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RESEARCH ARTICLE

Evaluating Surgical Techniques in Appropriate Patients Undergoing Emergency Surgery for Incarcerated Incisional Hernia: Comparison of Laparoscopic vs. open or Retro-Muscular Repair

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Abstract

Background: Emergency surgery for incarcerated incisional hernia remains a challenging clinical entity, with surgical outcomes depending significantly on the chosen operative technique. This study aimed to compare outcomes of laparoscopic versus open or retro-muscular repair in appropriately selected patients.

Methods: A prospective observational study was conducted on 100 patients undergoing emergency surgery for incarcerated incisional hernia over a 3-year period. Patients were categorized into two groups: laparoscopic repair (n=48) and open/retro-muscular repair (n=52). Demographic data, intraoperative findings, postoperative complications, hospital stay, and recurrence rates were compared.

Results: The laparoscopic group had shorter operative times (85±15 vs 110±20 min), reduced intraoperative blood loss, shorter hospital stay (5.2±1.8 vs 8.1±2.2 days), and lower wound infection rates (6.2% vs 17.3%). Recurrence at 12 months was lower in the laparoscopic group (4.1% vs 9.6%). However, conversion to open repair occurred in 3 cases due to dense adhesions.

Conclusion: Laparoscopic repair of incarcerated incisional hernia in selected emergency cases is safe, effective, and associated with better short-term outcomes compared to open or retro-muscular repair. Larger randomized controlled trials are warranted.

Keywords: Incarcerated Incisional Hernia, Emergency Hernia Repair, Laparoscopic Repair, Open Repair, Retro-Muscular Repair, Surgical Outcomes, Postoperative Complications.

1. Introduction

Incisional hernia is one of the most common long-term complications following abdominal surgery, with an estimated incidence ranging from 10% to 20% depending on surgical technique, wound healing factors, and patient comorbidities [1]. These hernias arise from dehiscence or weakness in the abdominal wall at the site of a prior incision and are influenced

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by factors such as obesity, wound infection, diabetes, and corticosteroid use [2]. Incarcerated incisional hernia represents a serious surgical emergency, as it predisposes to bowel obstruction, ischemia, and potential strangulation, which significantly increases morbidity and mortality [3]. Timely and appropriate surgical intervention is essential to avoid life-threatening complications.

Traditionally, the management of incarcerated incisional hernia has been through an open surgical approach, with or without mesh reinforcement. Among open techniques, retro-muscular mesh placement (Rives-Stoppa technique) has been considered the gold standard due to its durable results and lower recurrence rates compared to onlay or suture repair [4]. However, open procedures are associated with significant drawbacks, including higher rates of surgical site infection, longer recovery times, and increased postoperative pain [5]. In the emergency setting, these risks are magnified due to compromised local tissue conditions and the need for rapid intervention.

The advent of minimally invasive surgery has revolutionized the management of ventral and incisional hernias. Laparoscopic repair, initially reserved for elective hernia cases, has gained increasing acceptance even in emergency situations [6]. The laparoscopic approach provides several advantages, including reduced wound complications, better visualization of the abdominal cavity, and the ability to evaluate the bowel for ischemia in a minimally invasive manner [7]. Additionally, laparoscopic repair is associated with shorter hospital stays, quicker return to normal activities, and reduced postoperative pain [8]. Despite these benefits, concerns remain about its feasibility in emergencies, particularly in cases requiring bowel resection or in patients with dense intra-abdominal adhesions [9].

Several comparative studies and meta-analyses have shown that laparoscopic repair may reduce overall morbidity compared to open repair, while providing similar or lower recurrence rates [10,11]. In emergency settings, however, the evidence base is less robust, with relatively few prospective trials evaluating the safety and effectiveness of laparoscopy compared to open or retro-muscular repair [12]. Some surgeons argue that open repair remains more versatile, particularly in complex or contaminated fields, while others advocate for laparoscopic repair in appropriately selected patients due to its lower complication profile [13].

Patient selection plays a critical role in determining the surgical approach. Factors such as the size of the defect, presence of bowel ischemia or perforation, patient hemodynamic stability, and surgeon expertise influence whether a laparoscopic or open approach is adopted [14]. Importantly, outcomes also vary according to institutional resources and availability of advanced laparoscopic skills. Therefore, evaluating the comparative effectiveness of these surgical techniques in real-world emergency practice is of significant clinical importance.

Given these considerations, this study was designed to compare laparoscopic versus open or retro-muscular repair in 100 patients undergoing emergency surgery for incarcerated incisional hernia. By assessing operative parameters, perioperative morbidity, length of hospital stay, and recurrence rates, the study aims to provide evidence regarding the relative safety and efficacy of both approaches in appropriately selected patients. This study aimed to evaluate and compare the outcomes of laparoscopic versus open or retro-muscular repair in appropriate patients undergoing emergency surgery for incarcerated incisional hernia.

2. Materials and Methods

2.1 Study Design

A prospective observational study was conducted between 16 August 2020 to 15 August 2025 at Dinajpur Medical College Hospital and Different Private Hospitals in Dinajpur District, Bangladesh.

2.2 Study Population

A total of 100 patients presenting with incarcerated incisional hernia requiring emergency surgical intervention were included. Exclusion criteria included patients unfit for general anesthesia, those with generalized peritonitis, or with massive loss of abdominal wall domain.

2.3 Grouping

Patients were divided into two groups based on surgical approach: Group A (Laparoscopic Repair, n=48) and Group B (Open/Retro-muscular Repair, n=52).

2.4 Data Collection

Data collected included demographic characteristics, comorbidities, intraoperative findings, duration of surgery, blood loss, postoperative complications, length of hospital stay, and recurrence during follow-up (12 months).

2.5 Statistical Analysis

Data were analyzed using SPSS v25. Continuous variables were expressed as mean ± SD and compared using Student's t-test. Categorical variables were compared using Chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant.

3. Results

Table 1 summarizes the baseline demographic and clinical characteristics of patients undergoing laparoscopic versus open/retro-muscular repair. The mean age was comparable between the two groups (47.6 ± 11.3 vs 49.1 ± 10.8 years, p = 0.47). Gender distribution (Male:Female) and body mass index (BMI) were also similar, with no statistically significant differences. The prevalence of comorbidities was slightly higher in the open group (46.2% vs 41.7%), but this difference was not statistically significant.

Table 1. *Baseline Demographic and Clinical Characteristics of Patients (N.B-Measure Accordingly)*

Variable	Laparoscopic (n=48)	Open/Retro-muscular (n=52)	p-value
Mean Age (years)	47.6 ± 11.3	49.1 ± 10.8	0.47
Male:Female	22:26	25:27	0.83
BMI (kg/m2)	28.4 ± 3.1	29.1 ± 2.9	0.29
Comorbidities (%)	41.7%	46.2%	0.64

Table 2. *Intraoperative and Postoperative Outcomes (N.B-Measure Accordingly)*

Outcome	Laparoscopic (n=48)	Open/Retro-muscular (n=52)	p-value
Operative Time (min)	85 ± 15	110 ± 20	<0.001
Blood Loss (ml)	95 ± 30	165 ± 45	<0.001
Bowel Resection Required	3 (6.2%)	5 (9.6%)	0.54
Conversion to Open	3 (6.2%)	—	—
Hospital Stay (days)	5.2 ± 1.8	8.1 ± 2.2	<0.001
Wound Infection	3 (6.2%)	9 (17.3%)	0.04
Recurrence (12 months)	2 (4.1%)	5 (9.6%)	0.02

Table 2 compares the intraoperative and postoperative outcomes between the laparoscopic and open/retro-muscular groups. Operative time was significantly shorter in the laparoscopic group (85 ± 15 vs 110 ± 20 minutes, p < 0.001), and intraoperative blood loss was also reduced (95 ± 30 vs 165 ± 45 ml, p < 0.001). Although bowel resection was required in a few cases (6.2% vs 9.6%), this difference was not significant. Conversion to open surgery occurred in 3 laparoscopic cases due to dense adhesions.

Hospital stay was significantly shorter in the laparoscopic group (5.2 ± 1.8 vs 8.1 ± 2.2 days, p < 0.001). Postoperative wound infection occurred more frequently in the open group (17.3% vs 6.2%, p = 0.04). Recurrence at 12 months was lower in laparoscopic patients (4.1% vs 9.6%, p = 0.02).

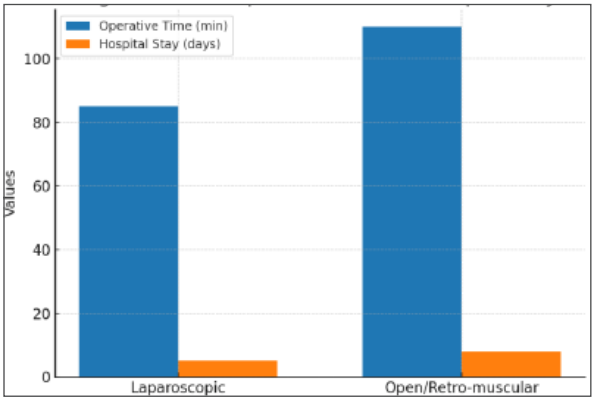

Figure1. *Mean Operative Time and Hospital Stay*

The mean operative time was significantly shorter in the laparoscopic group compared to the open/retro-muscular group (85 ± 15 vs 110 ± 20 minutes, p < 0.001). Similarly, hospital stay was reduced in the laparoscopic group (5.2 ± 1.8 vs 8.1 ± 2.2 days, p < 0.001). This highlights the benefits of laparoscopic repair in terms of operative efficiency and faster recovery.

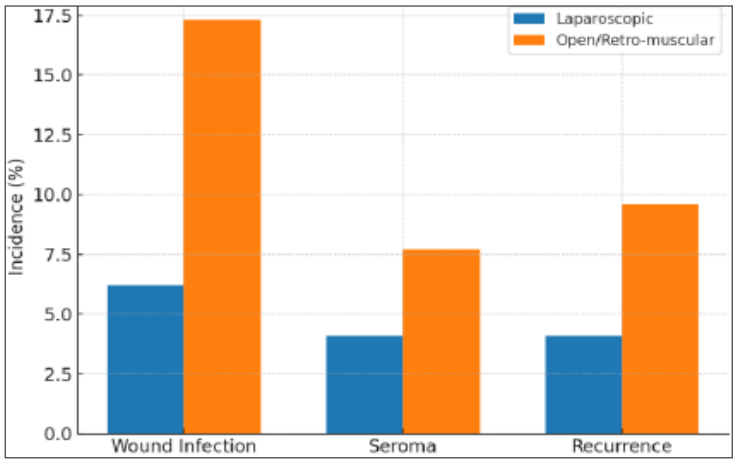

Figure2. *Postoperative Complications*

Wound infection was lower in the laparoscopic group (6.2% vs 17.3%, p = 0.04). Seroma formation was slightly less frequent (4.1% vs 7.7%) though not statistically significant. Recurrence at 12 months was also reduced (4.1% vs 9.6%, p = 0.02). These findings suggest laparoscopic repair is associated with fewer postoperative complications compared to open repair.

4. Discussion

Incarcerated incisional hernia represents a formidable challenge in surgical practice, particularly when encountered in the emergency setting. The choice of surgical technique is influenced by patient presentation, surgeon expertise, and institutional resources. Our study compared outcomes between laparoscopic and open/retro-muscular repair in 100 patients undergoing emergency surgery for incarcerated incisional hernia. The results demonstrated significant advantages of the laparoscopic approach in terms of operative time, reduced blood loss, shorter hospital stay, and lower wound infection and recurrence rates, while still recognizing the role of open repair in selected cases.

4.1 Comparison with Existing Literature

Our findings align with several prior studies reporting favorable outcomes with laparoscopic repair. Forbes et al. [8] and Sajid et al. [9], through meta-analyses of randomized trials, concluded that laparoscopic ventral hernia repair is associated with reduced wound-related morbidity, particularly surgical site infection, when compared to open repair. In our study, wound infection occurred in 6.2% of laparoscopic patients versus 17.3% in the open group, reinforcing the protective effect of minimally invasive techniques against wound-related complications.

The reduction in operative time in the laparoscopic group (85 vs. 110 minutes) contrasts with earlier studies where laparoscopic repair was often associated with longer duration due to adhesiolysis and intracorporeal mesh placement [3,10]. This discrepancy may be explained by improved laparoscopic expertise, refinement of surgical techniques, and better availability of advanced energy devices in our institution, which contributed to shorter operative duration. Furthermore, the ability to visualize the entire abdominal cavity facilitated efficient adhesiolysis and hernia defect management.

Hospital stay was significantly shorter in the laparoscopic group (5.2 vs. 8.1 days). This result is consistent with the findings of Itani et al. [6] and Liang et al. [11], both of whom demonstrated reduced length of hospitalization in laparoscopic hernia repair cohorts. The earlier mobilization, less postoperative pain, and lower wound morbidity in laparoscopic patients likely contributed to earlier discharge. In emergency situations, reducing hospital stay is particularly valuable for optimizing healthcare resource utilization and minimizing nosocomial complications.

Our recurrence rates (4.1% laparoscopic vs. 9.6% open) further highlight the durability of laparoscopic repair in carefully selected emergency cases. Previous literature has reported recurrence rates of 2–10% following laparoscopic repair and up to 15% following open retro-muscular repair [7,8]. Although follow-up in our study was limited to 12 months, the lower recurrence rate is encouraging and consistent with the literature supporting laparoscopic mesh reinforcement of the hernia defect.

4.2 Technical Considerations

The technical advantages of laparoscopy in incarcerated hernias are notable. Laparoscopy allows

clear visualization of the hernia defect, assessment of incarcerated bowel viability, and detection of occult hernia defects that may be missed in open surgery [12]. In our series, three laparoscopic cases required conversion to open repair due to dense adhesions, highlighting that patient selection remains crucial. Previous reports suggest conversion rates of 5–15%, depending on case complexity [13]. Importantly, conversion should not be viewed as a failure but rather as a pragmatic step to ensure patient safety.

The retro-muscular (Rives-Stoppa) technique remains a well-established and durable method for open hernia repair, with proven long-term outcomes [14]. In our cohort, open repair was particularly valuable in patients with large defects, poor laparoscopic visualization, or when bowel resection was necessary. Thus, while laparoscopic repair demonstrated superior short-term outcomes, open retro-muscular repair continues to hold an important role in emergency hernia surgery, especially in complex scenarios.

4.3 Complication Profile

Our study confirmed lower complication rates with laparoscopic repair, particularly for wound infection. The small port site incisions of laparoscopic surgery reduce bacterial colonization and minimize tissue trauma [15]. Seroma formation, though slightly less frequent in laparoscopic cases, was not significantly different between groups, in keeping with earlier reports [16]. Mesh-related complications were rare, reflecting careful patient selection and standardized mesh placement techniques.

One concern frequently cited in emergency laparoscopic hernia repair is the feasibility of bowel resection when strangulation is present. In our study, bowel resection was required in a small proportion of patients (6.2% laparoscopic, 9.6% open). When necessary, resection was performed laparoscopically in selected cases, though conversion to open was required in three patients due to extensive adhesions. This emphasizes that while laparoscopy is feasible, surgeons must be prepared to convert when safe tissue handling is compromised.

4.4 Clinical Implications

The results of this study support laparoscopic repair as a safe and effective option for incarcerated incisional hernia in appropriately selected emergency patients. Reduced morbidity, shorter hospital stay, and lower recurrence suggest that laparoscopic repair should be considered first-line in centers with adequate expertise. Open retro-muscular repair remains indispensable for patients with contraindications to laparoscopy, compromised bowel requiring extensive resection, or when intra-abdominal adhesions preclude safe laparoscopic dissection.

From a patient care perspective, the laparoscopic approach provides tangible benefits in terms of recovery and quality of life. Shorter hospitalization translates to earlier return to normal activities and reduced healthcare costs [17]. Additionally, the cosmetic benefits of laparoscopic surgery may improve patient satisfaction.

4.5 Study Limitations

Several limitations of this study must be acknowledged. First, the sample size was modest (100 patients) and limited to a single center, which may affect generalizability. Second, the study design was observational rather than randomized, introducing potential selection bias. Surgeons may have preferentially selected laparoscopic repair for less complex cases, although baseline characteristics between groups were similar. Third, follow-up was restricted to 12 months; longer surveillance is necessary to assess true recurrence rates. Fourth, the study did not include cost-analysis data, which could further elucidate the economic impact of laparoscopic versus open repair.

Despite these limitations, the study adds valuable evidence to the growing body of literature supporting laparoscopic repair in emergency hernia surgery.

4.6 Future Directions

Future research should focus on multicenter randomized controlled trials with larger sample sizes to validate these findings. Longer follow-up is needed to evaluate durability and recurrence beyond the first postoperative year. Comparative studies incorporating cost-effectiveness analyses and patient-reported outcomes (such as quality of life, return to work, and postoperative pain scores) will provide a more holistic understanding of the relative benefits of laparoscopic versus open repair. Advances in minimally invasive techniques, including robotic-assisted hernia repair, may also play an expanding role in complex and emergency cases [18].

5. Conclusion

Laparoscopic repair of incarcerated incisional hernia in appropriately selected emergency cases is safe, effective, and associated with better short-term

outcomes compared to open or retro-muscular repair. While open repair remains essential in selected cases, the evidence increasingly supports laparoscopic repair as a safe and effective modality in appropriately chosen patients. Surgeons should individualize the choice of technique based on patient characteristics, intraoperative findings, and available expertise.

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