Section: General Surgery

Original Research Article

PREDICTORS OF CONVERSION FROM LAPAROSCOPIC TO OPEN SURGERY IN EMERGENCY ABDOMINAL PROCEDURES

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ABSTRACT

Background: A laparoscopic approach is feasible in selected patients requiring emergency abdominal surgery. However, dense adhesions, inflammatory changes, contamination, bleeding or uncertain anatomy may necessitate conversion to an open procedure. Recognising factors associated with conversion is important for operative planning and patient counselling. The objective is to identify clinical, physiological, radiological and operative factors associated with conversion from a laparoscopic-first approach to open surgery in emergency abdominal procedures at a tertiary-care hospital. **Materials and Methods:** This single-centre observational study was conducted at Velammal Medical College and Hospital, Madurai, for the period from 1 April 2025 to 1 November 2025, with a sample of 50 adults selected for emergency abdominal surgery using an initial laparoscopic approach. Conversion to open surgery was the primary outcome. Recorded variables covered patient characteristics, ASA physical status, operative history, imaging, contamination, procedure category and intraoperative difficulties. Categorical associations were assessed using chi-square or Fisher exact tests, with odds ratios and 95% confidence intervals where applicable. **Result:** Among 50 procedures in the dataset, 10 (20.0%) were converted to open surgery. Higher conversion proportions were observed in patients aged ≥60 years, those with ASA III–IV status or previous abdominal surgery, and cases with contamination or free fluid or pus on imaging. **Conclusion:** Conversion may be necessary to maintain operative safety when laparoscopic dissection becomes difficult. Patient physiology, previous surgery, disease severity and operative complexity warrant attention during preoperative assessment. These findings emphasise the importance of anticipating operative difficulty before emergency laparoscopy.

INTRODUCTION

Laparoscopic surgery, once limited to elective operations, is now used in carefully selected emergency abdominal conditions. Current emergency-surgery guidelines support a laparoscopic-first approach in haemodynamically stable patients, provided that patients are properly selected and a surgeon with minimally invasive expertise is available.[1] National data also show that emergency laparoscopy is associated with a shorter hospital stay and lower mortality.[2]

Even so, laparoscopy is still used less often than open surgery in emergency practice, and conversion is common. In the NELA database, only 14.6% of major emergency abdominal operations were attempted laparoscopically, and 46.4% of these attempts were converted to open surgery. The type of procedure, intra-abdominal contamination and surgeon-related factors influenced whether the laparoscopic operation could be completed.[3]

The WSES consensus statement also lists poor physiological condition, previous abdominal surgery and an expected long operating time as barriers to emergency laparoscopy. When laparoscopy is attempted, conversion is usually needed because the patient's condition deteriorates, the anatomy is unclear, the bowel is perforated or bleeding occurs.[4]

Studies on individual procedures also point to disease severity. In acute appendicitis, conversion has been linked to older age, raised bilirubin, higher ASA grade, use of CT and complicated disease.[5] Other appendicitis series found obesity, earlier abdominal operations and peritonitis to be independent risk

factors.[6] In perforated peptic ulcer surgery, previous laparotomy, a larger perforation and a posterior ulcer have been associated with conversion.[7]

Conversion also matters for the patient after the operation. Large colorectal datasets have shown that converted patients have more complications, stay longer in hospital and incur higher charges than those whose laparoscopic operation was completed.[8] Even so, converting is the safer course when continuing laparoscopically could cause injury or uncontrolled bleeding.

Identifying factors associated with conversion may help surgeons anticipate technical difficulty and prepare for an open approach when necessary. The present single-centre study focuses on patient characteristics, disease-related findings and operative circumstances in emergency abdominal surgery.

Objectives

- To estimate the proportion of emergency abdominal procedures requiring conversion.
- To describe demographic and perioperative characteristics of converted and completed-laparoscopic cases.
- To evaluate associations between selected preoperative/intraoperative factors and conversion.
- To describe the principal reasons for conversion and short-term postoperative outcomes.

MATERIALS AND METHODS

Study design and setting: A single-centre observational study was conducted in the Department of General Surgery, Velammal Medical College and Hospital, Madurai, Tamil Nadu, India, for the period from 1 April 2025 to 1 November 2025.

Study population and sample size

The study population comprised 50 adults selected for emergency abdominal surgery with an initial laparoscopic approach. Eligibility was based on the indication for emergency surgery and documentation of the initial and final operative approaches.

Inclusion Criteria

- Adult patients undergoing emergency abdominal procedures with an initial laparoscopic approach.
- Emergency procedures for acute abdominal surgical pathology where laparoscopic exploration or treatment was judged feasible by the operating surgeon.
- Complete documentation of the operative approach and final conversion status.

Exclusion Criteria

- Primary open operations in which laparoscopy was never attempted.
- Trauma-related emergency operations were excluded where specified by the institutional eligibility criteria.
- Patients with incomplete records for the primary outcome.
- Cases planned for an open operation without laparoscopic assessment were excluded.

Data Collection

Clinical and operative variables included age, sex, body mass index, comorbidities, ASA physical status, symptom duration, haemodynamic status, previous abdominal operations, laboratory and imaging findings, surgical diagnosis, contamination, adhesions, visibility, bleeding, bowel injury, operative duration, postoperative complications and length of stay.

Variables and Statistical Analysis

Candidate predictors

Domain	Variable	Operational definition / recording
Demographic	Age	Age in years; categories <60 and ≥60 years
Demographic	Sex	Male / female
Physiological	ASA class	I–II vs III–IV
History	Previous abdominal surgery	Yes / no
Clinical	Peritonitis / contamination	Absent / localized / generalized, according to operative record
Imaging	Free fluid or pus	Present / absent on preoperative imaging
Procedure	Procedure complexity	Recorded procedure category; higher-complexity classification
Technical	Dense adhesions	Present / absent
Technical	Poor visualization	Present / absent
Technical	Bleeding	Conversion-related intraoperative bleeding documented
Outcome	Operative time	Minutes
Outcome	Hospital stay	Days
Outcome	Postoperative complications	Any complication within the predefined follow-up period

Statistical analysis: Continuous variables were described using mean and standard deviation or median, depending on the distribution. Categorical variables were expressed as frequencies and percentages. Group comparisons used chi-square or Fisher exact tests for categorical variables and Student's t test or Mann–Whitney U test for continuous variables, as appropriate. Binary associations were summarised using odds ratios with 95% confidence intervals.

RESULTS

Fifty emergency abdominal procedures were included in the analysis.

Forty procedures (80.0%) were completed laparoscopically, while 10 (20.0%) required

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conversion to open surgery. Five of the ten patients aged ≥60 years required conversion.

Six of the fourteen patients classified as ASA III–IV underwent conversion.

Conversion occurred in six of the twelve patients with a history of abdominal surgery.

Seven of the fourteen patients with peritonitis or intra-abdominal contamination required conversion.

Among the sixteen patients with free fluid or pus on imaging, seven underwent conversion.

Seven of the fifteen procedures classified as higher complexity required conversion.

The principal intraoperative reasons for conversion included dense adhesions, poor visualization, peritonitis/contamination, bleeding, and bowel injury or other technical difficulties.

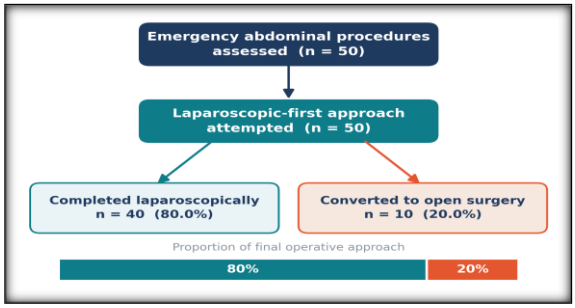


Figure 1: Operative approach in the 50-case dataset: 40 completed laparoscopically and 10 converted to open surgery.

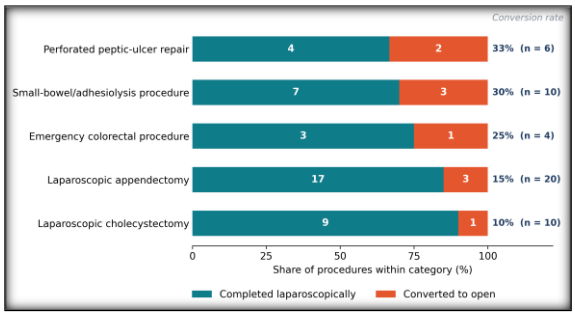


Figure 2: Conversion by emergency procedure category; bars show completed laparoscopic and converted cases.

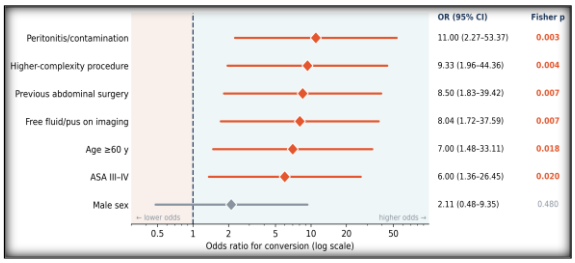


Figure 3: Odds ratios and 95% confidence intervals; the dashed line indicates OR = 1.

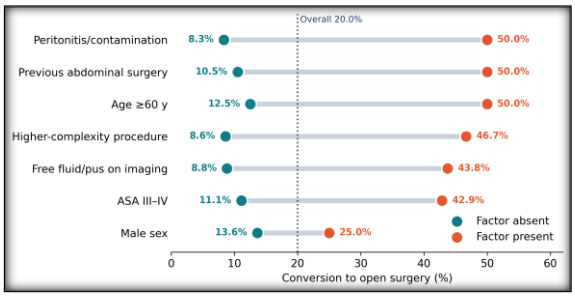


Figure 4: Conversion proportions according to selected predictors; the dotted line represents the overall conversion proportion (20.0%).

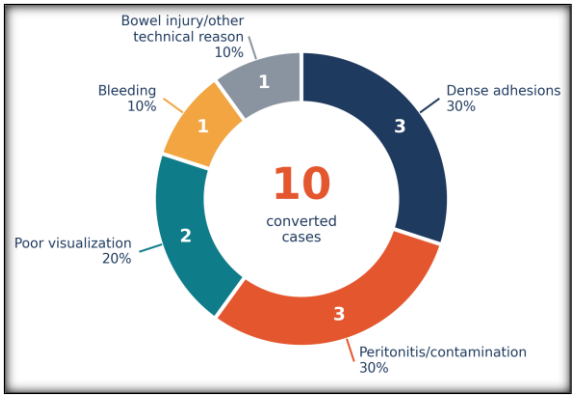


Figure 5: Distribution of reasons for conversion among converted cases (n = 10).

Table 1: Baseline characteristics by final operative approach

Variable	Total (n=50)	Laparoscopic (n=40)	Converted (n=10)
Age ≥60 years	10 (20.0%)	5 (12.5%)	5 (50.0%)
Male sex	28 (56.0%)	21 (52.5%)	7 (70.0%)
ASA III–IV	14 (28.0%)	8 (20.0%)	6 (60.0%)
Previous abdominal surgery	12 (24.0%)	6 (15.0%)	6 (60.0%)
Peritonitis/contamination	14 (28.0%)	7 (17.5%)	7 (70.0%)
Free fluid/pus on imaging	16 (32.0%)	9 (22.5%)	7 (70.0%)

Table 2: Emergency procedure categories and conversion

Procedure category	Total	Completed laparoscopy	Converted
Laparoscopic appendectomy	20	17	3
Laparoscopic cholecystectomy	10	9	1
Small-bowel/adhesiolysis procedure	10	7	3
Perforated peptic-ulcer repair	6	4	2
Emergency colorectal procedure	4	3	1
Total	50	40	10

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Table 3: Selected predictors of conversion

Predictor	Conversion / exposed	No conversion / exposed	OR (95% CI)	Fisher p
Age ≥60 y	5	5	7.00 (1.48–33.11)	0.018
Male sex	7	21	2.11 (0.48–9.35)	0.480
ASA III–IV	6	8	6.00 (1.36–26.45)	0.020
Previous abdominal surgery	6	6	8.50 (1.83–39.42)	0.007
Peritonitis/contamination	7	7	11.00 (2.27–53.37)	0.003
Free fluid/pus on imaging	7	9	8.04 (1.72–37.59)	0.007
Higher-complexity procedure	7	8	9.33 (1.96–44.36)	0.004

Table 4: Reasons for conversion and short-term outcomes

Measure	Converted group (n=10)
Dense adhesions	3 (30.0%)
Poor visualization	2 (20.0%)
Peritonitis/contamination	3 (30.0%)
Bleeding	1 (10.0%)
Bowel injury/other technical reason	1 (10.0%)
Mean operative time, min	142 ± 28
Mean hospital stay, days	8.2 ± 3.1
Any postoperative complication	4 (40.0%)
In-hospital mortality	1 (10.0%)

DISCUSSION

Several clinical and technical problems can affect the completion of emergency laparoscopy. Inflammation, contamination, bowel distension, adhesions and physiological instability can make dissection and anatomical identification difficult. The WSES consensus statement emphasises patient stability and operative expertise when selecting a laparoscopic approach.[1] Technical problems including bleeding and unclear anatomy can necessitate conversion.[2]

Procedure type is relevant when interpreting conversion rates. In the NELA analysis, small-bowel resection and right colectomy were associated with greater odds of conversion than washout procedures, and intra-abdominal pus or blood affected the likelihood of completing laparoscopy.[3] Comparing different emergency operations therefore requires attention to both operative indication and abdominal findings.

Previous abdominal surgery may make safe access and dissection more difficult because of adhesions. Previous laparotomy was associated with conversion in a study of perforated peptic-ulcer repair.[4] Similar associations have been reported in laparoscopic appendectomy.[5]

The extent of abdominal disease is another important consideration. Complicated appendicitis and peritonitis have been associated with conversion during emergency appendectomy.[6] Studies of cholecystectomy have also considered symptom duration, inflammation and imaging findings in relation to conversion.[7]

Clinical implication

Preoperative assessment of physiological status, surgical history and imaging findings can guide equipment preparation, availability of experienced surgical staff and planning for possible conversion. Conversion remains an appropriate safety measure when the laparoscopic approach cannot be continued without undue risk.

CONCLUSION

Difficult anatomy, adhesions, contamination and bleeding were among the documented reasons for conversion. Identifying these challenges before surgery may improve operative planning. Larger clinical series are needed to determine the strength of the observed associations.

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