Original Article

Access this article online

Quick Response Code:



Website: www.herniasurgeryjournal.org

DOI: 10.4103/ijawhs.ijawhs_63_26

Effect of chronic diseases on perioperative events among patients undergoing inguinal hernia surgery in a tertiary-care hospital

Omeshwar Subramanian, Vikas C. Kawarat, Shanmugam Vijayalakshmi, Kazzali Ahmed, Ethirajulu Gowtham

Abstract

BACKGROUND: Inguinal hernia repair is a common elective surgical procedure. With the increasing burden of noncommunicable diseases, many patients undergoing hernia surgery have chronic illnesses that may influence perioperative stability and recovery. Evidence regarding perioperative events in this group remains limited, especially in resource-constrained settings.

MATERIALS AND METHODS: This hospital-based prospective observational cohort study included 65 adult patients undergoing elective inguinal hernia surgery in a tertiary-care hospital. Patients were categorized into two groups based on the presence or absence of chronic diseases. Demographic, clinical, surgical, and anesthetic details were collected prospectively using a structured questionnaire. Perioperative events, including intraoperative complications and immediate postoperative outcomes, were recorded using predefined clinical criteria and analyzed using descriptive statistics and multivariable logistic regression.

RESULTS: Patients with chronic diseases showed a trend toward a higher frequency of intraoperative events, including bleeding, anesthesia-related events, hemodynamic instability, and cardiopulmonary events; however, most individual comparisons were not statistically significant. The presence of any chronic disease showed increased odds of intraoperative complications, but this association did not reach statistical significance (adjusted odds ratio: 2.62; 95% confidence interval: 0.94–7.32; $P = 0.06$). Patients with chronic illnesses had a significantly longer postoperative hospital stay.

CONCLUSION: Preexisting chronic diseases may be associated with a higher frequency of perioperative events and prolonged postoperative hospital stay among patients undergoing elective inguinal hernia repair. However, these findings should be interpreted cautiously due to the limited sample size and nonsignificant results for most individual outcomes. Careful preoperative assessment, optimization of comorbidities, and close intraoperative monitoring may improve perioperative care.

Keywords:

Anesthesia-related events, chronic diseases, inguinal hernia surgery, intraoperative complications, perioperative events, prospective observational cohort study

Department of General Surgery, Institute of General Surgery, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai, Tamil Nadu, India

Address for correspondence:
Dr. Omeshwar Subramanian, Department of General Surgery, Institute of General Surgery, Rajiv Gandhi Government General Hospital, Madras Medical College, Chennai 600003, Tamil Nadu, India.
E-mail: omeshdoctor@gmail.com

Submitted: 01-Jun-2026
Revised: 04-Jul-2026
Accepted: 22-Jul-2026
Published: XX-XX-XXXX

Introduction

Inguinal hernia repair remains one of the most frequently performed elective surgical procedures worldwide, accounting for more than 20 million repairs annually across all age groups.[1] Despite the availability of advanced mesh-based and laparoscopic techniques, intraoperative and perioperative complications continue to occur and may be influenced not only by surgical expertise and procedural factors but also by the patient's comorbidity status.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License (CC BY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Subramanian O, Kawarat VC, Vijayalakshmi S, Ahmed K, Gowtham E. Effect of chronic diseases on perioperative events among patients undergoing inguinal hernia surgery in a tertiary-care hospital. Int J Abdom Wall Hernia Surg 2026;9:135-41.

The rising prevalence of noncommunicable diseases (NCDs) such as diabetes, hypertension, ischemic heart disease (IHD), chronic kidney disease (CKD), and chronic obstructive pulmonary disease (COPD)[2] has significantly altered the clinical profile of patients presenting for elective hernia surgery, particularly in developing countries.[3]

Chronic diseases have a multifactorial impact on surgical outcomes through mechanisms such as impaired tissue healing, altered cardiopulmonary physiology, and metabolic instability during anesthesia.[4] Studies have shown that patients with preexisting comorbidities are at a higher risk of intraoperative complications such as bleeding, hemodynamic instability, and anesthesia-related events, as well as delayed postoperative recovery.[5] Also, the majority of individuals with NCDs prefer private healthcare despite low insurance coverage, indicating delayed, fragmented, or non-optimized chronic disease management in rural settings.[6] These risks are further amplified in resource-limited settings where preoperative optimization and multidisciplinary perioperative management may not always be feasible.

While substantial research has addressed postoperative outcomes in hernia repair, relatively few studies have specifically examined intraoperative events—the immediate and potentially preventable complications that can influence both surgical safety and prognosis .[7] A recent comparative study by Shaf *et al.*[7] demonstrated that comorbid conditions, particularly COPD, significantly increased intraoperative risks such as bleeding, anesthesia-related complications, and cardiopulmonary events among patients undergoing inguinal hernia repair. However, data from Indian tertiary-care centers remain scarce, and localized studies are essential to understand the magnitude and pattern of these risks in diverse healthcare environments.

Given the increasing burden of chronic diseases and the need for individualized perioperative care, this study was undertaken to evaluate the effect of preexisting chronic diseases including diabetes mellitus, hypertension, IHD, CKD, and COPD on the occurrence and pattern of intraoperative events among patients undergoing elective inguinal hernia surgery in a tertiary-care hospital. Secondary objectives were to compare intraoperative complication profiles between patients with and without chronic conditions, and to improve perioperative risk stratification and surgical planning.

Materials and Methods

A hospital-based prospective observational cohort study was conducted at the Institute of General Surgery of a tertiary-care teaching hospital in Tamil Nadu, India, from March to May 2025. Adult patients diagnosed with inguinal hernia and scheduled for elective surgical repair were included. Patients were categorized into two groups based on the exposure status: those with preexisting chronic diseases and those without chronic illness. Chronic disease was defined as documented diabetes mellitus, hypertension, IHD, CKD, COPD, or the presence of more than one comorbidity. Individual comorbidities were recorded separately; however, the primary comparison was between patients with and without any chronic disease because of the limited sample size.

The sample size was calculated based on the available prevalence of inguinal hernia in a tertiary-care setting as limited prior regional data were available regarding the expected difference in perioperative event rates between the two groups. Assuming a prevalence of 8.22%,[8] a 95% confidence level, and an absolute precision of 7%, the minimum sample size was estimated to be 59. After adjusting for a 10% non-response rate, the final sample size was fixed at 65 participants. Consecutive sampling was used until the required sample size was reached. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethics Committee of Madras Medical College, Chennai, approval number: IEC-MMC/Approval/36012025, dated January 28, 2025. Written informed consent was obtained from all participants.

Data were collected prospectively using a structured, pretested questionnaire adapted from Shaf *et al.*[7] and modified for the local clinical setting. Demographic details, comorbidities, type of hernia, type of surgery, anesthetic technique, intraoperative events, and immediate postoperative outcomes were recorded. Perioperative events were recorded using predefined clinical criteria. Intraoperative events included bleeding, anesthesia-related events, hemodynamic instability, cardiac events, pulmonary events, visceral injury, and other complications. Bleeding was defined as blood loss > 500 mL or the need for transfusion. Hemodynamic instability included hypotension, hypertension, tachycardia, or bradycardia, requiring intervention. Anesthesia-related events included airway difficulty, drug reaction, conversion of anesthetic technique, or delayed recovery. Immediate postoperative outcomes included pain within 24 h, wound infection, hematoma/seroma, hospital stay, and delayed recovery. The outcomes were limited to the index hospital stay; 30-day outcomes were not assessed.

Data were entered in Microsoft Excel and analyzed using IBM Statistical Package for the Social Sciences Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean and standard

deviation and categorical variables as frequency and percentage. The independent-sample *t* test, chi-square test, or Fisher's exact test was used as appropriate. Multivariable logistic regression was performed to assess the predictors of intraoperative complications. A *P* value < 0.05 was considered statistically significant.

Results

A total of 65 patients undergoing elective inguinal hernia surgery were included in the study, of whom 28 (43.1%) had one or more chronic diseases and 37 (56.9%) had no chronic illness. Baseline demographic, clinical, surgical, and anesthesia characteristics are presented in Table 1. The mean age of patients with chronic diseases was significantly higher than that of patients without chronic illness (62.4 ± 10.2 years vs. 48.7 ± 11.5 years; $P < 0.001$). The majority of participants were male (90.8%), with a similar sex distribution between the two groups. The mean body mass index was also comparable between groups. American Society of Anesthesiologists (ASA) grading differed significantly, with a higher proportion of patients with chronic diseases classified as ASA II and ASA III, while nearly half of those without chronic illness were classified as ASA I ($P = 0.002$). Smoking and alcohol use were more common among patients with chronic diseases, although these differences were not statistically significant.

Indirect inguinal hernia was the most common type in both groups, followed by direct and recurrent hernias, with no significant association between hernia type and chronic disease status. Open mesh repair was the predominant surgical approach in both groups. Spinal anesthesia was the most frequently used anesthetic technique, followed by general and epidural anesthesia. The mean duration of surgery was slightly longer among patients with chronic diseases, but the difference did not achieve statistical significance.

The distribution of specific comorbidities among patients with chronic diseases is shown in Figure 1. Hypertension was the most common comorbidity, followed by diabetes mellitus. Multiple coexisting conditions were observed in seven patients, while IHD, COPD, CKD, and other comorbidities were less frequent.

As shown in Table 2, intraoperative events were more frequent among patients with chronic diseases compared with those without chronic illness. Bleeding, defined as blood loss > 500 mL or requirement for transfusion, occurred in 14.3% of patients with chronic diseases compared with 5.4% of those without chronic illness. Anesthesia-related events, hemodynamic instability, cardiac events, and pulmonary events were also more frequent in the chronic disease group. However, these differences did not achieve statistical significance. A

Table 1: Baseline demographic, clinical, surgical, and anesthesia characteristics of study participants (*n* = 65)

Variable	With chronic disease (*n* = 28)	Without chronic disease (*n* = 37)	Total (*n* = 65)	*P* value
Age (year), mean ± SD	62.4 ± 10.2	48.7 ± 11.5	54.5 ± 13.2	< 0.001*
Sex, *n* (%)				
Male	25 (89.3%)	34 (91.9%)	59 (90.8%)	0.72
Female	3 (10.7%)	3 (8.1%)	6 (9.2%)	
BMI (kg/m^2), mean ± SD	25.8 ± 3.9	24.9 ± 3.4	25.3 ± 3.6	0.31
ASA status, *n* (%)				
I	4 (14.3%)	18 (48.6%)	22 (33.8%)	0.002*
II	18 (64.3%)	14 (37.8%)	32 (49.2%)	
III	6 (21.4%)	5 (13.5%)	11 (16.9%)	
Smoking, *n* (%)	11 (39.3%)	10 (27.0%)	21 (32.3%)	0.28
Alcohol use, *n* (%)	13 (46.4%)	12 (32.4%)	25 (38.5%)	0.25
Type of hernia, *n* (%)				
Direct	8 (28.6%)	9 (24.3%)	17 (26.1%)	0.83
Indirect	17 (60.7%)	23 (62.2%)	40 (61.5%)	
Recurrent	3 (10.7%)	5 (13.5%)	8 (12.3%)	
Type of surgery, *n* (%)				
Open mesh repair	22 (78.6%)	26 (70.3%)	48 (73.8%)	0.44
Laparoscopic repair	6 (21.4%)	11 (29.7%)	17 (26.2%)	
Type of anesthesia, *n* (%)				
Spinal	20 (71.4%)	25 (67.6%)	45 (69.2%)	0.79
Epidural	2 (7.1%)	3 (8.1%)	5 (7.7%)	
General anesthesia	6 (21.4%)	9 (24.3%)	15 (23.1%)	
Duration of surgery (min), mean ± SD	69.3 ± 14.5	63.7 ± 12.8	66.1 ± 13.7	0.08

ASA = American Society of Anesthesiologists; BMI = body mass index.
P values were calculated using an independent-sample *t* test for continuous variables and chi-square or Fisher's exact test for categorical variables.
*$P < 0.05$ was considered statistically significant

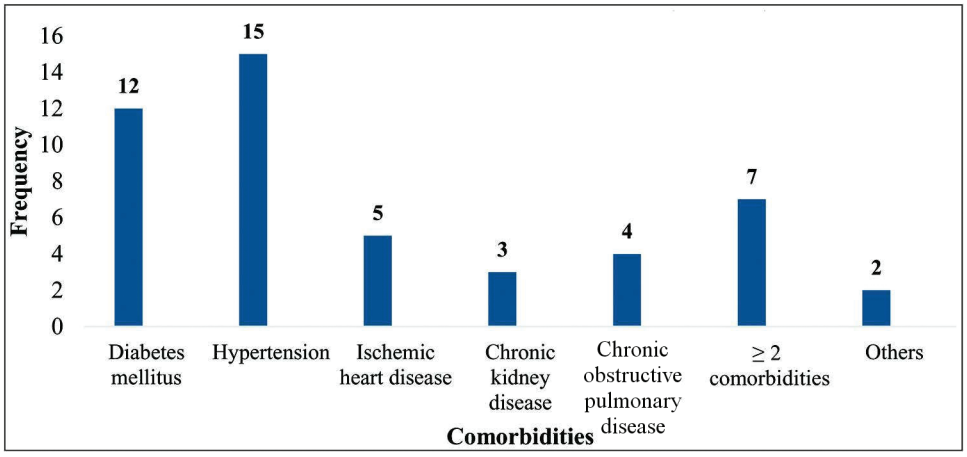


Figure 1: Hypertension was the most common chronic disease, followed by diabetes mellitus. Bars represent the number and percentage of patients among those with chronic diseases. Multiple comorbidities indicate the presence of two or more chronic conditions

Table 2: Intraoperative and immediate postoperative outcomes of participants (*n* = 65)

Complication	With chronic disease (*n* = 28)	Without chronic disease (*n* = 37)	Total (*n* = 65)	*P* value	OR (95% CI)
A. Intraoperative complications					
Bleeding (> 500 mL or transfusion)	4 (14.3%)	2 (5.4%)	6 (9.2%)	0.19	2.95 (0.52–16.4)
Anesthesia-related events	5 (17.9%)	3 (8.1%)	8 (12.3%)	0.21	2.45 (0.56–10.6)
Hemodynamic instability	6 (21.4%)	3 (8.1%)	9 (13.8%)	0.11	3.10 (0.74–12.8)
Cardiac events	3 (10.7%)	1 (2.7%)	4 (6.2%)	0.17	4.40 (0.41–47.0)
Pulmonary events	4 (14.3%)	2 (5.4%)	6 (9.2%)	0.19	2.95 (0.52–16.4)
Visceral injury	1 (3.6%)	1 (2.7%)	2 (3.1%)	0.84	1.32 (0.07–23.5)
Other complications	2 (7.1%)	1 (2.7%)	3 (4.6%)	0.41	2.75 (0.23–31.4)
Outcome	**With chronic disease (*n* = 28)**	**Without chronic disease (*n* = 37)**	**Total (*n* = 65)**	***P* value**	**OR (95% CI)**
B. Immediate postoperative outcomes					
Moderate/severe pain (within 24 h)	12 (42.9%)	10 (27.0%)	22 (33.8%)	0.17	2.03 (0.73–5.62)
Wound infection	4 (14.3%)	2 (5.4%)	6 (9.2%)	0.19	2.95 (0.52–16.4)
Hematoma/seroma	5 (17.9%)	4 (10.8%)	9 (13.8%)	0.38	1.80 (0.47–6.78)
Hospital stay (days), mean ± SD	4.2 ± 1.1	3.6 ± 0.9	3.9 ± 1.0	0.02*	–
Recovery affected/prolonged	6 (21.4%)	3 (8.1%)	9 (13.8%)	0.11	3.10 (0.74–12.8)

OR = odds ratio; 95% CI = 95% confidence interval.
P values were calculated using the chi-square test or Fisher's exact test for categorical variables and the independent-sample *t* test for continuous variables.
*A *P* value < 0.05 was considered statistically significant

trend toward higher intraoperative event rates was observed among patients with chronic diseases.

In the immediate postoperative period, moderate to severe pain within 24 h, wound infection, and hematoma/seroma formation were more frequent among patients with chronic diseases, although these differences were not statistically significant. The mean duration of hospital stay was significantly longer in the chronic disease group compared with the non-chronic

disease group (4.2 ± 1.1 days vs. 3.6 ± 0.9 days; $P = 0.02$). Delayed or affected recovery was also more frequent among patients with chronic diseases, but the difference did not achieve statistical significance.

Multivariable logistic regression was performed to identify the predictors of any intraoperative complication. After adjusting for age, sex, comorbidity profile, type of surgery, and duration of the procedure, the presence of any chronic disease showed increased odds of intraoperative complications; however, this association did not reach statistical significance (adjusted odds ratio [OR]: 2.62; 95% confidence interval [CI]: 0.94–7.32; $P = 0.06$). COPD also showed a higher adjusted odds of intraoperative complications, but this was not statistically significant (adjusted OR: 3.12; 95% CI: 0.81–11.95; $P = 0.09$). Increasing age showed a mild positive association with intraoperative risk, while diabetes, hypertension, type of surgery, and duration of surgery were not statistically significant predictors. Overall, no variable reached statistical significance in the adjusted model.

Discussion

In the present study, 43.1% of patients undergoing elective inguinal hernia surgery had one or more chronic diseases. Patients with chronic diseases showed a trend toward a higher frequency of perioperative events, including bleeding, anesthesia-related events, hemodynamic instability, cardiac events, pulmonary events, and delayed immediate postoperative recovery. However, most individual comparisons did not achieve statistical significance. The only statistically significant postoperative finding was longer hospital stay among patients with chronic diseases. Multivariable analysis showed increased odds of intraoperative complications among patients with any chronic disease and among patients with COPD, but these associations did not reach statistical significance.

Patients with chronic diseases were significantly older and had higher ASA grades compared with those without chronic illness. These baseline differences may have contributed to the higher frequency of perioperative events observed in the chronic disease group, as both age and ASA status are known to influence perioperative physiological reserve and anesthetic risk.[9] Although multivariable logistic regression was performed to adjust for selected variables, residual confounding cannot be excluded because of the limited sample size and small number of outcome events. Therefore, the observed association between chronic disease status and perioperative events should be interpreted cautiously.

The finding of more frequent hemodynamic instability and anesthesia-related events among patients with chronic diseases is clinically plausible. Chronic systemic illnesses may reduce physiological reserve and impair autonomic compensation during surgical and anesthetic stress.[10] Similar observations have been reported by Wolde *et al.*,[11] who found that advanced age and preexisting comorbidities were associated with intraoperative hemodynamic changes in elective surgical patients. Putowski *et al.*[12] also reported that intraoperative blood pressure variability may influence postoperative outcomes in non-cardiac surgery.

The significantly longer hospital stay observed among patients with chronic diseases may reflect slower immediate recovery and the need for closer postoperative monitoring. This is partly consistent with the findings of Haeuser *et al.*,[13] who reported that comorbidity burden and ASA status were associated with postoperative morbidity and length of stay. However, unlike larger multicenter studies, the present study was limited by a smaller sample size and focused only on inguinal hernia surgery, which may explain why several postoperative outcomes showed only nonsignificant trends.

Among individual chronic diseases, COPD showed higher adjusted odds of intraoperative complications, although statistical significance was not achieved. This finding is biologically plausible because COPD can impair ventilation, oxygenation, and pulmonary reserve during anesthesia. Licker *et al.*[14] described how underlying lung disease and anesthetic factors may affect perioperative oxygenation and hemodynamic stability. Similarly, diabetes and hypertension may affect surgical outcomes through altered wound healing, endothelial dysfunction, and cardiovascular instability, although they were not independent predictors in the present analysis. Previous evidence has shown that diabetes mellitus is associated with increased postoperative complications, prolonged hospitalization, and mortality after non-cardiac surgery.[15]

The chronic disease group in the present study included heterogeneous conditions such as diabetes mellitus, hypertension, COPD, IHD, and CKD. These conditions may influence perioperative outcomes through different mechanisms. Therefore, pooling them into a single chronic disease group may have reduced the ability to identify disease-specific associations. Although individual comorbidities were explored in the regression model, the limited number of patients and events restricted further subgroup analysis [Table 3].

Overall, the present study suggests that chronic diseases may influence perioperative stability and immediate postoperative recovery in patients undergoing elective inguinal hernia surgery. However, these findings should be interpreted cautiously because most individual

Table 3: Multivariable logistic regression for predictors of any intraoperative complication (*n* = 65)

Predictor	Adjusted OR	95% CI	*P* value*
Age (per year)	1.04	0.99–1.09	0.11
Male sex	1.21	0.32–4.51	0.78
Any chronic disease (yes vs no)	2.62	0.94–7.32	0.06
Diabetes	1.88	0.61–5.68	0.27
Hypertension	1.45	0.51–4.17	0.48
COPD	3.12	0.81–11.95	0.09
Laparoscopic versus open repair	0.74	0.21–2.47	0.62
Duration of surgery (per minute)	1.02	0.99–1.05	0.14

OR = odds ratio; CI = confidence interval; COPD = chronic obstructive pulmonary disease.
*A *P* value < 0.05 was considered statistically significant

outcomes did not achieve statistical significance and the study may have been underpowered to detect differences in less frequent complications. Increasing intraoperative physiological instability has also been associated with poorer postoperative outcomes in non-cardiac surgery, supporting the need for careful monitoring in patients with comorbidities.[16]

Conclusion

This prospective observational cohort study suggests that patients with chronic diseases undergoing elective inguinal hernia surgery may have a higher frequency of intraoperative and immediate postoperative events compared with patients without chronic illness. However, most individual perioperative outcomes did not achieve statistical significance, and the findings should be interpreted cautiously in view of the limited sample size, possible underpowering, and baseline differences in age and ASA status between the groups.

Patients with chronic diseases had a significantly longer postoperative hospital stay, suggesting a possible effect on immediate postoperative recovery. These findings support the importance of careful preoperative assessment, optimization of comorbid conditions, and vigilant intraoperative monitoring in patients undergoing inguinal hernia repair. Further adequately powered multicentric studies with standardized operative protocols, validated comorbidity indices, and 30-day follow-up are required to better define the independent effect of chronic diseases on the perioperative outcomes.

Limitations

The present study was conducted in a single tertiary-care hospital with a relatively small sample size of 65 participants, which may limit the generalizability of the findings. The sample size was calculated based on the prevalence of inguinal hernia rather than the expected difference in perioperative event rates between patients with and without chronic diseases. Therefore, the study may have had limited statistical power to detect significant differences in individual perioperative outcomes, particularly for less frequent complications. Hence, the borderline and nonsignificant findings should be interpreted cautiously.

Although the study was prospective in design, its observational nature limits causal inference regarding the relationship between chronic disease status and perioperative events. Patients with chronic diseases were significantly older and had higher ASA grades than patients without chronic illness, which may have confounded the association between chronic disease status and perioperative outcomes. Although adjusted analysis was performed, residual confounding may persist due to the small sample size and limited number of events.

The chronic disease group included heterogeneous conditions such as diabetes mellitus, hypertension, COPD, IHD, and CKD, each of which may have different biological effects on surgical and anesthetic outcomes. Pooling these conditions may have diluted disease-specific associations. In addition, a validated comorbidity scoring system such as the Charlson Comorbidity Index was not used in the present study, which may have limited standardized assessment of the overall comorbidity burden.

Certain intraoperative parameters, such as anesthetic depth and surgeon-related variables, could not be completely standardized. Surgeon experience, number of operating surgeons, individual case volume, and variations in the operative technique were not separately analyzed. These factors may independently influence perioperative outcomes irrespective of patient comorbidity status.

Postoperative follow-up was limited to the immediate postoperative period during the index hospital stay. Therefore, 30-day outcomes, delayed wound complications, readmission, recurrence, and long-term recovery could not be evaluated.

Author contributions

OS contributed to the conception and design of the study, data collection, literature review, data entry, statistical analysis, interpretation of results, and preparation of the initial manuscript draft. VCK contributed to study design, clinical supervision, data verification, interpretation of findings, and critical revision of the manuscript. SV contributed to conceptual guidance, methodological supervision, interpretation of results, critical review of the manuscript for important intellectual content, and overall academic guidance. KA contributed to data collection, clinical assessment, data organization, literature support, and manuscript

editing. EG contributed to patient recruitment, data collection, data entry, coordination of clinical records, and assistance in manuscript preparation. All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Ethical policy and Institutional Review Board statement

The study was conducted after obtaining approval from the Institutional Ethics Committee. This study was performed in accordance with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Ethics Committee of Madras Medical College, approval number No. IEC-MMC/Approval/36012025 on January 28, 2025. Patient confidentiality was maintained throughout the study.

Declaration of patient consent

The authors certify that appropriate patient consent was obtained from all participants included in the study.

Data availability statement

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Acknowledgments

The authors sincerely thank the Dean, Head of the Department, and Chief of the Institute of General Surgery, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, for their guidance, support, and permission to conduct this study. AI-assisted tools were used only for language refinement and formatting support. The authors reviewed, edited, and approved the final manuscript and take full responsibility for its content.

References

1. McDonnell D, Wakefield C. Adult groin hernias: Acute and elective. Surgery (Oxford) 2018;36:238-44.
2. Noncommunicable Diseases. WHO website. Available from: who.int/news-room/factsheets/detail/noncommunicable-diseases. [Last accessed on 19 Apr 2023].
3. Burcharth J, Pommergaard HC, Bisgaard T, Rosenberg J. Patient-related risk factors for recurrence after inguinal hernia repair: A systematic review and meta-analysis of observational studies. Surg Innov 2015;22:303-17.
4. Fowler AJ, Wahedally MAH, Abbott TEF, Prowle JR, Cromwell DA, Pearse RM. Long-term disease interactions amongst surgical patients: A population cohort study. Br J Anaesth 2023;131:407-17.
5. Jindal P, Patil V, Pradhan R, Mahajan HC, Rani A, Pabba UG. Update on preoperative evaluation and optimisation. Indian J Anaesth 2023;67:39-47.
6. Ramesh H, Ravichandran P, Gollapalli PK, Rajasekar VD, Arumugam S, Thomas RED, *et al*. Healthcare utilisation patterns among individuals with noncommunicable diseases in rural households of Chengalpattu district: A community-based cross-sectional study. Int J Noncommun Dis 2025;10:207-13.
7. Shaf HM, Falak F, Akhtar R, Islam SU, Ahsan M, Rani M. Comparative assessment of intraoperative complications in inguinal hernia repair surgery in healthy patients versus comorbid patients. JHWCR 2025;3:e351.
8. Yadav RN, Maharjan JS, Bajracharya J, Pradhan GBN, Shrestha S. Hernia among patients admitted to the department of surgery of a tertiary care centre. JNMA J Nepal Med Assoc 2023;61:911-4.
9. Adeleke I, Chae C, Okocha O, Sweitzer B. Risk assessment and risk stratification for perioperative complications and mitigation: Where should the focus be? How are we doing? Best Pract Res Clin Anaesthesiol 2021;35:517-29.
10. Cusack B, Buggy DJ. Anaesthesia, analgesia, and the surgical stress response. BJA Educ 2020;20:321-8.
11. Wolde Y, Desalegn M, Arigawi A. The incidence and predictors of intraoperative hemodynamic change following thoracic surgery in Ethiopia, 2023: Multi-centre approach. J Anesth Inten Care Med 2024;13:555866.
12. Putowski Z, Czok M, Krzych LJ. The impact of intraoperative blood pressure variability on the risk of postoperative adverse outcomes in non-cardiac surgery: A systematic review. J Anesth 2022;36:316-22.
13. Haeuser L, Herzog P, Ayub A, Nguyen DD, Noldus J, Cone EB, *et al*. Comparison of comorbidity indices for prediction of morbidity and mortality after major surgical procedures. Am J Surg 2021;222:998-1004.
14. Licker M, Hagerman A, Jeleff A, Schorer R, Ellenberger C. The hypoxic pulmonary vasoconstriction: From physiology to clinical application in thoracic surgery. Saudi J Anaesth 2021;15:250-63.
15. Zhang X, Hou A, Cao J, Liu Y, Lou J, Li H, *et al*. Association of diabetes mellitus with postoperative complications and mortality after non-cardiac surgery: A meta-analysis and systematic review. Front Endocrinol 2022;13:841256.
16. Wiórek A, Krzych LJ. Intraoperative blood pressure variability predicts postoperative mortality in non-cardiac surgery—A prospective observational cohort study. Int J Environ Res Public Health 2019;16:4380.