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Incisional hernia repair in cirrhotic patients with ascites: a multicenter retrospective experience

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Abstract

Objectives: Incisional hernia is a complication after abdominal surgery and is particularly challenging in patients with ascites because of increased intra-abdominal pressure, impaired wound healing, and infection risk. Evidence on surgical repair remains limited, particularly for incisional rather than umbilical hernias.

Methods: This retrospective multicenter study included 31 cirrhotic patients with ascites (22 males, 9 females; 45–72 years) who underwent incisional hernia repair between 2000 and 2025 at three tertiary General and Emergency Surgery Units. Liver disease severity was assessed using the Child–Pugh classification. Following preoperative ascites optimization, repair was performed with primary suture or mesh reinforcement. Primary outcomes were perioperative morbidity and mortality; secondary outcome was hernia recurrence.

Results: Perioperative mortality occurred in 5 patients (16.1 %), all with advanced liver disease. Major complications occurred in 8 patients (25.8 %), while minor complications developed in 10 (32.3 %), mainly surgical site infection, seroma or hematoma, and postoperative ileus. After a median follow-up of 26 months, hernia recurrence occurred in 11 patients (35.5 %) and was higher after primary suture than mesh repair.

Conclusions: Elective repair is feasible in selected patients after ascites optimization. Mesh reinforcement provides greater durability when infection risk is acceptable. Patient selection and perioperative management remain essential.

Keywords: incisional hernia; ascites; surgical repair; mesh reinforcement; peritoneovenous shunt; hernia recurrence

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Introduction

Incisional hernia remains one of the most common late complications of abdominal surgery [1, 2]. In patients with clinically significant ascites, the problem is magnified: sustained elevations in intra-abdominal pressure, impaired wound biology, malnutrition, portal hypertension–related coagulopathy, and a higher susceptibility to infection all contribute to undermining fascial healing [3–5]. The clinical picture is often one of progressive bulging, skin compromise, and intermittent leakage [3–5]. Not infrequently, acute events such as incarceration, strangulation, or rupture force emergency care in physiologically fragile patients [6]. Against this background, the surgeon faces a familiar dilemma: defer repair until ascites is controlled, and the patient is nutritionally repleted or intervening earlier to avert catastrophic complications while accepting a substantial perioperative risk [6].

Although several series have reported on ventral hernia repair in cirrhosis and other causes of ascites, the evidence

base remains heterogeneous [1, 5, 7, 8]. Reported cohorts vary in the balance of elective vs. emergency indications, the severity of liver disease, and the rigor of preoperative optimization protocols [1]. Surgical techniques range from primary suture closure to open or laparoscopic mesh reinforcement with diverse materials and positions including onlay, retromuscular (sublay), and intraperitoneal underlay [1, 5, 7, 8]. The resulting signal, particularly around recurrence, surgical site infection, and mesh related morbidity, has been noisy and difficult to generalize. Therefore, guideline level recommendations are cautious, and most decisions are individualized at the bedside, guided by institutional experience and the patient's risk profile. As a result, the optimal timing and technique for incisional hernia repair in cirrhotic patients with ascites remain poorly defined, particularly in real-world surgical practice.

Several mechanisms plausibly explain the higher failure rates in this population. Persistent ascites sustains tension across the repair and promotes seroma formation [8, 9]. Hypoalbuminemia and micronutrient deficiencies blunt fibroblast function and collagen deposition [8, 9]. Portal hypertension drives venous congestion and tissue edema. Repeated paracenteses, when needed, may seed or exacerbate local infection [8, 9]. Together, these factors tilt the balance away from durable fascial integration, particularly when suture only strategies are used or when postoperative fluid control is suboptimal [6, 8, 9]. Conversely, well-selected use of mesh can distribute load and reduce tension, potentially lowering recurrence at the cost of a higher theoretical and sometimes observed susceptibility to infection [1, 2, 9]. The trade-off is especially delicate where contamination risk is clinically relevant.

Adjunctive strategies aim to stabilize the biological and mechanical environment of the repair. Multimodal ascites control with diuretics, large volume paracentesis with albumin, sodium restriction, and in refractory cases shunting procedures can reduce perioperative leakage and wound complications [6, 9, 10]. Peritoneovenous shunting, though selectively used, may improve quality of life and mitigate the forces that drive recurrence when medical therapy alone is insufficient. Nutritional support, antimicrobial stewardship, and thoughtfully timed repair, elective rather than urgent whenever feasible, are recurring themes across experienced centers [6, 10, 11].

Within this context, we report a 25-year three-institution experience with surgical repair of incisional hernia in patients with ascites. The cohort includes 31 patients with liver cirrhosis and ascites treated between 2000 and 2025. For reference, the Child–Pugh classification of chronic liver disease is summarized in Table 1. Surgical strategies comprised primary suture closure and mesh-reinforced repair, selected according to clinical status and hernia characteristics. A minority of patients underwent peritoneovenous shunting as an adjunct to medical optimization. We report perioperative outcomes, complications, and hernia recurrence and interpret these findings in the context of contemporary practice. Our aim is to outline a risk-adapted approach integrating ascites control, infection prevention, and tailored technique selection to guide decision-making in this high-stakes setting. The first objective of the study was to characterize perioperative morbidity and mortality following incisional hernia repair (IHR) in cirrhotic patients with ascites. The second was to compare recurrence according to repair strategy, primary suture vs. mesh, within the constraints of a real-world cohort. The third was to propose a pragmatic management pathway incorporating preoperative optimization and adjunctive measures. Rather than advocating a single optimal technique, we emphasize aligning the operation with the patient's physiological reserve: strict perioperative ascites control, cautious use of mesh when benefits outweigh risks, and avoidance of elective repair in the most fragile patients unless compelling indications exist.

Materials and methods

Study design and patient population

This retrospective observational study was conducted at three tertiary referral General and Emergency Surgery Units in Italy. Institutional databases were reviewed to identify patients with cirrhosis and ascites who underwent surgical repair of incisional hernia between January 2000 and March 2025. The study was reported in accordance with the STROBE guidelines for observational studies.

For the purpose of the present analysis, only patients with liver cirrhosis were included, resulting in a final study cohort of 31 patients. All procedures were performed by senior surgeons following shared institutional principles for ascites optimization, antibiotic prophylaxis, and drain placement. A common institutional approach was adopted across centers and periodically updated during the study period to ensure consistency in perioperative management.

Inclusion criteria were the presence of a clinically evident incisional hernia following previous abdominal surgery, a diagnosis of liver cirrhosis with associated ascites, and availability of sufficient clinical data for perioperative and follow-up assessment. Patients with primary ventral hernias, patients without documented cirrhosis, and those with incomplete clinical records were excluded from the analysis.

Patient characteristics

The final study cohort consisted of 31 patients with liver cirrhosis and ascites who underwent surgical repair of an

Table 1: Child–Pugh classification for severity of chronic liver disease.

Parameter	1 point	2 points	3 points
Ascites	Absent	Slight	Moderate to severe/refractory
Bilirubin, mg/dL	<2.0	2.0–3.0	>3.0
Albumin, g/dL	>3.5	2.8–3.5	<2.8
Prothrombin time (seconds over control) or INR	<4 s or INR <1.7	4–6 s or INR 1.7–2.3	>6 s or INR >2.3
Hepatic encephalopathy	None	Grade I–II (or suppressed with medication)	Grade III–IV (refractory)

Total score = sum of points. Class A: 5–6 points (well compensated disease); **Class B**: 7–9 points (significant functional compromise); **Class C**: 10–15 points (decompensated disease, high surgical risk).

incisional hernia between 2000 and 2025. There were 22 men and 9 women, with an age range of 45–72 years (median 60 years; interquartile range 53–68).

Severity of liver disease was assessed using the Child–Pugh classification. Five patients were classified as Child–Pugh A, 17 as Child–Pugh B, and 9 as Child–Pugh C.

Baseline demographic and clinical characteristics of the study population are summarized in Table 2.

Formal nutritional scores and body composition assessments were not systematically recorded and, therefore, could not be included in quantitative analysis. Nevertheless, hypoalbuminemia and clinical features of sarcopenia were frequently observed and were considered qualitatively during preoperative risk assessment.

Table 2: Baseline demographic and clinical characteristics of cirrhotic patients undergoing IHR (n = 31).

Variable	Value
Patients, n	31
Age, years	45–72
	Median 60 (IQR 53–68)
Sex, male/female	22/9
Liver disease severity (Child–Pugh)	
– Class A	5
– Class B	17
– Class C	9
Type of repair	
– Primary suture	14
– Mesh reinforcement	17
Mesh type (n=17)	
– Synthetic	13
– Biologic	4
Peritoneovenous shunt (preoperative)	3

Baseline demographic and clinical characteristics of the study cohort. Only patients with liver cirrhosis and ascites were included in the final analysis. Severity of liver disease was assessed using the Child–Pugh classification. Mesh reinforcement included both synthetic and biologic prostheses, selected according to ascites control and infection risk. IQR, interquartile range.

Baseline assessment

Baseline demographic and clinical data were collected for all patients, including age, sex, comorbidities, and severity of liver disease. Liver function was assessed using the Child–Pugh classification, which was applied to all patients included in the analysis.

Data regarding the index abdominal operation leading to incisional hernia formation were recorded and reflected the heterogeneity of prior surgical procedures, including colorectal, hepatobiliary, and gynecologic surgery.

Nutritional status, biochemical parameters, and characteristics of ascitic fluid were reviewed when available as part of routine clinical assessment but were not systematically recorded and were, therefore, not included in the formal analysis.

Preoperative management

All patients underwent standardized preoperative optimization aimed at controlling ascites and improving overall clinical stability before surgical repair. Medical management included sodium restriction, diuretic therapy, and repeated large-volume paracenteses with albumin supplementation when indicated.

Ascites control was assessed clinically, with particular attention to the presence of persistent abdominal wall leakage or leakage through previous surgical scars, which was considered a marker of inadequate control and influenced the timing of surgery.

In selected patients with refractory ascites who failed medical therapy, a peritoneovenous shunt was placed before hernia repair to improve ascites control. Nutritional optimization was pursued when feasible, based on clinical evaluation, although no standardized nutritional protocol was applied.

Operative details

Surgical repair was performed using either primary suture closure or mesh reinforcement, according to hernia characteristics and the patient's clinical condition. In the final cohort of 31 cirrhotic patients, 14 underwent primary suture repair and 17 received mesh reinforcement. Mesh reinforcement was preferred when ascites control and infection risk were considered acceptable. In practical terms, mesh reinforcement was favored in patients with controlled or partially controlled ascites, absence of gross contamination, acceptable tissue quality, and no evidence of active wound infection. Primary suture repair was preferred in small defects, uncontrolled ascitic leakage, severe contamination risk, marked clinical instability, or when prosthetic implantation was considered unsafe.

Synthetic mesh was used in the majority of cases, whereas biologic mesh was selectively employed in high-risk patients with poor ascites control or increased concern for postoperative infection. Synthetic prostheses were generally used in patients with acceptable infection risk and satisfactory ascites control, whereas biologic meshes were reserved for selected high-risk scenarios characterized by impaired tissue quality or increased concern for contamination. Detailed data regarding mesh brand, fixation technique, and overlap were not consistently available throughout the entire study period and were, therefore, not included in the formal analysis. Mesh positioning was predominantly retromuscular (sublay), while intraperitoneal underlay placement was used in selected cases. Onlay positioning was deliberately avoided because of the elevated risk of surgical site infection in the presence of ascites. Three patients underwent placement of a peritoneovenous shunt before hernia repair as part of preoperative optimization for refractory ascites.

Closed-suction drainage was systematically employed in all patients. After primary suture repair, subcutaneous drains were routinely placed. In patients undergoing mesh reinforcement, both subcutaneous and periprosthetic drains were used.

Intraperitoneal drains were placed in most mesh repairs to assist postoperative ascites management. Exceptions included patients with well-compensated disease and those with a preexisting peritoneovenous shunt, in whom intraperitoneal drainage was avoided to reduce the risk of contamination. When used, intraperitoneal drains were removed as early as clinically feasible.

Perioperative antibiotic prophylaxis was administered intraoperatively in all patients. In accordance with the institutional protocols applied during the study period, postoperative antibiotic therapy was continued for at least 5 days and was individualized according to infectious risk and clinical course. Length of hospital stay was not systematically recorded and was, therefore, not included in the analysis.

These operative variables are summarized in Table 3.

Outcome measures

The primary outcomes were perioperative morbidity and mortality. The secondary outcome was long-term incisional hernia recurrence. Additional postoperative outcomes included wound-related complications such as surgical site infection, seroma, and hematoma.

Perioperative mortality was defined as death occurring within 30 days after surgery or during the index hospitalization. Postoperative morbidity was classified as major or minor. Major morbidity included life-threatening complications, organ failure, and events requiring reoperation or intensive care support. ICU admission or close postoperative monitoring was additionally recorded as a marker of clinical severity and resource use rather than as an independent

Table 3: Operative details and perioperative management in cirrhotic patients undergoing IHR (n=31).

Variable	Description
Surgical approach	Open repair in all cases
Type of repair	Primary suture repair or mesh reinforcement
Mesh use	Applied when ascites control and infection risk were considered acceptable
Mesh type	Synthetic or biologic, selected according to clinical risk profile
Mesh position	Retromuscular (sublay) or intraperitoneal underlay
Onlay mesh placement	Not used
Preoperative peritoneovenous shunt	Used in selected patients with refractory ascites
Drain placement	Closed-suction drainage in all patients
– After suture repair	Subcutaneous drains
– After mesh repair	Subcutaneous and periprosthetic drains
Intraperitoneal drainage	Used selectively to assist postoperative ascites management
Perioperative antibiotic prophylaxis	Administered intraoperatively in all patients
Duration of antibiotic therapy	Postoperative antibiotic therapy continued for at least 5 days and individualized according to infectious risk and clinical course

Operative strategy and perioperative management in the study cohort. Surgical technique and use of prosthetic material were individualized according to hernia characteristics, ascites control, and infection risk. Drain placement and antibiotic prophylaxis followed standardized institutional principles aimed at reducing postoperative wound complications in cirrhotic patients with ascites.

complication. Minor morbidity included wound-related complications managed conservatively, such as surgical site infections treated with antibiotics or drainage and self-limiting seromas or hematomas.

Hernia recurrence was defined as a clinically evident defect detected on physical examination and/or imaging during follow-up. Follow-up consisted primarily of outpatient clinical evaluation, with imaging performed selectively when clinically indicated. Routine radiological surveillance was not systematically available for all patients, and therefore, asymptomatic or subclinical recurrences may have been underestimated.

Statistical analysis

Owing to the limited sample size, statistical analysis was primarily descriptive. Continuous variables were summarized using median and range, whereas categorical variables were reported as absolute numbers and percentages. Exploratory comparisons between groups were considered, but the study was not powered to support inferential statistical testing. Accordingly, results are presented descriptively without formal hypothesis testing, and no causal associations were inferred.

Ethical considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki. Since this was a retrospective observational analysis based on anonymized data routinely collected in the clinical workflow, no active intervention or randomization was performed, and no identifiable patient information was used. According to national and institutional regulations, retrospective studies that do not involve changes in patient management and do not include sensitive or identifiable data do not require formal approval by the Ethics Committee. Therefore, specific ethics board approval was not required for this study. According to national regulations, ethics committee approval and informed consent were waived for this retrospective study.

Results

Postoperative morbidity and mortality

Among the 31 cirrhotic patients included in the analysis, perioperative mortality occurred in 5 cases (16.1 %). All perioperative deaths were observed in patients with advanced liver disease (Child–Pugh C or decompensated Child–Pugh B) and occurred after primary suture repair.

Major complications were recorded in 8 patients (25.8 %) and included perioperative death, bleeding from esophageal varices requiring intensive care support, and sepsis with multiorgan failure. Eight patients required ICU admission or close postoperative monitoring; this was considered a marker of complication severity and resource use rather than an additional independent complication.

Minor complications occurred in 10 patients (32.3 %) and were managed conservatively. These included four surgical site infections treated with antibiotics and/or drainage (12.9 %), 5 fluid collections such as seroma or hematoma managed with aspiration and medical therapy (16.1 %), and one postoperative ileus (3.2 %).

During the overall observation period, a total of 5 patients (16.1 %) died, all within the perioperative phase. No additional deaths were recorded during follow-up among the cirrhotic patients included in this analysis. The need for intensive care admission or close postoperative ICU monitoring was documented in 8 patients (25.8 %), reflecting the high physiological vulnerability of this population.

Postoperative morbidity and mortality are summarized in Table 4.

Follow-up and recurrence

Recurrence percentages were calculated using the original treatment groups as denominators. Because five perioperative

Table 4: Postoperative morbidity and mortality after IHR in cirrhotic patients with ascites (n=31).

Outcome	n, %
Perioperative mortality	5 (16.1)
Patients with at least one major complication	8 (25.8)
– Variceal bleeding	1 (3.2)
– Sepsis/multiorgan failure	2 (6.5)
ICU admission or close monitoring	8 (25.8)
Minor complications	10 (32.3)
– Surgical site infection	4 (12.9)
– Seroma/hematoma	5 (16.1)
– Postoperative ileus	1 (3.2)

Postoperative morbidity and mortality in cirrhotic patients undergoing IHR. Perioperative mortality was defined as death occurring within 30 days after surgery or during the index hospitalization. Major complications included life-threatening events, organ failure, or the need for intensive care. Minor complications included wound-related events managed conservatively. ICU, Intensive Care Unit. Major complication categories were not necessarily mutually exclusive. ICU admission or close postoperative monitoring was reported separately as a marker of clinical severity and resource use.

Table 5: Follow-up and hernia recurrence after IHR in cirrhotic patients with ascites (n=31).

Outcome	n, %
Follow-up duration, months	Median 26 (range 0–92)
Hernia recurrence (overall)	11 (35.5)
Crude recurrence proportion after primary suture repair (n=14)	9 (64.3 %)
Crude recurrence proportion after mesh reinforcement (n=17)	2 (11.8 %)
Symptomatic recurrences	0
Reoperation for recurrence	0

Follow-up outcomes and hernia recurrence in the study cohort. Recurrence was defined as a clinically evident incisional hernia detected on physical examination and/or imaging during follow-up. n indicates the number of patients. In particular, n=14 refers to the total number of patients who underwent primary suture repair, whereas n=17 refers to the total number of patients who underwent mesh reinforcement. For each surgical technique, recurrence rates are expressed as number of patients with hernia recurrence (numerator) over the total number of patients treated with that specific technique (denominator). These values are crude proportions based on the original treatment groups and are not time-to-event estimates. Five perioperative deaths occurred in the primary suture group and represented competing events for recurrence assessment.

deaths occurred in the primary suture group and follow-up duration varied among patients, the reported values represent crude recurrence proportions rather than time-to-event estimates. Perioperative death acted as a competing event and may, therefore, have resulted in underestimation of the recurrence burden, particularly in the primary suture group (Table 5).

The crude recurrence proportion was higher after primary suture repair than after mesh reinforcement (Figure 1). However, this descriptive difference should be interpreted cautiously because treatment allocation was not randomized, baseline clinical risk differed between groups, and all perioperative deaths occurred after primary suture repair.

All recurrences were clinically asymptomatic at the time of detection. None of the patients underwent reoperation specifically for recurrent hernia repair, as advanced liver disease, limited physiological reserve, or overall prognosis often contraindicated further surgical intervention. Formal statistical comparison was not performed due to limited sample size.

Discussion

Principal findings

This study provides long-term institutional experience with IHR in patients with cirrhosis and ascites, highlighting marked differences in outcomes according to repair strategy and underlying hepatic reserve. It should be emphasized that, although much of the available literature on hernia repair in ascitic patients focuses on umbilical hernias, the present study specifically addresses incisional hernia. This distinction is clinically relevant, as incisional hernias differ from umbilical hernias in terms of defect size, anatomical location, tissue quality, and reconstructive complexity.

First, although surgical repair was technically feasible in this fragile population, perioperative morbidity and mortality remained substantial. Major complications occurred in approximately one quarter of patients, and perioperative mortality reached 16.1 %. All perioperative deaths were observed in patients with advanced liver disease, underscoring the dominant role of hepatic reserve in determining short-term outcomes. These findings reflect the combined effects of ascites, portal hypertension, coagulopathy, malnutrition, and impaired wound healing on postoperative recovery in cirrhotic patients. These findings suggest that in the presence of clinically significant ascites, IHR should not be considered a purely technical exercise, but rather a physiological challenge in which the durability of the repair is primarily dictated by hepatic reserve and ascites control rather than by surgical craftsmanship alone.

Second, hernia recurrence emerged as a key determinant of long-term success. Overall recurrence affected more than one third of patients, but failure rates differed markedly according to surgical technique. In this cohort, the crude recurrence proportion was higher after primary suture repair than after mesh reinforcement. However, treatment allocation was not randomized, and this difference may have been influenced by confounding by indication, baseline liver disease severity, ascites control, contamination risk, tissue quality, and competing perioperative mortality. Primary suture repair may, nevertheless, remain a pragmatic option in selected high-risk or contaminated settings, although its long-term durability appears limited. This divergence supports the concept that persistent ascites generates significant mechanical stress on fascial closure, making tension-free repair with load distribution essential whenever ascites control and infection risk allow it.

Third, adjunctive strategies aimed at optimizing ascites control and perioperative management appeared to play an important role in stabilizing the repair. Measures such as meticulous drain management and, in selected cases, shunting procedures were used to mitigate postoperative ascitic leakage. In selected high-risk settings, biologic mesh was used when synthetic materials were considered unsuitable, although the limited number of cases does not allow conclusions regarding its comparative effectiveness.

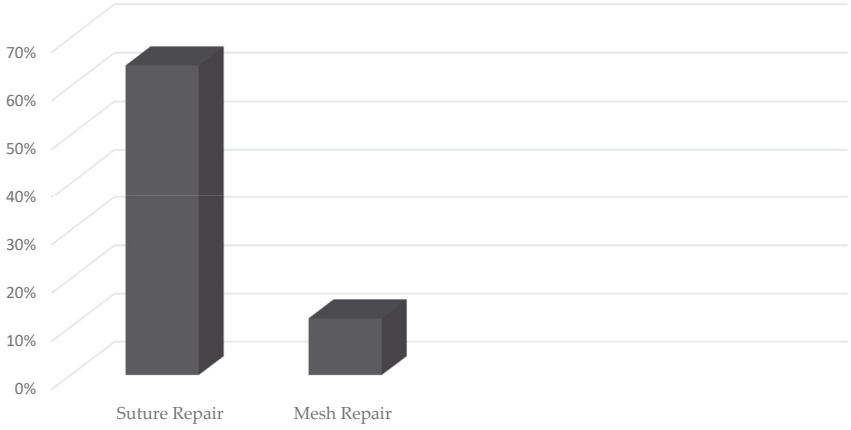

Figure 1: Crude hernia recurrence proportions after IHR according to surgical technique in cirrhotic patients with ascites. Legend: Crude hernia recurrence proportions according to repair technique in cirrhotic patients with ascites. Recurrence occurred in 9 of 14 patients (64.3 %) after primary suture repair and in 2 of 17 patients (11.8 %) after mesh reinforcement. Percentages are calculated within each surgical subgroup and, therefore, do not sum to 100 %. These percentages use the original treatment groups as denominators and should not be interpreted as time-to-event estimates. Perioperative death represented a competing event, particularly in the primary suture group. All recurrences were asymptomatic and were managed conservatively. No patient underwent reoperation for recurrent hernia.

These findings underscore that IHR in cirrhotic patients with ascites is not a standardized procedure but a highly individualized intervention in which surgical success depends on balancing operative technique, ascites control, and global patient condition.

Comparison with existing literature

The challenges of repairing incisional hernia in patients with cirrhosis and ascites are well documented, and published series consistently report higher morbidity, mortality, and recurrence compared with noncirrhotic populations. However, it must be acknowledged that most published series in this field predominantly concern umbilical hernias, whereas data specifically addressing incisional hernias in ascitic patients remain limited. As a result, comparisons with the existing literature should be interpreted with caution.

However, the available literature is highly heterogeneous, with substantial variability in patient selection, urgency of presentation, severity of liver disease, and perioperative optimization strategies, which limits direct comparison across studies.

Urgency of surgery represents one of the most important determinants of outcome. Series dominated by emergency repair of ruptured or strangulated hernias consistently report high complication rates and perioperative mortality [5, 12–14]. In contrast, elective repair performed after adequate ascites control is associated with more favorable postoperative outcomes [3, 15–21]. In this context, our experience aligns with previous observations, as all perioperative deaths occurred in patients with advanced liver disease, underscoring the central role of hepatic reserve rather than surgical technique alone.

Minimally invasive approaches, most commonly laparoscopic intraperitoneal onlay mesh repair, have been described in selected cirrhotic patients [2, 22]. Although technically feasible, these strategies raise concerns related to intraperitoneal mesh placement in the presence of persistent ascites, including infection risk and impaired mesh integration. Reported recurrence and complication rates appear higher in urgent or poorly optimized cases, suggesting that laparoscopic repair may be appropriate only in a highly selected subgroup with excellent ascites control [2, 22]. For these reasons and given the frequent presence of poorly controlled ascites in our population, an open approach was generally favored. Although minimally invasive techniques may be appropriate in highly selected patients with excellent ascites control, we deliberately favored open repair in this cohort, as persistent ascites, impaired wound biology, and the need for controlled drainage were felt to outweigh the potential benefits of reduced access trauma.

Across published series, recurrence rates vary widely according to surgical technique and patient selection. Although these observations largely derive from studies on umbilical hernia repair, the underlying pathophysiological mechanisms (persistent ascites, increased intra-abdominal pressure, impaired wound healing, and infection risk) are shared with incisional hernias and provide a relevant comparative framework.

Primary suture repair is consistently associated with poor long-term durability, particularly in the setting of ongoing ascites. Conversely, mesh reinforcement performed electively is associated with lower recurrence rates, although infection risk remains a relevant concern. In our series, mesh reinforcement resulted in substantially improved durability compared with suture repair, despite not completely eliminating recurrence.

However, this finding should be interpreted cautiously. The choice between primary suture and mesh reinforcement was not randomized and was strongly influenced by ascites control, contamination risk, liver function, tissue quality, and intraoperative judgment. Therefore, selection bias cannot be excluded, and the observed differences should be considered descriptive rather than causal.

Overall, our findings are consistent with the prevailing evidence supporting mesh reinforcement as the preferred strategy in cirrhotic patients with ascites when ascites control and infection risk allow it. Differences in reported outcomes across studies are likely driven by variations in hepatic reserve, ascites severity, urgency of repair, and perioperative management rather than by surgical technique alone.

Table 6 provides a comparative overview of our results with those from selected published series on hernia repair in ascitic patients.

Infectious morbidity is a recurrent theme in the literature, with surgical site infection rates typically ranging from 10% to 20 %, especially when ascites leakage or repeated paracenteses contaminate the field. Our SSI rate of 12.9 % (4/31) aligns with this range and is comparable to Banu (9 %), Yu (17 %), and elective portions of Ammar's series [4, 23, 24]. Importantly, no mesh explantation occurred, mirroring the experiences of Ammar, Banu, Perez, and Yu, and reinforcing that mesh use need not be contraindicated in ascitic patients when meticulous infection prophylaxis and ascites control are achieved [4, 17, 23, 24]. Within the limitations of this observational cohort, mesh reinforcement was not associated with mesh explantation and showed a lower crude recurrence proportion in selected patients with adequately controlled ascites and acceptable infection risk. However, the nonrandomized treatment allocation prevents conclusions regarding a causal reduction in recurrence. Consistent with Ammar's trial, no mesh explantation was required. Overall, these observations support considering mesh reinforcement in carefully selected patients when ascites is adequately controlled and the risk of contamination is acceptable. Perioperative antimicrobial management and drain use should be individualized according to clinical risk rather than applied as uniform requirements.

Published series show mortality ranging from 0 % in small elective laparoscopic cohorts to nearly 30 % in emergency repair of ruptured umbilical hernias. Licari's incisional series (where 10 of 27 patients underwent emergency repair) reported a mortality of 18.5 %, whereas Perez described only 2 % mortality when repair was performed during liver transplantation, under fully optimized hemodynamic and portal pressure conditions [3, 17]. Against this context, our perioperative mortality of 16.1 % lies between elective and emergency extremes and reflects both the frailty of our population and the benefits of delaying repair until stabilization was achieved. Perioperative mortality in patients with cirrhosis is closely linked to hepatic reserve. Most reports confirm that Child–Pugh class C patients have prohibitively high risk, with mortality rates of up to 40 % in some series. Importantly, our data reinforce the concept that elective IHR in Child–Pugh class C patients carries a prohibitive risk and should generally be avoided, unless surgery is mandated by acute, life-threatening complications. In contrast, Child–Pugh A patients can often undergo elective repair with acceptable outcomes. Our data support this gradient: mortality was limited to patients with advanced disease, reinforcing the consensus that elective repair in Child C patients should be avoided except in emergencies. Our perioperative mortality of 16.1 % remained lower than that reported in Licari's series of incisional hernias (18.5 %), likely reflecting the predominance of emergency cases in their cohort and underscoring the benefits of elective repair after optimization. Although our series derives from three institutions primarily dedicated to emergency surgery, our main objective was to operate these patients under the best possible conditions. Even when patients presented with acute symptoms in the emergency setting, we systematically attempted hernia reduction, clinical stabilization, and ascites control before proceeding to surgery electively. This strategy aimed to minimize perioperative risk and highlights that, whenever feasible, patients with ascites should undergo hernia repair in an elective setting. Exceptions may be made for selected Child–Pugh B patients, as already discussed.

The role of adjunctive measures remains debated. Transjugular intrahepatic portosystemic shunt (TIPS) has gained favor in hepatology for the management of refractory ascites, but concerns remain about hepatic encephalopathy and resource availability. Peritoneovenous shunt, although less widely used today, remains a viable option in selected contexts, as suggested by the three cases in our series. The contribution of these shunting techniques to surgical success deserves further systematic evaluation.

The studies summarized in Table 6 highlight three consistent principles: elective repair after adequate ascites control yields markedly better outcomes than emergency intervention; mesh reinforcement provides greater durability than suture repair across all ascitic subgroups; and patient selection based on hepatic reserve remains the predominant determinant of perioperative risk. Our results align closely with the most favorable elective mesh experiences, despite including a broader spectrum of liver disease severity.

Importantly, incisional hernias represent a distinct and often more complex reconstructive challenge compared with umbilical hernias, typically involving larger defects,

Table 6: Comparative outcomes of abdominal wall hernia repair in patients with ascites.

Study, year	n	Hernia type	Setting	Technique	Child–Pugh/MELD	Ascites	Follow-up	Recurrence	SSI	Mortality	Mesh explant	Notes
Telem 2010 [5]	21	Umbilical	Semi-elective 6/Emergency 15	Suture 18/Mesh 3	B/C	Refractory	36 mo	6 %	24 %	5 %	0	Preop TIPS reduces complications
Ammar 2010 [24]	80	Umbilical	Elective	Mesh vs. suture (RCT)	A/B	Yes	6–28 mo	2.7 %/14.2 %	↑ Mesh	0	0	No explants
Triantos 2010 [7]	1	Umbilical	Emergency after LVP	Mesh	C	Massive	Short	0 %	0	0	0	Single case; viable bowel
Guriță 2013 [15]	12	Umbilical, strangulated	**Emergency**	Dual mesh	Child A	Yes	12 mo	0 %	16 %	0	0	Early cirrhosis only
Tan 2013 [14]	3	Umbilical	Emergency after ascites decompression	Suture ± bowel resection	B	Massive	To discharge	NR	High	0	–	Incarceration after LVP/TIPS
Coelho 2016 [19]	–	Umbilical	Review	Mixed	All	Yes	–	Mesh 2–4%; suture ≤40 %	Mesh ↑ SSI	Var	Rare	Review summary
Umemura 2015 [22]	1	Umbilical	Elective	**Laparoscopic IPOM**	Advanced cirrhosis	Yes (PVS)	3 mo	0 %	0	0	0	First LUHR in PVS patient
Chatzizacharias 2015 [12]	11	Umbilical, ruptured	**Emergency**	Suture	B/C	Massive	To discharge	NR	High	27 %	–	Flood syndrome
Yu 2015 [23]	18	Umbilical	Elective 14/emergency 4	Lap IPOM (15), others (3)	A/B/C	Yes	19.5 mo	22 %	17 %	0	0	Complications mainly after emergency
Perez 2018 [17]	59	Umbilical	During liver transplant	Suture	MELD~18	97 %	21.8 mo	18 %	9 %	2 %	0	Repair during LT safe
Licari 2018 [3]	27	**Incisional**	Elective 17/emergency 10	Mesh	A/B/C	Yes	≥6 mo	11 %	Seromas	18.5 %	NR	Mortality mostly in emergencies
Banu 2019 [4]	22	Umbilical	Elective	Mesh only	A/B	Yes	12 mo	4.5 %	9 %	0	0	Mild ascites only
Malespin 2019 [13]	10	Umbilical, ruptured	**Emergency**	Suture	MELD-Na 21	Tense ascites	30 d	NR	Frequent	~30 % adverse	–	Predictors = BP, Mayo
Present series (2000–2025)	31	Incisional	Urgency not consistently available; stabilization attempted whenever feasible	Mesh 17/Suture 14	A/B/C	Yes	26 mo	11.8 %/64.3 %	**12.9** %	16.1 %	0	PV shunt in 3

n, number of patients; FU, follow-up; SSI, surgical site infection; PV, peritoneovenous; NR, not reported; mo, months; d, days; RCT, randomized controlled trial; MIS, minimally invasive surgery.

prior surgical scarring, and altered abdominal wall anatomy. The present series, therefore, provides complementary evidence to the predominantly umbilical hernia–based literature, extending existing concepts to a less frequently reported but clinically relevant scenario.

Clinical implications

The findings of this study have several practical implications for the management of incisional hernia in patients with cirrhosis and ascites. From a practical standpoint, our findings support a stepwise, risk-adapted strategy in which patient physiology, rather than hernia morphology alone, dictates both timing and technique of repair. First, elective repair in this population should never be approached as a routine procedure. Consistent with previous reports, outcomes are strongly influenced by hepatic reserve and ascites control, and emergency repair remains associated with prohibitively high risk. Whenever feasible, surgery should, therefore, be delayed until optimal medical stabilization has been achieved.

A multidisciplinary preoperative approach is essential and should involve hepatologists, anesthesiologists, nutrition specialists, and surgeons. Optimization of ascites through sodium restriction, diuretic therapy, and albumin supplementation represents the cornerstone of preoperative management. In selected cases with refractory ascites, shunting procedures may be considered to improve stability before surgery, although their role should be carefully weighed against potential complications.

From a surgical standpoint, repair strategy should be tailored to the individual patient rather than dictated solely by hernia characteristics. Primary suture repair, while technically straightforward, is associated with a very high risk of recurrence in the presence of ascites and should be reserved for small defects or situations in which prosthetic material is contraindicated. Within this framework, mesh reinforcement may be preferred in appropriately selected patients when ascites is adequately controlled and the risk of infection or contamination is acceptable, whereas primary suture repair may remain appropriate for small defects or situations in which prosthetic implantation is considered unsafe.

When ascites control and infection risk allow it, mesh reinforcement offers superior mechanical stability and improved long-term durability, although recurrence is not completely eliminated.

The risk of wound infection requires proactive management. In our practice, individualized postoperative antimicrobial management, meticulous drain placement, and strict postoperative ascites control were central components of perioperative care. Intraperitoneal drainage was selectively employed to reduce postoperative ascitic leakage through the wound, with early removal when feasible to limit contamination risk.

Finally, patient selection remains the most critical determinant of outcome. Elective repair appears justifiable in Child–Pugh A and carefully selected Child–Pugh B patients with adequate ascites control. In contrast, patients with decompensated disease, particularly Child–Pugh C, face an unacceptably high perioperative risk, and surgical intervention should generally be reserved for acute complications such as rupture, incarceration, or strangulation.

In Child–Pugh A and compensated B patients, elective repair can be justified if ascites is adequately controlled. In decompensated B and all Child C patients, elective repair should generally be deferred, with surgery reserved for acute complications such as rupture or strangulation.

Clinical decision-making algorithm

Based on our institutional experience, and acknowledging the descriptive nature of the present study, we propose a pragmatic clinical decision-making framework rather than a formal evidence-based guideline (Table 7). (1) Initial evaluation focuses on ascites control, hepatic reserve, and systemic stability through Child–Pugh classification and clinical assessment of ascitic leakage. (2) Medical optimization is pursued in all cases, including sodium restriction, diuretics, and scheduled large-volume paracenteses with albumin supplementation. (3) In refractory ascites, peritoneovenous shunting may be considered to achieve sufficient stability before surgery. (4) Elective repair is proposed only for Child–Pugh A and selected B patients who demonstrate adequate ascites control; Child–Pugh C patients undergo repair exclusively for acute complications such as rupture, incarceration, or strangulation. (5) Mesh reinforcement is preferred whenever infection risk and ascites control allow it, whereas primary suture is reserved for small defects or cases with high contamination risk. (6) Postoperative management includes strict ascites control, individualized antimicrobial therapy according to clinical risk and clinical course, and early removal of intraperitoneal drains when feasible. (7) Long-term follow-up focuses on detecting recurrence, reassessing liver function, and managing progression of liver disease that may influence abdominal wall stability. This algorithm reflects a risk-adapted, physiology-driven approach that integrates surgical technique with global patient condition to optimize outcomes.

Table 7: Risk-adapted management strategies for incisional hernia repair in ascitic patients.

Clinical scenario	Suggested strategy
Child–Pugh A, controlled ascites	Elective repair, mesh preferred
Child–Pugh B, partial control	Individualized decision, selective mesh
Child–Pugh C	Surgery only for acute complications
Refractory ascites	Consider shunting before repair
High contamination risk	Primary suture or delayed repair; avoid mesh when prosthetic implantation is considered unsafe

This table outlines a pragmatic, risk-adapted management approach for incisional hernia (laparocele) in ascitic patients. Decisions are guided by hepatic reserve, ascites control, and clinical presentation, with mesh reinforcement preferred when feasible.

Strengths and limitations

This study has several strengths. It represents a long-term institutional experience with IHR in patients with cirrhosis and ascites, a population that is typically underrepresented in surgical literature. The analysis focuses on a clinically well-defined cohort of cirrhotic patients, with detailed characterization of liver disease severity and surgical strategy. In addition, surgical management was performed in tertiary referral centers by experienced surgeons following shared principles of ascites optimization, infection prophylaxis, and drain management, contributing to internal consistency of the dataset.

Several limitations must also be acknowledged. The retrospective observational design inherently limits the ability to control for confounding factors and precludes causal inference. The sample size is relatively small, reflecting the rarity and high-risk nature of this clinical scenario, and limits the feasibility of formal statistical comparisons. Consequently, the present findings should be interpreted primarily as descriptive real-world observations rather than definitive comparative evidence supporting one repair strategy over another.

Some clinically relevant variables, including detailed nutritional parameters and standardized quality-of-life measures, were not systematically recorded and could, therefore, not be analyzed. Although formal nutritional scores and MELD-based stratification were not systematically available, clinical assessment of frailty and ascites severity remained the primary drivers of surgical decision-making, reflecting real-world practice in emergency and general surgery settings.

The 25-year study period represents an additional source of heterogeneity. During this interval, surgical techniques, prosthetic materials, anesthetic and intensive care support, antibiotic prophylaxis, and the medical management of ascites evolved and may have influenced postoperative morbidity, mortality, wound complications, and hernia recurrence. In addition, exact categorization into elective, semi-elective, and emergency presentation was not consistently retrievable across all study periods. Because of the limited sample size and incomplete availability of era-specific variables, outcomes could not be reliably stratified according to treatment period. Nevertheless, whenever clinically feasible, preoperative stabilization and ascites optimization were systematically pursued before surgery. Accordingly, the present findings should be interpreted as cumulative real-world experience rather than as evidence of uniform practice or as a direct comparison between different eras of surgical care.

Finally, follow-up duration varied among patients, which may have influenced recurrence assessment. Despite these limitations, the study provides meaningful descriptive data on outcomes and recurrence patterns after IHR in cirrhotic patients with ascites and highlights key factors that should inform clinical decision-making in this challenging population.

Future perspectives

Future work should focus on prospective, multicenter studies with standardized definitions of ascites control, infection risk, and recurrence. Determining the optimal mesh type, fixation method, and anatomical position in patients with ascites remains a key research priority. The role of biologic mesh in contaminated or high-risk settings warrants further exploration, particularly in patients awaiting liver transplantation.

Advances in ascites management, including more effective medical therapy and refined selection for shunting procedures in refractory ascites, may further improve the safety of elective repair. Minimally invasive and robotic techniques appear promising but require evaluation in well-selected cirrhotic patients with controlled ascites. Finally, integrating patient-reported outcomes related to symptoms, mobility, skin integrity, and quality of life may provide a more comprehensive picture of the benefits of elective repair in this frail population.

Conclusions

Incisional hernia repair in patients with cirrhosis and ascites remains a high-risk surgical endeavor, with perioperative

morbidity, mortality, and long-term outcomes largely determined by the severity of underlying liver disease. In this series, primary suture repair showed a high crude recurrence proportion, whereas mesh reinforcement was associated with a lower crude recurrence proportion in selected patients when ascites control and infection risk allowed its use. Because treatment allocation was nonrandomized and perioperative death represented a competing event, these findings should not be interpreted as proof of causal superiority. Elective repair may be considered in Child–Pugh A and carefully selected Child–Pugh B patients after rigorous preoperative optimization, while patients with decompensated disease, particularly Child–Pugh class C, face a prohibitive perioperative risk and should generally undergo surgery only for acute, life-threatening complications. Overall, successful management depends on a risk-adapted, multidisciplinary strategy that prioritizes ascites control, patient selection, and tailored surgical technique over technical considerations alone. Future prospective multicenter studies with standardized perioperative protocols are needed to better define optimal patient selection and reconstructive strategy in this challenging population.

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