ORIGINAL RESEARCH

Comparison of Different Types of Mesh in Intraperitoneal Onlay Mesh Ventral Hernia Surgery

George Chilaka Obonna[1], Martin Chibuike Obonna[2], Rajneesh K Mishra[3]

Abstract

A ventral hernia does occur on the anterior abdominal wall, and a substantial number are iatrogenic from surgical incisions. Surgical treatment has progressed over the decades using mesh to correct the laxity in the anterior abdominal wall. The Intraperitoneal Onlay Mesh (IPOM) method uses a mesh inserted into the peritoneal space to repair the abdominal defect. The best mesh is the ideal mesh, least associated with complications of mesh implantation such as hematoma formation, mesh failure, and discomfort to the patient.

Materials and methods: We evaluated patients who had IPOM in our center from January 2013 to January 2020 prospectively. Polypropylene polyvinylidene fluoride (PPV) mesh and the composite mesh were put under study. Other biological meshes have been used but not assessed. Factors assessed included intestinal obstruction, recurrence rates, and incidence of seroma. Both laparoscopic and open techniques were the procedures adopted in placing the meshes.

Results: We had 100 patients under study. Seventy patients presented with primary hernia, while 30 patients presented with incisional hernia. All the patients were followed up for 48 months (2 years). Forty (80%) patients in the PPV group had intestinal obstruction secondary to adhesion, while no patient in the composite group had intestinal obstruction ($p = 0.0001$). No patient in the PPV group had seroma/hematoma, while 12 (24%) patients in the composite group had seroma/hematoma ($p = 0.0001$). Five (10%) of patients in the PPV group had recurrence, while 15% of patients in the composite group had recurrence ($p = 0012$).

Conclusion: Mesh hernioplasty by IPOM is currently a procedure of choice and more preferable than ordinary suture closure of hernia. None of the mesh types are free from possible postoperative complications. A significant drawback in the use of PPV was intestinal obstruction from adhesion formation, but there was no incidence of seroma/hematoma and a much lower incidence of recurrence compared with the composite mesh. Therefore, none can be said to be superior to the other on the mesh type of choice in IPOM hernioplasty for ventral hernias.

Keywords: Composite, Intraperitoneal Onlay Mesh, Laparoscopy, Polypropylene polyvinylidene fluoride, Ventral hernia.

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Introduction

A ventral (abdominal) hernia occurs when viscera projects through a gap in the wall of its containing cavity. Examples include epigastric, paraumbilical, umbilical, and iatrogenic (incisional) hernias. Ventral hernias can get larger and worsen with time. They cannot get better on their own, and surgery is the way to go by repairing them. Untreated hernias can become difficult to repair and can lead to terrible complications, such as strangulations of parts of the gut. Clinical examination or imaging can discern a ventral hernia.[1] Open mesh placement is an option and so is laparoscopic mesh implant, though laparoscopic repair benefits the patient more in the fact that patient leaves the hospital in time and is minimally invasive with less pain and reduced wound infection rate. Laparoscopic repair gives between 0 and 9%[2,3] recurrence rate, and incisional hernias complicate 2–10% of abdominal surgeries. Suture repair of ventral hernia has been shown to be associated with high recurrence rate up to 54%. This justifies the use of mesh implant. Intraperitoneal Onlay Mesh is a way of mesh placement. In the treatment of incarcerated hernia, combined open and laparoscopic approach in the hybrid IPOM plus method is relevant. In this case, the hernia orifice is sutured, and this helps in reducing the recurrence rate.

Intraperitoneal Onlay Mesh which can be by open or laparoscopic approach involves placing a mesh into the abdominal cavity to cover the hernia orifice. Operative complication rates and recurrence rates are higher in open IPOM. Thus, open IPOM without a bridging scenario will reduce the recurrence rate, since in this case, the hernia orifice is suture closed. What this means is that in the open technique direct closure is done after placing the mesh intraperitoneally. In the laparoscopic approach, the mesh is placed intraperitoneally, and the use of tackers or trasfascial sutures peripherally reinforces the mesh. Methods of fixation include tackers and suture glue.

Polypropylene polyvinylidene fluoride is a noncoated, 100% synthetic two-component textile structure. Composite mesh is made from a composite structure of monofilament polyester textile on one side and a hydrophilic absorbable collagen film on the other side which is the side that abuts on the viscera.

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Table 1: Age of patients who had IPOM

	N	*Minimum*	*Maximum*	*Mean*	*Std. deviation*	*Skewness*	
	Statistic	*Statistic*	*Statistic*	*Statistic*	*Statistic*	*Statistic*	*Std. error*
Age	100	20	80	50.50	14.403	0.139	0.241
Valid N (listwise)	100						

Table 2: Age-group frequency

		Frequency	*Percent*	*Valid percent*	*Cumulative percent*
Valid	11–20	1	1.0	1.0	1.0
	21–30	5	5.0	5.0	6.0
	31–40	19	19.0	19.0	25.0
	41–50	28	28.0	28.0	53.0
	51–60	20	20.0	20.0	73.0
	61–70	15	15.0	15.0	88.0
	71–80	12	12.0	12.0	100.0
		100	100.0	100.0	

A small hernia defect is less than 4 cm. A 4–10 cm defect represents a medium hernia, while greater than 10 cm fascial defect indicates a large hernia. A high BMI is body mass index greater than 30 kg/m^2.

Current concepts in mesh implants include the newer meshes: surgisis, alloderm, and proceed. Surgisis is porcine intestinal submucosa. It is a collagen biomatrix, naturally occurring and acellular with 18 months shelf life. It supports the surgical site, while the body's natural healing process replaces the graft with new host tissue. Alloderm is biological dermal matrix from processed donated human tissue. Proceed is soft polypropylene mesh covered with polydioxanone sulfate and oxidized regenerated cellulose fabric.

Materials and Methods

This study of IPOM in our hospital: the University of Medical Science Teaching Hospital and the State Specialist Hospital, Okitipupa, Ondo state, Nigeria. Data were collected and analyzed using SPSS version 22.

Results

Analysis of data was done on demographics, and categorical data were compared using the Chi-square test. Qualitative variables were represented as percentages. *p* values of less than 0.05 were considered as statically significant.

A total of 100 patients had mesh hernioplasty by IPOM between January 2013 and January 2020.

Seventy patients (70%) presented with congenital (primary) hernia, while 30 patients (30%) presented with incisional hernia.

Sixty-five patients (65%) had open procedure, while 35 (35%) had laparoscopic repair.

Sixty-five patients (65%) were female, while 35 (35%) were male, giving a male to female ration 1:1.86. Twenty-eight patients (28%) were in the age range of 41–50 years, and the overall age range is 11–80 years as shown in Figures 1 and 2 and Tables 1 to 3.

The mean age is 50.5 ± 14.4 years. The median follow-up was 48 months. Fifty patients (50%) had hernia repair using PPV, while 50 patients also (50%) had hernia repair using composite mesh.

Table 3: Sex distribution according to mesh used at IPOM

Male (n = 35)		*Female (n = 65)*	
Mesh type		*Mesh type*	
PPV	Composite	PPV	Composite
20	15	30	35

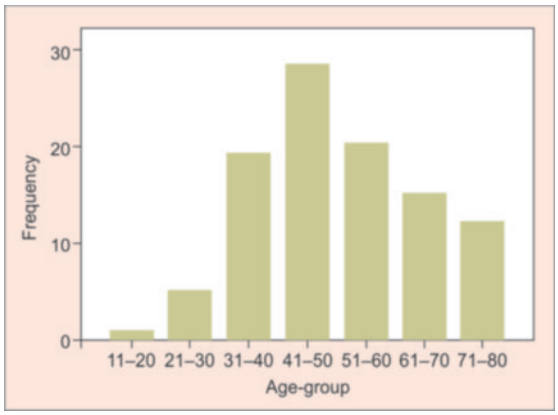

Fig. 1: Age-group frequency

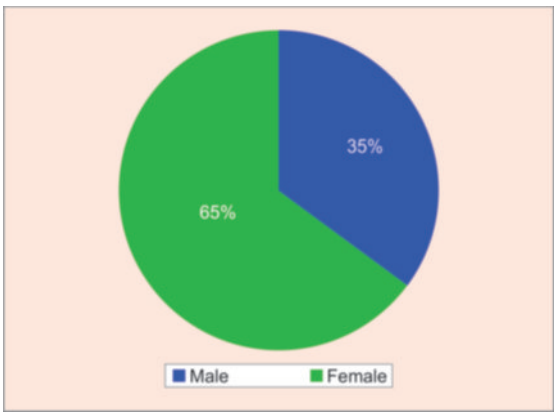

Fig. 2: Showing gender of patients that had IPOM

Table 4: Distribution of seroma/hematoma vs type of mesh used

	Seroma/hematoma		
Mesh types	*Yes (n = 12)*	*No (n = 88)*	*Total*
PPV	0	50	50
Composite	12	38	50
Total	12	88	100

Table 5: Chi-square tests for seroma/hematoma

	Value	*df*	*Asymp. sig. (two-sided)*
Pearson Chi-square	13.636	1	0.000

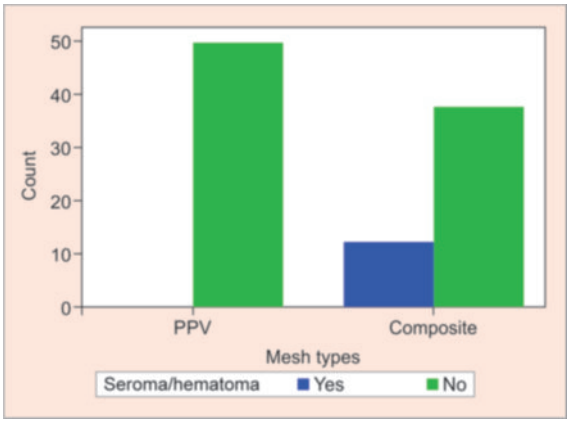

Fig. 3: Frequency of seroma/hematoma

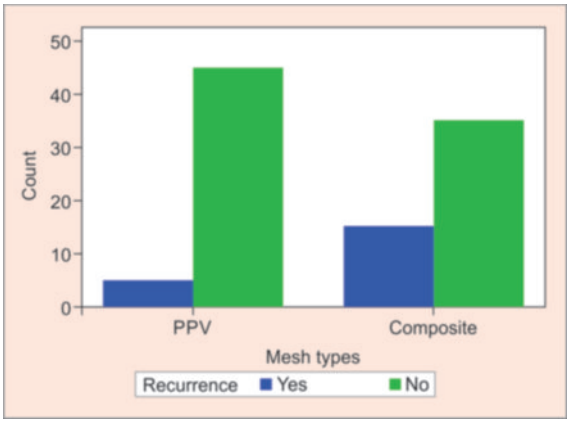

Fig. 4: Showing recurrence distribution

Table 6: Distribution of recurrence vs type of mesh used

	Recurrence		
Mesh types	*Yes*	*No*	*Total*
PPV	5	45	50
Composite	15	35	50
Total	20	80	100

Forty (80%) of patients in the PPV group had intestinal obstruction secondary to adhesions, while no patient in the composite group had intestinal obstruction ($p = 0.0001$). No patient in the PPV group had seroma/hematoma, while 12 (24%) of patients in the composite group had seroma/hematoma ($p = 0.0001$).

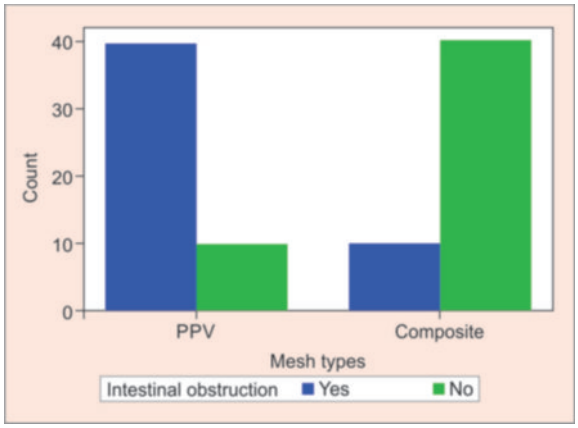

Fig. 5: Intestinal obstruction distribution

Table 7: Chi-square tests for recurrence

	Value	*df*	*Asymp. sig. (two-sided)*
Pearson Chi-square	6.250	1	0.012

Table 8: Distribution of intestinal obstruction vs type of mesh used

	Intestinal obstruction		
Mesh types	*Yes*	*No*	*Total*
PPV	40	10	50
Composite	10	40	50
Total	50	50	100

Table 9: Chi-square tests for intestinal obstrution

	Value	*df*	*Asymp. sig. (two-sided)*
Pearson Chi-square	36.000	1	0.000

Five (10%) of patients in the PPV group had recurrence while 15% of patients in the composite group had recurrence ($p = 0.012$) as shown in Figures 3 to 5 and Tables 4 to 9.

For the patients who presented with intestinal obstruction, simple conservative management resolved the obstruction. An ultrasonography scan was used to confirm patients who clinically had hematoma/seroma, and this occurred in the early postoperative period and settled spontaneously in follow-up and required no further intervention. In the laparoscopic repair, mesh fixation was by the use of proTack™, while in the open repair, unobservable nylon suture wan used.

There was no mortality in the study. There was no history of chest infection, peritonitis, wound infection, or sinus formation. Standard aseptic protocol and proper coverage of the patient with broad-spectrum prophylactic antibiotics were instituted in all the cases.

The average operation time was 2 hours in the open procedure and 2.5 hours in the laparoscopic procedure.

The mean duration of hospital stay was 72 hours in the open procedure and 48 hours in the laparoscopic approach.

Discussion

The introduction of polypropylene mesh repair by an usher in 1958 opened a new era of tension-free herniorrhaphy. Recurrence rates with prosthetic mesh decreased to 10–20%. Subsequently, it was

realized that the placement and fixation of the mesh were more crucial in determining the outcome of the repairs.

The placement of the mesh in the preperitoneal, retromuscular position with a wide overlap of at least 5 cm over hernia defect in all directions was introduced in the late 1980s. The extensive dissection in open procedure accounted for most of its complications

Omphalocele, gastroschisis, and divarication of rectus abdominis account for a congenital visceral hernia. Latrogenic factor accounts for incisional hernias. The faulty technique of closing the 10 mm port after surgery can also account for incisional hernias. Systemic and other comorbid conditions can also account for the development of incisional hernia such as cough, steroid intake, wound infection, cancer, morbid obesity, nutritional imbalance, and wound infection. These reduce collagen synthesis and wound healing.

Other factors include duration of the operation, crossing incisions, ineffective wound drainage, and excessive wound tension. Two other important variables include nutritional aspects as well as the presence of cancer[4] which overall reduces the ability for wound healing and collagen deposition in the wound. Three to thirteen percent of laparotomy patients develop incisional hernias. Multiple defects (Swiss cheese hernias) are best done by laparoscopy as all defects unlike in the open approach get directly visualized and appropriately covered by a single mesh.

Contraindication of laparoscopic repair of ventral hernia is very Large hernia with huge protrusion of skin which is thin enough, and skin fold is necessary to correct by abdominoplasty. Dense intra-abdominal adhesions are also a relative contraindication of laparoscopic repair of ventral hernia.

Clinical evidence suggests that omental adhesion is common, but bowel adhesion is not common and as such usage of PPV is safe.[5]

Incisional hernias mostly become clinically manifest between 2 and 5 years after surgery, and studies have shown that the process starts within the first postoperative month. They are said to occur as a result of the biochemical failure of the acute fascial wound coupled with clinically relevant impediments to acute tissue repair and normal support function of the abdominal wall. Our findings suggest that there were related complications with the use of both meshes.

In our series, PPV was associated with a significant incidence of bowel obstruction caused by adhesion and this has been proven histologicallyl.[6] Various experimental modes and studies suggest decreased adhesion formation with the use of composite mesh[7–11] with most questioning that coated meshes perform better with less adhesion formation. There may be individual idiosyncrasies to these meshes. However, more work has to be done to elucidate these variations. A higher rate of seroma/hematoma formation 24% was noted in the composite group in our study. Coated meshes that are commonly used in intraperitoneal mesh repairs are typically associated with seroma formation because of the resulting impaired drainage of fluid due to the barrier coating. There may be other contributing factors such as the number and size of the defects, the difficulty of dissection, mesh fixation technique, and operation time.

Titanium-coated lightweight mesh versus standard composite mesh comparison showed no differences in recurrence rate but a lower incidence of pain-related complications in the titanium-coated mesh group.[12]

In our study, a significant recurrence rate of 15% was noted in the composite mesh group as compared to 10% in the PPV group. Comparable single-institution case series and one multicenter randomized study reported recurrence rates as low as 0–2.5%.[13–17]

Our study showed no significant relation between mesh fixation by use of suture passer with transfascial sutures and nonabsorbable tackers and recurrence of the hernia, which is consistent with the existing literature.[14,15] There has been a recent focus on the use of glue for mesh fixation, particularly in areas such as the subcostal margins and close to the xiphisternum and pelvis. Other studies have emphasized that mesh fixation using fibrin glue in patients with a ventral hernia is associated with less postoperative pain.[18–20]

Conclusion

Intraperitoneal Onlay Mesh is an acceptable technique. In our study, even though PPV is shown to be associated with a significantly higher incidence of adhesion-related intestinal obstruction, it is still feasible to use because intestinal obstruction resulting from its usage easily gets relieved by simple conservative treatment as can be seen in our cases. Also, this study will further promote its usage as can be seen in the lower incidence of recurrence, seroma, and hematoma formation as compared to the composite mesh and also for the fact that it is cheaper than composite mesh. The composite mesh, however, can equally be used if the patients can afford it, especially in a resource-poor setting such as ours. However, for the newer meshes such as proceed and the biological meshes (surgisis and alloderm), more studies should be done.

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