ORIGINAL ARTICLE

Variability in Ilioinguinal nerve anatomy during open hernia repair and its association with post-operative pain

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Received:
2nd October 2017

Accepted:
11th February 2018

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Abstract

Background: Inguinal hernia repair is one of the most commonly performed procedure worldwide and one of the most common complication of this procedure is post-operative pain which may be due to ilioinguinal nerve damage. The aim of this study is to establish the variability of ilioinguinal nerve and to establish the fact that there is no need to unnecessarily explore the operative region for nerve identification as it is spared due to its anatomical position.

Material and Methods: It is a prospective, observational study conducted in Sindh Government Qatar Hospital from July 2016 to December 2016. The patients undergoing hernioplasty during this period were included in the study. There was no purposeful exploration done for the identification of ilioinguinal nerve. The patients were assigned four groups according to the status of identification and position of the ilioinguinal nerve. The first group included patients in which ilioinguinal nerve was not seen, the second group with those in whom ilioinguinal nerve was placed lateral to spermatic cord, the third group with nerve lying adherent to the cord and fourth one with nerve adherent to conjoint tendon. VAS (Visual Analogue Score) was recorded at discharge and at 6 months. The data was then analyzed via IBM SPSS Statistics version 23

Results: Out of the 57 patients included in the study, ilioinguinal nerve was identified intraoperatively in 37 (64.9%) patients while in 20 (35.1%) patients, ilioinguinal nerve was not seen intra-operatively. Among those patients in which the nerve was seen, 23(40.35%) patients had ilioinguinal nerve lying lateral to the spermatic cord while in 12(21.05%) patients the nerve was found adherent to the spermatic cord. In 2(3.51%) patients ilioinguinal nerve was found adherent to the conjoint tendon. VAS score assessment revealed no association of post-operative pain with ilioinguinal nerve identification or position.

Conclusion: It is concluded from the study that the anatomical position of the ilioinguinal nerve is most likely to be found lateral to the spermatic cord or lying adherent to the spermatic cord; so there is minimal chance of nerve entrapment which alleviates the need for exploration of ilioinguinal nerve during hernioplasty.

Keywords: Ilioinguinal, inguinal hernia, lichtenstein repair, hernioplasty, variations in position of ilioinguinal nerveb, conjoint tendon

Introduction:

Surgery for inguinal hernia repair is one of the most commonly performed procedures in general surgical practice. According to an estimate every 1 in 4 person in United States of America undergoes hernia repair.[1]

In other parts of the world, including Europe and Asia, the number of inguinal hernia repairs performed is very high as well. Most common hernia repairs are performed for different typesof inguinal hernias, including direct and indirect inguinal hernia.

There is a rich neuronal innervation of this area of abdomen, supplied by ilioinguinal, iliohypogastric, genital branch of the genitofemoral and lateral cutaneous branch of femoral nerve. The

understanding of the basic anatomy of these nerves including their course is vital to avoid post-operative complications.[2]

The basic techniques used for the open repair of hernia worldwide include either tension free primary aponeurotic suturing or tension free prostheses/synthetic mesh repair.[3]

The Lichtenstein prosthetic mesh tension free technique, introduced in 1989, is extensively used worldwide for hernioplasty procedure in both direct and indirect types of inguinal hernia.[4]

Despite of these techniques being very popular in modern era for the inguinal hernia repair and being widely used throughout the world, there are various complications of these procedures. One of these major complications of the tension free inguinal hernia repair is intra-operative damage or the entrapment of ilioinguinal nerve which causes pain in the area of regional supply of this nerve. Chronic pain (inguinodynia), caused by such neural tissue damage and the healing process via fibrosis induced by prosthetic mesh or the suture, reduces the quality of life.[5]

The variability in the anatomy of ilioinguinal nerve is a debatable topic. The incidence of a surgeon encountering ilioinguinal nerve is highly related to its damage and thus complication, including pain at the suture line of the external oblique aponeurosis closure.[6]

Moreover, the anatomical position of the nerve and variations in its course may influence the incidence of complications. This study was conducted in order to prove that in the local population this incidence is quite low and majority of the iatrogenic injuries to ilioinguinal nerve occur as a result of unnecessary exploration of the inguinal region to purposely identify and save the nerve.

The aim of this study is thus to establish that the variability in anatomical position of ilioinguinal nerve in local population is such that its excessive exploration is not necessary to prevent post-operative pain.

Materials and Methods:

This study was a prospective, sequential, non-randomized, observational study conducted in Sindh Government Qatar Hospital during a period of six months from July 2016 to December 2016. The sample included 57 patients who underwent hernia repair with Lichtenstein hernia repair and were evaluated during the fore mentioned time duration. All patients were included in the study after informed consent.

The sample size was estimated using WHO sample size calculator with one-sided hypothesis test mode. The level of significance was set to 5%. The power of the test was established to be 95%. The sampling technique used during the study was non probability consecutive technique thus nullifying the selection bias.

In exclusion criteria patients above the age of 80, below the age of 15, with femoral hernia, previous history of lower abdominal surgeries on the ipsi-lateral side or a history of recurrent hernia were excluded from the study. Patients that were lost to follow up were also excluded from the study. However patients with history of contra-lateral hernia repair and bilateral hernia were included in the study as the concerned regional anatomy was preserved in these cases.

All the patients were administered a single prophylactic dose of intravenous ceftriaxone 1g before induction. All the patients were operated under spinal anesthesia.

Lichtenstein repair was performed by five experienced surgeons in all patients. The assessment of the anatomy of ilioinguinal nerve intra-operatively was done without excessively exploring the wound for finding the nerve. Instead ilioinguinal nerve was noted as "seen" intra-operatively if found without further exploration of the wound than required for the procedure and vice versa.

Once found, the ilioinguinal nerve was carefully preserved and mobilized with the cord or pushed laterally with a retractor along with the lower lip of external oblique aponeurosis. The

Table-1: VAS Score at Discharge

		0	1	2	3	Total
Ilioinguinal Nerve	Seen	12	4	2	2	20
	Not Seen	24	5	4	4	37
Total		36	9	6	6	57

Table : VAS Score at 6 months

		0	1	Total
Ilioinguinal Nerve	Seen	19	1	20
	Not Seen	34	3	37
Total		53	4	57

poly-propylene mesh, 6x11cm in size, was used to ensure strengthening of posterior wall of the inguinal canal in Lichtenstein repair. During the mesh placement and suturing extreme caution was taken. The mesh was secured with interrupted sutures medially using a non-absorbable polypropylene suture and the dissected edges of overlying external oblique aponeurosis were then approximated with continuous absorbable sutures. This was followed by closure of sub-cutaneous tissue and skin.

The patients were divided into four groups with reference to the identification and anatomy of the ilio-inguinal nerve. The first group consists of patients in which the ilio-inguinal nerve was not seen intra-operatively. The second group consist of patients in which ilio-inguinal nerve was found lateral to the spermatic cord. The third group included the patients in which the nerve was seen adherent to the spermatic cord and in the fourth group the nerve was adherent to the conjoint tendon.

VAS score was noted at the time of discharge and at 6 months follow up. Its association with the status of intra-operative ilio-inguinal nerve identification was observed.

The identification of the nerves did not require any special training or equipment. Moreover, it did not alter the operating time as no purposeful effort for identification of the nerves was done. Thus this study was feasible as well as reproducible.

The data of this study was recorded and analyzed through IBM SPSS statistics version 23.

For quantitative variables, the statistical analysis was shown by mean and standard deviation in this study while relative and absolute frequencies were described for qualitative variables. Chi-square test was applied to observe the differences between categorical variables. An association between identification of ilio-inguinal nerve and VAS score (at discharge and at 6 months) was observed. A p-value of <0.05 was considered statistically significant.

Results:

A total of 57 patients that underwent inguinal hernia repair with Lichtenstein hernioplasty during the specified time duration of 6 months in Sindh Government Qatar Hospital, from July 2016 to December 2016, were included in the study.

Pre-operatively all the patients underwent routine investigations including ultrasound prostate. Confounding factors including age, patients that were lost to follow up, with previous history of lower abdominal surgery on ipsi-lateral side and recurrent hernia were excluded via exclusion criteria.

Results of the study shows all of these 57 patients were males and no female patients were present in the study. The minimum age was 17, maximum age was 77 and the mean age was 49.18. The standard deviation was found to be 17.217.

The diagnosis of right sided inguinal hernia was made in 26 (45.6%) out of these 57 patients. On the other hand, a diagnosis of left sided inguinal hernia was made in 31(54.4%) out of the total number of patients.

In 37(64.9%) patients out of 57, ilio-inguinal nerve was identified intra-operatively and reported as 'seen' while in 20(35.1%) patients ilio-inguinal nerve was not seen intra-operatively.

Out of the 37(64.9%) patients in which the ilio-inguinal nerve was seen, 23(40.35%) patients had the ilio-inguinal nerve lying lateral to the spermatic cord while in 12(21.05%) patients the

nerve was found adherent to the spermatic cord. In 2(3.51%) patients the ilio-inguinal nerve was found adherent to the conjoint tendon.

Patients were followed up at discharge and at 6 months and VAS score was recorded. Association of ilio-inguinal nerve identification with the VAS score was noted. The p-value of 0.94 was found for VAS score on discharge while a p-value of 0.66 was observed for VAS score at 6 months.

Discussion:

Surgeries involving the lower quadrant of the abdomen have been associated with neuronal injuries due to the abundant innervaton of the area. Iatrogenic damage to ilio-inguinal nerve is associated with post-operative groin pain.[7] The corner-stone of avoiding this complication after open inguinal hernia repair is a thorough understanding of the anatomy of the ilio-inguinal nerve.

The ilio-inguinal nerve arises from first anterior lumbar division along with the ilio-hypogastric nerve. It runs on the anterior surface of the psoas, quadratus lumborum and iliacus muscle to pierce through the transversus abdominis muscle. The nerve then passes through internal oblique muscle and joins the spermatic cord to course through the superficial inguinal ring.[8]

A large scale study reveals that open inguinal hernia repair, either hernioplasty or herniorraphy, is associated with post-operative pain and is a significant complication of the procedure. The study showed 43% of patients suffering from chronic pain and the pain being severe or very severe in 3% patients.[5]

The non-neuronal causes of post-operative chronic pain include excessive scar formation secondary to multiple hernia surgeries, periosteal reaction at the pubic tubercle and mechanical pressure of the mesh. Neuro-pathic causes include the compression of ilio-inguinal nerve secondary to peri-neural fibrosis or entrapment in suture material and prosthetic mesh during the surgery.[9] Direct trauma during dissection and tissue retraction while performing the surgery might also be a cause of injury.[10]

Several mechanisms might come into play when nerve damage occurs, including partial or complete transection. Other examples of injury to the nerve include stretching of the fibres, contusion and suture compression. One less studied mechanism of injury is cautery damage.[11]

It is of interest that Lichtenstein did a study that proposed transaction of the ilio-inguinal and genitofemoral nerve to avoid post-operative pain.[12] Moreover, Piccio et al. shows no association of pain with division of the ilio-inguinal nerve after open Lichtenstein hernia repair and only enhanced sensory disturbances in the innervated area was reported.[13]

However there are no strong evidence to support the fact that neurectomy reduces the incidence of post-operative pain as further large scale studies in this regard failed to provide a significant statistical difference in neurectomy and control goups.[14] As a matter of fact, several surgeons have reportedly objected to the concept of ilio-inguinal neurectomy.[15]

It is known that nerve entrapment is imminent if its course runs through or over the conjoint tendon. It is thus advised in many literatures to take extra care while suturing the conjoint tendon to avoid any nerve damage.[16,17]

We think on the same ground that post-operative neuronal pain is related directly to the compression or entrapment of the ilio-inguinal nerve intra-operatively while suturing the conjoint tendon for posterior wall repair. However the anatomy of ilio-inguinal nerve in the local population allows the ilio-inguinal nerve to escape such complications as a result of the latero-caudal or anterior presence of the nerve in relation to the spermatic cord.

In our study we performed 57 hernio-plasty repairs and evaluate the variability of ilio-inguinal nerve anatomy. This helped us to assess the chances of ilio-inguinal nerve getting trapped in suture material during the routine practice her-

nioplasty technique (Lichtenstein) being performed most commonly for the purpose worldwide. However non virgin area i.e. recurrent hernia or already placed mesh in the area, may pose a difficulty in identification of the nerve. Thus those patients with a recurrent hernia were excluded from the study.

A low weight poly-propylene mesh of 6x11cm size was used in the surgeries as it has been shown to be associated with lesser post-operative complications including groin pain.[18] However one drawback of using this type of mesh is that it has lesser tensile strength is more liable to cause early or mid-term recurrence.[19]

Al Dabbagh et al.[20] reveals in their study that the incidence of ilioinguinal nerve lying adherent to the spermatic cord is 21.8%. In comparison our study reveals an incidence of 21.05%. The same study reveals an 18% incidence of the ilioinguinal nerve lying lateral to the cord while our study reveals an incidence of 40.35%. According to another study by S. Emeksiz et al[9] the incidence of the nerve lying adherent and lateral to the cord is 21.6% and 15.5% respectively.

Our study reveals that only 3.51% of the patients were reported to have the ilio-inguinal nerve lying adherent to the conjoint tendon. In these patients there is a strong chance of ilio-inguinal nerve entrapment and consequently post-operative neuropathic pain. The ilio-inguinal nerve was not seen in 35.1% of the patients. The nerve lying adherent to spermatic cord or lateral to it was carefully lifted with cord or retracted laterally respectively, thus there was a negligible chance of neuropathic iatrogenic injury to the ilio-inguinal nerve. On follow up, the patients were noted to have no statistically significant association of pain with identification of the ilioinguinal nerve at discharge and at 6 months.

This is the first prospective study to assess the variability in the anatomy of ilio-inguinal nerve in local population. During our study we did not explore the operative region unnecessarily for identification of the ilio-inguinal nerve.

Conclusion:
It is concluded from the study that anatomy of the ilio-inguinal nerve is quite variable. However it is less likely to course through the conjoint tendon. Evidence is provided by this study that the ilio-inguinal nerve is most likely to be found lateral to the spermatic cord or adherent to the spermatid cord. Thus there is no need for unnecessary exploration of the operative region for identification of nerve as the chances of it getting damaged or transected intra-operatively is very low due to anatomical variations.

Conflict of interest: None

Funding source: None

Role and contribution of authors:
Dr Omer Fateh, substantial contributions to conception, design, analysis, interpretation of data and final approval of the version to be published

Dr Muhammad Samir Irfan Wasi, drafting the article or revising it critically for important intellectual content

Dr Syed Umar Rafiq, acquisition of data

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