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ANATOMICAL STUDY OF ILIOINGUINAL NERVE AND ITS CLINICAL CORRELATION

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ABSTRACT

Inguinal hernia repair is one of the most common operations. The surgical access to the inguinal region, notably during hernia repairs, exposes the ilioinguinal nerve to the risk of damage at the origin of the neuralgia. The incidence of these post-operative neuropathies and their medico legal consequences notify the importance of this study about the anatomical variations of the ilioinguinal nerve. With the aim of preventing its damage while giving the local anesthesia during repairs of groin hernias and to understand the factors of onset of chronic neuropathy of the ilioinguinal nerve, we dissected 40 inguinal regions of 20 cadavers during routine undergraduate dissection. We have studied ilioinguinal nerve with relation to inguinal canal and its contents. The results showed the high variability of the emergence and the distribution of the ilioinguinal nerve. The variations in the emergence and distribution of the ilioinguinal nerve are the cause of the failures of the ilioinguinal block and the difficulties at interpreting the ilioinguinal nerve during the groin surgeries leading to post operative and perioperative morbidity.

Keywords: Inguinodynia, anatomical variation, neuropathy, ilioinguinal block, inguinal hernia.

INTRODUCTION

The chronic groin pain (inguinodynia) is a potential complication following inguinal hernia mesh repair and has significant impact on the quality of life [1]. The incidence varies among studies, ranging between 0% and 62.9%, with 10% of patients fitting in the moderate to severe pain group [2-6]. However, only 2%-4% of the patients are adversely affected by chronic groin pain in their everyday life. This is significant, considering the volume of the operations performed. The main reasons hypothesized for chronic groin pain are intra-operative nerve damage, post-operative fibrosis, or mesh-related fibrosis. The chronic groin pain has been classified as either neuropathic or non-neuropathic pain. The three nerves potentially involved are the Ilioinguinal Nerve (IIN), Iliohypogastric Nerve (IHN) and genital branch of the Genitofemoral Nerve (GFN). These nerves can be damaged either by trauma during dissection or retraction of tissues, or nerve entrapment from post-operative fibrosis, mesh-related fibrosis or sutures used to fix the mesh. Smeds et al [7] suggested that the injury is mainly due to inadequate dissection, failure to visualize and protect the nerves, and failure to recognize the aberrant location and anatomic variations of the nerves. Any partial or complete transaction of the nerve leads to neuroma formation and consequent pain along the distribution of that nerve. Lange et al [8] and Alfieri et al [9] showed there was less incidence of chronic groin pain with identification of all 3 nerves during open inguinal hernia repair compared to no nerve identification. A large

prospective multicentre study conducted at 11 Italian institutions involving 955 patients showed that the overall pain rate was 5.5% and moderate to severe pain rate was 1.3% when all three nerves were identified. If no nerves were identified the rates of overall pain and moderate to severe pain were 21.6% and 4.7%, respectively. This was statistically significant. Alfieri et al [9] showed that relative risk of chronic groin pain increases from 2.2 to 19.2 if one or three nerves have not been recognized during the inguinal hernia repair. Amid and Wijsmuller suggested that identification of inguinal nerves helps to avoid damage to them by mesh or sutures and also that it is beneficial to cut clean if already damaged during dissection in order to avoid neuroma formation [10,11]. Smeds et al. [12] showed that non-identification of nerves leads to worse pain rates and that non-identification of IIN is worse than actual identification of both IHN and GFN. The difficulty in nerve identification has been shown to be due to variation in the anatomy and absence of one or more nerves, which is not uncommon in the inguinal area.

Ilioinguinal and Iliohypogastric nerve blocks are commonly used to provide analgesia for orchidopexy and repairs of inguinal hernia, hydrocele and varicocele [13]. The point at which the ilioinguinal nerve pierces the internal oblique muscle can be a variable distance from the ASIS, thus potentially leading to the failure of a single injection technique [14]. The variations in the emergence and distribution of the ilioinguinal nerve are the cause of the failures of the ilioinguinal block and the difficulties at interpreting the ilioinguinal nerve during the groin surgeries leading to post operative and perioperative morbidity [15].

The incidence of these post-operative neuropathies and their medico legal consequences notify the importance of the study about the anatomical variations of the ilioinguinal nerve [16].

Hence, the aim of this study was to explore anatomical variations of and to map the course of ilioinguinal nerve, also to study the relationship of ilioinguinal nerve with inguinal ligament, wall and content of the inguinal canal.

MATERIAL AND METHODS

The investigation was performed on 20 embalmed cadavers (16 male and 4 female) during routine undergraduate dissection hours in the Department of Anatomy, Government Medical College. 40 ilioinguinal nerves of 20 cadavers were observed and studied. The skin of anterior abdominal wall was reflected for routine dissection of anterior abdominal wall muscles. A horizontal incision was made from anterior superior iliac spine (ASIS) on apponeurosis of external oblique muscle to linea Alba in midline and from this point vertically down to pubic symphysis. The triangular flap of external oblique apponeurosis was reflected laterally and inferiorly to expose inguinal ligament, inguinal canal with its contents, ilioinguinal nerve and underlined internal oblique muscle. The distance of emergence of ilioinguinal nerve from anterior superior iliac spine was measured with the help of caliper. Further the course was observed and distance of termination from linea alba was measured.

Statistical methods: We used the mean for presentation of distance of ilioinguinal nerve from various bony prominences and soft tissue landmarks. Further % has been drawn for number of cases showing various modes of termination.

RESULTS

The results showed high variability of the emergence and distribution of the ilioinguinal nerve. Ilioinguinal nerve was present at all 40 sites. They were behind the external oblique apponeurosis. Proximal end pierced the internal oblique muscle on an average 3.77 cm medial and 2.92 cm inferior to the anterior superior iliac

spine. The ilioinguinal nerve travelled superficial to the internal oblique muscle, passing on average 1.2 cm from the inguinal ligament. The nerve followed a linear course to terminate at 2.2 cm lateral to linea alba. In male cadavers, ilioinguinal nerve travelled superficial to spermatic cord. The terminal division took place in the inguinal canal in 28.6% of cases, with terminal branches that sometimes perforated the fascia of the external oblique. In 63.4% cases it passed through superficial inguinal ring, before proceeding on anterior surface of spermatic cord.

In one of the female cadaver, (Image No. II) On left side, IIN showed a short course (2.5 cm) as its proximal end pierced the internal oblique muscle at 5.5 cm medial and 8 cm inferior to anterior superior iliac spine.

DISCUSSION

The ilioinguinal nerve originates from the L1 ventral ramus. It is smaller than the iliohypogastric nerve and arises with it from the first lumbar ventral ramus, to emerge from the lateral border of psoas major, with or just inferior to the iliohypogastric nerve. It passes obliquely across quadratus lumborum and the upper part of iliacus and enters transversus abdominis near the anterior end of the iliac crest. It sometimes connects with the iliohypogastric nerve at this point. It pierces internal oblique and supplies it and then traverses the inguinal canal below the spermatic cord. It emerges with the cord from the superficial inguinal ring to supply the proximal medial skin of the thigh and the skin over the root of the penis and upper part of the scrotum in males, or the skin covering the mons pubis and the adjoining labium majus in females. The ilioinguinal and iliohypogastric nerves are reciprocal in size. The ilioinguinal is occasionally very small and ends by joining the iliohypogastric, a branch of which then takes its place. Occasionally, the ilioinguinal nerve is completely absent when the iliohypogastric nerve supplies its territory [17].

Motor: The ilioinguinal nerve supplies motor nerves to transversus abdominis and internal oblique.

Sensory: The ilioinguinal nerve supplies sensory fibers to transversus abdominis and internal oblique. It innervates the medial skin of the thigh and the skin over the root of the penis and upper part of the scrotum in males or the skin covering the mons pubis and the adjoining labium majus in females.

Observations of the present study have revealed that the pattern of emergence of ilioinguinal nerve by piercing internal oblique muscle was different. In this study, it was observed that at all the sites the nerve emerges below the level of the anterior superior iliac spine. This is consistent with the findings by Zachary Klaassen et al [18], A. Ndiaye [19], M. Diop et al [20].

The distance of emergence of IIN from ASIS is 3.77cm medial and 2.92cm lateral, while that of Z. Klaassen et al is 2.8cm and 4cm and of Selda Yıldız [21] is 2.96cm and 3.5cm respectively. Further the distance of IIN from that of inguinal ligament is 0.97cm which is consistent with Selda Yıldız i.e. 0.95cm, while according to Z. Klaassen et al it is 2.1cm. Similarly, the termination distance of IIN from linea alba is 2.2cm, nearly equal to that of Selda Yıldız i.e. 2.4cm. While according to Z. Klaassen et al termination distance of IIN is 3cm.

In the present study, terminal division took place in the inguinal canal in 28.6% of cases while according to A. Ndiaye terminal division took place in the inguinal canal in 86% of cases. In the present study in 63.4% of cases IIN passed through superficial inguinal ring, before proceeding on anterior surface of spermatic cord, and according to M. Diop in 67.56% of cases it passed through superficial inguinal ring. In one case, (Image No. II) it was having a short course of 2.5 cm as its Proximal end pierced the

internal oblique muscle at 5.5 cm medial and 8 cm inferior to anterior superior iliac spine.

CONCLUSION

Hence from the above discussion it was concluded that, these results showed the high variability of the emergence of the ilioinguinal nerve. This also helps to understand the high failure rate of single injection technique of ilioinguinal nerve block given specially for pediatric age group patients undergoing groin surgery [16]. This further, reinforces the use of imaging techniques like ultrasonography for visualization of IIN as an alternative to the 'blind' standard techniques of ilioinguinal nerve block in pain medicine and anesthetic practice as suggested by Eichenberger [22] and Michael Gofeld [23]. These results suggests us to examine the possibilities of the nerve course variations, to be taken into consideration for the best way to identify it when surgical procedures are performed in the lower portion of the abdomen and especially in inguinal canal region. These results will enable to understand better the etiopathogenic aspects of certain neuropathies of the inguinal region and to propose techniques useful for the protection of the nerve during repairs of groin as well as during giving anesthesia. As this study was done in relation with ilioinguinal nerve only, the Iliohypogastric nerve was not studied, which is again an important cutaneous nerve which may get injured in lower abdominal surgeries. To get a clear-cut idea about these cutaneous nerves, Iliohypogastric nerve need to be further studied. Because the study was conducted in the Department of Anatomy during routine dissections hours, the sample size was less and hence unable to study the sexual dimorphism of ilioinguinal nerve course and it's variations.

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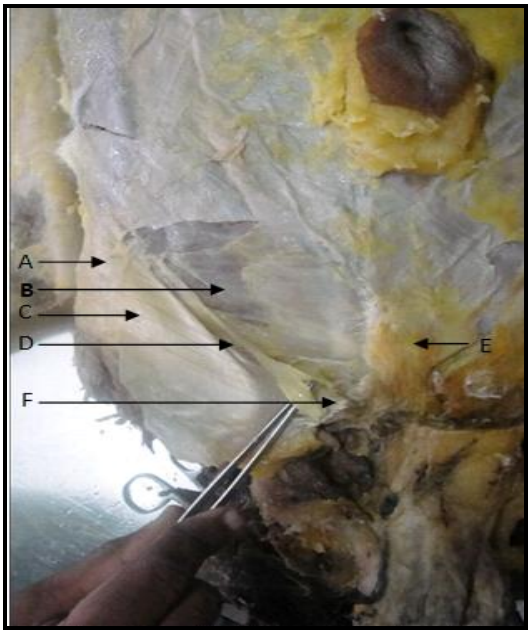
Table 1: Comparison of present study with previous study:

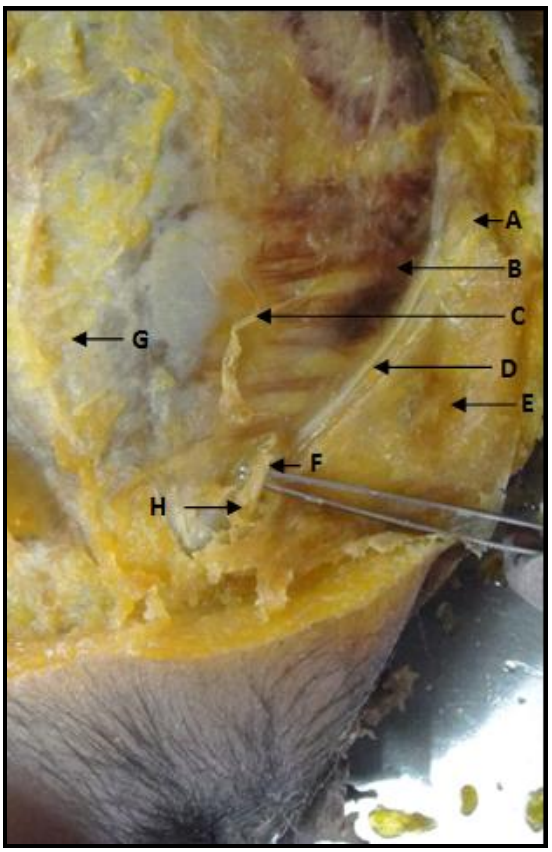
Studies	Mean distance from ASIS		Mean distance from inguinal ligament.	Mean Termination distance from linea alba
	medial	Lateral		
Z. Klaassen et al	2.8	4	2.1	3
Selda Yıldız	2.96	3.5	0.95	2.4
Present study	3.77	2.92	0.97	2.2

Image I: the course of Ilioinguinal nerve in inguinal canal by reflecting external oblique aponurosis



A: Anterior superior iliac spine
B: Internal oblique muscle
C: Reflected part of External oblique apponeurosis (anterior wall of inguinal canal)
D: Ilioinguinal nerve
E: linea alba
F: Spermatic cord at superficial ingunal ring

Image II: Short course of ilioinguinal nerve in female cadaver:



A: Anterior superior iliac spine
B: Internal oblique muscle
C: Iliohypogastric neve
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E: Reflected part of External oblique apponeurosis
F: Ilioinguinal nerve
G: linea alba
H: Superficial inguinal ring