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PREVALENCE AND DETERMINANTS OF INGUINODYNIA FOLLOWING INGUINAL HERNIOPLASTY: A PROSPECTIVE STUDY IN A TERTIARY CARE SETTING

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ABSTRACT

Background: Inguinodynia chronic groin pain persisting beyond three months following inguinal hernia repair — has emerged as a critical measure of surgical success, frequently outweighing recurrence as the leading postoperative concern(1,2). This study determined the prevalence, severity, and associated risk factors of inguinodynia in a tertiary-care population in Vadodara, Gujarat.

Methods: A prospective observational study was conducted on 200 patients undergoing inguinal hernioplasty (open Lichtenstein, laparoscopic TEP, or laparoscopic TAPP) between January 2024 and December 2025 at Smt. B.K. Shah Medical Institute and Research Centre, Vadodara. Pain intensity was quantified using the 10-cm Visual Analogue Scale at four time points: immediate postoperative, postoperative day 2, postoperative day 14, and 3 months. Inguinodynia was analyzed against variables including surgical technique, mesh type, nerve handling, and comorbidities using chi-square tests and repeated-measures ANOVA.

Results: The overall prevalence of inguinodynia at 3 months was 18.0% (36 of 200 patients). Bilateral inguinal hernia (37.5%) and open hernioplasty (37.5%) were the most common presentations. Among affected participants, 36.5% reported severe pain and 35.0% moderate pain. Stabbing pain was the most frequent character (32.0%), suggesting a neuropathic phenotype(2). Mesh type was the only variable significantly associated with chronic pain (), with lightweight mesh used in 50% of inguinodynia cases.

Conclusion: Inguinodynia affects approximately 18% of patients following hernioplasty, with pain intensity typically severe and character predominantly neuropathic. Mesh selection appears to be a major determinant of chronic pain development, whereas surgical technique, nerve handling, and analgesia protocol showed less impact in this cohort.

KEYWORDS: inguinodynia, chronic groin pain, hernioplasty, Visual Analogue Scale, mesh, neuropathic pain

1. INTRODUCTION

Inguinal hernia repair is among the most commonly performed general surgical procedures worldwide. Globally, inguinal, femoral, and abdominal hernias account for a substantial disease burden, with rising age-standardized prevalence and incidence reported by the 2019 Global Burden of Disease study (3). While the transition to tension-free mesh-based repairs and laparoscopic approaches such as transabdominal preperitoneal and totally extraperitoneal has reduced recurrence rates, it has heightened clinical attention to chronic postoperative inguinal pain, or Inguinodynia(1,4).

Inguinodynia is defined by the International Association for the Study of Pain as groin pain of ≥ 3 months' duration after surgery (2,5). Reported prevalence rates vary widely: 8–30% following open Lichtenstein repair, and 4–10% following laparoscopic TEP/TAPP (6,7). Although laparoscopic approaches are widely believed to lower chronic-pain rates because they avoid direct nerve dissection, registry data and the European Hernia Society guidelines suggest the long-term difference at 12 months is modest (4,8).

The condition substantially impairs daily functioning, sleep, and psychological well-being(5,9). In the Indian healthcare context, where most patients are engaged in manual or agricultural labor, the functional and economic consequences of chronic post-herniorrhaphy groin pain assume particular importance (10,11).

Few Indian centres have prospectively evaluated inguinodynia using a structured, longitudinal VAS-based design with intraoperative variables (mesh type, nerve handling) captured concomitantly. The present study therefore aimed to determine the 3-month prevalence, severity, character, and risk factors of inguinodynia in a tertiary-care cohort in Vadodara.

2. MATERIALS AND METHODS

2.1 Study Design

A prospective, single-centre, observational study with longitudinal follow-up. Consecutive sampling was used to minimize selection bias. The study is reported in accordance with the STROBE statement (von Elm et al., 2007) and ICMJE Recommendations.

2.2 Study Setting

Smt. B.K. Shah Medical Institute and Research Centre, Dhiraj General Hospital, Piparia, Vadodara — a 1100-bed tertiary-care teaching hospital affiliated with Sumandeep Vidyapeeth Deemed-to-be University. The hospital serves an estimated 1.4 million population in central Gujarat, including rural and peri-urban communities. The Department of General Surgery performs approximately 250–300 elective inguinal hernia repairs annually.

2.3 Study Period

Recruitment: January 2024 – July 2025.
Follow-up completion: December 2025.

2.4 Participants

Inclusion criteria

1. Age ≥ 18 years, either sex.
2. Clinico-radiologically confirmed primary or recurrent inguinal hernia (direct, indirect, pantaloon, or femoral).
3. ASA physical status I–III.
4. Elective repair via open Lichtenstein, laparoscopic TEP, or laparoscopic TAPP.
5. Provision of written informed consent, with thumb impression and witness signature for illiterate participants.

Exclusion criteria

1. Emergency repair for strangulated/incarcerated hernia.
2. Concurrent abdominal or pelvic surgery in the same anaesthetic episode.
3. Pre-existing chronic pelvic, groin, or lower-back pain of any etiology.
4. Cognitive impairment or psychiatric illness precluding VAS self-report.
5. Active local or systemic infection at the time of surgery.
6. Failure to complete the 3-month follow-up VAS assessment.

Withdrawal criteria

- Voluntary withdrawal at any time, with no impact on subsequent clinical care.
- Investigator-initiated withdrawal for safety reasons (e.g., severe postoperative complication unrelated to inguinodynia).

2.5 Sample Size and Justification

Sample size was estimated using the single-proportion formula:
Where:

- (95% confidence, two-sided)
- (anticipated inguinodynia prevalence based on Indian pilot data(5,11))
- (5% absolute precision)

With 10% anticipated attrition, target enrolment = 270; 200 patients completed follow-up, yielding precision of ± 5.5%. This sample also provides 80% power to detect an odds ratio of 2.0 for inguinodynia between mesh-type subgroups at .

2.6 Variables

Exposure variables

- Surgical technique (categorical: open Lichtenstein / Lap TEP / Lap TAPP)
- Mesh type (categorical: lightweight / standard-weight polypropylene / composite or heavyweight)
- Nerve handling (categorical: identified-preserved / identified-divided / not visualized)
- Analgesia protocol (categorical: 4 levels as described)
- Age, BMI, ASA grade, comorbidities (descriptive and confounder variables)

Outcome variable (primary)

- Inguinodynia at 3 months (binary: yes/no, defined as VAS ≥ 1 at the 3-month follow-up visit).

Outcome variables (secondary)

- VAS severity grade at 3 months (mild/moderate/severe)
- Pain character (categorical: stabbing / radiating / burning / throbbing / mixed)
- Functional impact (categorical: daily activities / work / sleep / sexual function)
- VAS trajectory across the four time points (continuous)

2.7 Data Sources and Measurement

All data were collected on a pre-piloted, paper-based case-record form by a single trained research fellow. VAS measurements used a 10-cm horizontal line with end anchors (0 = no pain, 10 = worst possible pain) (2). CRF fields captured demographic data, comorbidities, intraoperative findings, postoperative analgesia, and pain assessments. The CRF was piloted on the first 10 patients and refined for clarity. Data were double-entered into Microsoft Excel with range checks for plausibility.

2.8 Bias and Quality Control

- Selection bias: Minimised by consecutive sampling.
- Information bias (recall): Minimised by real-time intraoperative documentation.
- Interviewer bias: Addressed by using a single trained research fellow for VAS collection.
- Confounding: Acknowledged for mesh-type analysis (confounding by indication); multivariable logistic regression recommended as future work.

- Loss to follow-up: Documented and reported; sensitivity analysis planned if loss > 10%.

2.9 Statistical Methods

- Software: IBM SPSS Statistics v.26.
- Descriptive statistics: Mean ± SD for normally distributed continuous variables; median otherwise. Frequencies and percentages for categorical variables.
- Inferential tests:
  - Chi-square test for associations between categorical predictors and inguinodynia.
  - Independent-samples t-test for comparing VAS scores between inguinodynia and non-inguinodynia groups.
  - Repeated-measures ANOVA for the VAS trajectory.
  - Post-hoc Bonferroni correction for multiple pairwise comparisons.
- Threshold of significance: (two-sided).
- Missing data: Patients with missing 3-month VAS were excluded per protocol; sensitivity analysis not required because the loss-to-follow-up rate was below the 10% threshold.

2.10 Ethical and Regulatory Approvals

- Institutional Ethics Committee approval: SVIEC/172
- Written informed consent from every participant.
- Declaration of Helsinki and ICMR National Ethical Guidelines compliance.

3. RESULTS

3.1 Cohort And Baseline Characteristics (Table 1)

Table 1. Baseline Demographic and Clinical Characteristics (n = 200)

Characteristic	Category	n (%)
Age (years)	18–30	8 (4.0)
	31–40	22 (11.0)
	41–50	38 (19.0)
	51–60	43 (21.5)
	61–70	48 (24.0)
	71–80	32 (16.0)
	> 80	9 (4.5)
Sex	Male	188 (94.0)
	Female	12 (6.0)
Hernia laterality	Right	65 (32.5)
	Left	60 (30.0)
	Bilateral	75 (37.5)
Hernia type	Direct	64 (32.0)
	Indirect	110 (55.0)
	Pantaloon	18 (9.0)
	Recurrent	8 (4.0)
ASA grade	I	60 (30.0)
	II	96 (48.0)
	III	44 (22.0)
Comorbidities	None	76 (38.0)
	DM	30 (15.0)
	HTN	26 (13.0)
	DM + HTN	38 (19.0)
	CAD	38 (19.0)
	COPD	14 (7.0)
Smoking history	Current	52 (26.0)
	Former	30 (15.0)
	Never	118 (59.0)
Occupational heavy lifting	Yes	116 (58.0)
	No	84 (42.0)
BMI (kg/m²)	< 25	86 (43.0)
	25–30	78 (39.0)
	> 30	36 (18.0)

Mean age: 58.4 ± 14.7 years. Mean BMI: 26.3 ± 4.1 kg/m². DM = diabetes mellitus; HTN = hypertension; CAD = coronary artery disease; COPD = chronic obstructive pulmonary disease.

The cohort was predominantly elderly: 24.0% were aged 61–70 years and 21.4% were aged 51–60 years. Bilateral inguinal hernia was the most common presentation (37.5%). Open hernioplasty was the most frequent procedure (37.5%), followed by laparoscopic TEP (34.0%) and laparoscopic TAPP (28.5%). The most common comorbidities were diabetes mellitus with hypertension (19.5%) and coronary artery disease (19.0%).

3.2 Inguinodynia Prevalence and Severity (Tables 2 and 3)

Table 2. Operative Variables (n = 200)

Variable	Category	n (%)
Surgical technique	Open Lichtenstein	75 (37.5)
	Laparoscopic TEP	68 (34.0)
	Laparoscopic TAPP	57 (28.5)
Mesh type	Lightweight polypropylene	100 (50.0)
	Standard-weight polypropylene	70 (35.0)
	Composite / heavyweight	30 (15.0)
Nerve handling	Identified and preserved	92 (46.0)
	Identified and divided	60 (30.0)
	Not visualized	48 (24.0)
Fixation method (laparoscopic)	Self-fixating mesh	56 (44.8)
	Absorbable tackers	49 (39.2)
	Non-absorbable tackers	20 (16.0)
Anaesthesia	General	152 (76.0)
	Spinal	48 (24.0)
Analgesia protocol	Multimodal (PCM + Diclofenac + Gabapentin)	70 (35.0)
	NSAID + opioid	60 (30.0)
	NSAID alone	50 (25.0)
	Regional block + NSAID	20 (10.0)
Operative time (min)	Mean ± SD	78.6 ± 22.3
Hospital stay (days)	Mean ± SD	2.4 ± 1.1

Table 3. Pain Severity and Character at 3 Months (n = 36 with inguinodynia)

Variable	Category	n (%)
Severity grade	Mild (1–3)	10 (27.8)
	Moderate (4–6)	13 (36.1)
	Severe (7–10)	13 (36.1)
Pain character (multi-response)	Stabbing	12 (32.0)
	Radiating	9 (23.5)
	Burning	8 (22.5)
	Throbbing	4 (11.0)
	Mixed/other	3 (11.0)
Anatomical localisation	Inguinal (medial to ASIS)	18 (50.0)
	Suprapubic	9 (25.0)
	Lateral (over iliac crest)	6 (16.7)
	Scrotal/labial	3 (8.3)
Functional impact	Daily activities affected	17 (47.2)
	Work absenteeism (current)	11 (30.6)
	Sleep disturbance	14 (38.9)
	Sexual dysfunction	4 (11.1)
Treatment sought	NSAIDs only	20 (55.6)
	Neuropathic agent (gabapentin/amitriptyline)	10 (27.8)
	Nerve block	4 (11.1)
	Surgical reintervention	0 (0.0)
	No treatment	2 (5.5)
VAS at 3 months	Mean ± SD	5.8 ± 1.9

VAS = Visual Analogue Scale; ASIS = anterior superior iliac spine.

The prevalence of inguinodynia at 3 months was 18.0% (36 of 200 patients). Among affected participants, pain was severe in 36.5%, moderate in 35.0%, and mild in 28.5%. The most frequent descriptors were stabbing (32.0%), radiating (23.5%), and burning (22.5%) — collectively 78.0%, a profile consistent with neuropathic pain(2, (Elsakka et al., 2025; . Daily activities were affected in 47.2% of those with inguinodynia, and 30.6% reported absenteeism from work.

3.3 Longitudinal VAS Trajectory (Table 4 and 5)

Table 4. Longitudinal VAS Trajectory (n = 200)

Time point	Mean VAS ± SD	Median	95% CI
Immediate postoperative	5.52 ± 1.43	5.5 (4.6–6.4)	5.32–5.72
Postoperative day 2	4.08 ± 1.27	4.1 (3.2–5.0)	3.91–4.26
Postoperative day 14	1.63 ± 1.10	1.6 (0.7–2.5)	1.48–1.78
3 months	2.04 ± 1.94	1.8 (0.0–3.6)	1.77–2.31

Repeated-measures ANOVA: F = 303.780, p < 0.001. Post-hoc Bonferroni: all within-subject contrasts significant at p < 0.05.

Comparison of immediate-postoperative VAS in patients with vs without inguinodynia at 3 months: (Table 5)

Group	n	Mean VAS ± SD	95% CI	
Inguinodynia at 3 months	36	5.81 ± 1.40	5.34–6.28	0.282
No inguinodynia	164	5.45 ± 1.43	5.23–5.67	

Mean VAS scores declined from 5.52 (immediate postoperative) to 1.63 at POD 14, then showed a modest rebound to 2.04 at 3 months. Repeated-measures ANOVA confirmed this overall change was statistically significant (,). A post-hoc pairwise comparison revealed significant declines between the immediate, day-2, and POD-14 time points, with a small but significant rise between POD 14 and 3 months (), reflecting the onset of chronic pain in the 18% subgroup. Patients who developed inguinodynia had marginally higher immediate postoperative VAS scores than those who did not (5.81 versus 5.45), although this difference did not reach statistical significance.

3.4 Risk-Factor Analysis:

Table 6. Risk Factor Analysis for Inguinodynia at 3 Months

Factor	Inguinodynia (n = 36) n (%)	Total (n = 200) n (%)	(chi-square)
Surgical technique			0.163
Open	18 (50.0)	75 (37.5)	
Lap TEP	8 (22.2)	68 (34.0)	
Lap TAPP	10 (27.8)	57 (28.5)	
Mesh type			0.036
Lightweight	18 (50.0)	100 (50.0)	
Standard polypropylene	11 (30.6)	70 (35.0)	
Composite / heavyweight	7 (19.4)	30 (15.0)	
Nerve handling			0.850
Preserved	13 (36.1)	92 (46.0)	
Divided	13 (36.1)	60 (30.0)	
Not visualized	10 (27.8)	48 (24.0)	
Analgesia protocol			0.421
Multimodal	10 (27.8)	70 (35.0)	
NSAID + opioid	9 (25.0)	60 (30.0)	
NSAID alone	11 (30.6)	50 (25.0)	
Regional + NSAID	6 (16.6)	20 (10.0)	

Mesh type was the only variable significantly associated with inguinodynia (). Surgical technique, nerve handling, and analgesia protocol did not show statistically significant associations.

4. DISCUSSION

The 18.0% prevalence of inguinodynia observed in this study aligns with the 21.4% rate reported by Prabhu et al. in an Indian tertiary-care cohort (11) and the 12.0–22.0% range observed in Coimbatore-based data(5). Together, these findings suggest chronic groin pain affects roughly one in five patients who undergo inguinal hernia repair in the Indian setting — a figure consistent with global estimates of 8–30% after open repair (2,7).

The predominantly elderly male demographic is consistent with the global epidemiological pattern documented in the 2019 Global Burden of Disease study(3): abdominal wall weakening, cumulative connective-tissue fatigue, and chronic increases in intra-abdominal pressure (heavy lifting, COPD, chronic constipation) drive peak incidence in the 6th and 7th decades.

A notable finding of this study is the lack of statistically significant difference in chronic pain rates between open (Lightweight 50% open cases) and laparoscopic (TEP/TAPP) approaches . This contrasts with some meta-analytic findings favoring laparoscopy, but aligns with the European Hernia Society guidelines, which note that the long-term advantage of laparoscopic over open repair with respect to chronic pain is modest at best (4,8). One likely explanation is that the 3-month follow-up window in this study still captures an early phase in which inflammatory and neuropathic processes triggered by either approach have not yet resolved completely; differences emerge more clearly at 12 months (6,8).

The statistically significant association between mesh type and inguinodynia deserves careful interpretation. Lightweight meshes were originally engineered to reduce fibrosis, foreign-body sensation, and chronic inflammatory stimulation (4,12). In our cohort, however, lightweight meshes were preferentially used in larger defects, bilateral, and recurrent hernias — cases inherently at higher baseline risk. The observed association may therefore reflect confounding by indication rather than a direct causal effect of mesh weight; future propensity-matched analysis is warranted.

The predominance of stabbing (32.0%) and radiating (23.5%) descriptors — totalling 55.5% — strongly suggests a neuropathic mechanism, most plausibly ilioinguinal or iliohypogastric nerve entrapment by mesh, tacks, or sutures(2,9). This is consistent with the pathogenesis described by Hakeem and by the HerniaSurge Group guidelines(1,2), and underscores that nerve-aware operative technique — careful identification, gentle handling, and judicious division when preservation risks entrapment — remains a cornerstone of prevention.

Although the difference in immediate postoperative VAS scores between patients who later developed inguinodynia (5.81) and those who did not (5.45) did not reach statistical significance in our sample , the direction of effect is consistent with prior data (8,9). Multiple reviews identify early postoperative pain as a robust predictor of chronic pain development(9,11). Robust multimodal analgesia — particularly the gabapentin-inclusive protocol used in 35.0% of our cohort — may attenuate peripheral and central sensitisation, although our subgroup analysis did not reach significance. This may reflect the smaller sample size within each analgesia stratum; larger randomised comparisons are required.

Strengths and Limitations

Strengths

- Prospective design with consecutive sampling reduces selection bias.
- Standardised, intraoperative capture of mesh type and nerve handling limits misclassification.
- Longitudinal VAS measurements across four time points permit temporal trajectory analysis.

Limitations

- Single-centre design limits generalisability.
- Three-month follow-up window may underestimate full maturation of chronic pain; longer-term evaluation at 6 and 12 months is recommended.
- Sample size for subgroup analyses (mesh type, analgesia) is modest and may be underpowered.
- Absence of a preoperative baseline VAS precludes adjusting for pre-existing pain.
- Meshes were not randomised; confounding by indication cannot be excluded.

5. CONCLUSION

Inguinodynia affects approximately 18% of patients undergoing inguinal hernioplasty at our tertiary-care centre, with intensity often clinically significant (36.5% severe) and character predominantly neuropathic. Mesh type was the only variable significantly associated with chronic pain development. Surgeons should prioritise meticulous intraoperative nerve management and judicious mesh selection to mitigate the long-term burden of chronic groin pain.

6. Declarations

Conflict Of Interest

The authors declare no conflicts of interest.

Funding

This study received no external funding.

Ethical Approval

Institutional Ethics Committee, Smt. B.K. Shah Medical Institute and Research Centre . The study complies with the Declaration of Helsinki and ICMR National Ethical Guidelines.

Informed Consent

Written informed consent was obtained from all participants preoperatively, with re-affirmation at the 3-month follow-up visit. For participants lacking literacy, consent was documented by left thumb impression in the presence of an independent witness.

Data Availability

De-identified data are available from the corresponding author upon reasonable request, subject to institutional policy.

Acknowledgements

The authors thank the operating-theatre and outpatient staff of the Department of General Surgery for assistance with data collection.

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