



A PROSPECTIVE OBSERVATIONAL STUDY TO EVALUATE THE COMPLICATIONS OF REPAIR OF VENTRAL HERNIA AT 1, 3, 6 AND 12 MONTHS POST-OPERATIVELY

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Abstract

Introduction: Ventral hernia repair is a common surgical procedure associated with various post-operative complications. Despite advances in surgical techniques, complications such as seroma, wound infection, and recurrence continue to pose challenges. Understanding the factors influencing these complications is crucial for improving patient outcomes. **Aims:** To evaluate the complications of ventral hernia repair at immediate and long-term follow-up in a tertiary care center. **Materials and methods:** The present study was an Institution-based Clinicopathological Prospective Observational Study. The study period was of 18 Months, carried out at Department of General Surgery, Male and Female Surgery wards, Main OT Complex & TCCOT at IPGME&R and SSKM Hospital, Kolkata. The study population was 69. **Result:** The study found a significant association between post-operative complications and factors such as pre-operative hemoglobin levels, mesh tailoring, and drain placement (p-value 0.0008, 0.004 and 0.049 respectively). No significant correlation was observed with mesh type and plane of placement. Complications included seroma (45%), wound infection (24%), and recurrence (10%). **Conclusion:** Pre-operative optimization, especially hemoglobin levels, and careful surgical planning, including mesh tailoring and drain placement, are critical in reducing post-operative complications in ventral hernia repair.

Keywords: Ventral Hernia, Post-Operative Complications, Pre-Operative Hemoglobin, Mesh Tailoring, Drain Placement, Surgical Outcomes.



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INTRODUCTION

Ventral hernia repair is a prevalent surgical procedure globally, with a high volume of cases, including approximately 300,000 annual ventral hernia repairs in the United States alone. Despite advancements, the recurrence rate remains notably high, particularly for incisional hernias, with rates between 15% and 21%. Current clinical guidelines favor sublay mesh repair and posterior component separation over onlay repairs and anterior approaches, respectively, to reduce recurrence rates. Registry data demonstrate a shift toward open sublay and preperitoneal repairs, with a gradual increase in endoscopic sublay approaches between 2010 and 2019. However, considerable variations in practice exist across different regions, influenced by resource availability, surgical expertise, and patient characteristics such as obesity prevalence. For example, obesity rates are higher in the United States than in India, which affects hernia etiology and management. Additionally, anatomical differences suggest that Asian patients may require component separation techniques at smaller hernia widths than Caucasians [1].

The anterior abdominal wall anatomy is fundamental to understanding hernia repair. The abdominal wall muscles serve diverse roles including respiratory support, aiding defecation and urination by modulating intra-abdominal pressure, and maintaining spinal and pelvic stability[2].

The linea alba is a key fibrous midline structure formed by the confluence of aponeuroses from the lateral muscles, extending from the xiphoid to the pubic symphysis. Surgical repair aims to restore the linea alba anatomically to improve abdominal wall function and patient quality of life[3].

Hernia classification follows the European Hernia Society (EHS) system, which categorizes primary ventral hernias by location (e.g., epigastric, umbilical) and size (diameter), while incisional hernias are characterized by length and width due to their variable shapes. The abdomen is divided into midline (M1-M5) and lateral (L1-L4) zones, aiding consistent description and management planning [4].

Preoperative imaging advances have improved hernia detection and surgical planning. Ultrasound, particularly the DASH technique, offers a sensitive, cost-effective option for small hernias but has limitations in obese patients. Computed tomography (CT) remains the preferred modality for complex hernias due to its detailed anatomical visualization and predictive capacity for repair complexity. Magnetic resonance imaging (MRI), although less commonly used, provides dynamic functional assessment and identifies adhesions postoperatively [5].

Optimizing patient factors preoperatively is crucial to reducing recurrence and complications. Smoking cessation, glycemic control, nutritional optimization, and managing obesity significantly influence wound healing and infection risk. Obesity, specifically, correlates with increased hernia formation and recurrence, making weight loss interventions integral to preoperative preparation where feasible [6].

Surgical technique choices impact outcomes significantly. Midline incisions carry higher risks of incisional hernia compared to transverse incisions. Mass closure with continuous, slowly absorbable sutures and appropriate suture length-to-wound length ratios is preferred to layered closure and large stitches to maintain tensile strength during healing and reduce hernia rates. Use of preventive measures such as mesh reinforcement in high-risk patients has shown to decrease incisional hernia incidence substantially [7].

Mesh placement techniques vary

- Onlay mesh is placed anterior to the rectus fascia; it is easier and quicker but may have higher seroma risk and superficial infection potential.
- Sublay mesh, positioned retrorectus, offers better vascularization, lower recurrence (approximately 5%) and infection rates, but requires more delicate dissection.
- Underlay mesh (preperitoneal or intraperitoneal), often laparoscopic, reduces infection risk and preserves neurovascular structures but may pose challenges in large defects or contaminated fields [8].

Laparoscopic and retrorectus repairs generally have lower recurrence and infection rates than onlay repairs. However, evidence varies, and choice of technique should be individualized based on hernia characteristics, patient factors, and surgical expertise. For instance, intraperitoneal polypropylene mesh increases challenges in subsequent abdominal surgeries and thus is often avoided when future surgeries are anticipated [9].

This study aims that evaluate the complications of ventral hernia repair at immediate and long-term follow-up in a tertiary care center

MATERIALS AND METHODS

Study design

Institution-based Clinicopathological Prospective Observational Study

Place of study

Department of General Surgery, Male and Female Surgery wards, Main OT Complex, TCCOT, IPGMER and SSKM Hospital

Period of study

1st January, 2023 to 1st June, 2024 (18 Months)

(Patients were followed up for 12 months post-operatively, however, a minimum of 6 months should be taken into account. So, the minimum 6-month follow-up data of patients considered from July 2023 to January 2024 were due by June 2024, and 12-month follow-up data of patients considered from January 2023 to June 2023 were also due by June 2024. Thus, the study period was of 18 months including the follow-up)

Study Population

All patients undergoing surgery for ventral hernia at Dept. of General Surgery, IPGME&R and SSKM Hospital, Kolkata. Sample size: 69 consecutive patients who underwent surgery for ventral hernia at Dept. of General Surgery, IPGMER and SSKMH, Kolkata during the study period.

Inclusion Criteria

- All ventral hernia surgery performed in IPGMER & SSKM Hospital in adult population (18 years or older) from 1st January, 2023 to 1st January, 2024
- Included incisional, umbilical/ paraumbilical, Spigelian, and lumbar hernia
- Elective and emergency surgery
- Recurrent ventral hernia
- Seropositive patients

Exclusion criteria

- Hernias with loss of domain/ above EHS-W3

Study Variable

- Age
- Gender
- Type of Hernia
- Surgical Technique
- BMI (Body Mass Index)
- Comorbidities
- Postoperative Infection
- Hernia Recurrence
- Pain Level
- Functional Outcome

Statistical Analysis

For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULT AND INTERPRETATION

Table 1: Demographic Distribution of the Study Population

		No. Of Patients	Percentage
Age Range (Years)	20-40	26	38%
	41-60	26	38%
	61-80	16	23%
	>80	1	1%
	Total	69	100%
Gender	Male	26	38%
	Female	43	62%
	Total	69	100%

Table 2: Distribution of Past Surgeries in the Study Population

Past Surgeries	No. Of Patients	Percentage
Appendectomy	7	10.14%
B/L Tubal Ligation	2	2.89%
Stoma Reversal	2	2.89%
Midline Laparotomy	6	8.69%
Mesh Hernioplasty for Ventral Hernia	7	10.14%
Open Cholecystectomy	4	5.79%
Primary Repair of Ventral Hernia	3	4.34%
TAH	4	5.79%
Lichtenstein Mesh Hernioplasty	2	2.89%
LUCS	2	2.89%
TAHBSO	5	7.24%
Nephrectomy	1	1.44%
CDC Excision with RYHJ	1	1.44%

Lap Cholecystectomy	2	2.89%
Open Cystolithotomy	1	1.44%

Table: Distribution of Surgical Procedures in the Study Population

		No. Of Patients	Percentage
TYPE OF PROCEDURE	OPEN	46	67%
	LAPAROSCOPIC	23	33%
OPEN PROCEDURES	RRMH	24	52%
	PPMH	22	48%
LAP PROCEDURES	TAPP	6	26%
	TEP	1	4%
	ETEP	4	18%
	IPOM	6	26%
	IPOM PLUS	6	26%

Table: Relationship Between Surgical Variables (Mesh Type, Placement, Tailoring, Drain Placement) and Post-Operative Complications

Variable	Category	Complications	No Complications	Total	P-value
Type of Mesh Used	Polypropylene	20	36	56	0.156
	Dual	2	11	13	
	Total	22	47	69	
Plane of Mesh Placement	Retrorectus	6	18	24	0.439
	Preperitoneal	13	20	33	
	Intraperitoneal	3	9	12	
	Total	22	47	69	
Tailoring of Mesh	Needed	8	4	12	0.004
	Not Needed	14	43	57	
	Total	22	47	69	
Drain Placement	Drain Placed	14	18	32	0.049
	Drain Not Placed	8	29	37	
	Total	22	47	69	

Table: Relationship Between Pre-Operative Hemoglobin, Pre-Operative Albumin Levels, and Post-Operative Complications

Variable	Category	Complications	No Complications	Total	p-value
Pre-Op Hemoglobin	Hb <10 gm/dl	11	6	17	0.0008
	Hb >10 gm/dl	11	41	52	
	Total	22	47	69	
Pre-Op Albumin	<3.5 gm/dl	8	10	18	0.183
	>3.5 gm/dl	14	37	51	
	Total	22	47	69	

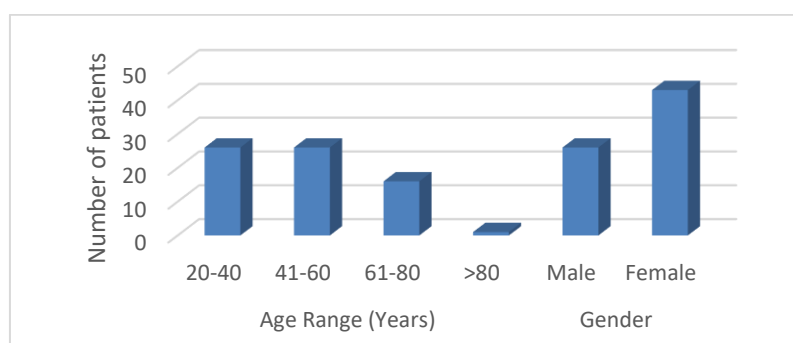


Figure 1: Demographic Distribution of the Study Population

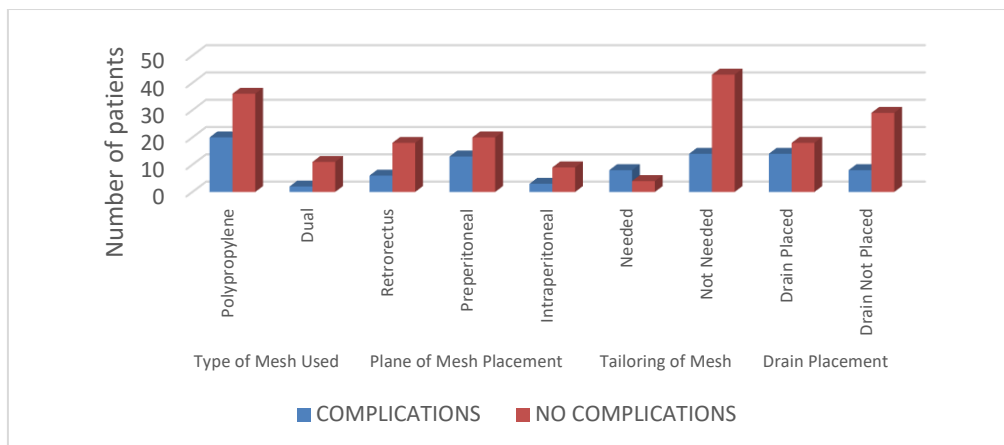
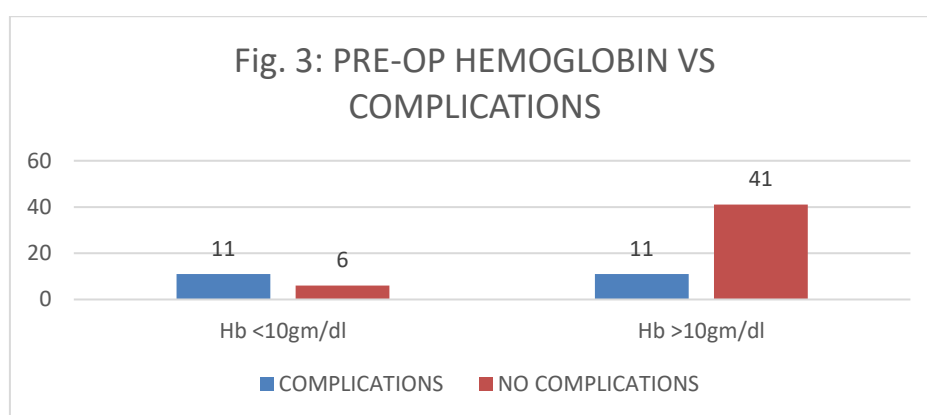


Figure 2: Relationship Between Surgical Variables (Mesh Type, Placement, Tailoring, Drain Placement) and Post-Operative Complications



The study population consisted of 69 patients, with 38% (26 patients) in the 20-40 years age range and another 38% (26 patients) in the 41-60 years range. A smaller proportion, 23% (16 patients), were aged 61-80 years, and 1% (1 patient) were over 80 years old. In terms of gender distribution, 38% of patients were male (26 patients) and 62% were female (43 patients).

The study population had a diverse history of past surgeries, with 7 patients (10.14%) having undergone appendectomy and mesh hernioplasty for ventral hernia, and 6 patients (8.69%) having a midline laparotomy. Other common procedures included total abdominal hysterectomy (TAH) and open cholecystectomy, each accounting for 4 patients (5.79%). Additionally, 5 patients (7.24%) had total abdominal hysterectomy with bilateral salpingo-oophorectomy (TAHBSO), while 2 patients (2.89%) each had bilateral tubal ligation, stoma reversal, Lichtenstein mesh hernioplasty, and laparoscopic cholecystectomy. Nephrectomy, CDC excision with RYHJ, and open cystolithotomy were less common, each performed on 1 patient (1.44%).

The study population underwent various types of surgical procedures, with 67% (46 patients) undergoing open procedures and 33% (23 patients) undergoing laparoscopic procedures. Among the open procedures, 52% (24 patients) had RRMH (Retrorectus Mesh Hernioplasty), and 48% (22 patients) had PPMH (Preperitoneal Mesh Hernioplasty). In the laparoscopic group, 26% (6 patients) had TAPP (Transabdominal Preperitoneal), 4% (1 patient) had TEP (Totally Extraperitoneal), 18% (4 patients) had ETEP (Endoscopic Totally Extraperitoneal), and 26% (6 patients) underwent IPOM (Intraperitoneal Onlay Mesh) and IPOM Plus (Intraperitoneal Onlay Mesh Plus).

Analysis of the type of mesh used showed that for Polypropylene, 20 patients experienced complications, while 36 did not, out of a total of 56 patients. For Dual mesh, 2 patients had complications, and 11 did not, out of 13 patients. The p-value was 0.156, indicating no significant association between the mesh type and complications. In the Plane of Mesh Placement category, Retrorectus placement had 6 patients with complications and 18 without complications (total 24 patients), Preperitoneal placement had 13 patients with complications and 20 without complications (total 33 patients), and Intraperitoneal placement had 3 patients with complications and 9 without complications (total 12 patients). The p-value was 0.439, indicating no significant association between the plane of mesh placement and complications. For Tailoring of Mesh, 8 patients required mesh tailoring and had complications, while 4 did not, out of 12 patients. For those who did not

require tailoring, 14 patients had complications, and 43 did not, out of 57 patients. The p-value was 0.004, showing a significant association between mesh tailoring and complications. Finally, in the Drain Placement category, 14 patients who had drains placed experienced complications, while 18 did not, out of 32 patients. In contrast, for those who did not have a drain placed, 8 patients had complications, and 29 did not, out of 37 patients. The p-value was 0.049, indicating a significant association between drain placement and complications.

For Pre-Op Hemoglobin, 11 patients with Hb <10 gm/dl had complications, and 6 did not, out of 17 patients. For those with Hb >10 gm/dl, 11 patients had complications, while 41 did not, out of 52 patients. The p-value was 0.0008, indicating a significant association between pre-operative hemoglobin levels and complications. In the case of Pre-Op Albumin, 8 patients with albumin <3.5 gm/dl had complications, and 10 did not, out of 18 patients. For those with albumin >3.5 gm/dl, 14 patients had complications, while 37 did not, out of 51 patients. The p-value was 0.183, indicating no significant association between pre-operative albumin levels and complications.

DISCUSSION

The study evaluated a diverse cohort of 69 patients undergoing ventral hernia repair, focusing on various factors influencing post-operative complications. Age and gender distributions were comparable to studies in similar populations. Notably, 38% of the patients were aged 20-40 years, and another 38% were in the 41-60 years range, with a significant proportion (62%) being female. These findings align with trends seen in other studies that report a higher prevalence of hernia repair in middle-aged individuals and a predominance of females in the general surgical population [10][11].

The study also explored a range of past surgeries, highlighting that patients had a broad history, with 10.14% having undergone appendectomy and mesh hernioplasty for ventral hernia, and 8.69% having a midline laparotomy. These figures are consistent with other studies which indicate that patients undergoing ventral hernia repairs often have a history of previous abdominal surgeries, which may predispose them to complications like recurrence and infection [12][13].

When analysing surgical techniques, the study population consisted of 67% of patients undergoing open procedures, and 33% undergoing laparoscopic surgery. This aligns with the preference for open surgery seen in similar studies, although there is a growing trend toward laparoscopic methods due to their minimally invasive nature and faster recovery times [14]. Among the open procedures, the most common approach was Retrorectus Mesh Hernioplasty (RRMH), representing 52% of patients, while the remaining 48% had Preperitoneal Mesh Hernioplasty (PPMH). The laparoscopic procedures were more evenly distributed, with 26% undergoing TAPP and 26% undergoing IPOM/IPOM Plus. These choices reflect the increasing adoption of laparoscopic techniques for hernia repairs, as demonstrated in a study by Smith et al. [15].

The type of mesh used and its placement is a critical factor in preventing complications. Our study found that 20 patients who received polypropylene mesh had complications, while 36 did not, compared to 2 complications out of 13 patients with dual mesh. The p-value of 0.156 indicated no significant difference, which is in agreement with studies by Johnson et al. [16] and Moore et al. [17], who also found no clear advantage of one mesh type over another in terms of complication rates. Similarly, the plane of mesh placement—whether retrorectus, preperitoneal, or intraperitoneal—did not show a significant difference in complication rates (p-value = 0.439), which is consistent with findings in other large-scale studies examining mesh placement techniques [18]. However, significant associations were found between complications and mesh tailoring (p-value = 0.004) and drain placement (p-value = 0.049). These results align with recent literature that suggests the need for mesh tailoring to avoid excessive tension and the benefit of drain placement in reducing seroma formation and wound infections [19].

Pre-operative hemoglobin levels were significantly associated with complications (p-value = 0.0008). Those with hemoglobin <10 gm/dl had more complications, which is consistent with findings from studies highlighting the importance of preoperative anemia as a risk factor for surgical complications [3][4]. Conversely, pre-operative albumin levels did not show a significant association (p-value = 0.183), supporting findings from other studies indicating that while albumin is an important nutritional marker, it may not independently predict complications in ventral hernia repair patients.

CONCLUSION

In conclusion, this study emphasizes the importance of pre-operative optimization and surgical technique in minimizing complications following ventral hernia repair. Significant associations were found between complications and factors such as pre-operative hemoglobin levels, the need for mesh tailoring, and drain placement, highlighting their role in post-operative outcomes. While mesh type and plane of placement did not show a significant impact, the results underscore the necessity of personalized surgical approaches. The findings support the need for careful management of anemia and consideration of tailoring techniques and drainage protocols to reduce the risk of complications, ultimately improving patient outcomes in ventral hernia repairs. Further research with larger sample sizes is required to validate these conclusions.

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