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Original Research Article

Laparoscopic Versus Open Approach in Emergency Bowel Obstruction: A Comparative Analysis of Outcomes and Cost-Effectiveness at a Tertiary Care Hospital in Gujarat

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Abstract:

Background: Small bowel obstruction (SBO) is a common surgical emergency, with adhesions causing up to 70% of cases. While laparoscopy offers faster recovery and lower morbidity than open surgery, its emergency use in India remains limited due to feasibility and cost concerns. This study from a tertiary center in Gujarat compares perioperative outcomes and cost-effectiveness of laparoscopic vs. open adhesiolysis to guide local surgical practice.

Material and Methods: A retrospective cohort study was conducted on 120 adults (>18 years) with adhesive SBO at a tertiary care hospital over a period of 18 months. Patients were grouped into laparoscopic (n=60) and open (n=60) surgery based on surgeon discretion and intraoperative findings. Inclusion criteria were imaging-confirmed adhesive SBO with failed conservative management, while exclusions included strangulated bowel, malignancy, or prior extensive surgery. Data collected included demographics, operative details, recovery, complications (Clavien-Dindo), length of stay, and direct costs (INR). Statistical tests used were Student's t-test for continuous variables, chi-square for categorical, and ICER for cost-effectiveness. A p-value <0.05 was considered significant. Ethical approval was obtained.

Results: Demographics were comparable (mean age 48±12 years; 55% female). Laparoscopic group showed longer operative time (92±18 min vs. 68±15 min, p<0.001) but reduced blood loss (45±20 ml vs. 120±35 ml, p<0.001), shorter LOS (4.8±1.2 days vs. 7.5±2.1 days, p<0.001), and lower complication rates (12% vs. 28%, p=0.01). Mortality was similar (3.3% vs. 5%, p=0.68). Total mean cost per case was INR 1,45,000±22,000 for laparoscopic vs. INR 2,10,000±35,000 for open (p<0.001), yielding an ICER of INR 12,500 per complication avoided.

Conclusion: Laparoscopic adhesiolysis for emergency small bowel obstruction offers superior outcomes with reduced morbidity and cost savings, supporting its preferential use in suitable candidates at resource-limited centers. Future prospective trials should validate these findings in diverse Indian populations.

Keywords: Small bowel obstruction, Laparoscopic adhesiolysis, Open surgery, Cost-effectiveness, Emergency surgery, Gujarat.

Introduction

Small bowel obstruction (SBO) remains a major surgical emergency, with postoperative adhesions responsible for most cases. [1] In India, the rising prevalence of abdominal surgeries due to infections and trauma has led to increasing rates of adhesive SBO, often straining emergency services in tertiary hospitals. Open surgery, though reliable, is linked to longer hospital stays, greater pain, and recurrent adhesions, perpetuating morbidity. Laparoscopy offers faster recovery and fewer complications, yet its emergency use remains debated in high-acuity, resource-constrained environments. [2] Laparoscopic management of SBO was first explored in the 1990s, with early concerns about bowel injury and incomplete adhesiolysis. However, systematic reviews, such as O'Connor and winter (2012), confirmed feasibility with conversion rates under 30% in experienced centers. Indian studies, including from AIIMS New Delhi, report reduced postoperative ileus with laparoscopy. Despite these advantages, regional disparities in surgical training, infrastructure, and cost remain barriers, especially in public hospitals like those in Gujarat. [3] This study evaluates laparoscopic versus open surgery for adhesive SBO at a large tertiary care teaching hospital serving

over 5 million people. By comparing perioperative outcomes and cost-effectiveness, we aim to generate local evidence to guide surgical practice, optimize resource allocation, and support training toward minimally invasive approaches in emergency care.

Materials and Methods

This retrospective study was conducted at the Department of General Surgery at a tertiary care center in Gujarat for a period of 18 months. Adults ≥18 years with acute adhesive SBO, confirmed clinically and radiologically, were included if conservative management failed within 48 hours. Exclusions were virgin abdomen, malignancy, IBD, hernias, peritonitis, or perforation. Patients underwent laparoscopic adhesiolysis (four-port technique, with conversion if dense adhesions/ischemia) or open midline laparotomy. Ethical clearance was obtained; consent was waived due to retrospective design.

Sample size was 120 (60 per group), calculated assuming a 20% LOS difference (α=0.05, power=80%). Groups were balanced by alternating trained surgeons. Preoperative care included optimization and LMWH prophylaxis; postoperative management followed ERAS protocols.

Data collected: demographics, operative details (time, blood loss, conversion), recovery indices (flatus, LOS), complications (Clavien-Dindo), 30-day outcomes, and direct hospital costs in INR. Statistical analysis used SPSS 26: t-test and Mann-Whitney for continuous, chi-square test for categorical, with multivariate regression for confounders. Cost-effectiveness was assessed using incremental cost-effectiveness ratio (ICER). Significance was set at $p<0.05$ with 95% CI.

Results

Over the study period, 120 patients met inclusion criteria, evenly split between laparoscopic (n=60) and open (n=60) groups. Baseline characteristics showed no significant intergroup differences (Table 1). The laparoscopic cohort had a 15% conversion rate, primarily due to extensive adhesions.

Table 1: Demographic and Preoperative Characteristics

Parameter	Laparoscopic (n=60)	Open (n=60)	p-value
Age (years, mean ± SD)	47.2 ± 11.8	49.1 ± 12.4	0.42
Sex (Female, %)	58%	52%	0.51
BMI (kg/m², mean ± SD)	22.4 ± 3.2	23.1 ± 3.5	0.31
Prior surgeries (mean)	1.8 ± 0.9	1.9 ± 1.0	0.68
ASA Grade III/IV (%)	25%	28%	0.72
Comorbidities (%)	42%	45%	0.79

Perioperative outcomes favored laparoscopy in most domains (Table 2). Operative duration was notably longer, but this was offset by minimal blood loss and rapid bowel function return. No intraoperative mortalities occurred.

Table 2: Perioperative Outcomes

Parameter	Laparoscopic (n=60)	Open (n=60)	p-value
Operative time (min, mean ± SD)	92 ± 18	68 ± 15	<0.001
Blood loss (ml, mean ± SD)	45 ± 20	120 ± 35	<0.001
Time to flatus (days, mean ± SD)	2.1 ± 0.8	3.4 ± 1.2	<0.001
LOS (days, mean ± SD)	4.8 ± 1.2	7.5 ± 2.1	<0.001
Conversion rate (%)	15%	-	-

Postoperative complications were significantly lower in the laparoscopic arm, with wound-related issues predominant in the open group (Table 3). Readmission rates at 30 days mirrored this trend, driven by ileus recurrences. Mortality, though low overall, trended toward equivalence after adjustment.

Table 3: Postoperative Complications and Mortality

Complication (Clavien-Dindo)	Laparoscopic (n=60)	Open (n=60)	p-value
Overall (%)	12% (7 cases)	28% (17 cases)	0.01
Grade I-II (%)	8%	18%	0.04
Grade III-IV (%)	3%	8%	0.16
Wound infection (%)	2%	12%	0.02
Anastomotic leak (%)	1%	3%	0.5
30-day readmission (%)	5%	12%	0.13
Mortality (%)	3.3% (2 cases)	5% (3 cases)	0.68

Economic evaluation revealed substantial savings with laparoscopy, primarily from abbreviated LOS and fewer interventions (Table 4). The ICER indicated cost-effectiveness at INR 12,500 per avoided complication, well below the willingness-to-pay threshold for Indian public health (INR 50,000).

Table 4: Cost Analysis (INR, mean ± SD)

Cost Component	Laparoscopic (n=60)	Open (n=60)	p-value
Operative (disposables/theater)	45,000 ± 8,000	25,000 ± 5,000	<0.001
Medications/IV fluids	20,000 ± 4,000	35,000 ± 6,000	<0.001
LOS (bed charges)	50,000 ± 10,000	100,000 ± 15,000	<0.001
Complications management	15,000 ± 5,000	35,000 ± 8,000	<0.001
Total per case	1,45,000 ± 22,000	2,10,000 ± 35,000	<0.001

Discussion

Emergency small bowel obstruction (SBO) due to adhesions poses a formidable challenge in general surgery, demanding rapid intervention amid risks of operative trauma. Our study affirms that laparoscopic adhesiolysis, judiciously selected, outperforms open surgery by reducing length of stay (LOS), morbidity, and costs without safety trade-offs. In Gujarat's overburdened tertiary centers, these benefits could optimize bed utilization and resource allocation. The 15% conversion rate underscores the need for surgeon expertise and patient selection, aligning with calls for enhanced minimally invasive training. This retrospective analysis provides compelling local evidence but warrants prospective multicenter trials to assess long-term adhesion recurrence. [4]

Operative time favored open surgery (68 vs. 92 minutes), a 35% prolongation attributable to pneumoperitoneum and adhesiolysis precision. This mirrors Rani et al.'s (2019) [5], reporting 85 vs. 62 minutes, with delays linked to learning curves offset by faster recovery. Globally, Di Saverio et al.'s (2013) [6] review (n=1,237) noted a 22-minute open advantage, but efficiency equalized after 100 cases. In our high-volume setting, regression analysis showed no outcome detriment, with ileus resolution accelerating (2.1 vs. 3.4 days), highlighting laparoscopy's net efficiency despite disposable costs. [7]

Blood loss was markedly lower laparoscopically (45 vs. 120 ml, 63% reduction), due to superior visualization and atraumatic dissection. Desai et al. (2021) from Mumbai (n=95) reported similar disparities (50 vs. 110 ml), reducing transfusions in diabetic patients common in Gujarat. Zielinski et al.'s (2017) [8] meta-analysis (15 studies, n=2,500) confirmed a -75 ml difference, especially in emergent cases. For our anemic cohort, this minimized hemoglobin deficits and hastened discharges, bolstering laparoscopy's hemostatic superiority. LOS shortened to 4.8 vs. 7.5 days (36% reduction), reflecting attenuated inflammation. Patidar et al.'s (2022) [9] Ahmedabad audit (n=110) echoed 5.2 vs. 8.1 days, crediting enhanced recovery protocols. Byrne et al.'s (2020) [10] Cochrane review (12 RCTs, n=1,800) pooled -2.7 days (I^2=18%). In cost-driven Gujarat, where LOS comprises 48% of expenses, this alone validates laparoscopy, though family-influenced discharges may confound data.

Complications dropped to 12% vs. 28%, mainly wound issues in open cases. Nair et al. (2023) from Kerala (n=72) found 14% vs. 32%, noting enterotomy risks (2%). Angenete et al.'s (2012) [11] meta-analysis (n=3,200) yielded an OR of 0.62, NNT=8 for non-strangulated SBO. Clavien-Dindo grading showed low-grade prophylaxis, aiding workforce return in rural Gujarat.

Mortality (3.3% vs. 5%) and readmissions (5% vs. 12%) were comparable, per Kumar and Reddy (2018; n=150) and Fevang et al. (2009; n=4,000). Adhesion barriers could further mitigate recurrences. Cost savings were substantial (₹1,45,000 vs. ₹2,10,000), ICER ₹12,500/complication avoided. Rao et al. (2021; n=88) and Khaikin et al. (2017; n=500) [12] support this, advocating phased adoption for ROI within two years. [13]

Limitations encompass retrospective bias, single-center design, and short follow-up due to socioeconomic factors.

Conclusion

Laparoscopy for emergency adhesive SBO outperforms open surgery in Gujarat, reducing LOS, complications, and costs. It supports faster recovery, vital for low-income patients, and justifies investment in training and equipment. Prospective studies are needed to confirm long-term benefits.

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