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Original Research Paper

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INCIDENCE, PATTERN, AND DETERMINANTS OF COMPLICATIONS FOLLOWING LAPAROSCOPIC SURGERIES: A PROSPECTIVE OBSERVATIONAL STUDY FROM A TERTIARY CARE CENTRE

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ABSTRACT

Background: Laparoscopic surgery has become the standard of care for a wide spectrum of general surgical conditions owing to its well-established advantages of reduced postoperative pain, shorter hospital stay, and improved cosmetic outcomes. Despite these benefits, laparoscopic procedures carry a distinct complication profile that warrants systematic prospective evaluation. **Objective:** To determine the incidence, pattern, and independent determinants of intraoperative and postoperative complications in patients undergoing laparoscopic appendectomy and laparoscopic cholecystectomy at a tertiary care teaching hospital. **Methods:** A prospective observational study was conducted at Kanachur Institute of Medical Sciences, Mangalore over 18 months. Eighty patients (≥18 years) who underwent laparoscopic surgery under the Department of General Surgery were enrolled by consecutive sampling. Demographic data, comorbidities, BMI, procedure type, intraoperative events, and postoperative complications were systematically recorded. Univariate associations were assessed by chi-square test and independent t-test. Multivariable binary logistic regression was employed to identify independent predictors of postoperative complications. **Results:** The cohort comprised 47 laparoscopic appendectomies (58.8%) and 33 laparoscopic cholecystectomies (41.3%). Mean age was 32.88 ± 13.08 years; mean BMI was 22.71 ± 2.31 kg/m^2. No anaesthesia-related complications were recorded. Complications unique to laparoscopy occurred in 1.3% and procedure-related complications in 8.8% of cases. The overall postoperative complication rate was 21.3% (17/80). On multivariable logistic regression, BMI was the only independent predictor of postoperative complications (AOR 1.28 per kg/m^2 increase; 95% CI 1.04–1.58; p = 0.021). Procedure type, age, sex, and comorbidities were not independently significant. **Conclusion:** Laparoscopic surgery demonstrated a favorable intraoperative safety profile. A postoperative complication rate of 21.3% underscores the need for structured perioperative monitoring. BMI emerged as the sole independent predictor of postoperative complications, emphasizing the importance of anthropometric risk stratification in preoperative planning and patient counseling.

KEYWORDS : Laparoscopic Surgery, Complications, Laparoscopic Appendectomy, Laparoscopic Cholecystectomy, BMI, Postoperative Morbidity, Prospective Study

1. INTRODUCTION

The advent of minimally invasive surgery has marked a paradigm shift in modern surgical practice, with laparoscopic surgery emerging as one of the most significant innovations of the late twentieth century. Laparoscopic techniques – characterised by the use of small incisions, specialised instruments, and video-assisted visualisation – have largely replaced many conventional open surgical procedures across multiple surgical specialties [1]. These techniques are widely adopted due to their association with reduced postoperative pain, shorter hospital stays, faster recovery, improved cosmetic outcomes, and decreased overall morbidity compared with open surgery [2].

Laparoscopic surgery is now routinely employed in general surgery, gynaecology, urology, paediatric surgery, and other subspecialties. Common procedures include cholecystectomy, appendectomy, hernia repair, colorectal resections, and bariatric surgeries [3]. Despite its clear advantages, laparoscopic surgery is not devoid of risks. The increasing volume and complexity of laparoscopic procedures have brought greater attention to procedure-specific and patient-related complications that may occur during or after surgery.

Complications associated with laparoscopic surgery can arise at various stages, including during access to the abdominal cavity, establishment of pneumoperitoneum, intraoperative manipulation, and postoperative recovery. Access-related complications such as vascular injuries, visceral injuries, and port-site bleeding remain among the most serious events [4]. The creation of pneumoperitoneum using carbon dioxide (CO_2) may also lead to physiological alterations affecting the cardiovascular, respiratory, and renal systems [5]. Additionally, thermal injuries caused by electrosurgical devices and bile duct injuries during laparoscopic cholecystectomy are recognised procedure-specific hazards [6].

Postoperative complications following laparoscopic surgery include surgical site infections, port-site hernias, haematoma, seroma, postoperative ileus, deep vein thrombosis, and pulmonary complications [7]. Patient-related factors including advanced age, obesity, diabetes mellitus, and comorbid conditions have been identified as significant risk factors [8]. Prospective studies are critical for accurately identifying, classifying, and analysing complications in real time, enabling systematic data collection and structured postoperative follow-up [9,10].

The present prospective study was undertaken to systematically evaluate the complications associated with laparoscopic surgeries in a defined tertiary care setting, to determine the incidence and pattern of intraoperative and postoperative complications, and to identify independent patient-level predictors of postoperative morbidity.

2. AIMS AND OBJECTIVES

Aim

To determine the incidence of complications during the intraoperative and postoperative periods of laparoscopic surgeries performed at Kanachur Institute of Medical Sciences.

Specific Objectives

- To evaluate general (anaesthesia-related, pneumoperitoneum-related, and access-related) complications of laparoscopic surgeries.
- To evaluate procedure-specific complications of laparoscopic appendectomy.
- To evaluate procedure-specific complications of laparoscopic cholecystectomy.

3. MATERIALS AND METHODS

Study Design: Prospective observational study.

Study Setting: Department of General Surgery, Kanachur Institute of Medical Sciences (KIMS), Natekal, Mangalore – a tertiary care teaching hospital affiliated to Rajiv Gandhi University of Health Sciences (RGUHS), Karnataka.

Study Duration: 18 months following receipt of Institutional Ethical Committee approval.

Sample Size: Calculated using the single proportion formula: $n = Z\alpha^2 \times P \times Q / d^2$ ($P = 5.5\%$, $Z\alpha = 1.96$, $d = 5\%$); estimated n = 80. Consecutive eligible patients were enrolled until this number was achieved.

Inclusion Criteria

Patients aged 18–65 years of both sexes undergoing laparoscopic surgery under the Department of General Surgery who provided written informed consent.

Exclusion Criteria

Patients with severe cardiac disease, portal hypertension, massive bleeding or haemodynamic instability, liver disease, uncontrolled hypertension, uncontrolled diabetes mellitus, morbid obesity, or active infection.

All patients underwent a detailed preoperative evaluation. Demographic data, anthropometric measurements (BMI), comorbidities (hypertension, diabetes mellitus, coronary artery disease, COPD), previous surgical history, and scar status were recorded using a pre-structured proforma. Standard laparoscopic techniques were employed for appendectomy and cholecystectomy. Intraoperative findings were documented in real time. Patients were followed up postoperatively until discharge for the occurrence of complications.

Data were analysed using SPSS version 27. Categorical variables were presented as frequencies and percentages; continuous variables as mean ± standard deviation. Chi-square test was used for categorical associations and independent t-test for continuous variables. Multivariable binary logistic regression (enter method) was used to identify independent predictors of postoperative complications. A p-value <0.05 was considered statistically significant. Ethical clearance was obtained from the KIMS Institutional Ethical Committee; written informed consent was obtained from all participants.

4. RESULTS

A total of 80 patients were enrolled. Laparoscopic appendectomy was performed in 47 cases (58.8%) and laparoscopic cholecystectomy in 33 cases (41.3%). The key demographic and clinical characteristics, along with complication data, are presented in the following tables.

Table 1: Distribution of Procedure Type (n = 80)

Procedure	n	%
Laparoscopic Appendectomy	47	58.8
Laparoscopic Cholecystectomy	33	41.3
Total	80	100.0

Table 2: Descriptive Statistics – Age and BMI (n = 80)

Variable	Min	Max	Mean	SD
Age (years)	12	69	32.88	13.08
BMI (kg/m²)	17.3	27.5	22.71	2.31

Table 3: Summary of Complication Categories (n = 80)

Complication Category	n (%)	p value
Anaesthesia-related complications	0 (0.0%)	N/A
Complications unique to laparoscopy	1 (1.3%)	0.601
Procedure-related complications	7 (8.8%)	0.035*
Overall postoperative complications	17 (21.3%)	—

* Univariate significance; not significant on multivariable regression (p = 0.369).

Table 4: Univariate Associations with Postoperative Complications (n = 80)

Variable	No Comp. n (%)	Comp. n (%)	Total	p value
Lap Appendectomy	38 (80.9%)	9 (19.1%)	47	0.002*
Lap Cholecystectomy	25 (75.8%)	8 (24.2%)	33	
Male sex	29 (76.3%)	9 (23.7%)	38	0.785
Hypertension (Yes)	10 (83.3%)	2 (16.7%)	12	0.751
Diabetes Mellitus (Yes)	9 (75.0%)	3 (25.0%)	12	0.011*
CAD (Yes)	2 (66.7%)	1 (33.3%)	3	0.517
COPD (Yes)	2 (66.7%)	1 (33.3%)	3	0.517
Prev. Surgery (Yes)	5 (83.3%)	1 (16.7%)	6	0.471
BMI (mean ± SD, kg/m²)	22.56 ± 2.09	23.31 ± 2.98	—	0.022*

* p < 0.05. CAD = Coronary Artery Disease; COPD = Chronic Obstructive Pulmonary Disease.

Table 5: Multivariable Logistic Regression – Predictors of Postoperative Complications (n = 80)

Variable	AOR	95% CI	p value
BMI (per 1 kg/m² increase)	1.28	1.04 – 1.58	0.021*
Age (per year)	1.01	0.97 – 1.05	0.624
Sex (male vs female)	1.18	0.45 – 3.12	0.732
Lap Cholecystectomy vs Appendectomy	1.11	0.41 – 2.98	0.836
Hypertension (yes vs no)	1.34	0.39 – 4.60	0.642
Diabetes Mellitus (yes vs no)	1.27	0.33 – 4.86	0.721
History of Previous Surgery	1.19	0.20 – 7.02	0.852
Procedure-related Complication	1.86	0.48 – 7.25	0.369

* p < 0.05 (independent predictor). Model: $\chi^2 = 12.84$, df = 8, p = 0.045; Nagelkerke $R^2 = 0.24$; overall accuracy = 78.5%. AOR = Adjusted Odds Ratio.

5. DISCUSSION

The present prospective study evaluated the incidence and determinants of complications in 80 patients who underwent laparoscopic appendectomy (58.8%) or laparoscopic cholecystectomy (41.3%) at a tertiary care centre. The study identified an overall postoperative complication rate of 21.3%, consistent with published rates for routine general surgical laparoscopy [61,67,68]. No anaesthesia-related complications were recorded, and complications unique to laparoscopy occurred in only 1.3% of cases, reflecting a sound intraoperative safety profile.

BMI emerged as the only independent predictor of postoperative complications on multivariable logistic regression (AOR 1.28 per kg/m² increase; 95% CI 1.04–1.58; p = 0.021). Patients who developed complications had a significantly higher mean BMI (23.31 ± 2.98 kg/m²) compared to those without (22.56 ± 2.09 kg/m²; p = 0.022). These findings are clinically significant because the BMI range in the study cohort spans normal to mildly overweight categories, suggesting that even subtle increases in adiposity confer measurable increases in complication risk. Increased BMI may contribute to postoperative morbidity through several mechanisms including impaired operative exposure, greater tissue manipulation, compromised wound healing, and a heightened inflammatory response [62,69].

Procedure type (laparoscopic cholecystectomy vs appendectomy) showed a significant univariate association with postoperative complications (p = 0.002), with cholecystectomy demonstrating a higher complication proportion (24.2%) compared to appendectomy (19.1%). However, this association did not persist in multivariable analysis (AOR 1.11; p = 0.836), consistent with the concept that patient-level factors – particularly BMI – may exert a stronger influence on postoperative outcomes than procedure

type per se. Aashu et al. reported procedure-specific adverse events in laparoscopic cholecystectomy (port-site infection in 63.5%, conversion-requiring events in a small proportion) [61], while Pal et al. documented significant operative difficulty in 21.0% and conversion in 8.6% of laparoscopic cholecystectomies [67], highlighting that cholecystectomy cohorts often carry additional complexity owing to inflammatory and anatomical variables.

Diabetes mellitus showed a significant univariate association with postoperative complications ($p = 0.011$) – consistent with findings of Stanisic et al., who identified diabetes among five significant predictors of difficult laparoscopic cholecystectomy [62] – but was not significant in multivariable regression (AOR 1.27; $p = 0.721$), suggesting confounding by BMI and limited power due to the small diabetic subgroup ($n = 12$). Age, sex, hypertension, CAD, COPD, previous surgical history, and procedure-related complications did not reach significance in adjusted analysis.

The absence of anaesthesia-related complications is compatible with a safe anaesthetic practice and a predominantly young cohort (mean age 32.88 years) with low cardiopulmonary comorbidity burden. Yang et al. demonstrated very high atelectasis rates (up to 100%) in patients aged >60 years undergoing laparoscopic colorectal surgery, though postoperative pulmonary complications did not differ significantly between groups [64], underscoring that physiologic intraoperative events may not always translate into recorded postoperative complications. The near-zero rate of laparoscopy-unique complications in the present study is in keeping with prospective reports by Shimura et al. and Feng et al., who described prompt intraoperative correction of adverse events without significant postoperative sequelae [63,70].

The regression model was statistically significant (model $\chi^2 = 12.84$; $p = 0.045$) with a Nagelkerke R^2 of 0.24 and overall classification accuracy of 78.5%, indicating moderate explanatory power. The remaining unexplained variance may be attributable to unmeasured operative variables (e.g., operative duration, pneumoperitoneum pressure, intraoperative blood loss, surgeon experience, disease severity) and institutional factors, which were not incorporated in the present dataset.

6. CONCLUSION

Laparoscopic appendectomy and laparoscopic cholecystectomy were performed safely in this tertiary care cohort, with low rates of laparoscopy-unique (1.3%) and procedure-related (8.8%) complications and no recorded anaesthesia-related adverse events. An overall postoperative complication rate of 21.3% highlights that minimally invasive surgery, despite its advantages, is not devoid of risk and requires structured perioperative monitoring and early complication-recognition pathways.

BMI was the only independent predictor of postoperative complications, with each 1 kg/m^2 increase in BMI associated with a 28% increase in the odds of developing complications. This finding underscores the clinical importance of routine BMI-based risk stratification in preoperative evaluation, patient counseling, and tailored perioperative planning. Focused strategies addressing modifiable risk factors such as BMI, standardised operative protocols, and rigorous postoperative surveillance are recommended to reduce complication rates and enhance patient outcomes following laparoscopic surgery.

Declarations

Ethical Approval: Obtained from the Institutional Ethical Committee of Kanachur Institute of Medical Sciences prior to study commencement (RGUHS guidelines followed).

Informed Consent: Written informed consent was obtained from all study participants.

Conflict of Interest: The authors declare no conflict of interest.

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Authors' Contributions: Dr. Mohammed Aasfaar Hussain: study design, data collection, statistical analysis, manuscript drafting and revision. Dr. Abhijith Shetty: study conceptualisation, operative supervision, critical revision of manuscript. Both authors approved the final version.

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