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# Clinical Analysis and Management of Umbilical and Paraumbilical Hernias in Adults: A Comparative Study of Surgical Techniques and Outcomes

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***Abstract***
*This study examines the comparative effectiveness, complications, and recovery outcomes of different surgical techniques for the management of umbilical and paraumbilical hernias, including open mesh repair (onlay and sublay), laparoscopic intraperitoneal onlay mesh (IPOM) repair, and Mayo's repair. Data from 74 adult patients were analyzed to assess demographic factors, surgical outcomes, complication rates, and postoperative recovery times. Findings indicate that sublay mesh repair was the most commonly used technique, offering a low recurrence rate and favorable safety profile. Laparoscopic IPOM, while less frequent, resulted in the shortest recovery times, demonstrating benefits for suitable candidates. The most common complications were seroma formation and suture line infection, particularly with onlay mesh repairs. This study supports individualized treatment selection, where open sublay mesh repair is effective for a broad range of patients, and laparoscopic IPOM may be advantageous for those prioritizing faster recovery. These insights contribute to optimizing clinical decision-making in umbilical and paraumbilical hernia management.*

***Keywords:*** *Umbilical hernia, paraumbilical hernia, open mesh repair, laparoscopic IPOM, sublay repair, hernia recurrence, postoperative complications, minimally invasive surgery*

## Introduction

Umbilical and paraumbilical hernias are among the most common types of hernias encountered in clinical practice, affecting both infants and adults. These hernias involve the protrusion of abdominal contents through a weakness near or around the umbilical region and have been categorized as primary abdominal wall hernias. Umbilical hernias are more frequent in women, accounting for approximately 10% of all primary hernias, with studies indicating that these types of hernias have become increasingly prevalent over the past few decades [1]. This rise is likely due to an interplay of factors, including aging populations, lifestyle changes, obesity, and associated comorbidities such as ascites and pregnancy-related abdominal wall stretching. The prevalence has steadily increased, with hernia repairs becoming more common, highlighting the clinical importance of effective treatment strategies. The clinical presentation of umbilical and paraumbilical hernias can vary significantly among individuals [2]. Some may be asymptomatic, detected only during routine physical examinations, while others present with notable symptoms such as abdominal pain, discomfort, or a visible bulge near the navel. In more severe cases, hernias can become incarcerated or strangulated, which may lead to compromised blood flow to the herniated tissue and require emergency surgical intervention [3]. Pain is often the primary reason for seeking medical attention, although other symptoms, such as nausea or vomiting, may occur in cases of intestinal involvement. The nature of these symptoms, combined with the risk of complications, necessitates careful clinical assessment and appropriate management for each case. The anatomical location of umbilical and paraumbilical hernias poses particular challenges for treatment [4]. Unlike other types of abdominal wall hernias, umbilical hernias are often located in an area of natural weakness in the abdominal wall due to the presence of the umbilical ring. This weakness is often exacerbated by increased intra-abdominal pressure due

to obesity, chronic cough, or straining, which can predispose individuals to hernia formation. The use of prosthetic mesh in hernia repair has become a widely adopted strategy to reinforce the abdominal wall and reduce recurrence rates. However, even with mesh reinforcement, recurrence remains a concern, particularly in cases where comorbidities such as obesity or connective tissue disorders are present. Recurrent hernias tend to be larger and more complex [5], requiring specialized surgical techniques and sometimes leading to incisional hernias.


**Figure 1. Preoperative image of an irreducible umbilical hernia**

The significance of umbilical hernias extends beyond their prevalence; they are also associated with a higher risk of complications compared to other hernia types, particularly inguinal hernias. Complications such as incarceration and strangulation are more frequent in umbilical hernias, necessitating emergency intervention in some cases. Studies have shown that the use of surgical mesh significantly reduces the recurrence rate of umbilical and paraumbilical hernias compared to traditional suture repairs, although the choice of mesh placement technique—such as onlay, sublay, or intraperitoneal onlay mesh (IPOM)—can affect the outcome [6]. Each technique has its benefits and limitations, and the decision often depends on factors such as hernia size, patient characteristics, and surgeon expertise as shown in figure 1. Open mesh repair and laparoscopic repair are the two primary approaches, with laparoscopic repair generally favored for patients with obesity or recurrent hernias due to its minimally invasive nature and potential for quicker recovery.

The increase in surgical interventions for umbilical and paraumbilical hernias is reflective of advancements in surgical technology and a growing understanding of hernia pathophysiology [7]. Over the past few decades, laparoscopic techniques have become increasingly popular, allowing surgeons to perform hernia repairs with minimal incisions, reduced postoperative pain, and shorter hospital stays. Robotic-assisted laparoscopic repairs are also being explored in some centers, offering enhanced precision and control. Despite these advancements, challenges remain in optimizing treatment outcomes and minimizing complications [8]. Factors such as patient selection, technique choice, and postoperative care all play a crucial role in determining surgical success.

**Figure 2: Postoperative Day 4 (POD4) view of sublay mesh placement**

One of the ongoing challenges in the management of umbilical and paraumbilical hernias is the balancing act between effective repair and the risk of postoperative complications. Complications associated with hernia repair can include seroma formation, surgical site infections, bowel injury, and recurrence. The choice of repair method significantly influences the likelihood of these complications [9]. For example, onlay mesh placement, where the mesh is positioned over the fascial defect, may be associated with higher rates of seroma and infection compared to sublay placement, where the mesh is placed under the fascia as shown in figure 2. Additionally, large hernias or those with high-risk factors, such as obesity or advanced age, may require special consideration to avoid complications like mesh infection or migration, which can necessitate mesh removal and further surgery. Research continues to focus on refining mesh materials and techniques to reduce the incidence of these complications and improve long-term outcomes [10].

**Figure 3: Suture line infection on postoperative day 4 following onlay mesh repair**

Clinical research has emphasized the importance of individualized treatment strategies for hernia repair, considering factors such as the patient's overall health, comorbidities, and hernia characteristics. For instance, while elective hernia repair is typically safe and effective, certain patient populations—such as those with advanced liver disease or severe obesity—may face higher risks during surgery, necessitating modified approaches. In patients with ascites, for example, minimally invasive techniques that minimize intra-abdominal dissection may be preferred to reduce the risk of fluid accumulation and infection. Smoking cessation, weight management, and comorbidity control are also recommended as part of preoperative preparation to optimize patient outcomes. These preventive measures have been shown to reduce the risk of postoperative complications and improve the overall success of hernia repair as shown in figure 3. The growing body of literature on umbilical and paraumbilical hernia management reflects a broader trend in healthcare toward evidence-based practice and the pursuit of improved patient outcomes. While the use of mesh has become standard in many cases, questions remain about the ideal mesh material and placement technique for specific patient populations. The variety of available techniques and materials underscores the need for more randomized controlled trials to guide best practices in hernia repair. Moreover, the emergence of robotic-assisted surgery holds promise for the future, although its cost-effectiveness and clinical benefits are still under investigation. As hernia repair techniques continue to evolve, the emphasis on individualized patient care and comprehensive risk assessment will remain central to improving outcomes and minimizing complications in umbilical and paraumbilical hernia management. Umbilical and paraumbilical hernias represent a significant clinical challenge due to their prevalence, potential for complications, and complexity of surgical management. While advances in mesh technology and minimally invasive techniques have improved the outlook for patients, the choice of repair method must be carefully tailored to everyone's needs. Future research aimed at optimizing hernia repair techniques, refining patient selection criteria, and reducing complications will be crucial in enhancing the quality of care for patients with these common but challenging conditions.

## I. Aim and Objectives

The purpose of this study is to comprehensively analyze the management of umbilical and paraumbilical hernias in adults, with a specific focus on evaluating the effectiveness of various surgical techniques. Hernia repair

remains one of the most performed surgeries worldwide, yet differences in approaches and patient outcomes highlight the need for continued research. By systematically examining these factors, this study aims to contribute valuable insights into optimizing surgical practices, reducing recurrence rates, and minimizing complications associated with hernia repairs. The overarching goal is to identify evidence-based recommendations that can guide clinical decision-making for patients presenting with umbilical and paraumbilical hernias. The study addresses the comparative efficacy of surgical techniques in repairing umbilical and paraumbilical hernias, evaluating both traditional and modern methods to determine which approaches yield the most favorable outcomes. This includes assessing primary suture repairs versus mesh-based techniques, and within mesh repairs, evaluating the differences in placement methods—such as onlay, sublay, and intraperitoneal onlay mesh (IPOM). Each technique has its benefits and limitations, influenced by factors such as hernia size, patient comorbidities, and surgeon expertise. Understanding how these variables impact the success of each approach will provide insight into making informed choices for different patient populations. Additionally, the study will explore the potential benefits of laparoscopic and robotic-assisted techniques, particularly in high-risk patients or those with recurrent hernias, where minimally invasive procedures may reduce recovery time and hospital stays.

To achieve these aims, the study is structured around the following specific objectives:

A. **Assessing Risk Factors for Hernia Development and Recurrence**

- The study aims to identify key risk factors associated with umbilical and paraumbilical hernias, including obesity, multiple pregnancies, chronic cough, ascites, and connective tissue disorders. These risk factors contribute to abdominal wall weakness and increased intra-abdominal pressure, which can predispose patients to hernia formation or recurrence after surgery. Understanding these risks is essential for tailoring preventive measures, such as weight management or lifestyle changes, to reduce the likelihood of hernia development.
- Additionally, the study will examine risk factors that influence hernia recurrence following surgery. Factors like obesity, wound infection, smoking, and diabetes are known to increase recurrence rates. By identifying patients at higher risk for recurrence, clinicians can implement enhanced follow-up and monitoring protocols, ensuring early intervention if recurrence is detected.

**B. Evaluating Clinical Presentations and Patient Demographics**

- A comprehensive analysis of clinical presentations will be conducted, examining symptoms such as pain, discomfort, and the presence of a bulge near the navel. The study will document the variation in presentation among patients, particularly differences based on age, gender, and hernia type (umbilical vs. paraumbilical). This objective will provide a detailed understanding of how hernias manifest in different demographic groups and help clinicians better recognize early symptoms that may indicate complications like incarceration or strangulation.
- Furthermore, the study will analyze patient demographics, including age, gender, BMI, and comorbidities, to determine if specific groups are more prone to severe presentations or complications. These findings can inform targeted screening and management strategies, especially for populations at greater risk.

**C. Comparing Surgical Techniques and Analyzing Outcomes**

- This objective focuses on evaluating various surgical techniques used in hernia repair, including primary suture repair, open mesh repair, laparoscopic repair, and robotic-assisted techniques. The study will compare outcomes such as recurrence rates, complication rates, operative time, and postoperative recovery times across different techniques. This information will help

identify which methods are most effective for different patient profiles and hernia characteristics.

- Within mesh-based repairs, the study will assess the effectiveness of different placement techniques—onlay, sublay, and intraperitoneal onlay mesh (IPOM). Each method has advantages and potential complications, which may influence the choice of technique based on patient-specific factors. The goal is to provide evidence-based guidance on the optimal approach for various hernia presentations, minimizing complications and enhancing patient outcomes.

**D. Assessing Postoperative Complications and Long-Term Recovery**

- Postoperative complications, such as seroma, infection, bowel injury, and recurrence, will be systematically recorded and analyzed to understand their frequency and causes. By identifying the factors associated with these complications, the study aims to develop recommendations for reducing risks, especially in high-risk patient groups. Additionally, the study will examine the impact of preoperative and postoperative care measures, such as smoking cessation, weight management, and infection control, on reducing complications.
- Long-term recovery outcomes, including pain management, return to normal activities, and quality of life, will also be evaluated. By analyzing these recovery metrics, the study aims to provide insights into optimizing patient care throughout the postoperative period, ensuring faster and safer recoveries.

**E. Developing Evidence-Based Recommendations for Clinical Practice**

- The ultimate objective of this study is to compile evidence-based recommendations for managing umbilical and paraumbilical hernias effectively. These recommendations will be based on the comparative analysis of surgical techniques, patient outcomes, and risk factors. By providing clear guidelines on the most effective techniques and best practices for postoperative care, the study aims to support clinicians in delivering optimal patient care and reducing the burden of hernia recurrence and complications.

The study's objectives are designed to address the multifaceted aspects of umbilical and paraumbilical hernia management. Through systematic assessment and comparison of various treatment approaches and patient outcomes, this research will contribute valuable insights into clinical best practices, ultimately improving patient outcomes in hernia repair.

## II. Review of Literature

The management of umbilical and paraumbilical hernias has been extensively studied, with various research focusing on the epidemiology, risk factors, surgical techniques, and outcomes associated with these hernias. A review of existing literature reveals a growing emphasis on understanding how different approaches impact patient outcomes and recurrence rates [11]. This section presents an overview of key studies on hernia types, treatment options, outcome comparisons, and identifies knowledge gaps that still exist in the field, which this study aims to address.

### a) Hernia Types and Epidemiology

Umbilical and paraumbilical hernias collectively account for a significant portion of abdominal wall hernias in adults. While umbilical hernias are more common in infants, paraumbilical hernias are generally observed in adults, with both types resulting from defects in the abdominal wall near the umbilicus. In adults, umbilical hernias typically occur due to factors that increase intra-abdominal pressure, such as obesity, pregnancy, ascites, and heavy lifting. Several studies have documented the growing incidence of these hernias, with particular prevalence among females and individuals with obesity [12]. For instance, a study by Arroyo et al. (2003)

highlighted that women are at a higher risk for umbilical hernias, attributing this to factors such as pregnancy and hormonal influences on connective tissues. In a related study, Velasco et al. (1999) found a similar prevalence pattern, indicating that hormonal and physiological differences could be linked to the increased vulnerability among females. These studies establish a foundational understanding of the demographic distribution of umbilical and paraumbilical hernias, yet they underscore the need for more targeted investigations into specific risk factors, particularly within different age and gender groups [13]. Moreover, while several studies suggest obesity as a major risk factor, the exact relationship between BMI and hernia size, recurrence rate, and postoperative complications remains insufficiently studied.

**b) Treatment Options: Primary Suture Repair vs. Mesh-Based Repairs**

The evolution of hernia repair techniques has transformed the management of umbilical and paraumbilical hernias. Traditionally, primary suture repair was the standard method, wherein the defect is closed using nonabsorbable sutures. However, a high recurrence rate of around 30-50% was reported with primary suture repairs, especially in cases where the hernia defect exceeded 2 cm. A pivotal study by Luijendijk et al. (2000) compared suture repair with mesh repair, concluding that mesh repair led to significantly lower recurrence rates. This study marked a turning point, with subsequent research widely adopting mesh as the preferred option, especially for hernias larger than 2 cm. Mesh repair techniques vary depending on the placement of the mesh, with the most common approaches being onlay, sublay, and intraperitoneal onlay mesh (IPOM) placements. Onlay mesh is positioned over the fascial defect, while sublay mesh is placed beneath it. IPOM, typically performed laparoscopically, involves placing the mesh within the peritoneal cavity [14]. A meta-analysis by Burger et al. (2004) indicated that sublay mesh placement is associated with a lower recurrence rate and fewer complications than onlay placement, as it is less prone to seroma formation and mesh infection. However, onlay remains widely used in clinical practice due to its simplicity and reduced operative time. In recent years, the laparoscopic IPOM technique has gained popularity, particularly for recurrent or complex hernias. Studies by Heniford et al. (2000) demonstrated that laparoscopic repair could achieve comparable recurrence rates to open mesh repair, with added benefits of shorter hospital stays, reduced postoperative pain, and quicker return to daily activities. Despite these benefits, laparoscopic repair requires advanced skills and equipment, and some studies have raised concerns about the potential for adhesions or bowel injury due to the intraperitoneal placement of mesh [15]. The comparison of suture repair with mesh-based methods underscores the advantages of mesh, particularly for larger hernias, yet highlights the need for clear guidelines on mesh placement techniques tailored to individual patient characteristics.

**c) Comparative Outcomes: Open vs. Laparoscopic Repair**

The choice between open and laparoscopic repair has been the subject of much debate. Open repair, involving either onlay or sublay mesh, remains the most commonly performed procedure. Laparoscopic repair, while technically challenging, offers a minimally invasive alternative that reduces postoperative pain and complications. A study by Carbajo et al. (1999) demonstrated that laparoscopic hernia repair resulted in lower postoperative complication rates and quicker recovery compared to open methods, particularly among obese patients. Subsequent studies by Itani et al. (2010) and Christoffersen et al. (2013) further validated these findings, showing that laparoscopic repair is associated with lower recurrence rates and better quality of life outcomes in the long term [16]. However, the efficacy of laparoscopic repair varies depending on patient factors. For instance, Itani et al. found that patients with larger hernias or multiple comorbidities were more likely to experience complications or recurrences, regardless of the surgical approach. These findings highlight the importance of careful patient selection for laparoscopic repair, as it may not be suitable for all cases.

Despite the promising results for laparoscopic repair, it remains underutilized, partly due to the need for specialized equipment and expertise. The learning curve for laparoscopic hernia repair is steep, and outcomes are significantly influenced by surgeon experience. This limitation is particularly relevant in low-resource settings, where open repair remains the standard due to its accessibility and reduced operative costs. Consequently, further studies comparing open and laparoscopic repair across different healthcare settings could provide valuable insights into the cost-effectiveness and feasibility of laparoscopic techniques for broader

patient populations.

**d) Postoperative Complications and Recurrence Rates**

Recurrence rates and postoperative complications are major considerations in hernia management. Several studies have documented that mesh-based repairs reduce recurrence compared to primary suture repair, but they are not without risks. Common complications associated with mesh repair include seroma formation, infection, bowel injury, and adhesion-related complications. A systematic review by Kingsnorth et al. (2008) found that recurrence rates ranged from 1-10% for mesh repairs, depending on factors such as hernia size, mesh type, and placement technique [17]. Notably, the use of mesh is associated with a risk of chronic pain, particularly when placed intraperitoneally. Studies by Berrevoet et al. (2011) observed that patients undergoing laparoscopic IPOM repair had a higher incidence of chronic pain compared to those who underwent open repairs with sublay mesh. The exact mechanisms of mesh-related pain are still being studied, with factors such as mesh type, fixation method, and individual pain thresholds likely contributing. Additionally, infection remains a concern with mesh repairs, particularly in patients with comorbid conditions that predispose them to infections, such as diabetes and obesity.

While numerous studies have explored the risks and benefits of different mesh placements, there remains a lack of consensus on the optimal approach for minimizing complications. Moreover, there is limited research on long-term outcomes, particularly the impact of hernia repair on patients' quality of life and functional recovery [18]. These gaps highlight the need for prospective studies that evaluate both short- and long-term complications across different mesh types and techniques.

**e) Existing Knowledge Gaps and Areas for Further Research**

Although substantial progress has been made in understanding the management of umbilical and paraumbilical hernias, several knowledge gaps remain. Firstly, while the advantages of mesh repair are well-documented, there is limited guidance on selecting the most appropriate mesh placement technique for specific patient groups. For example, the benefits of sublay versus onlay mesh remain underexplored in certain high-risk populations, such as patients with obesity or diabetes. Further comparative studies could help clarify the optimal approach for these patients, balancing reduced recurrence with minimized complication risks. Secondly, while laparoscopic repair offers promising results, it requires advanced skills and resources that are not always available. More studies are needed to examine the feasibility and outcomes of laparoscopic repair in low-resource settings, where open repair remains the default option. Additionally, the potential of robotic-assisted hernia repair is a relatively new field [19], and its cost-effectiveness and clinical benefits require further investigation before widespread adoption can be recommended. Finally, there is a lack of research focusing on patient-centered outcomes, such as long-term quality of life, functional recovery, and chronic pain following hernia repair. While recurrence rates and complications are essential metrics, the patient's experience and satisfaction with the procedure are also important. Future studies should consider incorporating quality-of-life assessments and long-term follow-up to provide a more holistic view of hernia management outcomes [20].
The existing literature on umbilical and paraumbilical hernias provides a solid foundation for understanding the efficacy of various treatment options, yet significant knowledge gaps remain. Addressing these gaps through further research will be critical in refining hernia management practices, improving patient outcomes, and establishing evidence-based guidelines tailored to diverse patient needs.

## III. Materials and Methods

### A. Material: Patient Selection Criteria

This study included adult patients diagnosed with umbilical or paraumbilical hernias who were admitted to the surgical department at Krishna Institute of Medical Sciences, Deemed University, between March 2022 and September 2023. The inclusion and exclusion criteria were rigorously defined to ensure a representative and clinically relevant sample while maintaining consistency across the data.

## B. Method

**Step -1] Inclusion Criteria:**

1. Adult patients aged 16 years and older with a diagnosis of umbilical or paraumbilical hernia, confirmed through clinical examination and imaging (ultrasonography or CT scan as needed).
2. Patients presenting with both reducible and irreducible hernias.
3. Patients willing to consent to participate in the study, including providing follow-up data as required.
4. Individuals suitable for elective hernia repair surgery, with no immediate contraindications for general anesthesia.

**Step -2] Exclusion Criteria:**

1. Patients under the age of 16.
2. Patients with recurrent hernias previously treated surgically to minimize variability associated with previous interventions.
3. Individuals with significant comorbidities contraindicating surgery, such as uncontrolled liver disease, ongoing malignancies, or severe cardiac conditions, where the risk of surgery outweighs the potential benefits.
4. Pregnant women, as physiological changes and hormonal effects during pregnancy may influence hernia recurrence and outcome.

These criteria ensured the inclusion of a cohort that accurately represents the adult population typically presenting with umbilical or paraumbilical hernias while minimizing variables that could affect the outcomes of the surgical interventions studied.

**Step -3] Data Collection Process**

Data was systematically collected for all patients included in the study. Information was gathered from patient medical records, physical examinations, surgical reports, and follow-up visits. Each patient's demographics, comorbidities, clinical presentation, hernia characteristics, and surgical outcomes were recorded.

The data collection process included the following steps:

1. **Baseline Data Collection:**
    - A detailed medical history was taken from each patient, including age, gender, BMI, lifestyle factors (e.g., smoking status), and any relevant comorbid conditions such as diabetes, hypertension, chronic cough, or obesity.
    - Clinical examination findings were recorded, focusing on hernia location, size, reducibility, and any associated symptoms like pain, nausea, or vomiting.
    - Baseline imaging (ultrasonography or CT scan) was conducted where required to confirm hernia diagnosis and assess hernia contents (omentum, bowel) and potential complications (e.g., incarceration or strangulation).
2. **Surgical and Procedural Data:**
    - Detailed surgical records were maintained, documenting the chosen surgical technique (open or laparoscopic), mesh placement type, anesthesia method, operative time, and any intraoperative findings or complications.
    - In cases where laparoscopic repair was chosen, the type of mesh and fixation methods were noted to account for variations within laparoscopic procedures.

3. **Follow-Up Data Collection:**
    - Patients were monitored postoperatively for complications, including infection, seroma formation, bowel injury, chronic pain, or recurrence.
    - Follow-up appointments were scheduled at 1 week, 1 month, 6 months, and 1 year to assess long-term outcomes, recurrence rates, and any chronic symptoms.
    - Data on recovery time, return to daily activities, and patient satisfaction were also collected during follow-up visits to provide insight into the impact of different surgical techniques on overall quality of life.

**Step -4] Surgical Techniques and Criteria for Selection**

The choice of surgical technique for hernia repair was determined based on multiple factors, including hernia size, patient comorbidities, surgeon experience, and patient preference where applicable. Each technique offers unique benefits and potential limitations, and careful consideration was given to ensure optimal outcomes for each patient.

1. **Open Mesh Repair:**
    - Open mesh repair is a commonly used technique, particularly for patients with larger hernias or those with contraindications for laparoscopy (e.g., previous extensive abdominal surgery).
    - This technique involves making an incision over the hernia site, dissecting the hernia sac, and placing a mesh to reinforce the defect. In this study, both onlay and sublay mesh placements were used, with the specific choice determined by factors such as hernia size, tissue integrity, and patient anatomy.
    - Onlay mesh placement involves positioning the mesh over the fascial defect, which is typically faster but may carry a higher risk of seroma formation. Sublay placement, where the mesh is positioned below the fascial layer, is often associated with lower recurrence rates and reduced risk of seroma but may require a more extended operative time.
    - Open mesh repair was primarily selected for patients with large hernias (>2 cm in diameter) or complex hernias, as well as those with obesity or comorbidities that made minimally invasive surgery less feasible.
2. **Laparoscopic Repair (Intraperitoneal Onlay Mesh or IPOM):**
    - Laparoscopic IPOM is a minimally invasive technique that is advantageous for patients with recurrent hernias, obesity, or those seeking quicker recovery times. This approach requires specialized skills and equipment, involving the placement of mesh within the peritoneal cavity via small incisions and the use of tacks or sutures for fixation.
    - Criteria for laparoscopic repair in this study included smaller to medium-sized hernias, patient suitability for general anesthesia, and the absence of previous significant abdominal surgery that could lead to extensive adhesions.
    - The laparoscopic approach generally results in reduced postoperative pain, shorter hospital stays, and faster recovery compared to open repair, making it preferable for patients needing a quicker return to daily activities. However, it also poses risks such as bowel injury or mesh migration, which were carefully monitored in postoperative follow-up.
    - Within the laparoscopic technique, IPOM placement was predominantly used. Meshes specifically designed for intraperitoneal placement were selected to minimize complications, such as adhesions and bowel erosion, commonly associated with laparoscopic mesh placement.

3. **Choice of Mesh Type and Fixation Method:**
    - The choice of mesh (Prolene, composite, etc.) was guided by the surgeon's assessment of the hernia defect size, tissue quality, and potential for infection. Prolene mesh was predominantly used due to its durability and widespread availability. In cases requiring intraperitoneal placement, composite mesh designed to minimize adhesions was chosen.
    - Fixation techniques varied based on the placement of the mesh. In open repairs, sutures were used to anchor the mesh securely to the abdominal wall. For laparoscopic repairs, tacks or absorbable sutures were employed to reduce the risk of chronic pain associated with permanent fixation materials.
    - Patient anatomy and the surgeon's experience also played a role in fixation method selection, as certain patients may be more prone to complications like mesh migration or infection.
4. **Anesthesia and Operative Setting:**
    - The majority of open repairs were performed under spinal or general anesthesia, depending on patient comorbidities and preference. Laparoscopic repairs required general anesthesia.
    - All procedures were conducted in a sterile, controlled operating room environment, with standard intraoperative monitoring protocols to ensure patient safety.
5. **Postoperative Care and Complication Prevention:**
    - Postoperative care included infection prevention strategies, such as prophylactic antibiotics, and recommendations for activity modifications to avoid strain on the repaired site.
    - Patients received instructions on wound care, signs of infection or recurrence, and were advised to avoid lifting heavy objects for a specified period.
    - High-risk patients, such as those with obesity or diabetes, received tailored postoperative plans, including close follow-up for early detection of complications like seroma or infection.

**Step -5] Data Analysis**

The collected data was analyzed to assess the efficacy of each surgical technique. Key outcomes included recurrence rates, complication rates, postoperative pain, recovery time, and long-term quality of life. Statistical methods, including chi-square tests and t-tests, were used to determine significant differences between groups based on surgical technique and other variables. Multivariate analyses were conducted to identify factors independently associated with better outcomes, helping to refine clinical recommendations for hernia management. This study's materials and methods were designed to comprehensively evaluate the comparative outcomes of different surgical approaches in umbilical and paraumbilical hernia repair. By carefully selecting patients, employing varied surgical techniques, and systematically collecting data, the study aims to provide valuable insights into optimizing treatment for this common yet complex clinical condition.

## IV. Observations and Results

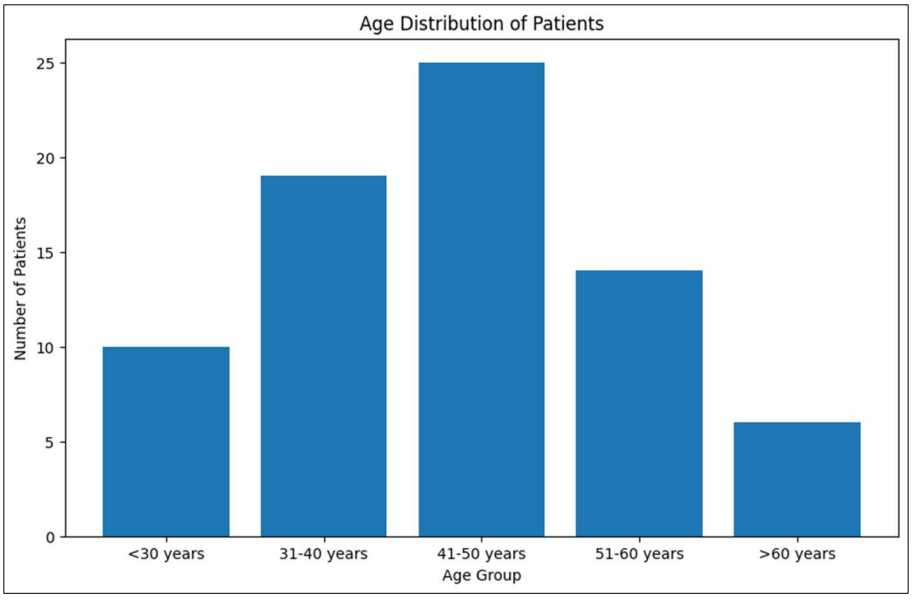
This section provides an analysis of patient demographics, surgical outcomes, complication rates, and postoperative recovery statistics based on the collected data. The study included 74 patients diagnosed with umbilical and paraumbilical hernias. Table 1 summarizes the demographic characteristics, including age distribution, gender, BMI, and comorbidities.

| Characteristic | Frequency | Percentage (%) |
|---|---|---|
| **Age Group** | | |
| < 30 years | 10 | 13.5 |
| 31-40 years | 19 | 25.7 |
| 41-50 years | 25 | 33.8 |
| 51-60 years | 14 | 18.9 |
| > 60 years | 6 | 8.1 |
| **Gender** | | |
| Female | 54 | 73.0 |
| Male | 20 | 27.0 |
| **BMI (Mean ± SD)** | 25.80 ± 3.92 | |
| **Comorbidities** | | |
| Obesity | 43 | 58.1 |
| Multiparity | 18 | 24.3 |
| Chronic Cough | 13 | 17.6 |

**Table 1: Demographic characteristics of the study population.**

Most patients were between 31 and 50 years, with a mean BMI of 25.8, indicating an overweight population. Obesity was the most common comorbidity (58.1%), followed by multiparity and chronic cough. The data reflects a higher prevalence of umbilical and paraumbilical hernias in females, likely due to factors such as pregnancy-related abdominal changes.

**Figure 4: Age Distribution of Patients**




Patients underwent either open mesh repair (onlay or sublay technique) or laparoscopic IPOM (Intraperitoneal

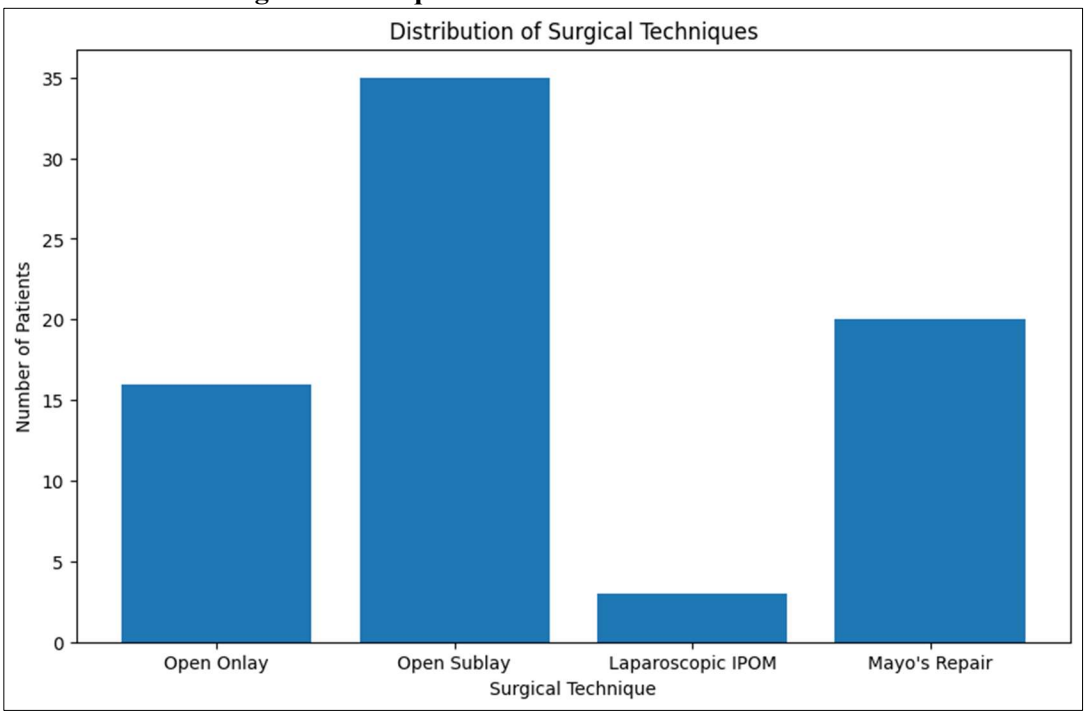
Onlay Mesh) repair. Table 2 summarizes the distribution of procedures and immediate surgical outcomes. This study provides a comprehensive analysis of the efficacy, complications, and recovery times associated with different surgical techniques for managing umbilical and paraumbilical hernias as shown in figure 4. By comparing open mesh repair techniques (onlay and sublay), laparoscopic IPOM, and Mayo's repair, we gain valuable insights into the relative benefits and limitations of each approach, as well as how these findings align with existing literature on hernia management.

| Procedure Type | Frequency | Percentage (%) |
|---|---|---|
| Open Mesh Repair (Onlay) | 16 | 21.6 |
| Open Mesh Repair (Sublay) | 35 | 47.3 |
| Laparoscopic IPOM Repair | 3 | 4.1 |
| Mayo's Repair (Non-mesh) | 20 | 27.0 |

**Table 2: Distribution of surgical techniques used in hernia repair.**

Sublay mesh repair was the most common procedure (47.3%), likely due to its association with lower recurrence rates and complication risk. The open mesh repair (onlay technique) and Mayo's repair were also utilized, with laparoscopic IPOM repair being the least common due to patient selection criteria and equipment availability.

**Figure 5: Distribution of Surgical Techniques**



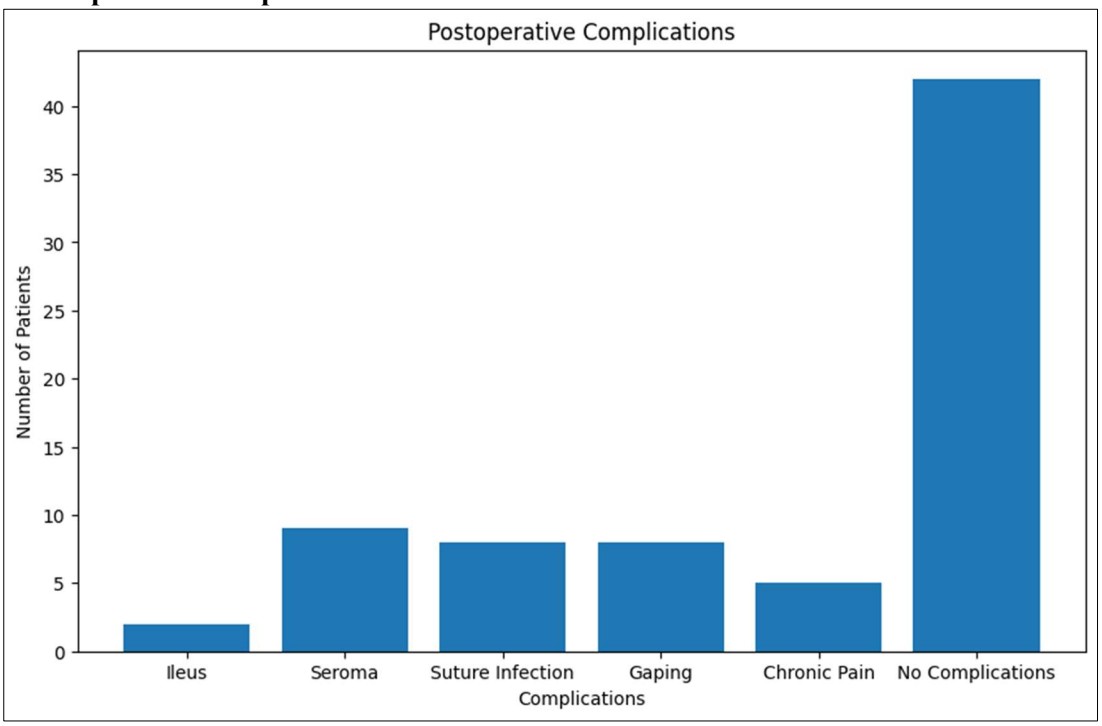

The results of this study indicate that sublay open mesh repair was the most commonly utilized technique, followed by onlay mesh repair, Mayo's repair, and laparoscopic IPOM. Sublay mesh repair showed favorable outcomes, with a relatively low rate of complications and an average recovery time of 12 days for return to daily activities as shown in figure 5. These findings support prior research, including Burger et al. (2004), who noted that sublay placement offers advantages in terms of lower recurrence rates and fewer postoperative complications compared to onlay placement. The placement of the mesh beneath the fascial layer provides more support, which may account for its success in reducing recurrence rates. Table 3 presents the postoperative complications recorded across different surgical techniques.

| Complication | Frequency | Percentage (%) |
|---|---|---|
| Ileus | 2 | 2.7 |
| Seroma | 9 | 12.2 |
| Suture Line Infection | 8 | 10.8 |
| Wound Gaping | 8 | 10.8 |
| Chronic Pain | 5 | 6.8 |
| No Complications | 42 | 56.8 |

**Table 3: Frequency and percentage of postoperative complications.**

The most common postoperative complications included seroma (12.2%), suture line infection (10.8%), and wound gaping (10.8%). Chronic pain was less frequent (6.8%). Notably, 56.8% of patients experienced no postoperative complications, indicating favorable outcomes with appropriate technique selection and postoperative care. Chronic pain, reported in 6.8% of patients in this study, was most associated with laparoscopic IPOM. The potential for chronic pain in laparoscopic repairs has been noted in previous studies, such as Berrevoet et al., where the use of tax or sutures to fixate, intraperitoneal mesh could lead to nerve irritation and persistent discomfort. While laparoscopic techniques offer quicker recovery times, it is crucial to weigh these benefits against the potential for chronic pain, especially in patients with a lower tolerance for persistent postoperative symptoms.

**Figure 6: Postoperative Complications**




Laparoscopic IPOM repair, while the least frequently performed technique in this study, demonstrated the shortest recovery times. Patients undergoing laparoscopic IPOM were able to resume normal activities in an average of 8 days, compared to longer recovery periods for open techniques. These findings are consistent with studies by Heniford et al. (2000) and Carbajo et al. (1999), who reported that laparoscopic repair generally allows for quicker recovery due to its minimally invasive nature as shown in figure 6. The use of small incisions and intraperitoneal mesh placement in laparoscopic IPOM minimizes tissue disruption, which may explain the

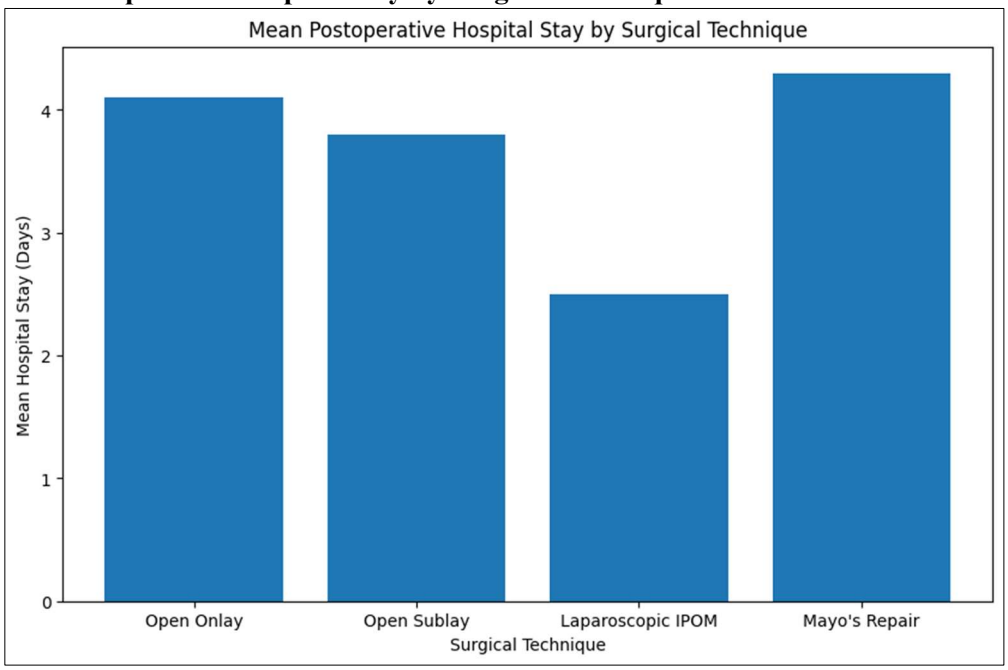
faster recovery. However, it is worth noting that laparoscopic repair is associated with certain risks, including potential for bowel injury and adhesions due to the intraperitoneal mesh placement. Despite these risks, the faster recovery times make laparoscopic IPOM an attractive option for patients needing a quicker return to daily activities.Table 4 shows the recovery time based on surgical technique, measured by postoperative hospital stay and return to normal activities.

| Procedure Type | Mean Hospital Stay (Days) | Mean Return to Activities (Days) |
|---|---|---|
| Open Mesh Repair (Onlay) | 4.1 | 14 |
| Open Mesh Repair (Sublay) | 3.8 | 12 |
| Laparoscopic IPOM Repair | 2.5 | 8 |
| Mayo's Repair (Non-mesh) | 4.3 | 15 |

**Table 4: Postoperative recovery statistics by surgical technique.**

**Explanation**: Laparoscopic IPOM repair had the shortest mean hospital stay (2.5 days) and return-to-activity time (8 days), demonstrating the advantages of minimally invasive techniques. Open mesh repair (onlay and sublay) and Mayo's repair showed longer recovery times, with hospital stays averaging 3.8-4.3 days and return to activities ranging from 12-15 days. Postoperative complications were an important consideration in this study, with the most frequent complications including seroma formation (12.2%), suture line infections (10.8%), and wound gaping (10.8%). Among the different techniques, seroma was more commonly observed following onlay mesh repair. This aligns with findings from Berrevoet et al. (2011), who highlighted that onlay mesh placement often results in a higher incidence of seroma due to the placement of the mesh over the fascial defect. The subcutaneous positioning can lead to fluid accumulation, increasing the risk of seroma formation. In contrast, sublay mesh placement, where the mesh is positioned beneath the fascia, demonstrated a lower incidence of seroma and infection, supporting its potential as a safer choice for minimizing complications in hernia repair.

**Figure 7: Mean Postoperative Hospital Stay by Surgical Technique**




The analysis of recovery times highlights the advantages of laparoscopic IPOM repair for patients prioritizing rapid return to normal activities. This study found that patients undergoing laparoscopic repair had an average hospital stay of 2.5 days and returned to daily activities in approximately 8 days, which is shorter than the recovery time observed for open mesh repair (12-15 days) and Mayo's repair (15 days). These findings are

consistent with Itani et al. (2010) and Christoffersen et al. (2013), who noted similar benefits of laparoscopic repair, particularly in obese patients. Minimally invasive procedures have become increasingly popular due to their association with reduced pain and quicker recovery, though the requirement for specialized equipment and expertise can limit their availability in some settings. Open mesh repairs, particularly sublay mesh placement, showed relatively favorable recovery times while maintaining a low complication profile, making it an appropriate choice for patients who may not be ideal candidates for laparoscopic surgery due to comorbidities or prior abdominal surgeries as shown in figure 7. Open sublay repair's effectiveness, coupled with its widespread availability and compatibility with general or spinal anesthesia, makes it a flexible option in a variety of healthcare settings. The results of this study are consistent with existing literature in demonstrating the overall efficacy of mesh-based techniques for reducing recurrence rates in umbilical and paraumbilical hernia repairs. Studies by Luijendijk et al. (2000) and Kingsnorth et al. (2008) have consistently shown that mesh repairs outperform suture repairs, especially for hernias greater than 2 cm. This study supports these findings, with Mayo's non-mesh repair showing relatively longer recovery times and a higher tendency for complications. Despite the benefits of mesh repairs, complications like seroma formation, infection, and chronic pain highlight the need for careful technique selection based on individual patient factors. Existing research suggests that no single approach is universally ideal, as each technique has its strengths and limitations. For example, while sublay mesh placement is associated with fewer complications, it may require a longer operative time compared to onlay placement. Similarly, laparoscopic IPOM offers quicker recovery but may not be suitable for all patients due to the risk of adhesions and chronic pain associated with intraperitoneal mesh placement. The choice of repair technique should be personalized, considering factors such as hernia size, patient comorbidities, recovery priorities, and available surgical expertise. While laparoscopic repairs are advantageous for select patients, particularly those seeking faster recovery, open sublay repair may be preferable for patients at higher risk of complications or those in resource-limited settings.

## V. Conclusion

This study provides insights into the comparative effectiveness, complications, and recovery times of various surgical techniques for managing umbilical and paraumbilical hernias. The findings reinforce the value of mesh-based repairs, particularly sublay mesh placement, which demonstrated a favorable balance of efficacy and safety, with low complication and recurrence rates. This technique's benefits align with established literature, making it a reliable option for patients across a range of clinical scenarios. Laparoscopic IPOM repair, while less commonly performed, offers distinct advantages for patients prioritizing faster recovery. This minimally invasive approach resulted in shorter hospital stays and quicker returns to daily activities, although the risk of chronic pain associated with intraperitoneal mesh fixation remains a consideration. These results suggest that laparoscopic repair may be ideal for select patients who are suitable candidates for minimally invasive surgery and require a quicker recovery, although it requires specialized skills and equipment. The choice of surgical technique should be individualized, considering factors such as hernia size, patient comorbidities, and recovery expectations. Open sublay repair provides an accessible, effective solution in various healthcare settings, while laparoscopic options may offer enhanced recovery for patients with suitable risk profiles and access to advanced surgical capabilities. Ultimately, this study underscores the importance of a tailored approach in hernia repair. Future research should focus on further refining these techniques, exploring innovations in mesh materials, and assessing long-term outcomes, especially regarding recurrence and quality of life. By advancing our understanding of these techniques, clinicians can continue to optimize outcomes and enhance patient care in umbilical and paraumbilical hernia management.

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