Ilioinguinal Nerve Neurectomy versus Preservation in Lichtenstein Hernia Repair: A Systematic Literature Review and Meta-Analysis

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Introduction: Hernias may be defined as "an abnormal protrusion of an organ or tissue through a defect in its surrounding walls."

Aim of work: To evaluate the incidence of chronic groin pain and sensational alterations after Lichtenstein inguinal hernia repair, comparing neurectomy with ilioinguinal nerve preservation surgery.

Patients and methods: This systematic review included studies after 2010. A total of 1441 relevant studies were obtained from the initial search. After screening of the titles and abstracts according to the inclusion and exclusion criteria, the full text was further read, and ultimately, 10 studies were included.

Result: The study found that neurectomy patients experienced significantly lower postoperative pain compared to preservation patients, with a pooled risk ratio of nearly four times lower. The neurectomy group required lower analgesia compared to the preservation group, with a significant decrease observed at the seventh day postoperative. Neuroctomy patients experienced significantly lower analgesia duration compared to preservation patients. The preservation group experienced higher but not statistically significant numbness compared to the neurectomy group, with no significant difference observed at the first day postoperative. The preservation group experienced higher hypothesia compared to the neurectomy group, with a significant increase at the first day postoperative.

Conclusion: The neurectomy of the ilioinguinal nerve during Lichtenstein hernia repair significantly reduced postoperative pain, analgesia requirement, and groin numbness and hypoesthesia, especially on the first day post-surgery. However, the results were not significant due to the small number of cases. It is now recommended that surgeons discuss the uncertain benefits and potential risks of neurectomy with patients and their families before performing hernioplasty.

Key words: Ilioinguinal nerve neurectomy, Lichtenstein hernia repair, a systematic literature review, meta-analysis.

Introduction

Hernias may be defined as "An abnormal protrusion of an organ or tissue through a defect in its surrounding walls." Chronic post herniorrhaphy groin pain is defined as pain lasting > 3 months after surgery, which is one of the most important complication occurring after inguinal hernia repair, occurs with greater frequency than previously thought. Incidence of long term (=1year) post-operative neuralgia reported for lichtenstein repair of inguinal hernia range from 6 - 29%.[1]

The prevalence rate of postoperative chronic pain (PCP) ranges from 0 to 63% independently of the surgical techniques used; this high variability is the consequence of different definitions of inguinal postoperative pain, end points of the studies, and methodologies of pain evaluation.[2]

Inguinodynia is the recommended generic term for chronic groin pain after hernia repair and should replace neuralgia or mesh inguinodynia to promote uniformity and avoid confusion in the literature.[3]

Inguinal postoperative chronic pain can be secondary to entrapment or stretching of nerves, inflammation, fibrotic reactions, or formation of neuromas, and it may require several interventions, including oral analgesics, local anaesthesia, physiotherapy, or further surgery. Ilioinguinal nerve section (Neurectomy) has been proposed to reduce the incidence of chronic groin pain after inguinal hernia repair.[4]

The concept of routine neurectomy in surgery is not unique to inguinal hernia repairs. Routine neurectomy is often performed during axillary and neck dissections in which the intercostobrachial and greater auricular nerves are sacrificed. Routine ilioinguinal nerve excision has been proposed as a means to avoid the troubling complication of long-term post herniorrhaphy neuralgia. Theoretically excision of ilioinguinal nerve would eliminate the possibility of inflammation neuralgia arising from entrapment, neuroma, fibrotic reactions yet controversies persist and the procedure is not widely accepted.[5]

Aim of work

Systematic review of included studies to evaluate the incidence of chronic groin pain and Sensational alterations after Lichtenstein inguinal hernia repair, comparing neurectomy with ilioinguinal nerve preservation surgery.

Patients and methods

Type of study: Systematic review study.

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Study period: studies after 2010.

Included studies: We included studies of cases with indication for nerve neurectomy in: Randomized control trails (RCTs). Controlled clinical trials. Retrospective cohort studies.

Excluded studies: Case reports. Case series studies. Cross sectional studies. Non-English studies.

Types of participants

Inclusion criteria: Studies of patients diagnosed with inguinal hernia elective for repair with Lichtenstein method.

Exclusion criteria: Studies of patients with other hernias or elective for other methods of repair.

Method: Systematic review of included studies to extract the following patient's data .

Complete history taking:

Personal history: Name, age, parity, residence, occupation, special habits of medical importance specially smoking

Complaint & its duration. Present history: Analysis of the current patient complaint. Medical history: cardiac problems, hypertension, chest diseases, renal diseases, liver diseases, blood diseases or bleeding tendency. Past Surgical history: history of previous operations.

Physical examinations

General examination: Vital signs (Blood pressure, Temperature, Heart rate, Respiratory rate), Signs of (Pallor, Cyanosis, Jaundice, and Lymph node enlargement).

Physical examination of inguinal hernia; Any hernia mass that is tender to palpation or associated with symptoms of nausea and vomiting should be considered possibly strangulated (Compromised vascularity of entrapped bowel), and no attempt should be made to reduce it manually. This condition represents an acute surgical emergency.

Investigational Studies:

Routine laboratory investigations: Complete blood picture (CBC): hemoglobin concentration (Hb %), red blood cells (RBCs), white blood cells (WBCs), platelet count Erythrocyte sedimentation rate and C-reactive protein. Liver Test Profile: Serum aspartate and alanine aminotransferases (AST and ALT), serum albumin, serum bilirubin, serum gamma-glutamyl transferase (GGT), prothrombin time Radiological investigation:

Ultrasound technique for inguinal hernia evaluation: Patient Positioning. High-Frequency Transducer. Transducer Placement. Identification of Hernia. Dynamic Maneuvers.

Types of interventions: Neurectomy and ilioinguinal nerve preservation surgery.

Lichtenstein hernia repair: Preparation. Incision. Hernia Reduction. Mesh Placement. Mesh Fixation. Closure.

Ilioinguinal nerve neurectomy: Identification of the Nerve. Nerve Transection.

Preservation in Lichtenstein hernia repair: Nerve Preservation.

Types of outcome measures: Incidence of chronic groin pain, Sensational alterations, Complications.

Ethical consideration: The data that were obtained from participants are confidential. The study participants will not be identified by name in any report or publication concerning this study.

Statistical analysis: Outcomes from included trials were combined using the systematic review manager software and manually screened for eligibility to be included. PRISMA flowchart was produced based on the search results and the inclusion/exclusion criteria, to facilitate the assessment of possible the risk of bias for each study, information was collected using the (Cochrane collaboration tool for assessing the risk of bias).

Results

10 studies were included 6 were RCT and 4 were prospective studies as shown in **(Table 1).**

928 cases were included and underwent to either neurectomy or nerve preservation with mean age 42 years as shown in **(Table 2).**

Comparison between neurectomy and preservation regarding pain occurrence

The pooled risk ratio (RR) of the occurrence of postoperative pain revealed that neurectomy was nearly four times lower in the postoperative pain than preservation (RR 0.64, 95% CI 0.51 to 0.80); the heterogeneity was significantly high [Chi2 = 3855.56, df = 25 (P<0.0001); I2 = 88.6%]. The subgroup analysis revealed that, no significant differences in the first day postoperative pain at rest in the neurectomy group vs. preservation group (RR 1.0, 95% CI 0.96 to 1.05); there was also a significant heterogeneity [Chi2 = 14.73, df = 6 (P = 0.02); I2 = 59%] at first day after operation. While, at last follow up there was a significant reduction in pain in the neurectomy group (RR 0.27, 95% CI 0.14 to 0.51); there was also a significant heterogeneity [Chi2 = 19.22, df = 8 (P = 0.01); I2 = 58%]. Similarly, no significant differences in the first day postoperative pain at exercise in the neurectomy group vs. preservation group (RR 0.89, 95% CI 0.72 to 1.11); there was a significant heterogeneity [Chi2 = 160.81, df = 4 (P<0.0001);

I2 = 98%]. While, at last follow up there was a significant reduction in pain in the neurectomy group (RR 0.18, 95% CI 0.06 to 0.54); there was also a significant heterogeneity [Chi2 = 12.22, df = 4 (P = 0.02); I2 = 67%].

Comparison between neurectomy and preservation regarding numbness occurrence

The pooled risk ratio of the postoperative numbness occurrence revealed that preservation group patients experienced higher but not statistically significant numbness compared to neurectomy group (RR 1.55, 95% CI 0.98 to 2.44); There was significant heterogeneity [Chi2 = 20.20, df = 9 (P=0.0.02); I2 = 55%]. Subgroup analysis revealed that there was nonsignificant higher numbness at first day postoperative in the preservation group (RR 2.31, 95% CI 0.78 to 6.84). Also, at last follow up there was no significant difference between the two groups.

(RR 1.49, 95% CI 0.98 to 2.26) with no significant heterogeneity heterogeneity [Chi2 = 0.24, df = 4 (P=0.99); I2 = 0%].

Table 1: Study characteristics

Author	Type of study
Bara B.K et al., 2021	RCT
Abdel Latif AM et al., 2021	prospective
Changazi SH et al., 2020	RCT
Bamnodkar P et al., 2020	RCT
Uppada G.L.P et al., 2020	RCT
Suresh Babu C et al., 2020	Prospective
Aggarwal M et al., 2020	RCT
Elhodaky A et al., 2020	Prospective
Nasir M et al., 2020	RCT
Neogi P et al., 2019	prospective

Table 2: Patients characteristics

Author	Procedure	Number	Age	m/f
Bara B.K et al., 2021	Neurectomy	40		
	Preservation	40		
Abdel Latif AM et al., 2021	Neurectomy	50	42.5	50/0
	Preservation	50	41.9	50/0
Changazi SH et al., 2020	Neurectomy	50	40.2	
	Preservation	50	44	
Bamnodkar P et al., 2020	Neurectomy	30	37.5	
	Preservation	30	39.5	
Uppada G.L.P et al., 2020	Neurectomy	30	50.3	29/1
	Preservation	30	45.1	30/0
Suresh Babu C et al., 2020	Neurectomy	23		23/0
	Preservation	23		23/0
Aggarwal M et al., 2020	Neurectomy	60	49.7	60/0
	Preservation	60	49.7	60/0
Elhodaky A et al., 2020	Neurectomy	120	43.5	
	Preservation	120	42.9	
Nasir M et al., 2020	Neurectomy	40	28.5	34/6
	Preservation	40	33.8	31/9
Neogi P et al., 2019	Neurectomy	20		
	Preservation	22		

Table 3: Numbness and hypothesis

Author	Procedure	Numbness 1st day Postoperative	Numbness last Follow up	Hypoesthesia 1st day Postoperative	Hypoesthesia last follow up
	Neurectomy				
Bara B.k. et al., 2021	Preservation				
	Neurectomy	12	7	15	0
Abdel Latif AM et al., 2021	Preservation	0	5	5	0
	Neurectomy				
Changazi S.H. et al., 2020	Preservation				
	Neurectomy				
Bamnodkar P. et al., 2020	Preservation				
	Neurectomy			8	3
Uppada G.L.P et al., 2020	Preservation			3	1
	Neurectomy	16	12	8	8
Suresh Babu C. et al., 2020	Preservation	13	8	6	4
	Neurectomy	22	4		
Aggarwal M. et al., 2020	Preservation	4	2		
	Neurectomy	30	18	36	0
Elhdaky A. et al. 2020	Preservation	0	12	12	0
	Neurectomy				
Nasir M. et al., 2020	Preservation				
	Neurectomy	6	2		
Neogi P. et al., 2019	preservation	7	2		

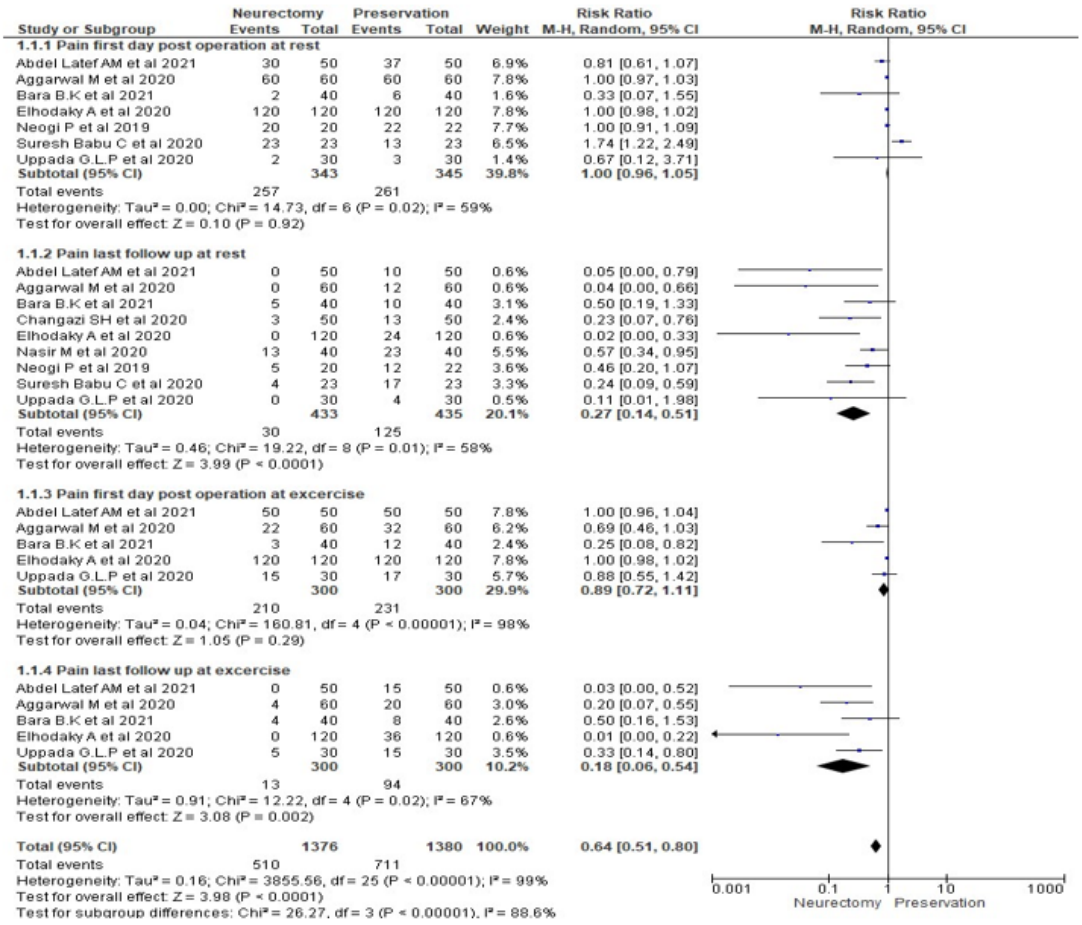

Fig 1: Comparison between neurectomy and preservation regarding pain occurrence.

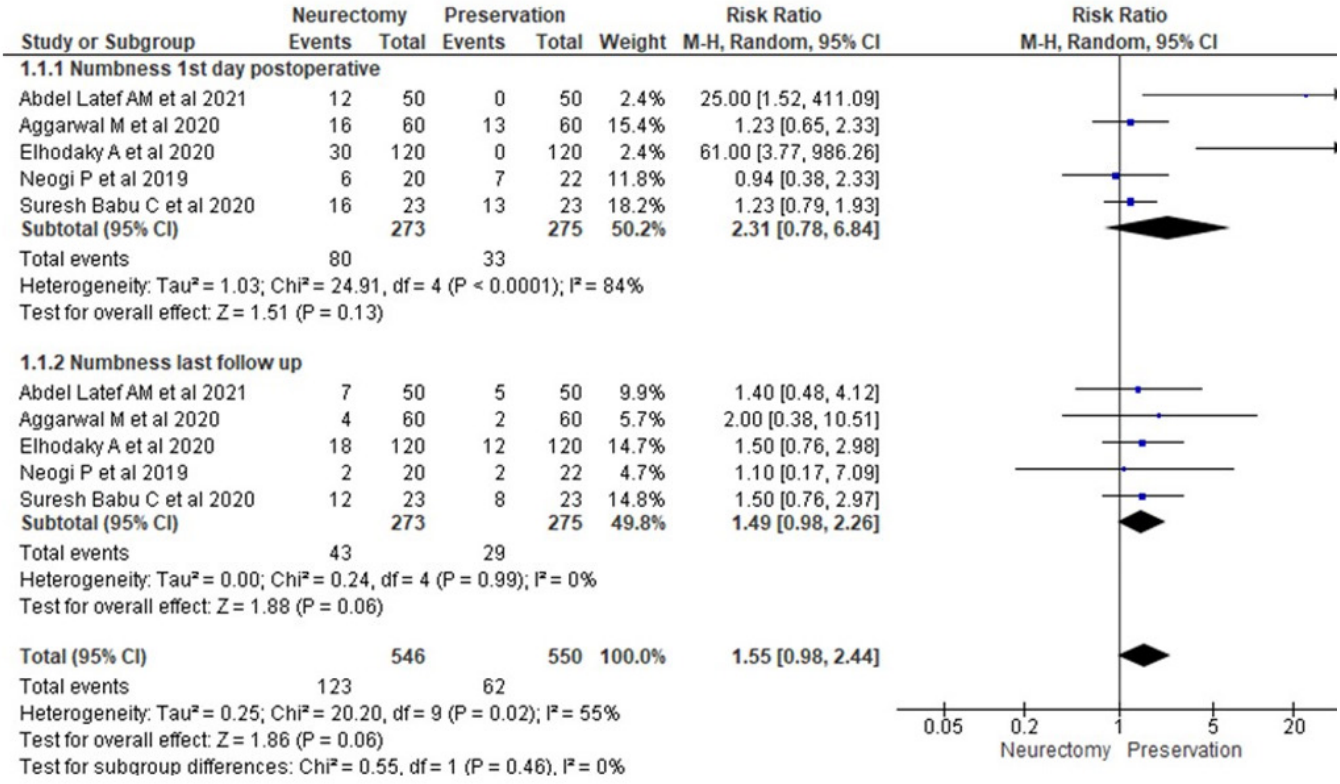

Fig 2: Comparison between neurectomy and preservation regarding numbness occurrence.

Discussion

Inguinal hernia is a common surgical condition worldwide, with a lifetime incidence of 27 to 43% in men and 3 to 6% in women (Stabilini et al., 2023).[6] Although laparoscopic procedures have become more prevalent,[7] open repairs are still commonly used, with the Lichtenstein technique being the most prevalent method.[6]

Postoperative pain and sensory disturbances remain important complications of inguinal hernia repair, with an incidence of 10 to 63% of patients experiencing any pain and 1 to 18% experiencing moderate to severe pain that affects their daily lives. However, these rates are highly debated and may be outdated (Gram-Hanssen et al., 2023).[8]

A systematic review by Reinpold, 2017,[9] concluded that risk factors for Chronic postoperative inguinal pain with strong evidence include female gender, young age, high intensity of preoperative pain, high early postoperative pain intensity, history of chronic pain other than chronic postoperative inguinal pain, operation for a recurrent hernia, and open repair technique.

It is assumed that the cause of pain is neurogenic in nature (Andresen & Rosenberg, 2018).[10] During open inguinal hernia repair, the three nerves potentially encountered are the ilioinguinal, iliohypogastric, and genitofemoral nerves (Suresh Babu, 2020).[11] No consensus has been reached regarding whether to cut or preserve the encountered nerves, and the topic remains controversial. Studies have shown positive results for both strategies in terms of chronic pain and sensory disturbances. Other studies have concluded that nerve identification is important for positive patient outcomes, although this too remains uncertain.[12,13] Ilioinguinal nerve section (Neurectomy) has been proposed to reduce the incidence of chronic groin pain after inguinal hernia repair.[13]

Given that the effectiveness and safety of ilioinguinal nerve neurectomy or preservation surgery for patients with Lichtenstein inguinal hernia repair were still unclear, further study is needed. Metaanalysis is a method of summarizing similar research results, which can expand the sample size and improve statistical validity, especially in the case of inconsistent results from previous studies. Metaanalysis has the ability to obtain results based on existing research results, and comprehensive analysis, which would be closer to real life.

Herein, we conducted this systematic review and meta-analysis to evaluate the incidence of chronic groin pain and Sensational alterations after Lichtenstein inguinal hernia repair, comparing neurectomy with ilioinguinal nerve preservation surgery.

According to the current meta-analysis, the comparison between Ilioinguinal neurectomy and preservation regarding pain occurrence showed

that the pooled risk ratio (RR) of the occurrence of postoperative pain revealed that neurectomy was nearly four times lower in the postoperative pain than preservation (RR 0.64, 95% CI 0.51 to 0.80); the heterogeneity was significantly high [Chi2 = 3855.56, df = 25 (P<0.0001); I2 = 88.6%].

The subgroup analysis revealed that, no significant differences in the first day postoperative pain at rest in the neurectomy group vs. preservation group (RR 1.0, 95% CI 0.96 to 1.05); there was also a significant heterogeneity [Chi2 = 14.73, df = 6 (P = 0.02); I2 = 59%] at first day after operation. While, at last follow up there was a significant reduction in pain in the neurectomy group (RR 0.27, 95% CI 0.14 to 0.51); there was also a significant heterogeneity [Chi2 = 19.22, df = 8 (P = 0.01); I2 = 58%].

Similarly, no significant differences in the first day postoperative pain at exercise in the neurectomy group vs. preservation group (RR 0.89, 95% CI 0.72 to 1.11); there was a significant heterogeneity [Chi2 = 160.81, df = 4 (P<0.0001); I2 = 98%]. While, at last follow up there was a significant reduction in pain in the neurectomy group (RR 0.18, 95% CI 0.06 to 0.54); there was also a significant heterogeneity [Chi2 = 12.22, df = 4 (P = 0.02); I2 = 67%].

The superiority of ilioinguinal neurectomy over ilioinguinal prevention was confirmed by the systematic review and meta-analysis by Cirocchi et al., 2021,[14] who included 16 RCTs with 1550 patients underwent Lichtenstein hernia repair with ilioinguinal nerve neurectomy (n=756 patients) or preservation (n=794 patients). The meta-analysis revealed that neurectomy was associated with significant reduction in groin pain at 6 months after surgery compared to nerve preservation group (8.94% vs. 25.11%; P< 0.00001). Moreover, the meta-analysis showed that the incidence of postoperative groin pain at rest, when performing daily activities, after moderate activities and after various activities were significantly low in the neurectomy group compared to preservation group.

Also, Mansour, 2023,[15] in a systematic review of 8 studies with 893 patients, evaluating the incidence of inguinodynia after the procedure of Lichtenstein inguinal hernia repair with elective ilioinguinal neurectomy compared to ilioinguinal nerve preservation during the surgery, revealed that at 4-week follow-up, neurectomy was associated with no significant reduction in groin pain compared to preservation group (0% vs. 10%; p=0.2).While, after vigorous exercises neurectomy group have lower rate of pain compared to preservation group (17% vs. 50% p =0.006). While after 6 months, there was no significant difference between the two groups regarding at rest pain. But after moderate exercises neurectomy group only 11% had mild to moderate groin pain, while, at preservation group 46% had mild to moderate pain (p< 0.005).

Another meta-analysis Hu, Q., Du, Y. X., Wang, D. C., Yang, Y. J., Lei, Y. H., & Wei, J. (2023),[16] included 20 studies and revealed that the incidence of severe pain on the first postoperative day was lower in the ilioinguinal neurectomy group (ING) than in the ilioinguinal nerve preservation group (INPG) [P < 0.0001]. The incidence of pain in the first month postoperatively [P = 0.0004], the incidence of pain in the sixth months postoperatively [P < 0.00001] was higher than that in the neurectomy group. There was no significant difference in the incidence of severe pain in the first month postoperatively [P = 0.20],

As well, a review article by Xu et al., 2021,[17] included 7 high-quality randomized-controlled trials (RCTs) to assess the outcomes of routine ilioinguinal neurectomy in the treatment of chronic pain during herniorrhaphy. The pooled results showed that neurectomy could reduce postoperative pain rate (RR = 0.40, 95% CI: 0.17-e0.95) and pain score (SMD =- 0.26, 95%CI: 0.46 to 0.06) at 6 months.

However, Charalambous & Charalambous, 2018,(18) in a meta-analysis of 9 randomized controlled trials showed that routine elective division of the ilioinguinal nerve during open mesh inguinal hernia repair does not significantly reduce chronic groin pain beyond 6 months. A substantial proportion of patients having open mesh inguinal hernia repair experience chronic groin pain when the ilioinguinal nerve is preserved (Estimated rate of 9.4% at 6 months and 4.8% at 1 year). Elective division of the nerve resulted in a significant reduction of groin pain at 6-months post-surgery (RR 0.47, p = 0.02), at 12-month post-surgery, the beneficial effect of nerve division on chronic pain was reduced, with no significant difference in the rates of overall groin pain (RR 0.69, p = 0.38), or of moderate-to-severe groin pain (RR 0.99, p = 0.98) between the two groups.

Also, the mean difference in duration of analgesia needs between the two groups revealed that neuroctomy was significantly lower in duration of analgesia compared to preservation (mean difference -6.35, 95% CI 6.46 to 6.24); There was no heterogeneity [Chi2 = 0.00, df = 1 (P=1.00); I2 = 0%].

The patients in neurectomy group required lower analgesia and have shorter duration of analgesia need compared to preservation group, due to the lower pain faced by patients in neurectomy group.

In concordance with the current meta-analysis, Xu et al., 2021,[19] in their review article showed that there are no statistical differences between postoperative numbness rate (RR = 1.48, 95%CI: 0.89-2.47) at 1- and 6-months postoperatively.

However, Charalambous & Charalambous, 2018,[18] in a meta-analysis showed that division of the nerve

resulted in an increase of subjective groin numbness at 6-months postoperatively (RR 1.55, p = 0.06). But at 12-month post-surgery, the prevalence of groin numbness was similar between the two groups at 12-month post-surgery (RR 0.79, p = 0.48).

Also, in contrast to the current meta-analysis Hu et al (2023)[15] revealed that ilioinguinal neurectomy was associated with higher rate of numbness at the first and the 6th month postoperatively compared to preservation group but the difference was statistically non-significant.

Regarding hypoesthesia, the current meta-analysis included 4 articles[17,19,20,21] and the pooled risk ratio of the postoperative hypoesthesia occurrence revealed that preservation group patients experienced higher hypoesthesia compared to neurectomy group (RR 2.43, 95% CI 1.66 to 3.55); There was no heterogeneity [Chi2 = 2.65, df = 5 (P=0.75); I2 = 0%]. Subgroup analysis revealed that there was significant higher hypoesthesia at first day postoperative in the preservation group (RR 2.48, 95% CI 1.64 to 3.75). While, at last follow up there was no significant difference between the two groups (RR 2.16, 95% CI 0.83 to 5.75). No significant heterogeneity was observed in the subgroup analysis.

In agreement with the current study Hu et al (2023),[15] in their meta-analysis revealed that there was no significant difference the hypoesthesia incidence in the first [P = 0.15] and sixth [P = 0.85] postoperative months between the two groups.

However, Cirocchi et al., 2021,[13] meta-analysis revealed that the incidences of paresthysia/ hypoesthesia were more in the neurectomy groups, but it was not statistically significant. The incidents of hypoesthesia or paresthesia in nerve preservation group might be caused by unintentional transection of the nerve.

Moreover, the chronic inguinal pain might be caused by the incorporation of the nerve into the mesh due to missed identification of the nerve during surgery.

Also, in contrast to our results Hsu et al., 2012,[22] in their meta-analysis showed that incidence of hypoesthesia was significantly higher in the neurectomy groups compared to preservation group at 6 and 12-months postoperatively.

Conclusion

Neurectomy of the ilioinguinal nerve during Lichtenstein hernia repair significantly reduced occurrence of postoperative pain and consequently reduced the rate and the duration of analgesia requirement, and may result in reduced rates of groin numbness and hypoesthesia, especially in the first day post-surgery, as compared to nerve preservation. Ilioinguinal nerve neurectomy in Lichtenstein hernia repair seems to offer some advantages about pain in the first postoperative period. Considering paresthesia and hypoesthesia, the result was not significant, although it was mostly in favor of neurectomy; it might be possible that the small number of cases led to this insignificancy. Nowadays, prudent surgeons should discuss with patients and their families the uncertain benefits and the potential risks of neurectomy before performing the hernioplasty.

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