DOI: 10.7860/JCDR/2022/56991.16871

Original Article

Surgery Section

Ilioinguinal Nerve Neurectomy vs Nerve Preservation in Lichtenstein Tension Free Mesh Hernioplasty: A Randomised Clinical Trial at a Tertiary Care Hospital in Udaipur, Rajasthan, India

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ABSTRACT

Introduction: A Lichtenstein tension-free mesh hernioplasty is the most commonly performed surgery for an inguinal hernia. Chronic inguinodynia is the most prevalent surgical complication, with a 25% overall incidence. The second most common complication is hypoesthesia. Ilioinguinal neurectomy has been proven in several studies to alleviate chronic inguinodynia.

Aim: To compare the postoperative inguinal pain and aesthesia in Ilioinguinal Nerve (IIN) preservation patients with neurectomy patients in Lichtenstein tension-free mesh hernioplasty.

Materials and Methods: This randomised clinical trial was conducted at GMCH, Udaipur, Rajasthan, India during January 2020 to June 2021 on 70 individuals (35 in each group). The IIN was excised in group A, while it was preserved in group B. Pain and aesthesia was assessed at day seven, one month and three month follow-up. Chi-square test was used for data analysis. A p-value <0.05 was considered significant.

Results: Mean age of the study sample was 55.95±15.61 years in group A and 55.4±17.22 years in group B. At Postoperative Day-7 (POD-7), 33 (94.28%) patients in group A and 18 (51.43%) patients in group B reported mild pain after vigorous activity, whereas 2 (5.71%) patients in group A and 15 (42.8%) patients in group B reported moderate pain after vigorous activity, and 2 (5.7%) patients in group B reported severe pain after vigorous activity. At POD-7, 2 (5.7%) patients in group A reported hypoaesthesia, out of them only 1 (2.85%) patient reported hypoaesthesia at one month and at three months of follow-up, whereas no patients in group B reported hypoaesthesia at POD-7, one month, or three months of follow-up.

Conclusion: It was evident in this study that prophylactic ilioinguinal neurectomy resulted in considerable reduction in incidence of post operative neuralgia, compared to nerve preservation.

Keywords: Hyperaesthesia, Hypoaesthesia, Inguinal hernia

INTRODUCTION

The term "hernia" is a Latin word which implies "rupture" of a portion of a structure [1]. In Greek, this term signifies "bud" [2]. Around the world, inguinal hernias account for 75% of all abdominal wall hernias. The most frequent male ailment in the world is inguinal hernia [3].

Lichtenstein tension free inguinal hernia repair is second most common surgical procedure after an appendectomy, which accounts around 10-15% of all surgical procedures [4]. Over 20 million inguinal hernia repairs are estimated to be performed each year, with rates ranging from 100 to 300,000 per year depending on the country [5]. In India, inguinal hernias are estimated to afflict 1,957,850 people each year [6].

General surgeons perform groin hernia repair more frequently than any other type of surgery, with groin hernias affecting more than 5% of the population [7]. As the recurrence rate after mesh surgery is now <5%, the long-term morbidity associated with open inguinal hernia repair is mostly attributable to chronic groin pain [8].

The Lichtenstein inguinal hernia surgery is the most commonly performed and is still regarded as the gold standard for inguinal hernia repairs [9]. Chronic inguinodynia, on the other hand, is a common side effect of this operation. One of the causes could be damage or entrapment of sensory nerves that pass through the inguinal region, such as the Ilioinguinal Nerve (IIN), iliohypogastric nerve, or genitofemoral nerve [10].

The IIN entrapment is a common technical flaw in the open mesh repair of hernias. Because it runs in the canal immediately under the divided external oblique aponeurosis and might be incorporated in sutures used for hernia repair or reapproximating the external oblique fascia flaps, the IIN is the most vulnerable to entrapment during open mesh hernioplasty [11].

Chronic groin pain can be divided into two types: neuropathic and nociceptive (somatic) pain. Neuropathic pain is caused by entrapment or direct nerve injury. Nociceptive (somatic) pain can be caused by mesh-related fibrosis, mechanical pressure generated by a folded mesh, gradual mesh displacement or contraction, wounded surrounding structures such as periosteal layers, musculotendinous tissues, or other postoperative causes [12]. The pain in the groin is usually modest, but it interferes with daily activities significantly.

Routine IIN excisions are recommended to avoid the painful complication of post herniorrhaphy neuralgia [13]. Although IIN excision should theoretically alleviate inflammatory neuralgia caused by entrapment, neuroma, and fibrotic reactions, there are still questions and concerns, and the procedure is still not universally recognised [14]. The IIN is typically met during open inguinal hernia repair because it is directly beneath the external oblique aponeurosis in the inguinal canal [15].

Until now, the IIN was preserved in all patients at the institute, and data on their complications has been collected, with the majority of patients complaining of inguinal pain and hyper- or hypoaesthesia.

Various studies have differing viewpoints on preservation and neurectomy, as well as differing outcomes, therefore this research study was conducted to assess how efficient ilioinguinal neurectomy is and to compare our findings to those of other studies [16,17].

In this study, postoperative inguinal pain and aesthesia in IIN preservation patients were compared with neurectomy patients, who had a lower rate of pain and hyper/hypo aesthesia.

MATERIALS AND METHODS

This Randomised Clinical Trial (RCT) was conducted in the Department of General Surgery, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India, from January 2020 to June 2021, after obtaining approval from the Institutional Human Research Ethics Committee (vide approval no. 2019/726 dtd. 20/12/2019). Patients were kept unaware of the study protocol, and written informed consent was obtained.

Inclusion criteria:

- Patients of both gender ≥18 years.
- Patients who gave informed written consent.
- All types of inguinal hernia (direct, indirect, pantaloons hernia) were included.

Exclusion criteria:

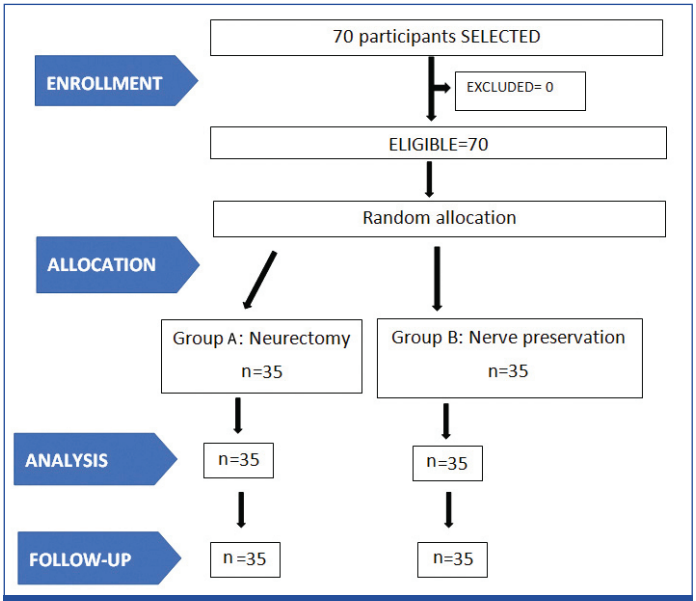
- Patients with an irreducible or strangulated hernia, history of previous open appendectomy, history of recurrence.
- Peripheral neuropathy due to any reason, impaired cognitive function, and limited mobility was excluded.
- History of previous pelvic and lower limb fractures.
- Patients with an HbA1c level greater than 6.5.
- Patients with grossly distorted liver or renal function.
- Patients with pre-existing gross infections at the surgical site.
- Patients taking chemotherapy, immunosuppressants, or anticoagulation therapy.
- Patients whose Haemoglobin (Hb) was less than 8 mg/dL.

With power of 95%, sample size of 70 patients with an inguinal hernia, scheduled for Lichtenstein tension-free mesh repair hernioplasty were divided into two groups with single blind randomisation:

Group A: who underwent ilioinguinal neurectomy (n=35)

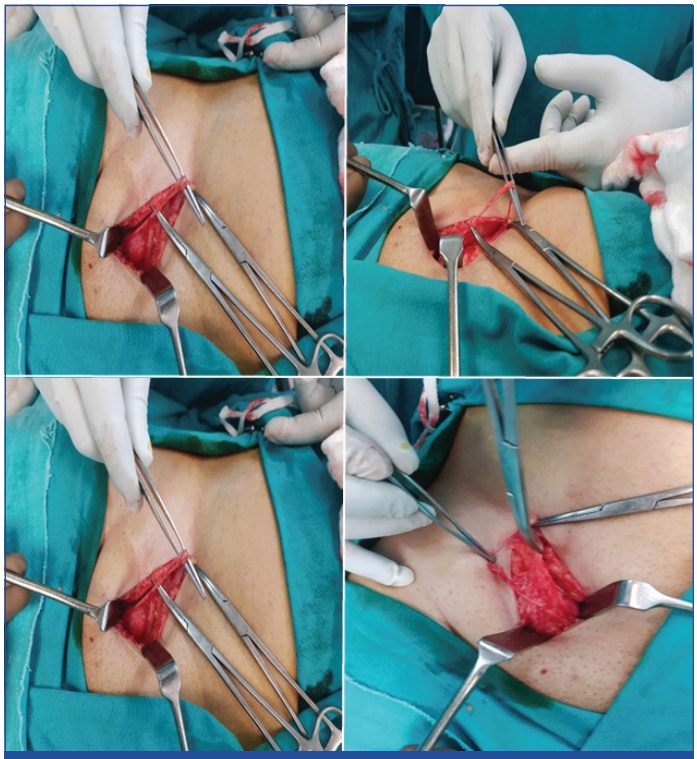
Group B: who underwent nerve preservation (n=35).

Patients were asked to pick-up a chit, and then were selected to the group accordingly [Table/Fig-1].



[Table/Fig-1]: CONSORT flowchart.

The IIN was identified intraoperatively and either cut or preserved [Table/Fig-2]. Patients were selected on the basis of clinical history and laboratory criteria suggestive of inguinal hernia, and findings of inguinal hernia on ultrasound were inducted into the study.



[Table/Fig-2]: IIN in inguinal canal during Lichtenstein tension free mesh hernioplasty.

Study Procedure

The study comprised all adult patients who underwent Lichtenstein tension-free mesh hernioplasty. Detailed history, thorough clinical examination, required laboratory investigations, e.g., Complete Blood Count (CBC), Random Blood Sugar (RBS), Prothrombin Time-International Normalised Ratio (PT-INR), Serum Electrolyte, Blood Urea, Serum Creatinine, Human Immunodeficiency Virus (HIV), Hepatitis B surface Antigen, Hepatitis C Virus (HCV), and radiological investigations, e.g., chest X-ray (PA View), Electrocardiograph (ECG), Ultrasonography (USG) whole abdomen, and 2D echo, were done when required.

Patients were graded using the Visual Analogue Scale (VAS) for pain, with the following categories: No pain (0), mild pain (1-3), moderate pain (4-7), severe pain (8-10).

Patients were assessed: At rest; Pain after normal daily activity; Pain while walking; Pain after climbing 10 stairs; Pain after vigorous activity (such as doing workouts, lifting light weight, running etc.).

Parameters assessed

- Postoperative pain was scored using the VAS on POD-7 at one-month follow-up and three months follow-up.
- Symptoms like hypoesthesia/numbness (partial or total loss of sensation) and hyperaesthesia (exaggeration of touch sensation) were evaluated at POD-7 at one month follow-up and three months follow-up.

STATISTICAL ANALYSIS

The results were calculated with the help of statistics, tables, and graphs. Chi-square test was applied for non parametric values. A p-value of <0.05 was considered significant. All relevant statistical tests were applied on the data using statistical software GraphPad Prism 9.

RESULTS

The patients were divided into two groups: group A (neurectomy) and group B (nerve preservation). Mean age was 55.95±15.61 years

in group A and 55.4±17.22 years in group B which was statistically non significant. All patients were men. In group A, 8 (22.8%) had preoperative pain while in group B, 3 (8.5%) had pain before surgery which is statistically non significant (p>0.05).

On POD-7, 30 patients in group A (85.7%) had no pain at rest, as compared to 22.86% patients in group B and the difference was statistically significant (p<0.0001). After one month, 3 (8.57%) patients in group B complained of mild pain at rest. Neither group reported postoperative pain at rest after three months of follow-up. [Table/Fig-3].

Pain at rest		Group A		Group B		Chi-square p-value
		n	%	n	%	
Follow-up at POD-7	No pain	30	85.71%	8	22.86%	<0.0001
	Mild pain	3	8.57%	23	65.71%	<0.0001
	Moderate pain	2	5.71%	3	8.57%	0.64
	Severe pain	0	0.00%	1	2.86%	0.31
Follow-up at 1-month	No pain	35	100.00%	32	91.43%	0.07
	Mild pain	0	0.00%	3	8.57%	0.07
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-
Follow-up at 3-months	No pain	35	100.00%	35	100.00%	1
	Mild pain	0	0.00%	0	0.00%	-
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-

[Table/Fig-3]: Distribution of cases based on pain at rest.

At POD-7, 14 (40%) of patients in group A and 24 (68.57%) of patients in group B reported mild pain after normal daily activities. Following a month of follow-up, 2 (5.7%) patients in group A and 8 (22.86%) patients in group B reported mild pain, and 2 (5.7%) patients in group B reported moderate pain while performing normal daily activities. The difference was statistically significant (p<0.05). At 3-month follow-up, 3 (8.57%) patients in group B had mild pain after normal daily activities [Table/Fig-4].

Pain after normal daily activities		Group A		Group B		Chi-square p-value
		n	%	n	%	
Follow-up at POD-7	No pain	19	54.29%	4	11.43%	0.0002 (HS)
	Mild pain	14	40.00%	24	68.57%	0.01 (S)
	Moderate pain	2	5.71%	7	20.00%	0.07 (NS)
	Severe pain	0	0.00%	0	0.00%	-
Follow-up at 1-month	No pain	33	94.29%	25	71.43%	0.01 (S)
	Mild pain	2	5.71%	8	22.86%	0.04 (S)
	Moderate pain	0	0.00%	2	5.71%	0.15 (NS)
	Severe pain	0	0.00%	0	0.00%	-
Follow-up at 3-months	No pain	35	100.00%	32	91.42%	0.07 (NS)
	Mild pain	0	0.00%	3	8.57%	0.07 (NS)
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-

[Table/Fig-4]: Distribution of cases, based on pain after normal daily activity.
S: Statistically significant; NS: Not significant

At POD-7, 6 (17.14%) patients in group A and 24 (68.5%) patients in group B had mild pain while walking. After a one-month follow-up, 2 (5.7%) of patients in group A and 17 (48.57%) of patients in group B reported mild pain. After three months only 1 (2.86%) patient in group A while 6 (17.14%) patients in group B had mild pain while walking, (p<0.05) [Table/Fig-5].

At POD-7, 6 (17.14%) patients in group A and 23 (65.7%) of patients in group B reported mild pain after climbing 10 stairs. After a month's follow-up, it was observed that 9 (25.7%) patients in group B reported mild pain. At three months, whereas 2 (5.71%) reported mild pain after climbing 10 stairs [Table/Fig-6].

Pain on walking		Group A		Group B		Chi-square p-value
		n	%	n	%	
Follow-up at POD-7	No pain	27	77.14%	6	17.14%	<0.0001 (HS)
	Mild pain	6	17.14%	24	68.57%	<0.0001 (HS)
	Moderate pain	2	5.71%	4	11.43%	0.39 (NS)
	Severe pain	0	0.00%	1	2.86%	0.31 (NS)
Follow-up at 1-month	No pain	33	94.29%	16	45.71%	<0.0001 (HS)
	Mild pain	2	5.71%	17	48.57%	<0.0001 (HS)
	Moderate pain	0	0.00%	2	5.71%	0.15 (NS)
	Severe pain	0	0.00%	0	0.00%	-
Follow-up at 3-month	No pain	34	97.14%	29	82.85%	0.04 (S)
	Mild pain	1	2.86%	6	17.14%	0.04 (S)
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-

[Table/Fig-5]: Distribution of cases based on pain while walking.

Pain after climbing 10 stairs		Group A		Group B		Chi-square p-value
		n	%	n	%	
Follow-up at POD-7	No pain	29	82.86%	8	22.86%	<0.0001 (HS)
	Mild pain	6	17.14%	23	65.71%	<0.0001 (HS)
	Moderate pain	0	0.00%	3	8.57%	0.07 (NS)
	Severe pain	0	0.00%	1	2.86%	0.31 (NS)
Follow-up at 1-month	No pain	35	100.00%	26	74.29%	<0.001 (HS)
	Mild pain	0	0.00%	9	25.71%	<0.001 (HS)
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-
Follow-up at 3-month	No pain	35	100.00%	33	94.29%	0.15 (NS)
	Mild pain	0	0.00%	2	5.71%	0.15 (NS)
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-

[Table/Fig-6]: Distribution of cases based on pain after climbing 10 stairs.

At POD-7, 33 (94.28%) patients in group A and 18 (51.43%) patients in group B reported mild pain after vigorous activity. At one month's follow-up, 12 (34.29%) patients in group A and 25 (71.4%) patients in group B reported mild pain, and 3 (8.57%) patients in group B reported moderate pain after vigorous activity. After three months, 3 (8.5%) of group A patients and 12 (34.28%) of group B patients had mild pain after vigorous activity, and the difference was statistically significant (p<0.05) [Table/Fig-7].

Pain after vigorous activities		Group A		Group B		Chi-square p-value
		n	%	n	%	
Follow-up at POD-7	No pain	0	0.00%	0	0.00%	-
	Mild pain	33	94.28%	18	51.43%	<0.0001 (HS)
	Moderate pain	2	5.71%	15	42.86%	0.0003 (HS)
	Severe pain	0	0.00%	2	5.71%	0.15 (NS)
Follow-up at 1-month	No pain	23	65.71%	7	20.00%	0.0001 (HS)
	Mild pain	12	34.29%	25	71.43%	0.002 (S)
	Moderate pain	0	0.00%	3	8.57%	0.07 (NS)
	Severe pain	0	0.00%	0	0.00%	-
Follow-up at 3-month	No pain	32	91.43%	23	65.71%	0.009 (S)
	Mild pain	3	8.57%	12	34.28%	0.009 (S)
	Moderate pain	0	0.00%	0	0.00%	-
	Severe pain	0	0.00%	0	0.00%	-

[Table/Fig-7]: Distribution of cases based on pain after vigorous activity.

At POD-7, 2 (5.7%) patients in group A reported hypoaesthesia, out of them only 1 (2.86%) patient reported hypoaesthesia at one month and at three months of follow-up, whereas no patients in group B reported hypoaesthesia. At POD-7, 3 (8.5%) patients in group B reported hyperaesthesia. The same 3 (8.57%) patients reported hyperaesthesia at one month's follow-up, but only 2 (5.7%) patients reported hyperaesthesia at three months' follow-up [Table/Fig-8].

Parameters		Group A		Group B		Chi-square p-value
		n	%	n	%	
Follow-up at POD-7	Hypoaesthesia	2	5.71%	0	0.00%	0.1 (NS)
	Hyperaesthesia	0	0.00%	3	8.57%	0.07 (NS)
Follow-up at 1-month	Hypoaesthesia	1	2.86%	0	0.00%	0.31 (NS)
	Hyperaesthesia	0	0.00%	3	8.57%	0.07 (NS)
Follow-up at 3-month	Hypoaesthesia	1	2.86%	0	0.00%	0.31 (NS)
	Hyperaesthesia	0	0.00%	2	5.71%	0.15 (NS)

[Table/Fig-8]: Distribution of cases based on Hypoaesthesia and Hyperaesthesia.

DISCUSSION

In this study, patients were divided into two groups: IIN neurectomy patients were in Group A, while IIN preservation were in Group B. All patients were men, comparable to Omar AA et al., [16] and Chatterjee S and Rohit K [17] research. Uppada GLP et al., [18] and Mirhashemi SH et al., [19] reported similar demographic data as present study. Diabetic and anaemic patients were excluded in this study due to their immunocompromised status.

In group A, 8 (22.8%) had preoperative pain while in group B, 3 (8.5%) had pain before surgery which was statistically non significant (p>0.05). In research conducted by Dittrick GW et al., [20], the most common complaint of all the patients was swelling, with 26% reporting pain and discomfort along with swelling and 74% reporting merely swelling.

It was observed that neither group had postoperative pain at rest after the 3-month follow-up period in both the groups (p>0.05, NS). Similar results were observed by various authors which are listed in the [Table/Fig-9] [18,21-23].

Studies	Place of study	After 1st month follow-up		After 3rd month follow-up		After 6 months follow-up	
		Group A	Group B	Group A	Group B	Group A	Group B
Uppada GLP et al., [18] 2020	India	10%	6.7%	10%	6.7%	-	-
Piccchio M et al., [21] 2004	Italy	51%	52%	-	-	37%	34%
Udapudi DG et al., [22] 2016	India	16.66%	30%	16.66%	20%	13.33%	-
Sangolagi P et al., [23] 2018	India	-	-	-	-	9%	-
Current study	India	-	8.57%	-	-	-	-

[Table/Fig-9]: Comparison of postoperative pain at rest [18,21-23].

As determined in a study by Uppada GLP et al., [18], 10% of patients in the group who had their IIN excised had pain after normal activities after a month, whereas 13.3% of patients in group who had the IIN preserved had pain after one month. At 8 months follow-up, no patients in group I reported pain, whereas 10% in group II complained of pain along with some discomfort. Mui WL et al., [24] discovered that both groups had a significant incidence of pain during normal daily activity at the end of the first month (66% vs 74.5%). However, in this study, only 8.57% of the nerve perseverance group had pain on normal activity after three months.

At one month's follow-up, Sangolagi P et al., [23] found that the incidence of pain after vigorous activity was the same in both aesthesia groups. However, 14 (38.8%) of patients in group B who had the IIN preserved had pain after vigorous activity at six months, compared to 4 (11.7%) of patients in group B who had the IIN dissected. The disparity in pain incidence was determined to be statistically significant (p=0.005). Similarly in this study also 34.28% of the patients in the nerve preservation group had mild pain after vigorous activity at three months follow-up as compared to only 8.57% of the patients in the neurectomy group.

In present study all patients in both the groups recovered fully at three months of follow-up and were lost to follow-up later, hence we couldn't report further. But at six months' follow-up, Dittrick GW et al., [20] discovered that patients in whom the IIN was dissected had substantially lower neuralgia rates than patients in whom the IIN was preserved (3% vs 26%, p=0.001), while at one year's follow-up, the neurectomy research group showed a noticeably lower incidence of neuralgia compared to the preservation research group (3% vs 25%, p=0.003). These findings are in accordance with those of Mirhashemi SH et al., [19], who observed a 6% vs. 21% difference (p=0.033). Picchio M et al., [21] showed that during a one-year follow-up, the incidence of pain in nerve excision and nerve preservation was substantially the same (27% vs 24%) (p=0.55). The results of a survey conducted by Ravichandra D et al., [25] in the year 2000 showed an infinitesimal difference between the two groups.

In the present study, in the nerve resection group, hypoesthesia was seen in two patients. Abdullah TI et al., [26] discovered that the incidence of postoperative numbness did not differ depending on whether the intercostobrachial nerve was preserved or divided in patients having an axillary node dissection for invasive breast carcinoma. This explains why, after resection of sensory nerves, there is frequently an initial pattern of numbness followed by a subtle recovery based on the growth of collateral nerves, which supports the findings of the study above [Table/Fig-10][18,20,24].

Studies	Place of study	After 1st month follow-up		At last follow-up	
		Group A	Group B	Group A	Group B
Uppada GLP et al., [18] 2020	India	26.7%	10%	11.5%	3.3%
Dittrick GW et al., [20] 2004	USA	-	-	13%	5%
Mui WL et al., [24] 2006	China	-	-	26%	18.4%
Current study	India	2.86%	8.57%	2.86%	5.71%

[Table/Fig-10]: Incidence of hypoesthesia according to previous studies [18,20,24].

Limitation(s)

Patients couldn't be followed-up after three months, as they were lost to follow-up due to long distances that needed to be travelled for treatment, as the tertiary care centre was in the tribal region.

CONCLUSION(S)

In comparison to individuals in whom the IIN was preserved, this study showed that prophylactic ilioinguinal neurectomy resulted in a considerable reduction in the incidence of postoperative neuralgia. Prophylactic ilioinguinal neurectomy is a better alternative for patients undergoing Lichtenstein tension-free mesh hernia repair and should be included as an optimal step in hernia repair. It is recommended to assess patients for longer durations (period more than a year), if possible, which can give a clear picture of results of ilioinguinal neurectomy in day to day life over period of time.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 15, 2022
- Manual Googling: Aug 05, 2022
- iThenticate Software: Aug 16, 2022 (14%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 08, 2022**
Date of Peer Review: **May 03, 2022**
Date of Acceptance: **Aug 08, 2022**
Date of Publishing: **Sep 01, 2022**