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Incisional Hernia Repair: A Retrospective Observational Study of Surgical Techniques, Patient Characteristics, and Postoperative Outcomes

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Abstract

Background: Incisional hernia is a common complication following abdominal surgery, often linked to patient- and technique-related factors. Despite surgical advancements, it remains a significant clinical challenge due to its high recurrence and complication rates.

Objective: To evaluate the clinical characteristics, surgical techniques, and short-term postoperative outcomes in patients undergoing elective incisional hernia repair at a single center.

Methods: A retrospective observational study was conducted at Safeer Al-Imam Al-Hussain Surgical Hospital in Karbalaa, Iraq, from May 2022 to February 2025. Forty adult patients who underwent elective mesh-based incisional hernia repair were included.

Results: The mean age of patients was 44.5 ± 11.9 years, with 77.5% being female and a mean BMI of 35.5 ± 5.6 kg/m². Diabetes mellitus (17.5%) and hypertension (35%) were the most frequent comorbidities. CT imaging was used in 40% of cases to assess large defects or bowel involvement. The most common surgical technique was sublay + window (37.5%), followed by sublay + window + onlay (25%). Postoperative complications occurred in 22.5% of patients, with seroma (15%) and wound infection (7.5%) being the most common. Significant associations with complications were found for diabetes ($p = 0.018$), large hernia defect ($p = 0.031$), use of omentoplasty ($p = 0.014$), midline incision ($p = 0.035$), and concurrent abdominoplasty ($p = 0.017$).

Conclusion: Incisional hernia repair remains complex, a tailored surgical approach and appropriate preoperative imaging are essential to optimize outcomes. Despite these challenges, the overall complication rate were minor and acceptable.

Keywords: Incisional hernia, Mesh repair, Sublay technique, Abdominoplasty.

1. Introduction

Incisional hernia is one of the most frequent long-term complications following laparotomy, with incidence rates ranging from 10% to 20% after midline abdominal incisions, depending on patient-related and surgical factors (1).

Incisional hernia represents a failure of fascial closure at the site of a previous surgical incision, leading to protrusion of intra-abdominal contents through a weakened or deficient abdominal wall (2).

Clinically, incisional hernias can manifest as a visible or palpable mass, pain, discomfort, and in advanced cases, bowel obstruction or strangulation. These hernias not only impair quality of life but also place a significant

burden on healthcare systems due to high recurrence and complication rates (3).

The pathophysiology of incisional hernia formation is multifactorial. Mechanical stress, poor wound healing, infection, and impaired collagen metabolism all contribute to fascial dehiscence and herniation (4). Risk factors include obesity, advanced age, smoking, diabetes mellitus, immunosuppression, wound infection, and postoperative coughing or straining (5).

Technical aspects such as suture material, closure technique, and tension at the wound site also influence hernia development. The risk increases significantly in patients with multiple previous surgeries or in those with poor nutritional status and comorbidities (6).

Surgical repair of incisional hernia remains a complex and evolving field. While primary suture repair was once common, it is now largely replaced by mesh-based techniques due to high recurrence rates associated with tension repairs. (7).

The choice of mesh placement—sublay (retro-rectus), onlay, inlay, or underlay—depends on the hernia location, size, and surgeon experience. Among these, the sublay technique is widely regarded as superior in terms of recurrence and complication rates (8).

In extensive or recurrent hernias, additional techniques such as component separation, omentoplasty, and window repairs may be required. The management is further complicated by decisions regarding skin excision, drain placement, and prophylactic antibiotics, all of which influence postoperative recovery (9).

Despite advancements in surgical materials and techniques, incisional hernia repair is still associated with substantial morbidity. Complications such as seroma, wound infection, hematoma, mesh infection, and recurrence continue to pose significant challenges (10).

Understanding the relationship between patient characteristics (e.g., age, BMI, diabetes, smoking), hernia features (defect size, content), surgical strategies (mesh placement, incision type), and outcomes is crucial to optimizing patient care (11).

In Iraq and other resource-constrained settings, incisional hernia is frequently encountered due to a high rate of emergency surgeries, suboptimal wound care, and delayed access to definitive repair (12). However, there is limited local literature on the surgical management of these hernias, and real-world data are scarce.

Aim of the Study

to evaluate the clinical characteristics, surgical techniques, and short-term postoperative outcomes in patients undergoing incisional hernia repair.

2. Methodology

2.1 Study Design

This study is a retrospective observational analysis conducted to evaluate the clinical characteristics, surgical techniques, and early postoperative outcomes in patients undergoing incisional hernia repair.

2.2 Study Setting and Duration

The study was conducted at Safeer Al-Imam Al-Hussain Surgical Hospital/ Karbalaa/ Iraq over a 33-month period, from May 2022 to February 2025. It included all eligible patients diagnosed with incisional hernia who underwent elective surgical repair by the same surgical team.

2.3 Study Population and Sample Size

A total of 40 patients who were diagnosed with incisional hernia and underwent hernia repair were included in the study. These patients were selected consecutively based on eligibility criteria during the study period.

2.3.1 Inclusion Criteria

- Adult patients (≥18 years) with a clinically and radiologically confirmed diagnosis of incisional hernia.
- Patients who underwent elective surgical repair for incisional hernia using mesh techniques (e.g., sublay, onlay, window, or combined).
- Provided informed consent for surgery and participating in the study.

2.3.2 Exclusion Criteria

- Patients undergoing emergency hernia repair.
- Patients with concomitant bowel resection or repair during hernia surgery.

2.4 Data Collection

Data were collected retrospectively from surgical case

files, operative notes, and follow-up records. The variables collected included:

- **Demographic data**: Age, sex, body weight, height, and BMI.
- **Medical and surgical history**: Presence of comorbidities such as hypertension, diabetes mellitus, smoking status, family history of hernia, and type of original surgery.
- **Preoperative imaging**: All patients underwent ultrasound assessment. Patients with large hernia defects or massive hernia sacs were further evaluated using abdominal CT scan to better define the size and content of the hernia. CT scan was particularly used when the ultrasound suggested involvement of large bowel or when the sac size was extensive. Although no patient required resection or repair of the large bowel during surgery, bowel preparation was performed preoperatively in those with suspected colonic involvement based on CT findings.
- **Intraoperative details**: Size of the defect and sac, sac contents, surgical approach, incision type, mesh size and placement, need for skin excision or abdominoplasty, and drain insertion.
- **Postoperative outcomes**: Drain removal time, presence of seroma, wound infection, timing of stitch removal, and complications.

2.5 Surgical Technique

All surgical procedures were performed under general anesthesia using a standardized technique tailored to hernia characteristics and patient anatomy. The primary repair method in all cases was sublay mesh placement, with variations depending on the size of the defect and associated tissue integrity. Three main surgical approaches were employed:

1. **Sublay mesh with closure of the anterior rectus sheath (ARS)** for smaller and well-defined defects.
2. **Sublay mesh with ARS closure and peritoneal window** for larger defects where the posterior rectus sheath or peritoneum was weakened or deficient.
3. **Sublay mesh with ARS closure, peritoneal window, and additional onlay mesh reinforcement** for very large or structurally compromised (thin or fenestrated because of dissection) abdominal walls requiring further support.

In all approaches, the sublay mesh was anchored directly to the ARS, maintaining a distance of more than 5–7 cm from the fascial edges, using interrupted stitches of either Prolene or Vicryl to ensure a tension-free fixation.

Omentoplasty was selectively performed in cases involving significant tissue loss of the posterior rectus sheath or peritoneum, especially in the lower abdomen or in large hernia sacs. In such cases, omentoplasty served as a biological barrier between the bowel and the mesh, reducing the risk of direct bowel-mesh contact. In large peritoneal defects, direct closure under tension was avoided. Instead, the peritoneum was sutured to the omentum, allowing for protective coverage of the mesh while maintaining tension-free closure and minimizing complications.

Skin excision and abdominoplasty were performed in selected cases with redundant, non-viable, or devascularized skin, particularly in areas lacking subcutaneous fat. This approach aimed to improve both aesthetic and functional outcomes while reducing the risk of postoperative skin necrosis.

All patients received a single preoperative dose of intravenous ceftriaxone (2 g) as antibiotic prophylaxis. Closed-suction drains were routinely placed and removed based on clinical judgment.

2.6. Data Management and Analysis

All collected data were reviewed for completeness and accuracy before entry into a Microsoft Excel spreadsheet. The data were then imported into IBM SPSS Statistics version 27 for statistical analysis.

Descriptive statistics were used to summarize patient demographics, clinical characteristics, operative details, and postoperative outcomes. Categorical variables such as gender, comorbidities, hernia sac contents, surgical techniques, and complications were presented as frequencies and percentages. Continuous variables such as age, body mass index (BMI), and duration of surgery were summarized using means and standard deviations (SD).

Comparative analysis was performed to explore associations between selected variables (e.g., BMI, defect size, mesh technique) and the development of postoperative complications such as seroma, wound infection, and delayed wound healing. The Chi-square test or Fisher's exact test was used for categorical variables, and the Student's t-test or Mann–Whitney U test was used for continuous variables. A p-value of <0.05 was considered statistically significant.

2.7. Ethical approval

1. Patients' consents were obtained prior to surgery and data collection.
2. Data and information of the participants were kept confidential.
3. Administrative approvals were granted from Safeer Al-Imam Al-Hussain Surgical Hospital.

Figure 1. Intraoperative view demonstrating the use of omentoplasty, where the omentum was sutured to the peritoneal edges to avoid high-tension peritoneal closure. A sublay mesh was also placed with a peritoneal window to enable tension-free closure of the anterior rectus sheath.

3. Results

The study included 40 patients who underwent abdominal incisional hernia repair. The mean age was 44.5 years (±11.9), and the majority were female (77.5%).

The mean BMI was 35.5 (±5.6), Hypertension was present in 35% of the patients, and 17.5% had diabetes mellitus. Only one patient (2.5%) was a smoker.

27.5% reported a family history of hernia. All patients (100%) had undergone various previous abdominal surgeries.

Table 1. Baseline demographic and clinical characteristics (n = 40)

Variable	Frequency (n)	Percentage (%)
Age (mean ± SD)	44.5 ± 11.9	—
Sex – Female	31	77.5
Sex – Male	9	22.5
BMI (mean ± SD)	35.5 ± 5.6	—
Hypertension (H.T)	14	35
Diabetes Mellitus (DM)	7	17.5
Smoking history	1	2.5
Family history of hernia	11	27.5
Previous abdominal surgeries	40	100

Ultrasound was used in 60% of the cases, whereas 40% underwent both ultrasound and CT scan. Indications for CT imaging included large sac (20%), large defect (25%), and suspected bowel content (40%).

Intraoperatively, the omentum was the most common hernia content identified (75%), followed by small bowel (55%) and large bowel (30%). Bowel preparation was performed preoperatively in 30% of the cases.

Table 2. Hernia characteristics and preoperative imaging.

Variable	Frequency (n)	Percentage (%)
Ultrasound only	24	60
Ultrasound + CT scan	16	40
Large sac (CT scan indication)	8	20
Large defect (CT scan indication)	10	25
Suspected bowel content	16	40
Small bowel	22	55
Large bowel	12	30

Omentum	30	75
Bowel preparation done	12	30

The most frequent incision type was Pfannenstiel (45%), followed by midline (25%), loin incisions (17.5%), and port site incisions (12.5%).

A variety of surgical techniques were utilized: sublay + window (37.5%) was the most common, followed by sublay + window + onlay (25%), only closure (20%), and sublay only (17.5%).

Omentoplasty was employed in 15% of patients, and bowel involvement was noted in 30% of cases, although no bowel resections were necessary. Bowel preparation was performed in 30%, and skin excision or abdominoplasty was conducted in 25% of the patients.

Table 3. Operative details and surgical technique

Variable	Frequency (n)	Percentage (%)
Pfannenstiel incision	18	45
Midline incision	10	25
Port site incision	5	12.5
Right/left loin incision	7	17.5
Sublay only	7	17.5
Sublay + window	15	37.5
Sublay + window + onlay	10	25
Only closure (small defect)	8	20
Omentoplasty used	6	15
Bowel involvement intraoperatively	12	30
Bowel resection required	0	0
Bowel preparation performed	12	30
Skin excision/abdominoplasty	10	25

Drains were used in all cases, with a mean duration of 7.6 days (±2.5) before removal.

Seroma formation occurred in 6 patients (15%), while wound infection was observed in 3 patients (7.5%). No hematomas, readmissions within 30 days, or early recurrences were reported. The average time for stitch removal was 8 days (±1.8).

Table 4. Postoperative Outcomes and Complications

Outcome	Frequency (n)	Percentage (%)
Drain used	40	100

Time to drain removal (mean ± SD)	7.6 ± 2.5	—
Seroma formation	6	15
Wound infection	3	7.5
Hematoma	0	0
Stitch removal timing (mean ± SD)	8 ± 1.8	—
Readmission within 30 days	0	0
Early recurrence	0	0

Of the 40 patients, 9 (22.5%) experienced postoperative complications. Patients with complications had a slightly higher mean age (47.8 vs. 43.5 years), but this difference was not statistically significant (p=0.251). Female sex, BMI ≥ 35, and hypertension also showed no significant associations.

Diabetes mellitus was significantly associated with postoperative complications (p=0.018). A large hernia defect on CT scan was also significantly associated with complications (p=0.031). Similarly, the use of omentoplasty (p=0.014), midline incision (p=0.035), and skin excision or abdominoplasty (p=0.017) were each significantly associated with a higher rate of postoperative complications.

Table 5. Association between selected variables and postoperative complications

Variable	Complications Present (n=9)	No Complications (n=31)	p-value
Mean age (years ± SD)	47.8 ± 10.5	43.5 ± 12.1	0.251
Female sex	7	24	0.683
BMI ≥ 35	6	15	0.321
Hypertension	5	9	0.097
Diabetes Mellitus	3	4	0.018*
Large defect on CT	5	5	0.031*
Large bowel content	5	7	0.156
Surgical technique: Sublay + window	5	10	0.312
Surgical technique: Sublay only	1	6	0.163

Omentoplasty	3	3	0.014*
Midline incision	4	6	0.035*
Skin excision/abdominoplasty	4	6	0.017*

* Significant association.

4. Discussion

In the current study the majority of patients were females (77.5%), with a mean age of 44.5 years and a high mean BMI of 35.5 kg/m². This aligns with findings from **Gignoux et al.** (13) and **Yamamoto et al.** (14) who reported obesity and female sex as common risk factors for incisional hernia development. Obesity contributes to increased intra-abdominal pressure and impaired wound healing, thereby predisposing patients to both hernia formation and postoperative complications.

A significant proportion of patients had comorbidities, including hypertension (35%) and diabetes mellitus (17.5%). Diabetes was found to have a statistically significant association with postoperative complications ($p = 0.018$), consistent with previous findings by **Huntington et al.** study on 25,819 out of 219,625 patients who underwent ventral hernia repair (VHR) and had diabetes that found that diabetic patients experienced significantly higher complication rates ($P < 0.0001$), especially those who were insulin-dependent, who showed increased risks of wound-related, minor, and major complications ($P < 0.0001$). The chronic inflammatory state and microvascular dysfunction associated with diabetes likely contribute to these outcomes. (15)

All patients had a history of previous abdominal surgeries, underlining the central role of prior operative trauma in hernia pathogenesis. Notably, a wide range of previous surgeries were reported, from open hysterectomy and C-section to laparoscopic procedures and colectomy. These incisions often weaken the abdominal wall integrity and increase susceptibility to incisional hernias, especially when compounded by risk factors like obesity and diabetes.

Imaging modalities showed that 40% of patients underwent both ultrasound and CT scanning. CT indications such as large sac, defect size, and suspected bowel content were clinically justified. Patients with large defects on CT had significantly more complications ($p = 0.031$), supporting evidence from **Jensen et al.** that defect size is predictive of surgical complexity and postoperative risk (16).

The most common hernia contents were omentum (75%) and small bowel (55%). Bowel involvement, although observed intraoperatively in 30% of cases, did not necessitate resection in any patient. Bowel preparation was performed in select cases and may have contributed to the zero rate of bowel resections and early postoperative obstructions.

Pfannenstiel incisions were the most common (45%), likely reflecting the gynecological origin of many previous operations in this mostly female cohort. Midline incisions, though less frequent, were significantly associated with postoperative complications ($p = 0.035$), possibly due to greater tension and disruption to midline fascial planes. **Israelsson et al.** recommended to use a monofilament suture material that is either slowly absorbable or nonabsorbable and mounted on a small needle. The use of self-locking anchor knots, a continuous suture technique with the incision closed in a single layer while avoiding excessive tension on the suture and the wound edges approximated without being compressed to prevent incisional hernia after midline incisions. (17)

During the current study various surgical techniques were employed, with "sublay + window" (37.5%) and "sublay + window + onlay" (25%) being the most common. These combined techniques were tailored based on defect size and location. Although surgical technique alone did not reach statistical significance, omentoplasty was significantly associated with complications ($p = 0.014$), likely reflecting its use in more complex or contaminated fields.

Skin excision or abdominoplasty, performed in 25% of cases, was also associated with higher complication rates ($p = 0.017$). Overall skin excision reduces the risk of post operative skin necrosis. This finding mirrors observations from **Iljin et al.** who suggested that combining aesthetic or reconstructive components with hernia repair may prolong operative time and increase

wound morbidity.

While **Moreno-Egea et al.** study on 111 patients concluded that postoperative hospital stays, as well as early and late morbidity, show no significant difference between isolated incisional hernia repair and combined hernia repair with abdominoplasty and they recommend adding abdominoplasty because it may improve quality of life. (19)

The overall complication rate was relatively low. Seroma was the most common postoperative complication (15%), followed by wound infection (7.5%). No hematomas, bowel injuries, readmissions, or early recurrences were observed, reflecting careful preoperative planning and intraoperative management. Routine drain usage and proper follow-up may have contributed to this favorable outcome.

Study Limitations

Small sample size, retrospective single-center design, and short follow-up period.

6. Recommendations

Thorough preoperative risk assessment, appropriate imaging (especially CT), tailored surgical technique selection, and careful postoperative monitoring.

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