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Elective Division Versus Preservation of The Ilioinguinal Nerve to Reduce Postoperative Pain in Hernioplasty for Inguinal Hernia

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ABSTRACT

Background: Lichtenstein tension-free mesh hernioplasty is the gold standard and the method of choice for the repair of inguinal hernia in developed countries. Chronic post-operative inguinal pain (CPIP), which is defined as pain lasting at least 2–3 months after surgery, is a major problem that affects about 8-16 % of inguinal hernia patients and affects their daily lives. Pain can be caused by perioperative injury to nerves or nerves that are being trapped and impaired by sutures or perforated by fixation devices such as tacks. Ilioinguinal nerve trauma throughout dissection, inflammation or fibrosis, and nerve entrapment by the mesh have all been involved in the pathogenesis of inguinodynia.

Objective: To evaluate the effect of ilioinguinal neurectomy versus nerve preservation on the incidence and severity of chronic groin pain following Lichtenstein tension-free mesh hernioplasty for inguinal hernia.

Patients and Methods: This prospective study was conducted on 100 patients with inguinal hernias who underwent Lichtenstein tension-free mesh hernioplasty. They were divided randomly into 2 equal groups; ilioinguinal neurectomy group (A) and nerve preservation group (B). There was no significant difference in patients of both groups regarding age, type of the hernia, precipitating factors, or type of anesthesia. Follow-up of postoperative groin pain was done at1st and 7th POD and after 1, 3, and 6 months during rest as well as after minor exercises using NRS.

Results: The Incidence of postoperative groin pain was significantly lower in the neurectomy group than the preservation group in all follow-up periods.

Conclusion: Resection of ilioinguinal nerve during inguinal hernia repair reduces significantly the incidence of post-operative chronic pain.

Keywords: Inguinal hernia, Ilioinguinal nerve, Chronic groin pain, Elective division

INTRODUCTION

Lichtenstein tension-free mesh hernioplasty is the gold standard and the method of choice for the repair of inguinal hernia in developed countries [(1)]. Chronic post-operative inguinal pain (CPIP), which is defined as pain lasting at least 2–3 months after surgery, is a major problem that affects about 8-16 % of inguinal hernia patients and affects their daily lives [(2)].

Many factors are attributed to the incidence of chronic pain after inguinal hernia surgery but it is not possible to point to a special reason for the pain in a specific patient. Pain can be caused by perioperative injury to nerves or nerves that are being trapped and impaired by sutures or perforated by fixation devices such as tacks [(2)].

Many regimens for the management of CPIP have been experienced including non-surgical and surgical routes. Surgical treatment consists of resection of the inguinal nerves, either by selective or triple neurectomy including all inguinal nerves which is the most performed surgical procedure for neuropathic CPIP. Removal of the mesh (meshectomy), either complete or partial can be considered when the mesh is the origin of non-neuropathic post-operative pain [(3)].

Ilioinguinal nerve trauma throughout dissection, inflammation or fibrosis, and nerve entrapment by the mesh have all been involved in the pathogenesis of inguinodynia. The ilioinguinal nerve is a peripheral branch of the lumbar plexus. It goes through the lateral abdominal muscles, then into the inguinal canal, before innervating the superomedial part of the thigh, the teguments of the pubis, the scrotum in men, and the labia majora in women. The ilioinguinal nerve is usually faced during open inguinal hernia repair and has been involved in the pathogenesis of postoperative chronic groin pain [(4)].

Elective detachment of the ilioinguinal nerve has been recommended in an attempt to reduce the frequency of chronic groin pain following open mesh hernia repair. The importance of elective nerve detachment to decrease postoperative pain was highlighted by some authors, considering the ilioinguinal neurectomy to be a part of the regular surgical step. Good planning preoperatively for ilioinguinal nerve resection has been observed to decrease the incidence of postoperative pain. A major source of morbidity is reduced using this simple procedure [(5)].

The present study aimed to evaluate the effect of ilioinguinal neurectomy versus nerve preservation on the incidence and severity of chronic groin pain

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following Lichtenstein tension-free mesh hernioplasty for inguinal hernia.

PATIENTS AND METHODS

This prospective case series study was conducted during the time between March 2020 to February 2021 in Mansoura Endocrine Surgery Unit Mansoura University Hospital.

Ethical Considerations:

After obtaining the approval from Institutional Research Board "IRB", 100cases of inguinal hernia who underwent Lichtenstein tension-free mesh hernioplasty. Informed written consent was taken from all patients. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Patients included in this study were divided into two groups; A and B.

Group A (ilioinguinal neurectomy group): Included 50 inguinal hernias where the ilioinguinal nerve was excised and the cut ends were left alone without implantation into muscle or ligation.

Group B (ilioinguinal nerve preservation group): Included 50 inguinal hernias where the whole ilioinguinal nerve was carefully protected throughout the operation to avoid inclusion of nerve during suturing or mesh implantation.

Preoperative care and anesthesia: The pubic hair was shaved immediately before surgery. All patients were advised to be fasting for six to twelve hours before the operation. General or spinal anesthesia was used. All patients received intravenous antibiotics with induction of anesthesia after the sensitivity test.

Surgical technique:

Lichtenstein tension-free mesh hernioplasty:

Operative data: In group (A) patients were subjected to IIN excision, and in group (B) IIN was preserved.

All operations were performed under spinal or general anesthesia.

Post-operative management and follow-up:

The patient was transported to the ward.

The patient resumed oral fluid intake after 2 hours and started a light diet after 6 hours. The patient was allowed to mobilize after complete recovery of anesthesia. The patient received I.V antibiotics during the period of hospitalization, and on oral antibiotics for 5 days.

In the same POD, after recovery of analgesic effect of spinal anesthesia and those who recovered from general anesthesia received I.V paracetamol 500 mg / 8 hours.

In 1st POD, Pain was assessed using the Numerical Rating pain Scale (NRS) during rest and after minor activities like walking for 10 minutes. Sensory changes were assessed using the 4-point verbal rating scale (VRS) (0= absent and 1= present) during rest only.

Patients were asked to mark on the line where they think their pain was and pain intensity was determined. Cut-off point using NRS were 1-3 for mild pain, 4-6 for moderate pain, and > 6 for severe pain.

Mild pain was defined as occasional or discomfort that did not limit daily activity, with a return to pre hernia repair lifestyle without the need for analgesics. Moderate pain was defined as pain that interfered with a return to normal activities with rarely needed analgesics. Severe pain was defined as pain that incapacitated the patient, at frequent intervals or interfered with everyday activities with frequent need of pain killers.

Numbness/paresthesia was defined as a non-painful ongoing sensation. Hypoesthesia was defined as a reduced response to non-painful stimuli when compared to the contra-lateral side and it was assessed objectively using a cotton swab or by pinching of the skin.

All patients were discharged on the 2nd POD:

On 1st visit to the outpatient clinic at 7th POD, all patients were examined for any minor postoperative complications like scrotal edema, seroma, wound infection, or recurrence. Sutures were removed. Pain, as well as sensory changes, were assessed and patients' needs for analgesia were recorded. Patients were asked to come to follow-up after 1, 3, and 6 months at the outpatient clinic.

Statistical analysis

The collected data were coded, processed, and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi-square test ($\chi 2$) to calculate the difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P-value < 0.05 was considered significant.

RESULTS

During the period from March 2020 to February 2021, a total of 100 adult male patients with 100 primary inguinal hernias underwent Lichtenstein tension-free mesh hernioplasty in the endocrine surgery unit, general surgery department, Mansoura University. They were randomly divided into two equal groups (A and B) using the toss method.

Patients in group A were subjected to IIN resection during hernia repair while patients in group B were subjected to nerve preservation. Regarding the age of patients in both groups; the mean age of patients in group A was 42.55±3.573 while it was 41.9±2.99 in group B. Table (1) there was no statistically significant difference between both groups (p= 0.652).

Table (1): Comparison between both groups regarding age.

	Group A(n=50)	**Group B(n=50)**	**T**	**P-value**
Range	21-64 years	19-65 years	2.544*	0.652*
Mean	42.55	41.9		
SD	3.573	2.99		

T: **Student t-test** P: p-value for comparing between **Group A** and **Group B**
*Statistically significant at p≤0.05

As regards the precipitating factors (smoking, BPH, splenomegaly, bronchial asthma) and type of work Table (2) the difference between the two groups wasn't statistically significant for both precipitating factors and type of work. (p>0.05).

Table (2): Number and percentage of patients who had precipitating factors for hernia in both groups.

	Group A(n=50)		**Group B(n=50)**		**χ2**	**P-value**
	N	**%**	**N**	**%**		
Smoking:						
Smokers	30	60	27	54	0.102	0.749
Non-smokers	20	40	23	46		
BPH	12	24	5	10	1.558	^{FE}p= 0.407
Splenomegaly	3	6	5	10	0.360	^{FE}p= 1.000
Bronchial asthma	3	6	8	16	1.111	^{FE}p= 0.605
Type of work:						
Heavy manual	20	40	25	50		
Work						
Light manual work	15	30	20	40	2.681	^{MC}p= 0.449
Students and	13	26	5	10		
Employees:						
Not working	2	4	0	0		

χ^2: **Chi-square test MC: Monte Carlo** FE**: Fisher Exact**
P: p-value for comparing between **Group A** and **Group B** *: Statistically significant at p≤0.05

Regarding the type of hernia, there was no statistical difference between the two groups (p=0.276). Regarding the side of hernia, there was a statistical difference between the two groups (p=0.025). Regarding other inguinoscrotal conditions (varicocele & hydrocele) the difference between the two groups wasn't statistically significant (p=1.000) (Table 3).

Table (3): Comparison between both groups regarding side, type of hernia, and other inguinoscrotal conditions

	Group A(n=50)		**Group B(n=50)**		**χ2**	**P-value**
	N	**%**	**N**	**%**		
Side of hernia:						
Right	36	72	22	54	5.013*	0.025*
Left	14	28	28	56		
Type of inguinal hernia:						
Direct	8	16	18	36	2.774	MCp= 0.276
Oblique	40	80	32	64		
Pantaloon	2	4	0	0		
Varicocele:	7	14	6	12	1.129	0.288
Patients underwent intervention	6	12	2	4	0.229	FEp= 1.000
Hydrocele:	7	14	6	12	0.229	FEp= 1.000
Patients underwent intervention	0	0	2	4	1.026	FEp= 1.000

χ^2: **Chi-square test MC: Monte Carlo** FE**: Fisher Exact**
P: p-value for comparing between **Group A** and **Group B**
*: Statistically significant at p≤0.05

The selection of the type of anesthesia was depending on the evaluation of the anesthesiologist. General anesthesia was used in patients, in whom spinal anesthesia was failed. The difference between both groups was found to be statistically insignificant. (p=0.235) **(Figure 1).**

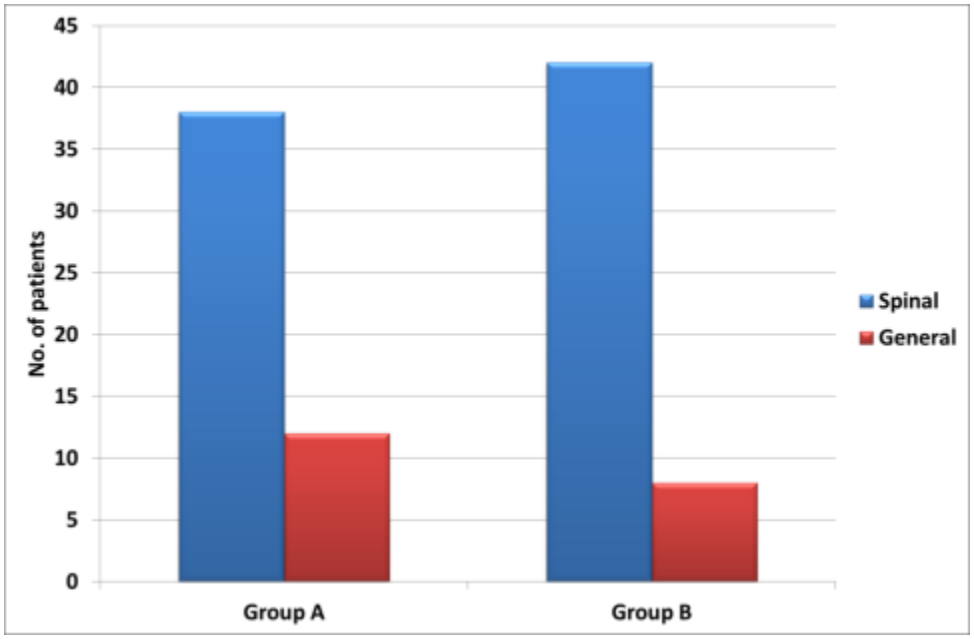


Figure (1): Comparison between both groups regarding the type of anesthesia.

As regards the minor postoperative complications (scrotal edema, wound infection, seroma, urine retention) the difference between both groups was found to be statistically insignificant for minor complications collectively (p=0.215) **(Figure 2).**

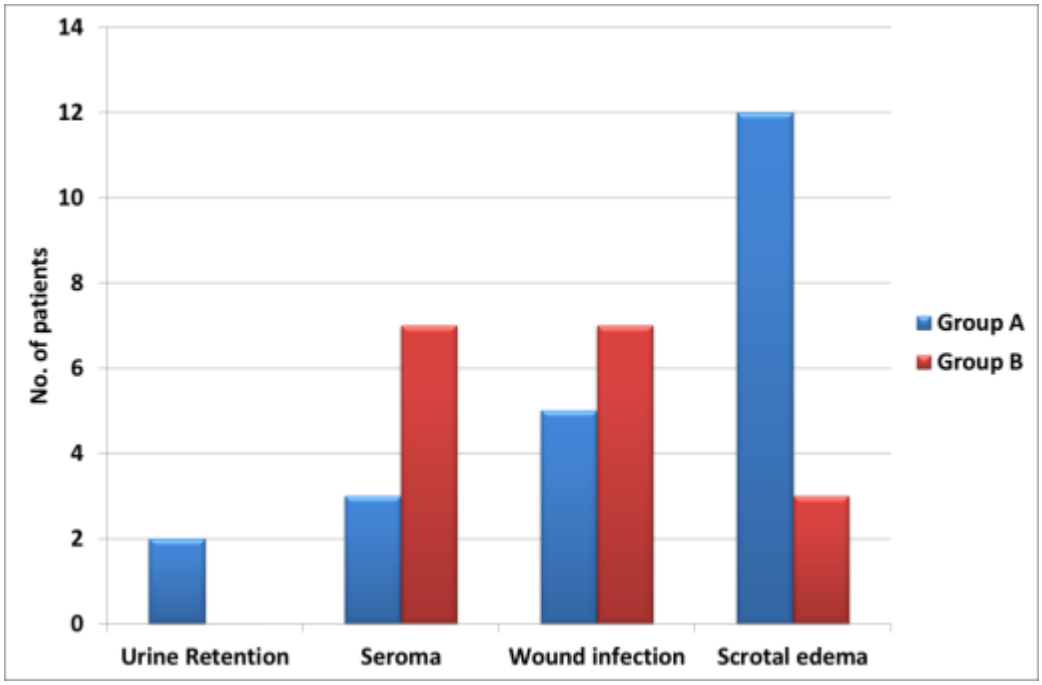


Figure (2): Incidence of postoperative minor complications in both groups.

Postoperative inguinal pain was assessed using NRS at 1st POD, 7th POD, then after1, 3, and 6months during rest as well as after minor exercises. **Figures (3, 4)**. The incidence of pain during rest and after minor exercise was much statistically significantly lower in group A than in group B ($p<0.05$).

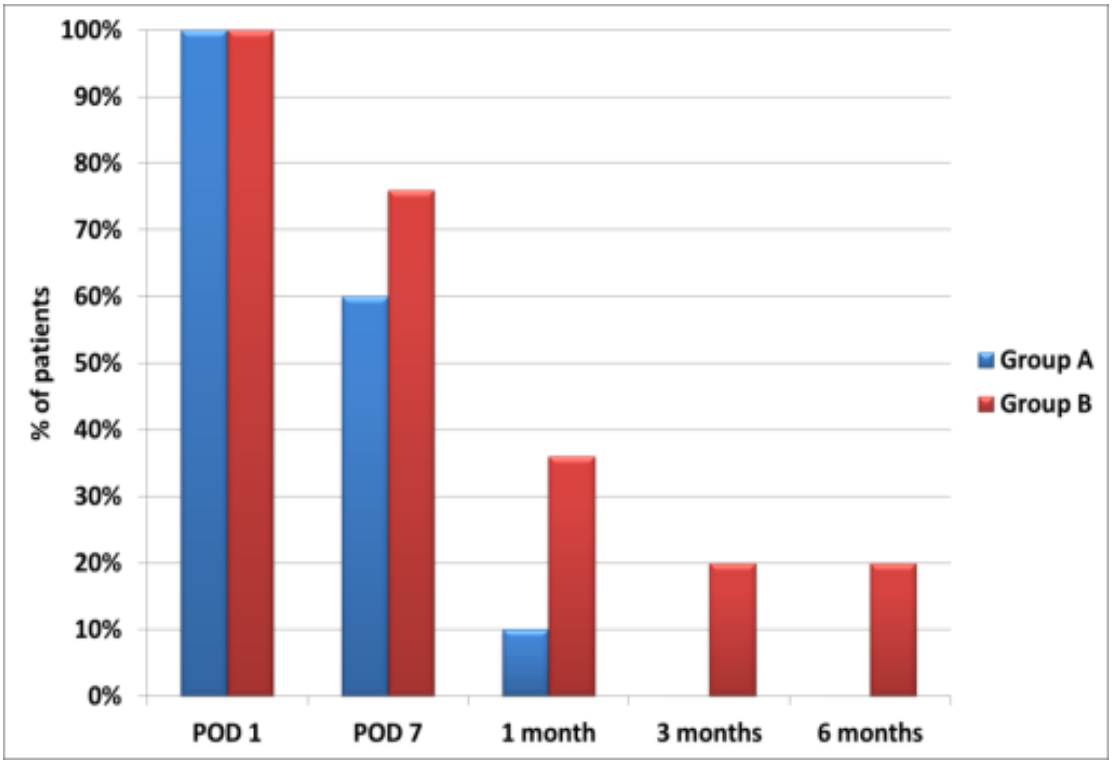


Figure (3): Incidence of postoperative neuralgia among patients of both groups during rest.

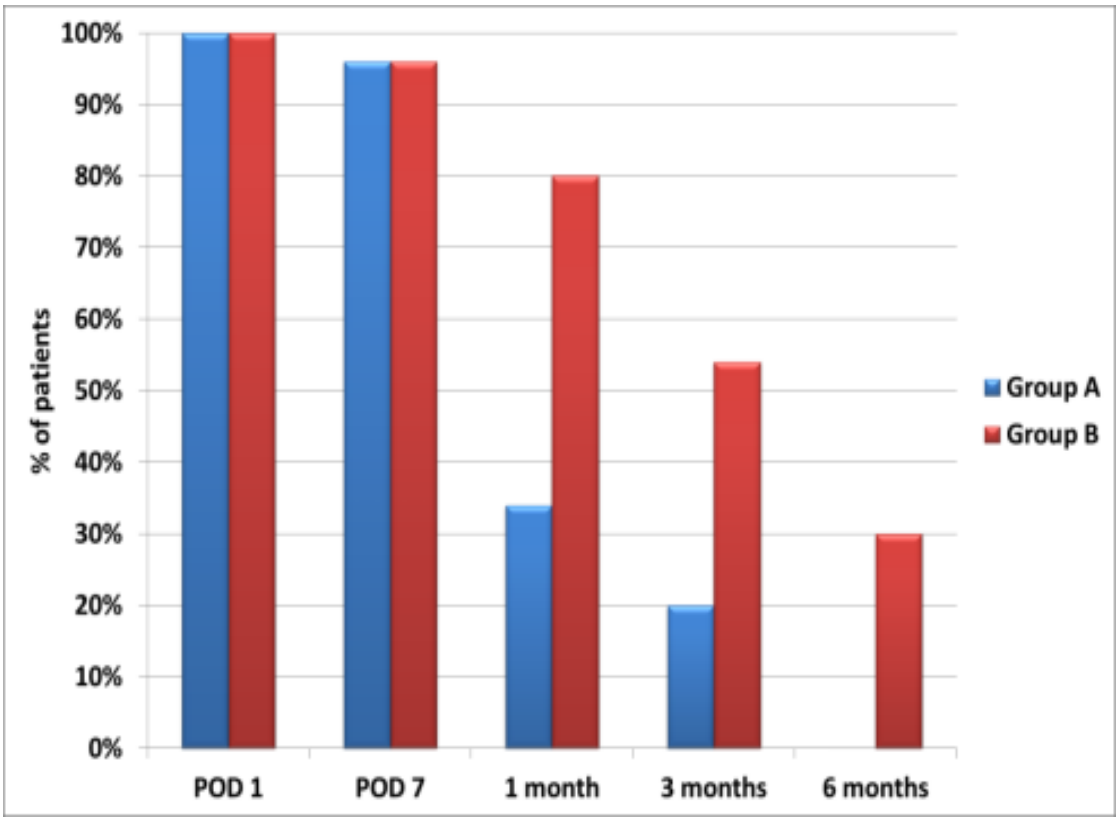


Figure (4): Incidence of postoperative neuralgia among patients of both groups after minor exercise.

The difference between both groups regarding the severity of postoperative inguinal pain during rest was found to be statistically insignificant ($p>0.05$) (Table 4).

Table (4): Comparison between both groups regarding the severity of postoperative inguinal pain during rest.

		Group A (n=50)		Group B (n=50)		χ2	P-value
		N	%	N	%		
1st POD	-No Pain	0	0	0	0	4.41	MCp=0.099
	-Mild Pain≤3	25	50	10	20		
	-Mod. pain (4-6)	25	50	38	76		
	-Severe Pain > 6	0	0	2	4		
	-No Pain	20	40	13	26	1.14	MCp=0.657
	-Mild Pain≤ 3	25	50	30	60		
	-Mod. pain (4-6)	5	10	7	14		
	-Severe Pain > 6	0	0	0	0		
1 Month	-No Pain	45	90	33	66	3.62	MCp=0.124
	-Mild Pain ≤ 3	5	10	15	30		
	-Mod pain (4-6)	0	0	2	4		
	-Severe Pain > 6	0	0	0	0		
3 Months	-No Pain	50	100	40	80	3.98	MCp=0.112
	-Mild Pain ≤ 3	0	0	8	16		
	-Mod pain (4-6)	0	0	2	4		
	-Severe Pain > 6	0	0	0	0		
6 Months	-No Pain	50	100	40	80	4.44	FEp=0.106
	-Mild Pain ≤ 3	0	0	10	20		
	-Mod pain (4-6)	0	0	0	0		
	-Severe Pain > 6	0	0	0	0		

χ^2: **Chi-square test MC: Monte Carlo** FE**: Fisher Exact** P: p-value for comparing between **Group A** and **Group B**
*: Statistically significant at p≤0.05

The difference between both groups regarding the severity of postoperative inguinal pain after minor exercises was found to be statistically higher in group B than in group A especially at follow-up at 1, 3, and 6 months (p=0.013, 0.033, 0.018) respectively **(Table 5).**

Table (5): Comparison between both groups regarding the severity of postoperative inguinal pain after minor exercises.

		Group A (n=50)		Group B (n=50)		χ2	P-value
		N	%	N	%		
1st POD	-No Pain	0	0	0	0	15.692*	<0.001*
	-Mild Pain ≤3	28	56	0	0		
	-Mod pain (4-6)	10	20	30	60		
	-Severe Pain>6	12	24	20	40		
7th POD	-No Pain	2	4	2 1	4	5.988	MCp=0.046*
	-Mild Pain ≤3	25	50	104	20		
	-Mod pain (4-6)	23	46	33	66		
	-Severe Pain > 6	0	0	5	10		
1 month	-No Pain	33	66	10	20	8.464*	MCp=0.013*
	-Mild Pain ≤3	15	30	28	56		
	-Mod pain(4-6)	2	4	12	24		
	-Severe Pain >6	0	0	0	0		
3 months	-No Pain	40	80	22	44	6.423*	MCp=0.033*
	-Mild Pain ≤3	10	20	18	36		
	-Mod pain(4-6)	0	0	10	20		
	-Severe Pain>6	0	0	0	0		
6 months	-No Pain	50	100	35	70	6.371	MCp=0.018*
	-Mild Pain ≤3	0	0	10	20		
	-Mod pain(4-6)	0	0	5	10		
	-Severe Pain>6	0	0	0	0		

χ^2: **Chi-square test MC: Monte Carlo** FE**: Fisher Exact**
P: p-value for comparing between **Group A** and **Group B** *: Statistically significant at p≤0.05

The range of duration during which patients required analgesia in group A was 2-6 days with a mean of 3.45 ± 0.3118 and was 5-14 days with a mean of 9.8± 0.67121in group B. Table (6) The difference between both groups regarding type and duration of analgesia were statistically significantly higher for patients in group B than in patients of group A (p<0.05).

Table (6): Comparison between both groups regarding analgesia requirements.

Patients required analgesia		Group A (n=50)		Group B (n=50)		Test of Sig.	P-value
		N	%	N	%		
		50	100	50	100		
1st post-operative 24hrs.	Patients required no analgesia	0	0	0	0	$\chi2$=6.465*	0.011*
	Patients controlled by oral paracetamol	33	66	12	24		
	Patients controlled by inj. Ketorolac	17	34	38	76		
7th POD	Patients required no analgesia	50	100	23	46	$\chi2$=11.503*	MCp=0.002*
	Patients controlled by oral paracetamol	0	0	18	36		
	Patients controlled by inj. Ketorolac	0	0	5	10		
Mean of duration for which patients required analgesia		3.45		9.8		t=38.371*	<0.001*
Standard deviation		0.3118		0.67121			
Range		2-6 days		5-14 days			

χ^2: **Chi-square test MC: Monte Carlo** FE**: Fisher Exact** P: p-value for comparing between **Group A** and **Group B**
*: Statistically significant at p≤0.05

The difference between both groups regarding the incidence of postoperative sensory changes was statistically insignificant except for the 1st and 7th POD, it was significant (p=0.047) (Table 7).

Table (7): Comparison between both groups regarding the incidence of postoperative numbness/hypoesthesia.

		Group A (n=50)		Group B (n=50)		$\chi2$	P-value
		N	%	N	%		
1st POD	Numbness	12	24	0	0	5.714*	FEp=0.047*
	Hypoesthesia	15	30	5	10	2.500	FEp=0.235
7th POD	Numbness	12	24	0	0	5.714*	FEp=0.047*
	Hypoesthesia	10	20	2	4	2.057	FEp=0.342
1 month	Numbness	7	14	5	10	0.229	FEp=1.000
	Hypoesthesia	17	34	7	14	2.133	FEp0.144
3 months	Numbness	10	20	5	10	0.173	FEp=1.000
	Hypoesthesia	5	10	0	0	2.105	FEp=0.487
6 months	Numbness	7	14	5	10	0.229	FEp=1.000
	Hypoesthesia	0	0	0	0	-	-

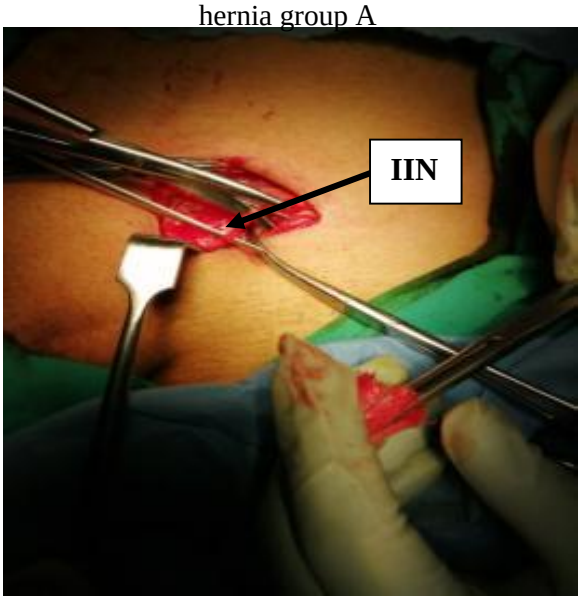
χ^2: **Chi-square test** FE**: Fisher Exact**
p: p-value for comparing between **Group A** and **Group B**
*: Statistically significant at p ≤ 0.05

Examples of patients in our study:

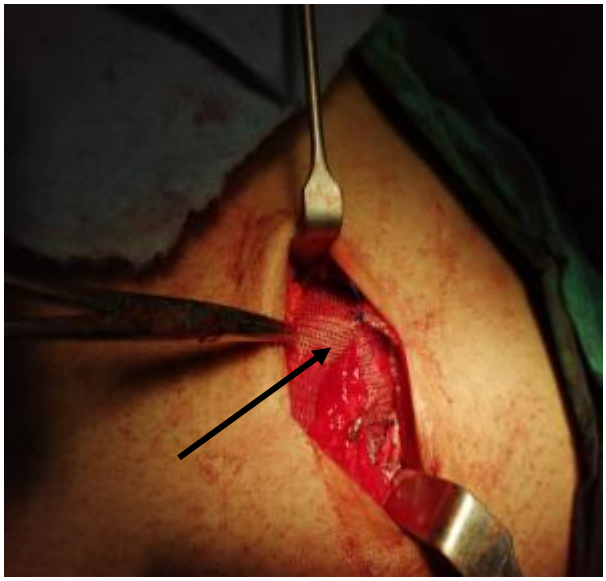
Patient No. 1

Male patient 59 yrs. old with Lt direct inguinal hernia group A

Landmark of inguinal incision



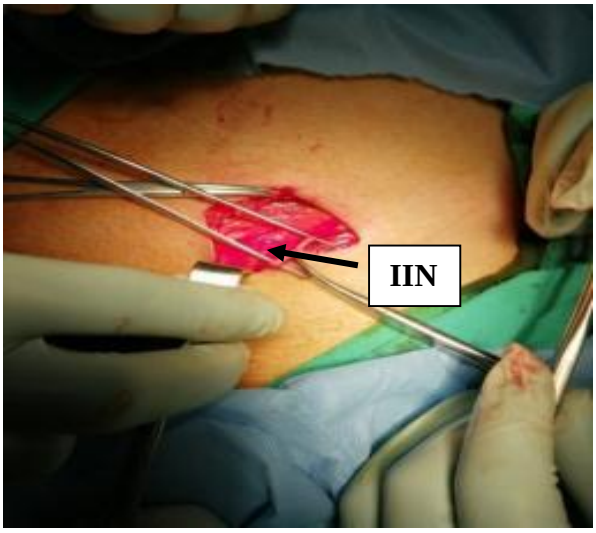
IIN excision



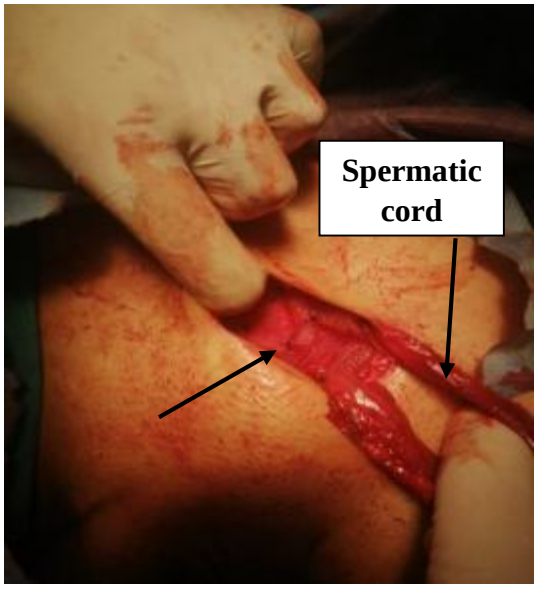
Mesh repair of Lt indirect inguinal hernia

Patient No. 2

Male patient 23 yrs. old with Lt indirect inguinal hernia group B



Identification and preservation of IIN



Mesh repair


skin closure

DISCUSSION

Chronic pain is a significant problem following open mesh hernioplasty for inguinal hernia. Although the pain is often mild, the different studies for quality of life have shown that chronic pain, irrespective of severity, can significantly interfere with normal daily activities [(6)]. The present study was undertaken to evaluate the effect of IIN excision on the incidence and severity of postoperative groin pain as well as the incidence of sensory changes.

In our study, postoperative groin pain was evaluated in 100 patients categorized into 2 equal groups (A and B, 50 patients each). In group A, IIN was excised while in group B, IIN was carefully protected throughout the operation, extreme care was taken during surgery to avoid nerve entrapment during suturing and mesh placement. The patients were followed up for assessment of pain as well as sensory changes at 1st POD, 7th POD, 1, 3, and 6 months postoperatively.

All patients in our study were males like studies done by **Omar *et al.*** [(7)] **and Chatterjee *et al.*** [(8)]**.** In 2 large studies, the authors found that women reported more severe acute postoperative pain in general which might be related to estrogen modulation of nociceptive processing. (3)

The mean age of patients in group A was 42.55±3.573 and it was 41.9±2.99 for group B (p=0.015) compared to 39±14 and 31±20 for neurectomy and preservation groups, respectively in a study by **Amuthan *et al.*** [(9)]**.**

Our work was similar to the study done by **Mui *et al.*** [(6)]**.** Assessment of pain was done at 1 and 6 months postoperatively during rest as well as after minor activities. At 1 month, there was no statistically significant difference between both groups regarding the incidence of pain. At the 6th month follow-up, the incidence of chronic groin pain was significantly lower in group A than in group B (8 vs. 28.6%) (p=0.008). The incidence of pain after walking 3 flights of stairs and cycling for 10 minutes was also significantly lower in group A than group B (2 vs. 14%) (p=0.03) and (4 vs.20.4%) (P=0.015), respectively. The difference between both groups regarding the incidence of pain during normal daily activities was found to be statistically insignificant (p=0.24)

The results of our work agreed with a study done by **Shah *et al.*** [(10)]**.** Postoperative groin pain was recorded at 1 and 6 months during rest and after different activities (routine daily activities, moderate activities like walking for 10 minutes, and also, after vigorous/severe activities like cycling for 10 minutes). There was no difference between both groups at rest (p>0.05) while the pain after moderate/severe activities was significantly lower in the neurectomy group than the preservation group (p=0.031 and 0.030, respectively).

Concerning the severity of experienced postoperative groin pain, we found that the difference between both groups during rest at end of the follow-up period was statistically insignificant (p=0.106). After minor exercises, it was statistically significantly lower in group A than in group B especially at later follow-up periods (p=0.018).

Our work agreed with **Amutha *et al.*** [(11)] study, they also found fewer incidences of moderate/severe pain among neurectomy group patients than the preservation group.

Results of our thesis agreed with the study done by **Mulkipatil *et al.*** [(4)]**,** which concluded that pain was more severe among patients of the nerve preservation group than the neurectomy group.

Our work coincided with results of the meta-analysis done by **Charalambous *et al.*** [(12)]**,** which included 9 randomized control trials evaluating 1510 patients, having either elective division of the IIN (733 patients) or nerve preservation (777 patients), it

showed that experienced chronic groin pain when the nerve was preserved at 6 months was 9.4% and at 1 year 4.8% while identification and elective division of the IIN have resulted in a significant reduction in the rate of groin pain at 6 months after surgery (p=0.02). Also, it decreased the risk of moderate/severe pain (p=0.01). However, the beneficial effect of nerve division on the incidence of chronic groin pain was reduced, with no significant difference in the rates of groin pain (p=0.38), or of moderate/severe groin pain (p=0.98) between both groups during follow-up at 12 months postoperatively.

In another meta-analysis done by **Barazanchi *et al.*** [13] included 13 randomized control trials, with short term follow-up <3 months, midterm 3-12 months, and long term >12 months. Regarding pain scores in this meta-analysis, short-term and midterm pain scores showed a statistically significant reduction favoring IIN neurectomy. However, the long-term pain score showed an insignificant trend favoring IIN neurectomy. Also, significantly fewer patients experienced moderate/severe pain in the neurectomy group for short and midterm follow-up. Only 2 studies by **Crea *et al.*** [14] **and Karakayali *et al.*** [15]**,** analyzed the incidence of moderate and severe pain >1 year. Both showed also reduction with neurectomy, but the overall effect was insignificant (p>0.05).

In this study, there was a significant decrease in the analgesic requirement among neurectomy group patients when compared to the preservation group for the 1st POD and 7th POD. Although mild and moderate grades of pain were present on exercise at1, 3, and 6 months follow-up especially in the preservation group, there was no significant difference between both groups as regard analgesia requirement.

CONCLUSION

From our study, it is shown that resection of the ilioinguinal nerve during inguinal hernia repair reduces significantly the incidence of post-operative chronic inguinal pain, so it is advisable to sacrifice the ilioinguinal nerve during inguinal hernia repair.

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Conflict of interest: Nil.

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