Journal of Gastrointestinal & Digestive System

Al-Taan et al., J Gastrointest Dig Syst 2015, 5:3
DOI: 10.4172/2161-069X.1000284

Research Article Open Access

Polyvinylidene Fluoride-coated Polypropylene Mesh for Intraperitoneal Onlay Mesh (IPOM) Repair of Ventral and Incisional Herniae

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Rec date: Feb 6, 2015, **Acc date:** Apr 28, 2015, **Pub date:** May 5, 2015

Abstract

Background: Dynamesh is a Polyvinylidene fluoride-coated polypropylene mesh. Its main use is for ventral hernia repairs as an on-lay mesh. The mesh was designed to have similar elasticity to the abdominal wall. It is reported to have good anti-adhesive properties while the large pores ensure rapid integration into the abdominal wall. A small series last year reported a high rate of complications with such a mesh. We have used this mesh with few anecdotal concerns and therefore present a more formal retrospective study of complications in our series.

Method: Theatre logs were reviewed for Hernia cases where Dynamesh was used between April 2007 and January 2011. The notes of patients were reviewed highlighting any recurrence of symptoms, complications or re-operations.

Results: 154 cases were performed during the study period, with 30 using open approach and 124 performed laparoscopically, at our institution, between 9 surgeons. Of these, 7 required laparoscopic division of adhesions. Four of them completed successfully and in 3 cases the mesh had to be removed.

Conclusions: Contrary to the conclusions of the previous study, we find Dynamesh to be effective and safe. Some of the complications relating to our series would be likely to occur with any form of repair. It is true that adhesions do sometimes form to the mesh but these only required re-intervention in 2.5% of cases.

Keywords: Dynamesh; Intraperitoneal onlay mesh; Ventral incisional hernia

Introduction

The use of synthetic meshes has reduced the recurrence rate in incisional hernia repair by up to 60% [1-4]. The type of mesh and the plane in which it is inserted it have been a matter of debate among surgeons over the last 3 decades and results remain variable. Until recently the mesh was inserted outside the peritoneal cavity to avoid adhesions to, and erosions into, the intestines. Advocates of the sublay mesh made compelling arguments of the biomechanical advantage of mesh repairs in deeper layers [5,6]. A natural progression of this was to insert the mesh in the peritoneal cavity, as close to the defective posterior sheath as possible. Fear of mesh related intestinal complications lead to the development of intraperitoneal on lay meshes (IPOM), with anti-adhesive properties [7,8].

This method of repair gathered popularity among surgeons rapidly as a method of repairing ventral and/or incisional hernias [8]. This has been driven by the promise of supplying strength to abdominal wall, spreading tension with minimal side effects from adhesions to bowels. On the other hand the increased utilisation of minimal access surgery to repair ventral hernias led to more demand for such meshes this repair is technically simpler than dissecting anterior to the sac [8-10].

The first few meshes produced were based on a synthetic material that supplies the backbone (strength and durability) which is then covered or coated by an inert material to prevent or reduce adhesions to bowels. This coating material would be usually absorbed or lysed by the body, over time whilst permitting the mesothelial encapsulation of the mesh. There are several examples of this design and Table 1 shows the different materials used to cover the mesh.

Mesh name	Backbone	Coating
Proceed	Polypropylene	Oxidised regenerated cellulose
Sepramesh	Polypropylene	Polyglycolic acid
Parietex	Polyester	Resorbable collagen film
C-QUR	Polypropylene	Omega-3 fatty acids
Composix	Polypropylene	ePTFE

Table 1: Commonly used meshes for IPOM repair, their main material coating material.

The success of these meshes depends on several factors including: tensile strength; minimal scar plate formation; their inert nature; reproducible, robust results and minimal complications such as infection and adhesion related problems. Adhesion prevention requires an efficient and reliable non-stick barrier. This barrier could be jeopardised if the material is absorbed quickly exposing the non-absorbable material or by mechanical damage to the barrier during handling. Adhesions may also occur to fixation devices or possibly in areas of visceral trauma [11].

A different type of mesh was then introduced where the mesh is made from a material that prevents adhesions. DynaMesh (PVF-PP) is an example of this design, it was introduced in 2004. It has 2 surfaces that are different in structure. The parietal surface is made of polypropylene while the visceral side is made of polyvinylidene fluoride. These 2 different surfaces are supposed to promote integration into the abdominal wall through growth of peritoneum into the pores while the visceral side prevents adhesions to the bowels. Its use had been backed by safe data together with a large series of 344 patients [12] with no long term complications and even the cases of early infection were treated conservatively without removing the mesh. However; a recent study has questioned the safety of this mesh [1]. Fortelny et al. reported a series of 29 cases with an alarmingly high incidence of re-operation after PVF-PP insertion (20%). All the re-operations were due to symptomatic adhesions and in 1 case as soon as 1 week after surgery.

In this paper we review our experience in using the PVF-PP mesh to repair ventral hernias. In our hospital these meshes have been in use since 2007 to repair incisional hernias as well as other ventral hernias when indicated (Paraumbilical, Spigelian and epigastric).

Methods

The cases of hernia repair using mesh between April 2007 and January 2011 were reviewed. This was done by reviewing theatre record books and surgeons own prospectively coated databases and details of operations were retrieved. Operative details including the dimensions of hernial defects and meshes used were recorded.

Post-operative complications were recorded with special focus on symptoms of a clinical diagnosis of bowel adhesions. Patients who showed symptoms possibly related to adhesions were identified through follow up clinic letters. Any re-presentations and re-operations were reviewed.

Operative technique

The laparoscopic approach was performed using 2-7 ports for access. Reduction of the hernia contents was performed; the defect size measured internally and externally and the mesh size tailored accordingly ensuring an overlap of 5 cm at least in each direction. Measures were taken to fashion the mesh so that it covered the defect and the whole original scar whenever possible. In cases where there was more than 1 defect, the measurements were taken to include the maximum diameter across the defects. The mesh was then inserted and orientated to cover the defect (s). The main method used to fix the meshes was to put orientating midline transfascial sutures followed by double crown non-absorbable titanium (ProTack™) fixation. In cases where the defect was large , transfascial sutures were also placed laterally followed by the ProTack™.

Results

There were 154 cases of hernia performed where the PVF-PP was used (148 de novo and 6 recurrent hernias). The age range of the patients was 16-87 year old (Median 58 years). Male to female ratio was 85/69. One hundred and twenty four cases were performed laparoscopically (80.5%) while 30 (19.5%) patients had open hernia repair, with the mesh placed intraperitoneally. The types of hernia repaired included 90 (58.4%) incisional, 40 Paraumbilical (25.9%), 10 epigastric (6.4%), 8 parastomal (5.2%), and 6 (3.8%) Spigelian hernias. The sizes of the defect ranged from 1 × 1 cm to 9 × 11 cm. However; there were 4 cases with multiple defects and the maximum measurements were between 14 × 20 cm and 27 × 37 cm where 2 meshes had to be used. All these large defects were repaired laparoscopically. The largest defect (27 × 37 cm) was in a patient who had Crohn's disease with multiple operations and a collection of 10 hernias and the measurements were from the extremes of those hernias collectively. Two thirds of the cases 109 (67.7%) were performed by 2 surgeons and the other 52 cases (32.3%) were spread across 7 different surgeons.

Mesh infection happened in one case after surgery and was treated conservatively. Twenty one patients (13.6%) had abdominal pain after surgery with earliest symptoms starting within 1 month after surgery. Sixteen patients experienced colicky abdominal pain, 2 had small bowel obstruction while 3 patients experienced a chronic type of abdominal pain without evidence of obstruction. Two thirds of the cases [13,14] were managed conservatively and 7 cases (4.5%) had further surgery. All cases [7] were explored laparoscopically to try and diagnose the cause of pain. The earliest re-operation for adhesions was 4 months after the initial hernia surgery. The procedures done included 4 cases where the adhesions were broken down laparoscopically and the symptoms improved post operatively requiring no further intervention. In other 3 cases mesh explantation was required after diagnostic laparoscopy for two different reasons. In one of the cases an attempted laparoscopic division of adhesions caused small bowel injury that had to be repaired through open approach and the mesh was removed. In the other 2 cases of mesh explantation a laparoscopy was attempted to diagnose symptoms of adhesions but the findings were that a small bowel loop was lying between the mesh and abdominal wall. It was decided in both cases that laparoscopic freeing of the loop was inappropriate and the procedures were converted to open approach that included removal of the mesh. The latter problem was addressed in the following cases and avoided by fixing the mesh circumferentially to the abdominal wall leaving no potential space for bowel loops to enter. The follow up of patients involves reviewing the patient for 2-3 times after the surgery over a period of 12 months. However; in cases where the hernia defect was large the follow up has been extended to 2 years. After discharge the patients were asked to return to the same clinic should new symptoms arise.

Discussion

Surgeons have been wary of using mesh within the peritoneal cavity for fear of foreign body adhesions, erosions and bowel injury. The mesh used in our series (Dyna Mesh) was developed specifically to minimise the risk of adhesion formation. Despite promising results reported by Berger et al in 2009 after using this mesh in 344 cases [12], there was recent criticism from a small series (29 patients) that reported 17.24% re-operation rate due to adhesions (5 cases) and explantation of 3 meshes [1]. The importance of the latest paper is that it describes adhesion forming through the pores of the mesh rather than to the mesh itself. However, in our series of consecutive cases we had no intra-operative complications and the rate of developing symptomatic adhesions was far below that reported previously.

One of the factors that have been identified as a cause for adhesions formation immediately after mesh insertion is cutting the mesh to fit the size of the defect. Theoretically this exposes part of the mesh that in not covered by the coating material or forms sharp edges and results in quick adhesions. However; PVF-PP could be cut to the size of defect

as there is no polypropylene to be exposed by the cut. Furthermore, in our experience the meshes had been cut according to the size of hernia defect but there was no increase in complications from the edges.

The cases that had to be re-operated upon in our series had adhesions across the mesh area but mostly to the periphery of the mesh and the fixation tacks. The laparoscopic adhesiolysis was not complicated and all patients had 1-2 days of ileus after which they made a good recovery and had improvement in symptoms. In one case re-operation was performed 5 months after the initial surgery and dense adhesions were centred around the fixation tacks, a problem that is well recognised.

Despite some concern regarding adhesion formation after repair of ventral hernias using the , our experience has been very favourable with few significant complications. Nevertheless we are still monitoring the long term results to consolidate the short and medium term findings.

It should be noted that any IPOM mesh repair will attract some adhesion formation and therefore some adhesion related problems are to be expected. It is always difficult to compare different types of meshes in a randomised trial but a recent study done on rats comparing Timesh and Ultrapro; Proceed; Parietex Composite and C-Qur meshes showed adhesions to the bowels with variable degrees. It also showed that the difference in anti-adhesion property of the coating disappears within 30 days which means their long term results are similar [13]. Another study done on rats also compared the Sepramesh and parietex showed better results compared to Polypropylene alone as IPOM but a degree of adhesions was also present [14].

Adhesions, by their nature, will form in some patients after minimal trauma and not in others after marked dissection or inflammation and it is likely that any operation such as ventral incisional hernia repair will be occasionally attended by adhesion-related complications. Accordingly adhesions will occasionally form regardless of the type of mesh or its coating material used [15]. The question of whether to use this type of meshes or not will always depend on the balance between accepting the complications risk (including adhesions) and controlling the hernia symptoms and whether the benefit of these meshes justify taking the risk of adhesions. There are ongoing mesh technology developments and developments in fixation that may minimise these risks. Until then, we believe our experience offers an acceptable risk profile for these, sometimes complex, patients. We accept that further improvements are desirable but in our experience, IPOM mesh repair of ventral incisional hernias with PVF-PP has given very good results, with rare significant complications.

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