

Local versus general anaesthesia for open inguinal hernia repair: a retrospective cohort study of postoperative complications and patient-reported outcomes

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ABSTRACT

Aim To compare outcomes of elective open inguinal hernia repair under local anaesthesia (LA) and general anaesthesia (GA).

Methods This retrospective cohort included 833 adults treated in Tuzla during 2017–2025. The primary outcome was any early adverse outcome within 30 days. Secondary outcomes included analgesic requirement, chronic groin pain, discomfort, dissatisfaction, and recurrence. Logistic regression adjusted for age, American Society of Anesthesiologists physical status, hernia characteristics, and technique. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported; Benjamini-Hochberg correction was applied to secondary outcomes.

Results The LA group included 425 patients and the GA group 408. Postoperative analgesia was required in 338 (79.5%) and 110 (27.0%) patients, respectively ($p < 0.001$). An early adverse outcome occurred in 79 (18.6%) and 35 (8.6%) patients (aOR 2.08, 95% CI 1.31–3.30; $p = 0.002$), mainly because of more haematomas with LA, 54 (12.7%) versus 20 (4.9%) ($p < 0.001$). Chronic groin pain did not differ after adjustment (aOR 1.26, 95% CI 0.81–1.96; $p = 0.310$). Dissatisfaction was higher with LA, 85 (20.8%) versus 40 (10.1%) (aOR 1.95, 95% CI 1.27–2.99; $p = 0.002$). Eight recurrences were recorded. Median follow-up was 14 months (interquartile range 12–18 months).

Conclusion LA was associated with more early adverse outcomes and dissatisfaction than GA. Chronic pain did not differ after adjustment, and recurrence was similar. Selection bias and residual confounding should be considered.

Keywords: anaesthesia, hernia, inguinal, patient satisfaction, postoperative complications

INTRODUCTION

Inguinal hernia repair is one of the most frequently performed surgical procedures worldwide, with more than 20 million operations performed annually (1). Open mesh repair remains widely used, particularly where minimally invasive resources are limited or an anterior approach is clinically preferred. Because most procedures are elective and increasingly organised within ambulatory pathways, the choice of anaesthesia can influ-

ence perioperative efficiency, recovery, and the overall patient experience.

Local anaesthesia (LA) avoids airway instrumentation and may shorten operative and recovery times, reduce resource use, and lower the risk of urinary retention compared with general anaesthesia (GA). However, findings for postoperative pain, early complications, and patient satisfaction are inconsistent across observational studies, randomised trials, and meta-analyses (2–5). Updated international guidelines therefore recognise LA as a valid option for open inguinal hernia repair when appropriate expertise, patient selection, and perioperative support are available (1).

Beyond conventional surgical outcomes, anaesthetic selection may affect intraoperative comfort, postoperative analgesic

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requirements, chronic groin symptoms, and satisfaction. These outcomes are sensitive to local practice, including case selection, infiltration technique, surgeon experience, and postoperative care. A single-centre study of emergency hernia surgery showed that operative activity and outcomes varied with service conditions, illustrating the context-dependent nature of hernia care (6). However, comparative data on LA and GA for elective open inguinal hernia repair in Bosnia and Herzegovina remain limited.

The aim of this study was to compare early and long-term outcomes of elective open inguinal hernia repair under LA and GA at the University Clinical Centre Tuzla.

MATERIAL AND METHODS

Patients and study design

This retrospective cohort study included all consecutive adults who underwent elective open inguinal hernia repair at the University Clinical Centre Tuzla between January 2017 and May 2025. Patients were identified from the institutional surgical database.

Eligible patients were aged 18 years or older and underwent repair of a primary or recurrent unilateral or bilateral inguinal hernia, with a minimum planned follow-up of 12 months. Exclusion criteria were emergency surgery for an incarcerated or strangulated hernia, femoral hernia, contraindication to LA, previous mesh infection at the same site, recurrent hernia after repair at another institution, and body mass index greater than 40 kg/m².

Methods

Patients received a standardised explanation of LA and GA during outpatient consultation. Anaesthetic technique was selected through shared decision-making based on patient preference, American Society of Anesthesiologists (ASA) physical status, and surgeon judgement; no formal allocation protocol was used.

For LA, a buffered mixture of 20 mL 2% lidocaine with adrenaline 1:200,000, 30 mL 0.5% bupivacaine with adrenaline 1:200,000, 50 mL 0.9% sodium chloride solution, and 2 mL 8.4% sodium bicarbonate was prepared immediately before step-wise field-block infiltration by the operating surgeon (7,8). Patients with ASA physical status 1–2 were monitored using pulse oximetry without routine anaesthesiologist involvement. Patients with ASA physical status 3–4 undergoing LA and all patients receiving GA were managed by a consultant anaesthesiologist. Three patients initially treated under LA required intraoperative conversion to GA because of inadequate anaesthesia or anxiety.

All repairs used an open anterior approach with synthetic macroporous polypropylene mesh. Lichtenstein tension-free repair was the predominant technique (9,10). The Prolene Hernia System (PHS; Ethicon, Inc.) or a mesh plug was used selectively for large defects or wide internal rings.

The primary outcome was any early postoperative adverse outcome within 30 days. Recorded events were wound haematoma, surgical site infection, urinary retention requiring bladder catheterisation, early recurrence, and readmission. Secondary outcomes were postoperative analgesic requirement beyond routine paracetamol within 24h, chronic groin pain persisting for at least three months, groin discomfort, patient dissatisfaction, and recurrence during follow-up.

Chronic pain severity was recorded as very mild, mild, severe, or very severe. Groin discomfort included pain, numbness, stabbing pain, or burning. Satisfaction was recorded on a three-point scale; satisfied and very satisfied responses were combined for analysis.

Follow-up was conducted through outpatient review and telephone interview at a minimum of 12 months after surgery. Long-term outcome data were available for 408 of 425 LA patients and 395 of 408 GA patients. Median follow-up was 14 months (interquartile range 12–18 months).

Statistical analysis

Statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA) and R version 4.3.3 (R Foundation for Statistical Computing, Vienna, Austria). Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. Continuous variables were presented as medians and ranges and compared using the Mann-Whitney U test. Multivariable logistic regression evaluated three pre-specified outcomes: any early postoperative adverse outcome, chronic groin pain, and patient dissatisfaction. Models included anaesthesia group, age, ASA physical status 1–2 versus 3–4, hernia type, hernia origin, and operative technique. Results are reported as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). The primary outcome was assessed using a two-sided $p < 0.05$. The Benjamini-Hochberg false discovery rate (FDR) correction was applied to secondary comparisons, with an FDR-adjusted $p < 0.05$ considered statistically significant.

RESULTS

Table 1. Baseline characteristics according to anaesthesia group

Variable	LA (N = 425)	GA (N = 408)	<i>p</i>
	N (%)		
Sex			
Male	369 (86.8)	380 (93.1)	0.004
Female	56 (13.2)	28 (6.9)	
Hernia type			
Indirect	278 (65.4)	293 (71.8)	0.126
Direct	128 (30.1)	98 (24.0)	
Bilateral	19 (4.5)	17 (4.2)	
ASA physical status			
1	128 (30.1)	249 (61.0)	<0.001
2	153 (36.0)	112 (27.5)	
3	121 (28.5)	38 (9.3)	
4	23 (5.4)	9 (2.2)	
Hernia origin			
Primary	390 (91.8)	373 (91.4)	0.957
Recurrent	35 (8.2)	35 (8.6)	
Operative technique			
Lichtenstein	358 (84.2)	371 (90.9)	0.014
PHS	50 (11.8)	28 (6.9)	
Mesh plug	17 (4.0)	9 (2.2)	

ASA, American Society of Anaesthesiologists; GA, general anaesthesia; LA, local anaesthesia; PHS, Prolene Hernia System.

A total of 833 patients were included: 425 (51.0%) in the LA group and 408 (49.0%) in the GA group. Overall, 749 (89.9%) were male, and the median age was 60 years (range 19–80 years). Sex distribution differed between groups ($p = 0.004$), whereas

Table 2. Early postoperative outcomes according to anaesthesia group

Outcome	LA (N = 425)	GA (N = 408)	p
	N (%)		
Postoperative analgesia requirements	338 (79.5)	110 (27.0)	< 0.001
Any early postoperative adverse outcome	79 (18.6)	35 (8.6)	< 0.001
Haematoma	54 (12.7)	20 (4.9)	< 0.001
Urinary retentions	6 (1.4)	5 (1.2)	1.000
Wound infection	7 (1.6)	4 (1.0)	0.547
Early recurrence	4 (0.9)	4 (1.0)	1.000
Readmission within 30 days	8 (1.9)	2 (0.5)	0.108

GA, general anaesthesia; LA, local anaesthesia. Urinary retention was defined as inability to void spontaneously requiring bladder catheterisation.

Table 3. Early postoperative outcomes according to operative technique and anaesthesia group

Outcome	Lichtenstein		PHS		Mesh plug	
	LA	GA	LA	GA	LA	GA
	(N = 358)	(N = 371)	(N = 50)	(N = 28)	(N = 17)	(N = 9)
	N (%)					
Any early adverse outcome	60 (16.8)	15 (4.0)	10 (20.0)	15 (53.6)	9 (52.9)	5 (55.6)
Haematoma	40 (11.2)	10 (2.7)	8 (16.0)	8 (28.6)	6 (35.3)	2 (22.2)
Urinary retentions	5 (1.4)	2 (0.5)	1 (2.0)	3 (10.7)	0 (0.0)	0 (0.0)
Wound infection	5 (1.4)	1 (0.3)	1 (2.0)	1 (3.6)	1 (5.9)	2 (22.2)
Early recurrence	3 (0.8)	2 (0.5)	0 (0.0)	1 (3.6)	1 (5.9)	1 (11.1)
Readmission	7 (2.0)	0 (0.0)	0 (0.0)	2 (7.1)	1 (5.9)	0 (0.0)

GA, general anaesthesia; LA, local anaesthesia; PHS, Prolene Hernia System.

Table 4. Long-term outcomes among patients with available follow-up according to anaesthesia group

Outcome	LA (N = 408)	GA (N = 395)	<i>p</i>	FDR- <i>p</i>
	N (%)			
Patient dissatisfaction	85 (20.8)	40 (10.1)	<0.001	<0.001
Chronic groin pain	61 (15.0)	42 (10.6)	0.073	0.110
Pain severity among patients with chronic pain				
Very mild	23 (37.7)	18 (42.9)	0.695	0.695
Mild	27 (44.3)	13 (31.0)	0.134	0.201
Severe	7 (11.5)	11 (26.2)	0.063	0.126
Very severe	4 (6.6)	0 (0.0)	0.139	0.208
Groin discomfort	77 (18.9)	62 (15.7)	0.263	0.263
Type of discomfort among affected patients				
Pain	25 (32.5)	28 (45.2)	0.165	0.248
Numbness	28 (36.4)	17 (27.4)	0.323	0.323
Stabbing pain	12 (15.6)	10 (16.1)	1.000	1.000
Burning	12 (15.6)	7 (11.3)	0.617	0.617
Recurrence	4 (1.0)	4 (1.0)	1.000	1.000

FDR-p values were calculated using the Benjamini–Hochberg procedure. FDR, false discovery rate; GA, general anaesthesia; LA, local anaesthesia.

hernia type ($p = 0.126$) and hernia origin ($p = 0.957$) did not. ASA physical status was higher in the LA group ($p < 0.001$) (Table 1).

Lichtenstein repair was performed in 729 (87.5%) patients, PHS repair in 78 (9.4%), and mesh-plug repair in 26 (3.1%). Operative-technique distribution differed between groups ($p = 0.014$) (Table 1). Three patients in the LA group required conversion to GA because of intraoperative anxiety or inadequate anaesthesia.

Postoperative analgesia beyond routine paracetamol was required in 338 (79.5%) LA and 110 (27.0%) GA patients ($p < 0.001$). An early postoperative adverse outcome occurred in 79 (18.6%) and 35 (8.6%) patients, respectively ($p < 0.001$).

Haematoma was more frequent with LA, 54 (12.7%) versus 20 (4.9%) ($p < 0.001$), whereas urinary retention, wound infection, early recurrence, and readmission did not differ significantly (Table 2).

Across operative techniques, the proportion of patients with an early adverse outcome was 16.8% with Lichtenstein repair under LA and 4.0% under GA. Higher proportions were observed in the smaller PHS and mesh-plug subgroups (Table 3).

Patient dissatisfaction occurred in 85 (20.8%) LA and 40 (10.1%) GA patients ($p < 0.001$; FDR-adjusted $p < 0.001$). Chronic groin pain was reported by 61 (15.0%) and 42 (10.6%) patients, respectively ($p = 0.073$; FDR-adjusted $p = 0.110$). Most patients with chronic pain described it as very mild or mild.

Table 5. Multivariable logistic regression of prespecified outcomes

Outcome	aOR (LA vs. GA)	95% CI	p	FDR-p
Any early postoperative adverse outcome	2.08	1.31–3.30	0.002	—
Chronic groin pain	1.26	0.81–1.96	0.310	0.310
Patient dissatisfaction	1.95	1.27–2.99	0.002	0.004

Models were adjusted for age, ASA physical status, hernia type, hernia origin, and operative technique.

aOR, adjusted odds ratio; ASA, American Society of Anaesthesiologists; CI, confidence interval; FDR, false discovery rate; GA, general anaesthesia; LA, local anaesthesia.

Groin discomfort occurred in 77 (18.9%) LA and 62 (15.7%) GA patients ($p = 0.263$; FDR-adjusted $p = 0.263$). Eight recurrences were recorded, four in each group (1.0% in both groups; $p = 1.000$) (Table 4).

After multivariable adjustment, LA remained associated with an early postoperative adverse outcome (aOR 2.08, 95% CI 1.31–3.30; $p = 0.002$) and patient dissatisfaction (aOR 1.95, 95% CI 1.27–2.99; $p = 0.002$; FDR-adjusted $p = 0.004$). The association with chronic groin pain was not statistically significant (aOR 1.26, 95% CI 0.81–1.96; $p = 0.310$; FDR-adjusted $p = 0.310$) (Table 5).

DISCUSSION

In this retrospective cohort, LA was associated with a higher frequency of early postoperative adverse outcomes and patient dissatisfaction after adjustment for measured confounders. Chronic groin pain and recurrence did not differ significantly between anaesthesia groups.

The substantially greater postoperative analgesic requirement in the LA group contrasts with several trials and meta-analyses reporting favourable early recovery and analgesic outcomes with LA (2–4,11–14). This difference may reflect variation in infiltration technique, adjunct medication, postoperative analgesic protocols, patient selection, or institutional practice rather than an inherent limitation of LA alone. A randomised study of laparoscopic abdominal surgery also showed that postoperative pain intensity varied according to the analgesic regimen, supporting the use of standardised multimodal protocols when anaesthetic strategies are compared (15). In the present cohort, the recorded requirement for analgesia should therefore be interpreted as an outcome of the complete perioperative pathway rather than of the anaesthetic technique in isolation.

Urinary retention was uncommon and did not differ between groups. Previous evidence generally reports lower urinary retention after LA than after regional or general anaesthesia, although patient age, previous urinary symptoms, operative duration, and perioperative catheterisation also influence the risk (3–5,16).

Haematoma accounted for much of the difference in early outcomes. Potential explanations include variation in surgical complexity, operative technique, and haemostasis after infiltration with an adrenaline-containing solution. Local vasoconstriction may also delay recognition of minor bleeding until the intraoperative effect of adrenaline subsides, although this mechanism was not evaluated. Data on anticoagulant use, operative duration, defect size, and surgeon experience were unavailable; therefore, the observed association should be regarded as hypothesis-generating. LA remained associated with the composite outcome after adjustment, but residual confounding and selection bias cannot be excluded.

The chronic groin pain rates were within the range reported in systematic reviews (17,18). The absence of a significant adjusted association suggests that anaesthetic technique alone may

not be a major determinant of chronic pain. Established contributors include preoperative pain, severe early postoperative pain, recurrent repair, postoperative complications, and nerve-related factors.

Patient dissatisfaction remained more frequent after LA. Intraoperative awareness of manipulation, discomfort during infiltration, anxiety, and postoperative pain may contribute, although these factors were not measured. Because satisfaction was assessed using a simple three-point scale, it likely reflected the combined intraoperative and postoperative experience rather than anaesthesia alone. Previous randomised studies have generally reported acceptable satisfaction with LA when patient preparation, communication, and perioperative analgesia are standardised (13,14).

Recurrence was uncommon in both groups. This finding is consistent with evidence that technical factors and operative expertise are more important determinants of recurrence than anaesthetic technique alone (9,10,19). The higher adverse-outcome proportions in the PHS and mesh-plug subgroups should be interpreted cautiously because of small sample sizes and possible case-selection effects.

This study has several limitations. Its retrospective, non-randomised design and shared decision-making for anaesthetic selection introduce confounding by indication. Residual confounding from surgeon experience, patient anxiety, prostate disease, medication use, and operative complexity is possible. Some patients lacked long-term follow-up, and the questionnaire used for chronic pain was not externally validated. The single-centre setting may also limit generalisability.

CONCLUSION

In this retrospective single-centre cohort, LA was associated with more early postoperative adverse outcomes and greater patient dissatisfaction than GA. Chronic groin pain did not differ after adjustment, and recurrence was similar between groups. Because anaesthetic technique was not randomly allocated, these findings should be interpreted cautiously and confirmed in prospective controlled studies.

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CONFLICTS OF INTEREST

None to declare.

ETHICS STATEMENT

This retrospective study was conducted in accordance with the Declaration of Helsinki. Patient data were anonymised prior to analysis. Formal ethics committee approval was obtained from the Ethics Committee of the University Clinical Centre Tuzla (Approval No. 02-09/2-87-2/26, issued on 29 January 2026).

DATA AVAILABILITY STATEMENT

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS (CRediT)

Conceptualization: A.T., K.L.; **Data curation:** A.T., N.L.; **Formal analysis:** A.T., N.L.; **Investigation:** A.T., K.L.; **Methodology:** A.T., K.L.; **Project administration:** K.L.; **Resources:** K.L.; **Software:** A.T.; **Supervision:** K.L.; **Validation:** K.L.; **Visualization:** A.T.; **Writing – original draft:** A.T.; **Writing – review & editing:** K.L., E.B., M.B., N.L., J.M., B.H. All authors have read and agreed to the published version of the manuscript.

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