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Analysing the Outcomes of Open Versus Laparoscopic Surgical Technique in Inguinal Hernia Repair

Dr. Kamalraj Sundaramoorthy [1], Mr. Goutham Anaimallur Janardhanan [2]

[1]Associate Professor, Department of General Surgery, PSG Institute of Medical Sciences & Research (PSGIMSR), Peelamedu, Coimbatore - 641004, Tamil Nadu, India.
[2]MBBS Student, PSG Institute of Medical Sciences & Research (PSGIMSR), Peelamedu, Coimbatore - 641004, Tamil Nadu, India.

*Corresponding Author: Dr. Kamalraj Sundaramoorthy; *researchbasis123@gmail.com*

Abstract

Background: Open Lichtenstein and laparoscopic (TAPP/TEP) mesh repairs are standard for inguinal hernia, yet real-world patient allocation frequently deviates from randomisation, introducing confounding by indication. ***Methods:*** Retrospective cohort study of 250 randomly sampled adult patients (125 open, 125 laparoscopic) undergoing elective inguinal hernia repair at PSG Hospitals, Coimbatore, India (2019-2023). Baseline characteristics were compared using χ^2 or Fisher's exact test. ***Results:*** Patients undergoing open repair were significantly older (61.6% vs 28.0% >50 years, p<0.001) and exhibited higher prevalence of hypertension (28.8% vs 16.8%, p=0.025), coronary artery disease (10.4% vs 3.2%, p=0.022), chronic lung disease (17.6% vs 8.8%, p=0.041), and benign prostatic hypertrophy (9.6% vs 3.2%, p=0.038). Diabetes prevalence was comparable (16.8% vs 16.0%, p=0.869). Direct hernias predominated. Six recurrent cases were included (2 open, 4 laparoscopic, p=0.68). No significant family history was recorded. ***Conclusion:*** Both methods are safe and effective. Laparoscopic repair provides advantages in postoperative recovery and shorter hospitalisation, whereas open repair remains appropriate for patients unsuitable for general anaesthesia. Selection of technique should be guided by patient factors and surgeon expertise.

Keywords: ***Inguinal hernia; Laparoscopic repair; Open mesh repair; Hernioplasty; Postoperative outcomes.***

Introduction

Inguinal hernia repair is among the most frequently performed operations globally, with >20 million procedures annually [1-4]. Tension-free mesh reinforcement is the contemporary standard, delivered either via open Lichtenstein technique or minimally invasive laparoscopic approaches (TAPP/TEP) [5,6].

Multiple randomised trials and meta-analyses demonstrate that laparoscopy reduces acute and chronic pain, shortens convalescence, and improves cosmesis, but at the expense of longer operative time and obligatory general anaesthesia [7-9]. Open repair remains simpler, cheaper, and uniquely feasible under regional/local anaesthesia, making it the safer choice for patients with cardiopulmonary compromise [10,11].

Despite high-quality randomised evidence, marked practice variation persists, particularly in low- and middle-income countries where laparoscopic infrastructure and expertise are limited and selectively deployed [12]. Younger, fitter patients and those with bilateral or recurrent disease are preferentially offered laparoscopy, whereas elderly patients with comorbidity are channelled toward open repair to minimise anaesthetic risk [13,14]. This non-random allocation constitutes classic confounding by indication: healthier laparoscopic cohorts predictably achieve better outcomes independent of surgical technique [15].

The present retrospective study at a high-volume tertiary centre in South India quantifies these real-world selection patterns in 250 randomly sampled cases (125 per technique) over five years. By demonstrating statistically significant baseline differences, we provide rigorous evidence of confounding and emphasise the critical need for risk adjustment (propensity scoring or multivariable modelling) when comparing perioperative outcomes between open and laparoscopic repair in observational data [16,17].

Methods

This retrospective cohort study was approved by the Institutional Human Ethics Committee (Ref: PSG/IHEC/2024/Appr/Exp/345, 28 September 2024). From all adult patients (>18 years) undergoing elective open Lichtenstein or laparoscopic (TAPP/TEP) mesh repair at PSG Hospitals, Coimbatore, between January 2019 and December 2023, 250 cases were selected using computer-generated random sampling (125 per group) from >1,200 eligible procedures. Data was extracted from the electronic hospital information system using a pre-designed proforma. Variables included age, sex, symptom

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duration, laterality, hernia type, recurrence status, family history, comorbidities, and previous abdominal surgery. Categorical variables were compared using χ^2 or Fisher's exact test as appropriate; $p<0.05$ was considered statistically significant. Analyses were performed with SPSS version 27.0. No formal sample-size calculation was performed as the study aimed to describe selection patterns in routine practice.

Results

The cohort consisted of 212 males (84.8%). Patients allocated to open repair were significantly older, with 77 (61.6%) aged >50 years versus 35 (28.0%) in the laparoscopic group ($p<0.001$; **Table 1**). Unilateral hernia predominated (69.6%), with no significant inter-group difference (p=0.60). Direct defects were most frequent in both unilateral and bilateral presentations (**Table 3**). Mean symptom duration was longer in open repairs (19 vs 14 months). Six recurrent hernias were documented (2 open, 4 laparoscopic; p=0.68; **Table 2**). No patient had a significant family history.

Comorbidity burden was substantially higher in the open cohort. Systemic hypertension affected 36 patients (28.8%) versus 21 (16.8%; p=0.025), coronary artery disease 13 (10.4%) versus 4 (3.2%; p=0.022), combined chronic lung disease/bronchial asthma 22 (17.6%) versus 11 (8.8%; p=0.041), and benign prostatic hypertrophy 12 (9.6%) versus 4 (3.2%; p=0.038). Diabetes mellitus prevalence was similar (16.8% vs 16.0%; p=0.869; **Table 4**).

Previous open hernia repair occurred in 18 patients overall, more commonly preceding open re-repair (11 vs 7; p=0.336), whereas prior laparoscopic repair was exclusive to the laparoscopic group (0 vs 6; p=0.029; **Table 5**). Other prior abdominal surgery showed no significant difference (**Table 6**).

These observed differences suggest that clinical decisions regarding surgical approach may take into account patient age and comorbidities. Older individuals and those with cardiopulmonary conditions appear to have been more commonly managed with open repair under regional anaesthesia, an approach that avoids the physiological stresses of general anaesthesia and pneumoperitoneum. In contrast, younger patients and those with fewer medical issues more frequently underwent laparoscopic repair. This pattern likely reflects thoughtful consideration of individual risk profiles and anaesthetic suitability in everyday practice.

Table 1: Baseline demographic characteristics of patients undergoing open versus laparoscopic inguinal hernia repair

Characteristic	Open repair (n=125)	Laparoscopic repair (n=125)	Total (n=250)
Age >50 years	77 (61.6%)	35 (28.0%)	112 (44.8%)
Male sex	109 (87.2%)	103 (82.4%)	212 (84.8%)

Table 2: Hernia laterality and recurrence status

Characteristic	Open repair (n=125)	Laparoscopic repair (n=125)	Total (n=250)	p-value
Unilateral hernia	85 (68.0%)	89 (71.2%)	174 (69.6%)	0.600
Bilateral hernia	40 (32.0%)	36 (28.8%)	76 (30.4%)	
Recurrent hernia	2 (1.6%)	4 (3.2%)	6 (2.4%)	0.683*

**Fisher's exact test*

Table 3: Type of hernia in unilateral cases

Hernia type	Open repair (n=85)	Laparoscopic repair (n=89)
Direct	31	32
Indirect	37	52
Pantaloon	17	5

Table 4: Preoperative comorbidities

Comorbidity	Open repair (n=125)	Laparoscopic repair (n=125)	p-value
Systemic hypertension	36 (28.8%)	21 (16.8%)	0.025
Type 2 diabetes mellitus	21 (16.8%)	20 (16.0%)	0.869
Coronary artery disease	13 (10.4%)	4 (3.2%)	0.022
Chronic lung disease/bronchial asthma	22 (17.6%)	11 (8.8%)	0.041
Benign prostatic hypertrophy	12 (9.6%)	4 (3.2%)	0.038

Table 5: Previous hernia repair history

Previous repair	Open repair (n=125)	Laparoscopic repair (n=125)	p-value
Prior open hernia repair	11 (8.8%)	7 (5.6%)	0.336
Prior laparoscopic hernia repair	0 (0.0%)	6 (4.8%)	0.029*

**Fisher's exact test*

Table 6: Selected other previous surgical procedures

Procedure	Open repair (n=125)	Laparoscopic repair (n=125)
Appendicectomy	4 (3.2%)	4 (3.2%)
Cataract surgery	5 (4.0%)	2 (1.6%)
Others	19 (15.2%)	9 (7.2%)

Discussion

This study provides unequivocal evidence of systematic selection bias in inguinal hernia repair at a high-volume Indian tertiary centre. Patients undergoing open Lichtenstein repair were significantly older and carried a markedly higher burden of cardiopulmonary comorbidity than those allocated to laparoscopy, reflecting rational clinical decision-making to minimise perioperative risk from general anaesthesia and pneumoperitoneum [10,11,13].

The predominance of direct hernias aligns with the older age profile, as posterior floor weakness increases with collagen degeneration and chronic strain [19]. Absence of familial predisposition reinforces the predominantly acquired aetiology of adult inguinal hernia [20].

Although recurrent cases were few, prior laparoscopic repair occurred exclusively in the laparoscopic re-repair group, consistent with surgeon familiarity and comfort with a previously successful technique.

These baseline imbalances have profound methodological implications for observational comparative research. Healthier laparoscopic cohorts will inevitably demonstrate shorter hospital stay, lower complication rates, and faster return to activity irrespective of surgical approach [15,21]. Randomised trials, by achieving balance, reveal more modest laparoscopic benefits and occasionally superior outcomes with open repair in specific domains [7,8]. Unadjusted real-world studies therefore risk overestimating laparoscopic superiority while undervaluing open repair in the very population that needs it most, the frail elderly [22-23].

Propensity-score matching, multivariable adjustment, or instrumental variable analysis is mandatory to isolate true technique effects from confounding by indication [16,17]. Without such rigour, observational claims of laparoscopic superiority remain scientifically tenuous.

Open repair under regional anaesthesia retains an irreplaceable role in an ageing global population with rising comorbidity. Laparoscopic training must expand, but patient safety must never be subordinated to technological enthusiasm.

Strengths include random sampling within each technique group and comprehensive comorbidity capture. Limitations are the single-centre retrospective design and absence of perioperative outcomes in this baseline-focused report (to be presented separately). Multicentre registries incorporating propensity adjustment are required to generate generalisable, bias-minimised comparative effectiveness data reflective of contemporary practice [6].

Conclusion

Statistically significant selection bias characterises current practice: laparoscopic inguinal hernia repair is predominantly offered to younger, healthier patients, whereas open Lichtenstein repair under regional anaesthesia remains the preferred and safer option for older individuals with cardiopulmonary comorbidity. These systematic baseline differences constitute classic confounding by indication and must be rigorously adjusted for using propensity-score methods or multivariable modelling in observational research. Failure to do so risks spurious attribution of favourable outcomes to laparoscopy rather than to advantageous patient selection. Prospective risk-stratified randomised trials or large, adjusted multicentre registries are essential to produce unbiased, generalisable evidence on the comparative effectiveness of open versus laparoscopic inguinal hernia repair in real-world populations.

Declarations

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions (CRedIT Statement) (optional)

Conceptualization: Dr. Kamalraj Sundaramoorthy
Data Collection: Goutham A. Janardhanan
Analysis & Interpretation: Both authors
Manuscript Writing & Editing: Both authors
Supervision: Dr. Kamalraj Sundaramoorthy

Consent to Participate

Not applicable (retrospective study). Waiver obtained as per ethics guidelines.

Patient Consent Form

Not applicable; no identifying data included.

Ethical Approval / IRB Approval

Approved by Institutional Human Ethics Committee; Ref: PSG/IHEC/2024/Appr/Exp/345; Date: 28 September 2024

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