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Research Article

Predictors of Chronic Groin Pain (Inguinodynia) Following Inguinal Hernia Repair: A Prospective Observational Study

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ABSTRACT
Background: Chronic groin pain (inguinodynia) is among the most significant long-term complications following inguinal hernia repair, with reported incidence rates of 10–30%. Despite improvements in surgical technique and mesh technology, its etiology remains multifactorial and incompletely understood.
Objectives: To prospectively evaluate clinical, surgical, and technical predictors of inguinodynia in patients undergoing elective inguinal hernia repair.
Methods: A prospective observational study was conducted over 12 months at a tertiary care centre. One hundred and ten adult patients undergoing elective inguinal hernia repair were enrolled. Data on demographics, operative technique (open Lichtenstein vs. laparoscopic TEP/TAPP), mesh weight, fixation method, and intraoperative nerve handling were recorded. Postoperative pain was assessed using the Visual Analogue Scale (VAS). Inguinodynia was defined as groin pain persisting beyond three months post-surgery. Univariate and multivariate logistic regression analyses were performed to identify independent predictors.
Results: The incidence of inguinodynia was 30% (n=33/110). On multivariate analysis, severe early postoperative pain (VAS ≥7; OR 4.21, 95% CI 1.83–9.67, p=0.001) and failure to identify/preserve the ilioinguinal or iliohypogastric nerve (OR 3.87, 95% CI 1.61–9.30, p=0.003) were independent predictors. Open repair and heavyweight mesh were associated on univariate analysis but did not retain significance after adjustment.
Conclusions: Inguinodynia is a clinically significant complication whose incidence can be reduced through meticulous nerve identification, optimized perioperative analgesia, and judicious mesh selection. Standardization of surgical protocols incorporating these elements is strongly recommended.

Keywords: Inguinodynia, Chronic Groin Pain, Inguinal Hernia Repair, Lichtenstein Repair, Laparoscopic Hernia Repair, Nerve Identification, Mesh Hernioplasty.

1. INTRODUCTION

Inguinal hernia repair is one of the most commonly performed surgical procedures globally, with over 20 million repairs performed annually.[1] The introduction of tension-free mesh-based techniques-particularly the Lichtenstein repair and laparoscopic approaches such as Totally Extraperitoneal (TEP) and Transabdominal Preperitoneal (TAPP) repair-has dramatically reduced hernia recurrence rates to below 2%.[2] However, as recurrence has been largely controlled, chronic groin pain, or inguinodynia, has emerged as the predominant

long-term complication and a major determinant of patient-reported outcomes.

Inguinodynia is defined as pain in the groin region persisting for more than three months after surgery. Published incidence rates range from 10% to 30%, with severe, disabling pain reported in up to 5-6% of patients.[3,4] This condition adversely impacts quality of life, functional capacity, occupational performance, and psychological wellbeing, and represents a significant socioeconomic burden.

The pathophysiology of inguinodynia is multifactorial. Proposed mechanisms include direct nerve injury (to the ilioinguinal, iliohypogastric, or genitofemoral nerves), perineural fibrosis secondary to mesh incorporation, inflammatory responses to mesh materials, and central sensitization perpetuated by inadequately controlled early postoperative pain.[5] Additionally, patient-level factors such as preoperative pain, anxiety and pain sensitization phenotype have been implicated.

Despite growing recognition of this complication, comparative prospective data specifically evaluating the interplay between surgical technique, mesh characteristics, nerve handling, and postoperative pain management in the Indian population remain limited. The identification of modifiable predictors is of immediate clinical relevance, as it offers pathways for surgical optimization and targeted prevention.

This prospective observational study was therefore designed to systematically evaluate clinical and operative predictors of inguinodynia in patients undergoing elective inguinal hernia repair at a tertiary care centre, with the specific objective of identifying actionable risk factors amenable to surgical intervention.

2. MATERIALS AND METHODS

2.1 STUDY DESIGN AND SETTING

This prospective observational study was conducted over a period of 12 consecutive months (November 2023-November 2024) in the Department of General Surgery, Government Medical College and Hospital, Cuddalore District, Tamil Nadu, India. Ethical clearance was obtained from the Institutional Ethics Committee, and written informed consent was obtained from all participants prior to enrolment. The study was conducted in accordance with the Declaration of Helsinki.

2.2 STUDY POPULATION

Consecutive adult patients (age ≥18 years) presenting with primary unilateral or bilateral inguinal hernia and scheduled for elective surgical repair were screened for inclusion. Patients with recurrent hernia, emergency presentation (incarcerated or strangulated hernia), contraindications to general or regional anaesthesia, pre-existing chronic pain conditions, concurrent use of opioid analgesics, or loss to follow-up at the three-month assessment were excluded. A total of 110 patients meeting the eligibility criteria were enrolled.

2.3 OPERATIVE VARIABLES

All procedures were performed by consultant general surgeons with experience in both open and laparoscopic hernia repair. Operative data systematically recorded included:

i) Surgical approach (open Lichtenstein repair vs. laparoscopic TEP/TAPP).
ii) Mesh weight category (lightweight ≤50 g/m² vs. heavyweight >50 g/m²).
iii) Mesh fixation method (suture vs. tacker vs. glue).
iv) Intraoperative nerve identification and handling (ilioinguinal, iliohypogastric, and genitofemoral nerves-documented as identified and preserved, identified and sacrificed, or not identified).
v) Operative duration.

2.4 OUTCOME MEASURES

The primary outcome was the development of inguinodynia, defined as pain in the groin region with a VAS score ≥3 persisting at the three-month postoperative follow-up visit.[4] Secondary outcomes included pain intensity (VAS) at postoperative days 1, 7, 30, and 90, and the impact of inguinodynia on daily activities assessed using a structured questionnaire.

2.5 STATISTICAL ANALYSIS

Categorical variables were summarized as frequencies and percentages; continuous variables as means ± standard deviations (SD). Univariate associations between candidate predictors and inguinodynia were assessed using Pearson's chi-square test or Fisher's exact test for categorical variables, and the independent samples t-test for continuous variables. Variables with $p<0.10$ on univariate analysis were entered into a binary logistic regression model to identify independent predictors. Results are reported as adjusted

odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was defined as $p<0.05$. All analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY).

3. RESULTS

3.1 PATIENT DEMOGRAPHICS AND OPERATIVE CHARACTERISTICS

A total of 110 patients were enrolled over the study period. The mean age was 44.8 ± 11.8 years (range: 20-72 years), and the cohort was predominantly male (93.6%, n=103). Thirty-three patients (30.0%) met the primary outcome criterion of inguinodynia at three months. The demographic and operative profiles of patients with and without inguinodynia are presented in Table 1.

Table No. 1. Demographic and Operative Characteristics Stratified by Inguinodynia Status

Variable	Inguinodynia (n=33)	No Inguinodynia (n=77)	p-value
Age (years), mean ± SD	47.3 ± 12.1	43.8 ± 11.6	0.14
Male sex, n (%)	31 (93.9%)	72 (93.5%)	0.95
Bilateral hernia, n (%)	9 (27.3%)	14 (18.2%)	0.29
Preoperative pain (VAS ≥4), n (%)	21 (63.6%)	28 (36.4%)	0.01*
Open repair (Lichtenstein), n (%)	24 (72.7%)	39 (50.6%)	0.04*
Laparoscopic repair (TEP/TAPP), n (%)	9 (27.3%)	38 (49.4%)	0.04*
Heavyweight mesh, n (%)	20 (60.6%)	28 (36.4%)	0.02*
Nerve identified and preserved, n (%)	10 (30.3%)	58 (75.3%)	<0.001*
Severe early postoperative pain (VAS ≥7), n (%)	25 (75.8%)	18 (23.4%)	<0.001*

* Statistically significant ($p<0.05$). VAS = Visual Analogue Scale; SD = Standard Deviation.

3.2 UNIVARIATE ANALYSIS

Factors significantly associated with inguinodynia on univariate analysis included: preoperative pain (VAS ≥4) (63.6% vs. 36.4%, p=0.01), open Lichtenstein repair (72.7% vs. 50.6%, p=0.04), heavyweight mesh use (60.6% vs. 36.4%, p=0.02), failure to identify and preserve inguinal nerves (69.7% vs. 24.7%, p<0.001), and severe early postoperative pain (VAS ≥7) at 24 hours (75.8% vs. 23.4%, p<0.001). Age, sex, laterality, and fixation method did not reach statistical significance.

3.3 MULTIVARIATE ANALYSIS

Variables significant at p<0.10 on univariate analysis were entered into the logistic regression model. On multivariate analysis (Table 2), two factors emerged as independent predictors of inguinodynia: severe early postoperative pain (VAS ≥7; adjusted OR 4.21, 95% CI 1.83-9.67, p=0.001) and failure to identify or preserve the inguinal nerves (adjusted OR 3.87, 95% CI 1.61-9.30, p=0.003). Heavyweight mesh use (OR 2.14, p=0.08) and open repair (OR 1.98, p=0.12) showed trends toward association but did not achieve statistical significance after adjustment for confounders.

Table No. 2: Multivariate Logistic Regression Analysis: Independent Predictors of Inguinodynia

Predictor Variable	Odds Ratio	95% CI	p-value
Severe early postoperative pain (VAS ≥7)	4.21	1.83-9.67	0.001*
Nerve not identified/injured	3.87	1.61-9.30	0.003*
Heavyweight mesh	2.14	0.91-5.04	0.08
Open repair (vs. laparoscopic)	1.98	0.84-4.68	0.12
Preoperative pain (VAS ≥4)	1.76	0.74-4.20	0.20

* Statistically significant independent predictor ($p<0.05$). OR = Odds Ratio; CI = Confidence Interval.

4. DISCUSSION

This prospective study of 110 patients undergoing elective inguinal hernia repair reports a 30% incidence of inguinodynia at three months, consistent with the upper range of previously published estimates.[3,5] The finding that two-thirds of affected patients had identifiable and potentially modifiable operative risk factors underscores the preventive opportunity inherent in surgical technique optimization.

The strongest independent predictor identified was severe early postoperative pain (VAS ≥7 within 24 hours), with an adjusted OR of 4.21. This finding corroborates an established body of evidence indicating that inadequately controlled acute postoperative pain is a cardinal risk factor for central sensitization and transition to chronicity.[6] The biological substrate likely involves wind-up of spinal nociceptive pathways and synaptic potentiation in dorsal horn neurons, processes that are amplified by uncontrolled acute pain. From a clinical standpoint, this finding highlights the importance of multimodal analgesia protocols-incorporating paracetamol, NSAIDs, regional nerve blocks (ilioinguinal/iliohypogastric block or transversus abdominis plane block), and judicious short-term opioid use-as a preventive strategy against inguinodynia.

The second independent predictor was failure to identify and preserve the inguinal nerves (OR 3.87). The ilioinguinal, iliohypogastric, and genitofemoral nerves traverse the inguinal canal in close proximity to the operative field and are thus at risk of direct injury, entrapment within mesh, or compression from fixation sutures. Our finding aligns with Alfieri *et al.*, who demonstrated that systematic nerve identification and preservation significantly reduced chronic pain rates compared to nerve sacrifice or inadvertent injury.[7] The debate between deliberate neurectomy and preservation remains unresolved, but our data support a policy of routine identification with preservation as the default strategy, reserving neurectomy for nerves that are visibly damaged or at high risk of entrapment.

Open Lichtenstein repair was associated with higher inguinodynia rates on univariate analysis (72.7% vs. 27.3%), consistent with the greater tissue dissection, nerve manipulation, and mesh fixation (suture-related) inherent to the open approach. However, this association lost significance on multivariate adjustment, suggesting that the effect of surgical approach may be substantially mediated by nerve handling and perioperative analgesia quality, both of which can be optimized in the open setting. Laparoscopic repair (TEP/TAPP) generally involves less nerve trauma due to extraperitoneal dissection planes and the avoidance of inguinal floor dissection, which may explain the lower crude inguinodynia rates observed.

Heavyweight mesh was associated with inguinodynia on univariate analysis (p=0.02), consistent with its known propensity for greater inflammatory reaction, fibrosis, and mesh contracture, which may entrap or compress adjacent nerves.[8] While this did not achieve independent significance in our regression model-potentially due to sample size limitations-the biological plausibility and supporting data from other studies[9] argue for preferential use of lightweight, large-pore meshes where feasible, particularly in patients already at elevated risk.

This study has several limitations. As a single-centre prospective study with a relatively modest sample size, statistical power for subgroup analyses was limited and generalizability to other settings requires validation. The study was not blinded, introducing potential assessment bias. Three-month follow-up, while standard in many studies of inguinodynia, may not capture late-onset cases or longitudinal changes in pain trajectory. Patient-reported psychological factors and pain sensitization phenotypes-recognised modifiers of chronic pain outcomes-were not systematically evaluated and represent an avenue for future research. Finally, individual surgeon volume and technical proficiency, both recognised determinants of hernia repair outcomes, were not fully accounted for.

Future multi-centre prospective trials with longer follow-up, standardized nerve handling protocols, and patient-level psychosocial profiling would further delineate the relative contributions of these and other risk factors, and facilitate development of a validated predictive scoring tool for inguinodynia risk stratification.

5. CONCLUSION

Chronic groin pain (inguinodynia) occurs in approximately 30% of patients following inguinal hernia repair in this prospective cohort. Severe early postoperative pain and failure to identify and preserve the inguinal nerves are independent, modifiable predictors. These findings advocate strongly for the adoption of multimodal perioperative analgesic protocols and meticulous, standardized intraoperative nerve identification as core components of hernia repair technique. Careful attention to mesh selection-favouring lightweight, large-pore prostheses-and surgical approach may provide additional benefit. Institutional protocols embedding these principles have the potential to substantially reduce the burden of

inguinodynia and improve patient-reported outcomes following inguinal hernia repair.

DECLARATIONS

Ethical Approval: Ethical clearance was obtained from the Institutional Ethics Committee. The study was conducted in accordance with the Declaration of Helsinki.

INFORMED CONSENT: Written informed consent was obtained from all individual participants included in the study.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

FUNDING: No funding was received for this study.

DATA AVAILABILITY: Data supporting the findings of this study are available from the corresponding author on reasonable request.

REFERENCES

1. Kingsnorth A, LeBlanc K. Hernias: inguinal and incisional. Lancet. 2003;362(9395):1561-1571. https://doi.org/10.1016/S0140-6736(03)14746-0
2. Simons MP, Aufenacker T, Bay-Nielsen M, *et al*. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. Hernia. 2009;13(4):343-403.
3. Kehlet H, Jensen TS, Woolf CJ. Persistent postsurgical pain: risk factors and prevention. Lancet. 2006;367(9522):1618-1625.
4. Poobalan AS, Bruce J, Smith WC, King PM, Krukowski ZH, Chambers WA. A review of chronic pain after inguinal herniorrhaphy. Clin J Pain. 2003;19(1):48-54.
5. Nienhuijs SW, Rosman C, Strobbe LJ, Wolff A, Bleichrodt RP. An overview of the novel meshes used in hernia repair and their characteristics. Acta Chir Belg. 2007;107(6):630-635.
6. Werner MU, Míner MH. Predicting persistent postoperative pain: a review of studies defining chronic postsurgical pain. Pain. 2011;152(3):S5-S13.
7. Alfieri S, Rotondi F, Di Giorgio A, *et al*. Influence of preservation versus division of ilioinguinal, iliohypogastric, and genital nerves during open mesh herniorrhaphy: prospective multicentric study of chronic pain. Ann Surg. 2006;243(4):553-558.
8. Sajid MS, Leaver C, Baig MK, Sains P. Systematic review and meta-analysis of the use of lightweight versus heavyweight mesh in open inguinal hernia repair. Br J Surg. 2012;99(1):29-37.
9. O'Dwyer PJ, Kingsnorth AN, Molloy RG, Small PK, Lammers B, Horeyseck G. Randomized clinical trial assessing impact of a lightweight or heavyweight mesh on chronic pain after inguinal hernia repair. Br J Surg. 2005;92(2):166-170.