubic tract, a condensation in TF), and preperitoneal fascia (PPF) covering the cord structures and indirect hernial sac ; B-D, dissection of vas deferens (V), gonadal vessels (GV) and IHS from PPF; E-G, dissection of indirect hernial sac (IHS) from cord structures by teasing away PPF which is clearly seen to ensheathe the cord structures distally and entering into the inguinal canal (PPFC) while Transversalis fascia (TFP) covers the pelvic areas ; E-G, parietalization of cord structures from IHS, with clear define of the angle of doom containing external iliac vessels (EIV) in the depth that was covered by TF; H, medial dissection with urinary bladder (B) covered by TF.

The cord structures and the indirect hernial sac were found enclosed within a separate

fascial layer derived from pre-peritoneal fascia which extended into the inguinal canal around the cord structures as their innermost covering, i.e., the internal spermatic fascia (Figure 3B-F). This fascial disposition was constantly seen in all the patients not only during the pulling-in and dissection of the hernial sac from within the inguinal canal for inversion or ligation/transection of the hernial sac (Figure 3E-F) but also during the parietalization of the cord structures for adequate requisite space for the proper mesh placement (Figure 3G). In 6 of these cases, there was a significant cord lipoma which was found continuous with the pre-peritoneal fat (Figure 2).

Discussion

There is apparent accord about the groin anatomy described in textbooks, although questions have been raised since 1937.[5,6] Moreover, wide anatomic variations in the groin & adjacent areas have been documented in the recent literature.[7-12] For the First Time in 1998, two great anatomists & investigators - Colborn and Skandalakis[13] utilized the laparoscope to study cadaveric anatomy of Groin. But tissue planes are hard to follow, easily disrupted and without the advantage of blood flow, pale and difficult to distinguish.[1]

Arregui (1997)[1] reported first time during TEPP that the so-called 'Pre-Peritoneal Fat' is really double layer – outer membranous layer & inner fatty layer. This Preperitoneal Fascia was quite distinct from Fascia Transversalis with separate blood supply. Our observations support the findings of Arregui. The study of Arregui (1997)[1] of preperitoneal fat/ fascia in the lower abdomen is the only research work on the laparoscopic anatomy reported in the literature. No further research work on laparoscopic groin anatomy, especially the pre-peritoneal fat/fascia appeared in the recent Anglo-Saxon literature. Arregui (1997)[1] lamented that there remains not only little understanding but also little interest among the practicing surgeons for the laparoscopic surgical anatomy of the pre-peritoneal fascia/fat & transversalis fascia.

The so-called cord lipoma was observed in 20% of our cases, which is in tune with an overall incidence of 22.5% (19.6% during laparoscopic repair and 29% during open repair) reported by Lilly and Arregui (2002)[14]. Present observations support the opinion of Tobin et al (1946)[15] and Nyhus et al (1991)[16] that the cord lipomas are fatty protrusions of the extraperitoneal fat into the inguinal canal, mostly through the deep inguinal ring. However, Fawcett and Rooney (1997)[17] has reported a 'true' lipoma of the cord but in only one of his 140 patients (0.7%) while fatty protrusions of the extraperitoneal fat was present in 46 patients (32.8%).

Conclusion

Pre-peritoneal fascia was consistently found as a definite anatomical entity of membranous nature, which covered the pre-peritoneal fat in all of our patients. It was single layer of membranous nature in 83.3% of our patients, albeit thin attenuated often. It was found double layer in 16.7 % and both the layers were membranous, enclosing a minimal amount of fatty/fibrofatty tissues in between. The internal spermatic fascia was found as a direct extension of the pre-peritoneal fascia, with formation of a secondary internal ring of the inguinal canal. The pre-peritoneal fat was consistently seen as a definite fibro-fatty layer of variable thickness between the pre-peritoneal fascia and the parietal peritoneum, which was seen extending into the inguinal canal and often forming the cord lipoma. The pre-peritoneal fascia/fat was quite distinct from the Transversalis fascia with separate neurovascular supplies with practically little/no communication between them. The pre-peritoneal fascia had extensive fine neurovascular connections with the pre-peritoneal fat as well as the parietal

peritoneum. Plane of surgical dissection was difficult and bloody between the peritoneum and the pre-peritoneal fascia/fat but it was straightforward and avascular between the pre-peritoneal fascia/fat and the Transversalis fascia. This possibly reflects the common embryological origin of the pre-peritoneal fascia/fat and the parietal peritoneum, which is different from the embryological origin of the Transversalis fascia.

Keen observation of pre-peritoneal tissues and judicious dissection into the 'surgical pre-peritoneal space' instead of the 'true pre-peritoneal space' is recommended for smooth rapid execution of TEP hernioplasty with safety. In reality, the journey of scientific research is endless, not only changing the perceptions of surgical anatomic knowledge with newer technology but also often making the humble senior teacher into a student of the 1st grade of medical school. HD Endovision is a real technological boon and is highly recommended for the laparoscopic hernia surgeon.

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