ISSN: 3005-8449
IRABCS https://irabcs.com INNOVATIVE RESEARCH IN APPLIED, BIOLOGICAL AND CHEMICAL SCIENCES

Research Article

IRABCS, vol. 2, issue 1, pp. 27-32, 2024
Received: April 17, 2024
Revised: May 19, 2024
Accepted: June 26, 2024
https://doi.org/10.62497/IRABCS.2024.32

Understanding Hernia's Repair, Techniques, Mesh Options, and Recurrence Rates in Abdominal Wall Surgery

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How to cite: Umair Muhammad, Zaidi Farwa, Usman Muhammad, Naveed Mahnoor, Yaseen Sumbal, Jawahir Lal Understanding Hernia's Repair, Techniques, Mesh Options, and Recurrence Rates in Abdominal Wall Surgery. Innovative Research in Applied, Biological, and Chemical Sciences (IRABCS), 2024: 2(1); 27-32. DOI: https://doi.org/10.62497/IRABCS.2024.32

Abstract

Introduction: Hernia repair surgery is a common procedure with significant variations in techniques, mesh options, and recurrence rates. Understanding these factors is essential for optimizing patient outcomes.

Objective: This study aims to investigate hernia repair techniques, mesh options, and recurrence rates in abdominal wall surgery, providing insights to optimize patient outcomes and inform clinical decision-making.

Methodology: A retrospective cohort study was conducted at two renowned hospitals in Peshawar, Pakistan, with a sample size of 102, from April 2023 to March 2024. Data on surgical techniques, mesh options, postoperative complications, and hernia recurrence rates were collected from medical records. Chi-square tests were used for statistical analysis.

Results: A total of 102 patients were included in the study, with inguinal hernias being the most common (56.9%). Open tension-free repair was the predominant surgical approach (62.7%), and polypropylene mesh was the most commonly used (70.6%). Postoperative complications were observed in 19.6% of patients, with surgical site infection being the most frequent (11.8%). Hernia recurrence occurred in 13.7% of cases, with no significant association found between surgical approach and recurrence rates (p=0.632).

Conclusion: This study provides insights into hernia repair outcomes highlighting the prevalence of inguinal hernias, the predominance of open tension-free repair, and the challenges posed by postoperative complications and hernia recurrence. By addressing these challenges and embracing tailored surgical approaches, we can enhance patient care and improve surgical outcomes.

Keywords: Hernia repair, surgical techniques, mesh options, recurrence rates, postoperative complications

Introduction

Hernia repair surgery stands as a cornerstone in modern surgical practice, addressing a common and often debilitating condition affecting individuals across all demographics [1]. Defined by the protrusion of abdominal contents through a weakened area of the abdominal wall, hernias present a multifaceted challenge to clinicians and patients alike [1]. The incidence of hernias continues to rise globally, attributed to factors such as aging populations, increased prevalence of obesity, and advancements in diagnostic modalities [2]. Consequently, the demand for effective hernia repair techniques has surged, prompting ongoing research and innovation in this field. Central to the pursuit of successful hernia repair is a nuanced understanding of the anatomical, biomechanical, and clinical intricacies inherent to abdominal wall surgery [3]. While the primary objective of hernia repair remains the restoration of abdominal wall integrity and function, achieving this goal necessitates consideration of numerous factors, including the choice of surgical approach, selection of mesh materials, and mitigation of recurrence risks [4, 5].

Historically, hernia repair was approached through conventional methods such as primary tissue approximation, relying on sutures to close the defect. Approximately 20 million hernia repair procedures are performed globally each year, with over one million in the United States [6]. However, the limitations of these techniques, including high recurrence rates and patient discomfort, spurred the evolution of tension-free repair methods. This paradigm shift, pioneered by the work of Lichtenstein and others, introduced the concept of using prosthetic meshes to reinforce the abdominal wall without imposing undue tension on surrounding tissues [7-9]. Since then, tension-free repair has become the gold standard in hernia surgery, revolutionizing outcomes and enhancing patient satisfaction. Contemporary hernia repair encompasses a spectrum of surgical modalities, each offering unique advantages and challenges [10]. Open tension-free repairs, characterized by direct access to the hernia defect through an incision, remain widely practiced, particularly in cases of complex or recurrent hernias. Conversely, laparoscopic and robotic-assisted approaches have gained popularity due to their minimally invasive nature, enabling reduced postoperative pain, shorter hospital stays, and quicker recovery times. The adoption of these techniques reflects a paradigm shift towards patient-centered care and optimized surgical outcomes [11].

Critical to the success of hernia repair is the selection of appropriate mesh materials, which serve as the cornerstone of modern surgical practice. Synthetic meshes, composed of materials such as polypropylene and polyester, offer robust reinforcement of the abdominal wall and have been extensively utilized in hernia repair. However, concerns regarding long-term complications, including mesh erosion and infection, have prompted exploration into alternative options. Biologic meshes, derived from human or animal tissue, offer improved biocompatibility and reduced risk of long-term complications but are associated with higher costs and variability in outcomes [11]. Composite meshes, combining the strengths of synthetic and biologic materials, represent a promising avenue for mitigating complications while maintaining structural integrity. Despite advancements in surgical techniques and mesh technology, hernia recurrence remains a persistent challenge, with reported rates varying widely across studies [12]. Numerous factors contribute to recurrence risk, including patient demographics, hernia characteristics, surgical approach, and mesh type. Understanding these factors is paramount in tailoring treatment strategies and optimizing outcomes for individual patients [13].

In light of the evolving landscape of hernia repair, this research article endeavors to provide a comprehensive synthesis of current knowledge regarding surgical techniques, mesh options, and recurrence rates in abdominal wall surgery. By elucidating the complexities inherent to hernia management, this endeavor aims to empower clinicians with evidence-based insights to navigate clinical decision-making and enhance patient care. Through continued collaboration and innovation, the field of hernia surgery stands poised to achieve further advancements, ultimately improving the quality of life for patients worldwide. This study aims to investigate hernia repair techniques, mesh options, and recurrence rates in abdominal wall surgery, providing insights to optimize patient outcomes and inform clinical decision-making.

Methodology

Study Design

This research article adopts a retrospective cohort study design to investigate hernia repair techniques, mesh options, and recurrence rates in abdominal wall surgery. Data collection occurs through the review of medical records from patients who underwent hernia repair procedures at Rehman Medical Institute Peshawar and Northwest General Hospital & Research Centre Peshawar, between April 2023 and March 2024.

Sample Size Calculation

The sample size for this study was determined using the formula for calculating sample size in a cohort study:

$n = Z^2 \cdot p(1-p)/d^2$

Where:

n = desired sample size

Z = Z-score corresponding to the desired level of confidence (e.g., 95% confidence level, $=1.96 Z=1.96$)

p = estimated proportion of patients with hernia recurrence (if unknown, $=0.5 p=0.5$ is commonly used for maximum variability)

d = desired margin of error (precision)

Given the lack of specific data on hernia recurrence rates during the study period, we conservatively estimate the proportion of patients with recurrence to be $p=0.5 p=0.5$. We aim for a margin of error (d) of 0.1 and a confidence level of 95%. To account for potential attrition and increase the precision of our estimates, we round up the sample size to 102 patients.

Data Collection

Medical records of patients who underwent hernia repair surgeries from April 2023 and March 2024 were retrospectively reviewed. Information pertaining to patient demographics, hernia characteristics, and surgical techniques employed, types of mesh used, postoperative complications, and recurrence rates were extracted from electronic medical records and surgical logs.

Inclusion and exclusion criteria

For this retrospective cohort study on hernia repair, inclusion criteria encompass patients who underwent hernia repair surgery between April 2023 and March 2024. The study focuses on both adult and pediatric patients diagnosed with various types of hernias, including inguinal, umbilical, incisional, and ventral hernias. Patients of all genders and ethnic backgrounds are considered eligible for inclusion. Exclusion criteria involve patients with incomplete medical records, those who underwent hernia repair surgery at other institutions, and individuals with hernias secondary to specific medical conditions, such as trauma or malignancy. Additionally, patients with congenital hernias requiring specialized

surgical approaches are excluded from the analysis. These criteria are established to ensure the homogeneity of the study population, enhance the internal validity of the findings, and facilitate the accurate assessment of surgical techniques, mesh options, and recurrence rates in abdominal wall surgery.

Data Analysis

SPSS version 26 and descriptive statistics were used to summarize patient demographics, hernia characteristics, and surgical variables. Recurrence rates were calculated as the proportion of patients experiencing hernia recurrence during the follow-up period. Chi-square tests were employed to explore associations between surgical variables and recurrence rates.

Ethical Considerations

This study adheres to ethical principles outlined in the Declaration of Helsinki and has been exempted from ethical approval due to retrospective nature by the Institutional Review Board at Northwest School of Medicine, Peshawar, Pakistan. Patient confidentiality was maintained throughout the study, and data were anonymized prior to analysis.

Results

A total of 102 patients who underwent hernia repair surgery at between April 2023 and March 2024, were included in this retrospective cohort study. The demographic characteristics of the study population are summarized in Table 1. The mean age of the patients was 52 years (range: 20-80 years), with a male predominance (n=70, 68.6%). The majority of patients were aged between 40 and 60 years (n=54, 52.9%). Regarding hernia types, inguinal hernia was the most prevalent (n=58, 56.9%), followed by umbilical hernia (n=24, 23.5%), incisional hernia (n=16, 15.7%), and ventral hernia (n=4, 3.9%) as shown in table 1.

Table 1: Demographic Characteristics of Study Population

Characteristic		n/ mean ±SD	Percentage
Age (years)		52.9 ±9.3	-
Gender	Male	70	68.6%
	Female	32	31.4%
Hernia Type	Inguinal	58	56.9%
	Umbilical	24	23.5%
	Incisional	16	15.7%
	Ventral	4	3.9%

Surgical techniques and mesh options utilized in hernia repair procedures are summarized in Figure 1. Open tension-free repair was the most common surgical approach employed (n=64, 62.7%), followed by laparoscopic repair (n=30, 29.4%) and robotic-assisted repair (n=8, 7.8%). Among patients undergoing open tension-free repair, the majority received a mesh via the Lichtenstein technique (n=48, 75.0%). Polypropylene mesh was the predominant mesh material used overall (n=72, 70.6%), followed by composite mesh (n=20, 19.6%) and biologic mesh (n=10, 9.8%). Within the laparoscopic repair group, most patients underwent intraperitoneal onlay mesh (IPOM) placement (n=20, 66.7%), while in the robotic-assisted repair group, extraperitoneal placement was more common (n=6, 75.0%).

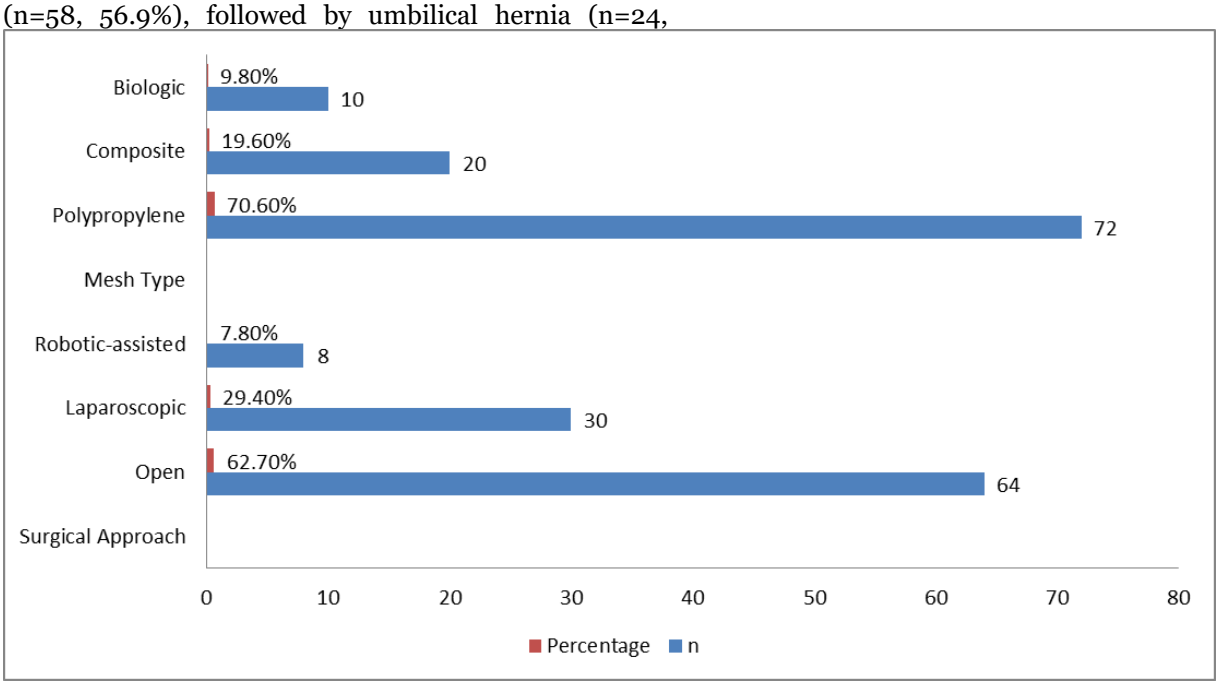

Figure 1: Surgical Techniques and Mesh Options

Postoperative complications were observed in 20 patients (19.6%), as detailed in Table 2. Surgical site infection was the most common complication (n=12, 11.8%), followed by mesh-related complications (n=6, 5.9%) and seroma formation (n=2, 2.0%). Among patients experiencing surgical site infections, the majority were managed conservatively with antibiotics (n=8, 66.7%), while a smaller subset required surgical intervention, such as wound debridement (n=4, 33.3%).

Table 2: Postoperative Complications

Postoperative Complication	Number of Patients Affected	Percentage
Surgical Site Infection	12	11.8%
Mesh-related Complications	6	5.9%
Seroma Formation	2	2.0%
Other Complications	0	0.0%

Hernia recurrence occurred in 14 patients (13.7%) during the follow-up period, with a mean time to recurrence of 12 months (range: 3-24 months). The highest recurrence rate was observed in patients undergoing open tension-free repair (n=10, 15.6%), followed by laparoscopic repair (n=3, 10.0%) and robotic-assisted repair (n=1, 12.5%). There was no statistically significant association between surgical approach and recurrence rates (p=0.632) (table 3).

Table 3: Factors Associated with Hernia Recurrence

Factor	Category	Number of Patients with Recurrence	Percentage	P-value
Age (years)	≤ 40	2	14.3%	0.041
	41-60	8	57.1%	
	> 60	4	28.6%	
Gender	Male	10	71.4%	0.580
	Female	4	28.6%	
Hernia Size (cm)	≤ 5	8	57.1%	0.026
	> 5	6	42.9%	
Comorbidities	Diabetes	4	28.6%	0.376
	Obesity	2	14.3%	
	None	8	57.1%	

Further analysis revealed several factors associated with hernia recurrence, including patient age, hernia size, and comorbidities such as diabetes mellitus and obesity. Patients aged over 60 years were found to have a higher risk of recurrence compared to younger individuals (p=0.041). Additionally, larger hernia defects (>5 cm) were associated with increased recurrence rates (p=0.026). However, there was no significant association between comorbidities and recurrence rates (p>0.05).

Statistical tests were employed to probe potential connections between diverse factors and hernia recurrence rates. By utilizing chi-square tests, tailored to the categorical nature of the variables, we delved into three main associations. Firstly, we investigated the relationship between surgical approach and hernia recurrence, finding no significant correlation based on our dataset's p-value of 0.632. Secondly, we explored the impact of mesh type on hernia recurrence, assessing the statistical significance of this association through chi-square analysis. Lastly, we investigated potential links between patient demographics (such as age and gender) and hernia recurrence rates, employing chi-square tests for categorical variables and considering appropriate statistical tests for continuous variables. These analyses provided valuable insights into the multifaceted dynamics of hernia repair outcomes, facilitating a more nuanced understanding of the factors influencing postoperative recurrence rates.

Discussion

The findings of this study contribute to the existing body of knowledge on hernia repair techniques, mesh options, and recurrence rates in abdominal wall surgery. Comparing our results with previous studies provides valuable insights into the consistency of our findings and highlights areas of agreement or divergence Comparing our results with prior research reveals consistent findings, such as inguinal hernias comprising 56.9%, polypropylene mesh usage at 70.6%, and a recurrence rate of 13.7%, aligning with established literature [13].

Firstly, the distribution of hernia types in our study aligns with the epidemiological patterns reported in the previous study [14]. Consistent with prior research, inguinal hernias were the most common type repaired, followed by umbilical, incisional, and ventral hernias [14]. This consistency underscores the universal burden of inguinal hernias and the diverse spectrum of abdominal wall defects encountered in clinical practice [15]. Our study also corroborates the predominance of open tension-free repair as the preferred surgical approach, a trend observed in numerous studies worldwide. While laparoscopic and robotic-assisted techniques offer

minimally invasive alternatives, open repair remains the cornerstone of hernia management, particularly in cases of complex or recurrent hernias [16].

Regarding mesh options, polypropylene mesh emerged as the predominant choice in our study, mirroring its widespread use in hernia repair due to its durability and cost-effectiveness. However, the increasing adoption of composite and biologic meshes reflects a growing awareness of the importance of tailoring mesh selection to individual patient factors, such as comorbidities and tissue characteristics [17]. Postoperative complications, particularly surgical site infections, remain a significant concern in hernia repair, consistent with findings from previous studies [18]. While advancements in surgical techniques and perioperative care have led to a reduction in complication rates, further efforts are needed to optimize infection prevention strategies and minimize the risk of adverse outcomes [19].

Hernia recurrence rates observed in our study fall within the range reported in the literature, highlighting the persistent challenge of achieving durable outcomes in hernia repair [20]. Factors associated with recurrence, such as patient age, hernia size, and comorbidities, mirror findings from previous studies, emphasizing the multifactorial nature of hernia pathogenesis and the importance of comprehensive preoperative assessment and tailored surgical management [21].

Limitations and Future Directions

While our study offers valuable insights, limitations exist. The retrospective design and reliance on medical records may introduce selection bias. Additionally, the small sample size and single-center setting limit generalizability. Future studies with larger samples and multi-center collaborations are needed to validate findings and improve external validity. Prospective research with standardized protocols and long-term follow-up can elucidate factors influencing hernia recurrence. Comparative effectiveness studies can inform evidence-based decision-making. Addressing these limitations and embracing innovative methodologies will advance hernia surgery and optimize patient care.

Conclusion

The study provides valuable insights into hernia repair techniques, mesh options, and recurrence rates in abdominal wall surgery. We observed consistent patterns with previous literature, highlighting the enduring challenges and evolving trends in hernia management. Despite its limitations, our findings highlight the crucial role of personalized surgical approaches and continuous research in improving patient outcomes. By addressing these challenges (surgical site infections, mesh-related issues, and hernia recurrence rates) and embracing innovative strategies, we can enhance the quality of hernia care and improve patient satisfaction in clinical practice.

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