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The use of PROCEED mesh in ventral hernias: A pilot study on 22 cases

Almoutaz A. Eltayeb, Ibrahim A. Ibrahim, Mohamed B. Mohamed

ABSTRACT

Background: The management of major omphalocoele and large incisional hernias is a common problem and constitutes a great challenge for paediatric surgeons. In most cases, the abdominal cavity is so small and does not allow immediate reduction. Prosthetic materials are becoming increasingly popular for such repair, but direct contact between the bowel and these synthetic materials carries the risk of adhesions and intestinal obstruction. The relatively new PROCEED mesh with absorbable layer in contact with the bowel and another polypropylene non-absorbable layer against the abdominal wall may not produce such adhesions. The aim of this study is to evaluate the feasibility and outcome of this relatively new prosthetic mesh for repair of ventral hernia. **Patients and Methods:** Between June 2009 and December 2012, a pilot study was conducted on 22 cases with large ventral hernias subjected to open surgical repair using PROCEED mesh. The inclusion criterion was cases with large ventral hernias (>4 cm). The evaluating parameters were all the early and late postoperative complications. **Results:** The defect size ranged from 5 to 12 cm. The early postoperative complication (≤1 month) was seroma discharged from the wound in four cases, while the late complications were recurrent herniation and stitch sinus that occurred in three cases. No manifestations of intestinal obstruction, enterocutaneous fistula or mortality were encountered in any of the 22 cases. **Conclusion:** The use of PROCEED composite mesh in ventral hernias is feasible and has minimal complication rates.

Key words: Composite mesh, proceed, ventral hernia repair

Department of Surgery, Assiut University Hospital, Assiut, Egypt

Address for correspondence:
Dr. Almoutaz A. Eltayeb,
Pediatric Surgery Unit, Surgical Department,
Assiut University Children Hospital,
Assiut, Egypt.
E-mail: almoutazeltayeb@hotmail.com

INTRODUCTION

Repair of ventral hernias can be performed by either primary closure or by a prosthetic mesh.[1,2] Primary repair has recurrence rates of 25-52%.[3,4] Although the use of prosthetic meshes has reduced this rate to 13-19%,[5,6] their use was associated with significant morbidity related to the direct contact between the mesh and abdominal viscera, which cannot always be avoided. Technical advances in recent years have introduced a new generation of prostheses (a composite mesh) containing a lesser proportion of material (low weight or low density) and offering improved wall behavior. These meshes have emerged to achieve two goals: First, minimising adhesions between the mesh and abdominal viscera and secondly, the parietal surface of the mesh incite fibrous in growth to provide secure fixation of the mesh to the abdominal wall.[7-9] PROCEED mesh was one of the recently introduced composite meshes to achieve the above goals. The feasibility of using this composite mesh in humans has not been fully established.[2] The aim of this study is to evaluate the feasibility and outcome of this relatively new prosthetic mesh in the repair of ventral hernias.

PATIENTS AND METHODS

This pilot study was conducted between June 2009 and December 2012 at Assiut University Children Hospital (a tertiary care hospital in Upper Egypt). Twenty-two cases (15 males and 7 females) with large ventral hernia were included in this study. The inclusion criteria were cases with large ventral hernias (>4 cm) where primary closure could not be obtained or direct contact between the prosthetic mesh and intestine could not be avoided. The exclusion criteria were: Patients requiring emergency surgery, and patients with acute infection or risk of sepsis and burst-infected wounds.

All patients were subjected to through clinical history taking and examination, and pre-operative data including

the type of hernia, surgical incision and previous attempts of primary closure, if present, were collected. Operative details including defect size, surgical procedure and suture material used were recorded. Informed consent to use PROCEED mesh was taken from all parents after explaining to them all the risks and benefits of using such a prosthetic mesh. Approval of the ethical comity was obtained. The evaluating parameters were all the early and late postoperative complications.

The prosthetic material used (PROCEED; Proceed Ethicon Inc., Somerville, NJ, USA) is a thin, flexible laminated mesh. It consists of outer layer of polypropylene (PP), inner absorbable oxidised regenerated cellulose (ORC) layer and polydioxanone (PDS) layer joining both the outer and inner layers. The PP layer is designed to allow tissue colonisation. The ORC layer constitutes a bioabsorbable physical barrier separating the PP layer from the intra-abdominal organs to minimise the adhesions. The fine, flexible PDS layer acts as a joining element between the PP mesh and the ORC layer.

All cases were subjected to open surgical repair using PROCEED mesh, where all the scarred tissues were removed with dissection of lateral skin flaps and then the peritoneal cavity was opened and any adhesions were dissected and removed. The defect size was assessed and measured in centimetres. The mesh was fixed and secured pro-peritoneal with PROLENE sutures (sub-lay) technique. A subcutaneous suction drain was inserted and then the skin flaps were closed without tension [Figures 1-5]. All the patients received broad-spectrum IV antibiotics per-operatively.

RESULTS

The 22 patients consisted of 10 cases with major omphalocoele treated conservatively during their neonatal period, with their age during the study



Figure 1: Large ventral hernia following conservative treatment of exomphalos major



Figure 2: The scarred tissues are removed with dissection of lateral skin flaps

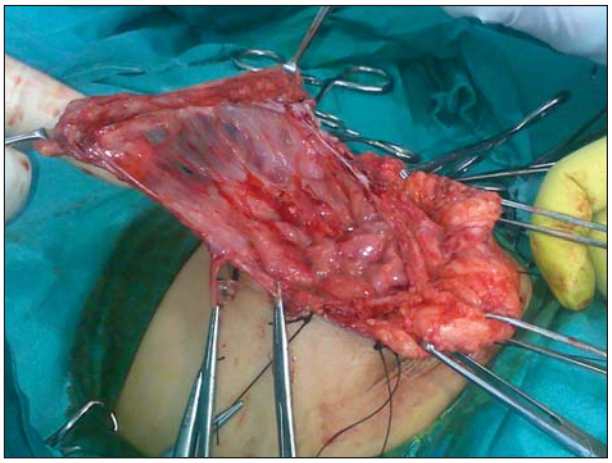


Figure 3: Peritoneal cavity is opened and all adhesions are dissected and removed



Figure 4: PROCEED mesh being applied in sub-lay technique

ranging from 6 months to 3 years, and 12 cases with large incisional hernia, with their age ranging from 9 months to 12 years; the incisional hernia followed colostomy closure in 5 cases, neglected intussusception in 4 cases and acute septic peritonitis in 3 cases [Table 1]. No previous surgical repair was done in any of them. The hernia defect size ranged from 5 to 12 cm.

The early postoperative complication was seroma discharge that drained from the wound in four cases (18%) and did not progress to frank wound sepsis [Table 2]. The total duration of hospital stay for all patients ranged from 4 to 12 days.

The late postoperative complication (>1 month) was recurrent herniation in two cases (9%) that occurred 5 and 8 months postoperatively scheduled for redo surgery and one case with chronic stitch sinus(4.5%) that needed excision [Table 2].

All the patients paid their first follow-up visit in the outpatient clinic 1 month postoperatively and then on a 3-month basis thereafter. The follow-up period ranged from 9 to 18 months during which no cases had manifestations of intestinal obstruction or enterocutaneous fistula. No mortality was encountered.

DISCUSSION

Major omphalocoele is a common paediatric surgical problem. The reported incidence for major omphalocoele is 1:6000 live births. The incisional hernia has a considerable risk after abdominal operations, which may reach 3-11%. This risk rises to 23% in patients experiencing infection in their laparotomy wound.[1] Recent results from a randomised controlled trial prove that the use of a prosthetic mesh for hernia repair reduces the hernia recurrence rate. Still, the surgeon has to face two questions: what type of prostheses should be used and which is the best position for the prosthesis to be put in.[10,11]



Figure 5: Skin closure with subcutaneous suction drain applied

Prosthetic material was firstly introduced with steel mesh. Usher was the first to use plastic prosthetics that had distinct advantages over steel mesh.[12] Later, he developed the monofilamented PP meshes.[13] This was followed by the introduction of multifilamented polyester mesh and double filamented PP mesh. Since then, it has been the widely used prosthetic material for hernia repair.[14] The ideal mesh should incite tissue in growth into the parietal surface, permit neoperitoneum formation on the visceral surface and minimise visceral adhesion formation. It also should be biocompatible, nontoxic and non-immunogenic.[9] Previous experimental studies in animals have shown that PROCEED mesh is completely covered by neoperitoneum within 14 days, the PDS laminas enveloping it disintegrate in 2 weeks and absorb within 3 months to allow tissue colonisation.[2,15] There are few studies in the literature on the use of PROCEED mesh in humans without agreement in results yet about the use of PROCEED mesh.[16-18] Jacob *et al.* concluded that parietex composite mesh was superior to PROCEED mesh regarding the visceral adhesions, fibrous ingrowth into the parietal surface and mesh shrinkage.[9] However, Egea *et al.* and Rosenberg support the use of PROCEED mesh, reporting that it has two basic characteristics: First, it allows excellent tissue

Table 1: Types of operation causing incisional hernia in the 12 cases of incisional hernia

Type of operation causing incisional hernia	Number
Colostomy closure	5
Neglected intussusceptions	4
Septic peritonitis	3

Table 2: Early and late postoperative complications of the 22 cases

Early postoperative complications	Number (22)	Percentage (%)
Seroma discharge	4/22	18
Wound infection	0/22	0
Bleeding	0/22	0
Late postoperative complications		
Stitch sinus	1/22	4.5
Recurrence	2/22	9
Adhesive intestinal obstruction	0/22	0
Faecal fistula	0/24	0

colonisation and the second one is the avoidance of adherence to the underlying viscera. Moreover, PROCEED mesh uses low-density PP which reduces the amount of material implanted and the final scar rigidity, thereby contributing to improved wall physiology after repair.[16,19] The goal of successful prosthetic repair is to minimise the recurrence rate with the lowest possible complications such as inflammation, visceral adhesions and mesh erosion with consequent fistula. To achieve this, the surgeon should make every effort to keep the bowel out of contact from the mesh. The hernia sac, omental interposition and fibrin glue have been used as an option to overcome this problem.[20,21] In this study, we faced two major problems: first, the large gap ventral hernias with small abdominal compartment made primary closure impossible and fatal if tried and the second one is the direct contact between the mesh and bowel.

Although the subfascial repair was found to be associated with extensive tissue dissection with subsequent high recurrence, it allows the abdominal contents to buttress and support the mesh against the abdominal wall.[22,23] The reported recurrence rate for open prosthetic mesh hernia repair is 13-19%.[5,6] In our study, we had 9% recurrence rate, but none of our patients showed manifestation of adhesive intestinal obstruction, mesh erosion or enterocutaneous fistula.

The open prosthetic mesh repair is associated with increased incidence of seroma and wound infection, the incidence of which is quite variable in the literature.[7,24,25] This series had slightly higher incidence of seroma discharge (18%) than that of Rosenberg.[16] This high percentage may be acceptable regarding our small sample size. This seroma was drained successfully and did not progress to frank wound infection, although it is a concept that patients undergoing prosthetic mesh repair have increased wound infection rates and consequently are more likely to receive antibiotics and have the subcutaneous drains placed. Studies showed that neither the use of antibiotics nor the subcutaneous drains had an effect on the incidence of wound-related complications.[24,25] In fact, recent studies showed that wound infection was rare after PROCEED mesh repair which is attributed to its large pore size allowing permeation of the exudates, thus avoiding bacterial colonisation.[2,16] El-Shafei[26] in his series reported 22.2% infection rate and 11% stitch sinus rate after PROCEED mesh repair. He attributed the high infection rate in his study to the application of mesh in potentially contaminated wounds. In this study, we did not have any wound infection and the stitch sinus rate was only 4%. This may be due to our exclusion criteria in patient selection.

With primary closure of large ventral hernias, most patients may need assisted ventilation until the abdominal cavity accommodates the contents.[27] The insertion of PROCEED mesh helped to solve this problem where none of our patients needed postoperative ventilation, resulting in relatively short period of hospital stay and consequently low total cost in spite of the relatively high price of the mesh.

CONCLUSION

Repair of ventral hernias using PROCEED mesh is safe with minimal complications and is a cost-effective technique. Further long-term study on larger number of patients is needed to reach solid conclusions.

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