

Clinical Science

# Prospective repair of Ventral Hernia Working Group type 3 and 4 abdominal wall defects with condensed polytetrafluoroethylene (MotifMESH) mesh



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Surgical site  
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Mesh

## Abstract

**BACKGROUND:** Treatment of clean–contaminated and contaminated ventral hernia defects remains controversial. Newer prosthetic materials may play an important role in these patients.

**METHODS:** Ten patients with Ventral Hernia Working Group types 3 and 4 were prospectively enrolled and subsequently treated with direct supported repairs with condensed fenestrated polytetrafluoroethylene mesh. The primary outcome was hernia occurrence at 1 year after surgery. Secondary outcomes included surgical site infection, surgical site occurrence, medical complications, pain, and other patient-reported outcomes.

**RESULTS:** There were no immediate postoperative infections and one minor postoperative hematoma treated in the office. One patient required delayed mesh removal 9 months after placement. Importantly, the mesh removal procedure was straightforward because of the material properties of the mesh. Of the 9 patients still with mesh, there were no hernia recurrences at the repair site with one full year of follow-up.

**CONCLUSION:** Contaminated and clean–contaminated abdominal wall defects can be effectively and durably treated with condensed polytetrafluoroethylene mesh.

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Optimal management of the patient with a contaminated or clean-contaminated abdominal wall defect remains hotly debated. Contamination can be at the level of the abdominal wall with wounds or areas of drainage, or may be because of bowel manipulation with a suture line. The ability to close surface wounds preoperatively is an excellent strategy for many, but it is not always feasible and often requires a second operative procedure.<sup>1,2</sup> Patients with hernias who require a gastrointestinal procedure need strategies to contain the viscera to prevent evisceration after the hernia sac is opened and the bowel work completed. The ideal operation for a contaminated or potentially contaminated ventral hernia would be reproducible, single stage, and durable. Simple suture approximation of the abdominal wall ventral hernia defect is associated with high failure rates.<sup>3</sup> Bioprosthetic mesh reinforcement of the hernia suture line, originally thought to have great promise, has shown limitations with long-term follow-up in the single-stage closure of contaminated defects.<sup>4,5</sup> Cautions to the use of prosthetic mesh were raised by the Ventral Hernia Working Group (VHWG) in Grades 3 (potentially contaminated) and 4 (contaminated) repairs because of the presumed difficulty in reoperation if the mesh became contaminated.<sup>6</sup>

Condensed fenestrated polytetrafluoroethylene (cPTFE; MotifMESH; Proxy Biomedical, Galway, Ireland) has several physical characteristics and properties that potentially render it a useful tool in these challenging clinical scenarios. Considering the suboptimal alternative current treatment strategies, a prospective study was designed to determine the clinical outcomes of 10 patients treated for contaminated or clean-contaminated ventral hernias. To our knowledge, this is the first clinical study performed using this 510K US Food and Drug Administration-approved cPTFE mesh submitted for publication.

## Patients and Methods

A single surgeon prospective case series for treatment of 10 patients with VHWG Grade 3 and 4 hernias received IRB approval and commenced in 2011. The study complies with the Declaration of Helsinki ethical principles for medical research involving human subjects. Enrollment criteria included a ventral hernia with an overlying wound that could not be easily closed with a preoperative surgical procedure, or a ventral hernia with a planned entry into the gastrointestinal tract. Exclusion criteria included age under 18 or over 80 years, inability to provide written consent in English, pregnancy, American Society of Anesthesiologists Physical Status Class IV, inguinal hernias, body mass index (BMI) greater than 40, and patients with grossly infected wounds with necrosis. Patients were enrolled from a busy plastic surgery clinic without outside recruitment. The primary investigator obtained informed consent for each patient. Preoperative data collected included demographics, prior surgical history, and prior medical history. A

preoperative abdominal and pelvic noncontrast CT scan was obtained for characterization of the hernia. Intraoperative data collected included surgical technique for closure, assessment of local tissue quality, need for components releases, and ability to achieve fascial closure. Postoperative data were collected at standard points for 1 year. Five postoperative visits were scheduled for each patient, including the first and second postoperative weeks, as well as 1, 3, and 12 months after surgery. Primary outcome variables included the presence of surgical site infection (SSI) as defined by the National Surgical Quality Improvement Project within 30 days, surgical site occurrence (SSO) including seroma, wound dehiscence, enterocutaneous fistula as defined by the VHWG, and the development of a hernia. A postoperative computed tomography (CT) was obtained in all patients at the time of their final follow-up. Medical complications in the postoperative period were recorded. In addition, assessments of pain, fatigue, movement, and overall well-being were assessed on a 10-point scale preoperatively and at all postoperative time points.

## Surgical procedure

While the patients entered this study with differing diagnoses, the surgical principles used for treatment were the same. No specific regimen for preoperative preparation was undertaken except for mechanical bowel prep the day before surgery consisting of magnesium citrate and 10 mg bisacodyl with clear liquids only. The patients were all widely surgically prepped with chlorhexidine gluconate without special drapes or skin covers. In the presence of an open wound, povidone-iodine was used for a preparatory skin antiseptic. For patients undergoing bowel surgery, the procedures commenced with general surgery, and turned over to plastic surgery for their closure. For the remaining patients, the procedures commenced with an en bloc excision of inflamed and contaminated tissue to reduce bioburden.<sup>7</sup> Skin flap elevation was minimized to preserve skin perforators, as this has been shown to decrease local wound complications.<sup>8</sup> The skin was elevated off of the fascia approximately 4 cm to allow placement of anchoring sutures. When present, bowel suture lines were covered with vascularized tissue, such as the omentum, and located away from the mesh. The total amount of mesh used for the case was minimized to limit the total amount of foreign material present, decrease soft tissue elevation necessary for placement, and avoid mesh wrinkling.<sup>9</sup> A 7.5 cm width piece of cPTFE mesh was utilized for a direct supported repair with either intra-abdominal or retrorectus mesh placement.<sup>10</sup> Interrupted transabdominal wall "U" shaped 0-polypropylene sutures spaced approximately 2 cm from each other and 4 cm from the fascial midline were used to anchor the mesh in place. This creates 4 cm of underlay of the mesh and allows for approximation of the fascial midline using interrupted figure of eight 0-polypropylene sutures.

Eight patients underwent intra-abdominal mesh placement (with mobilization of preperitoneal fat or omentum to provide a layer of vascularized tissue between the mesh and bowel) and 2 patients with midline defects had retrorectus mesh placement. In all but one case, a direct supported repair with primary fascial closure was achieved. One patient had a bridged repair of a 22 cm defect ultimately requiring bilateral components releases and 8 cm of spanning mesh between the rectus muscles.

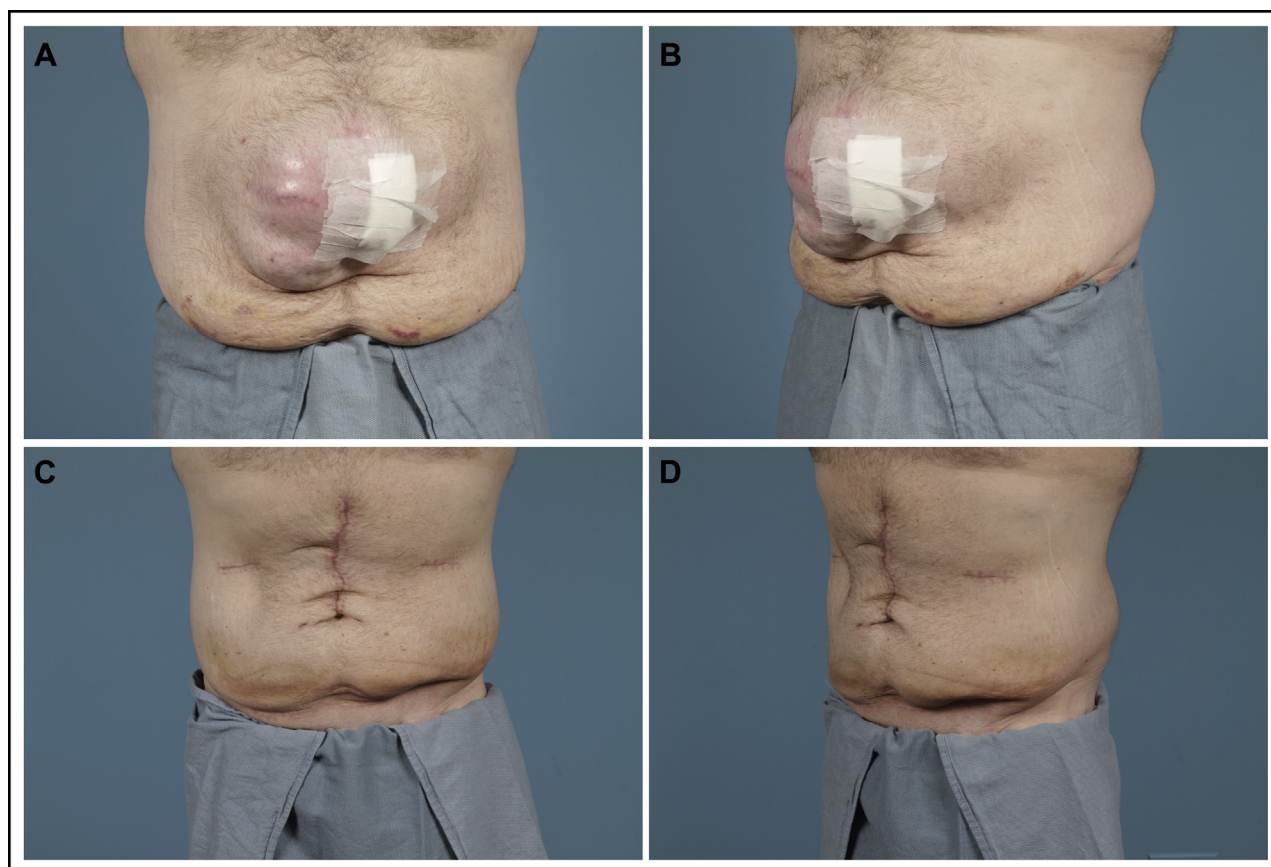
Four patients underwent components separation, with separate lateral subcostal incisions performed to maintain skin vascularity (Fig. 1A–D). Eight of the 10 cases were directly in the midline, one chevron incision hernia involved both vertical and transverse components, and the last involved reconstruction of a transverse rectus abdominis myocutaneous flap defect with absent right rectus muscle.

The soft tissues were kept moist during the procedure with antibiotic irrigation (80 mg gentamicin per liter). Excess skin at the incision site was removed sharply to decrease surgical dead space, to remove potentially ischemic skin flaps, and as a final means to cleanse the incision of possible implanted bacteria at the time of closure. Skin was quilted down to the abdominal wall where technically possible to decrease surgical dead space.

The skin was closed with absorbable monofilament deep dermal sutures and staples or running intracuticular permanent monofilament sutures depending on patient preference. Seven millimeter Jackson–Pratt clot stop drains were placed in the subcutaneous plane for all patients. Two drains were used for single incision repairs and 3 drains were utilized if lateral components release incisions were required. Most of the drains were removed before the patient left the hospital.

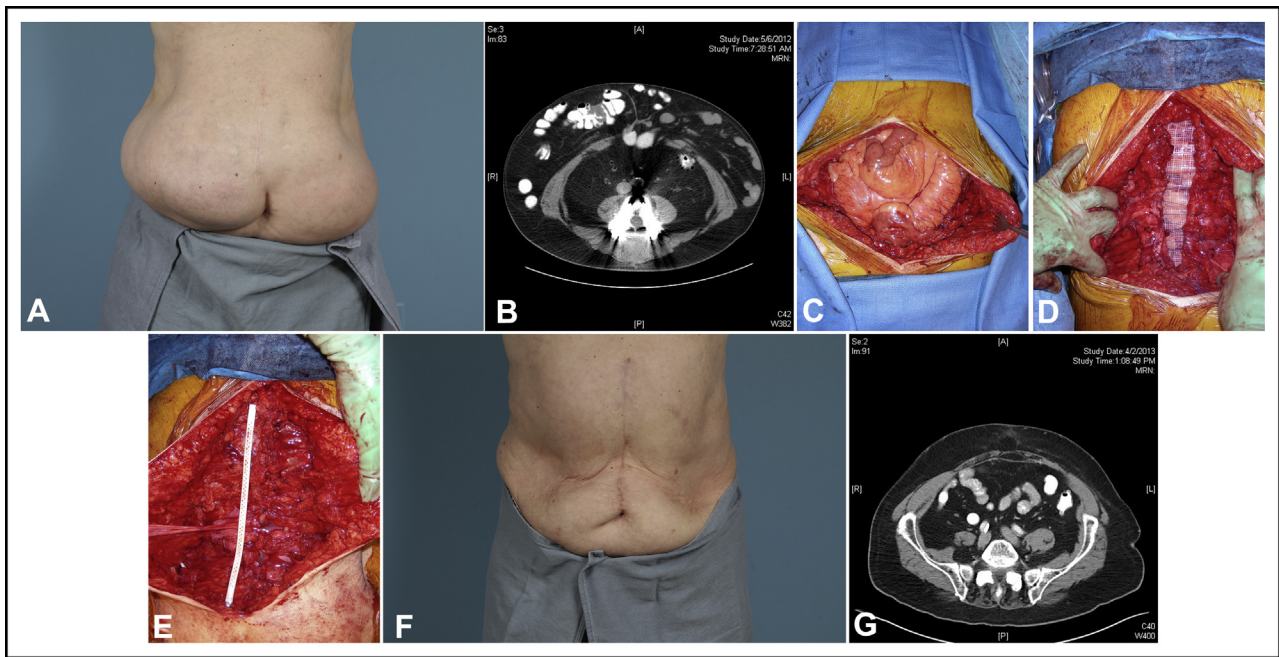
No nasogastric tubes were used postoperatively, and parenteral narcotics were used for analgesia. Intravenous antibiotics were used for a mean of 2.6 days and a median of 2 days for the group. Patients did receive postoperative anticoagulation with enoxaparin. Average hospital stay was 8 days.

**Case 1.** A 76-year-old male has a 7-cm wide midline ventral hernia, loss of domain, and 4 prior attempts at repair. He is found on physical examination to have a right colon cancer palpable within the hernia sac. A right hemicolectomy is performed through a midline incision. The hernia is closed with components separation releases, perforator preservation, and a direct supported repair with cPTFE mesh. He had an uneventful postoperative recovery



**Figure 1** (A–D) A 37-year-old male with a 12-cm incisional hernia following a gastric pull-up procedure and open abdominal wounds. He was treated with bilateral components releases, intra-abdominal cPTFE hernia repair, and excision of the thinned skin and abdominal wounds.





**Figure 2** (A) Preoperative photo of a 76 year old with a massive hernia, loss of domain, and right colon cancer. (B) Preoperative CT scan of hernia with loss of domain. (C) Intraoperative photo after right colectomy (D) Intra-abdominal cPTFE (MotifMESH) partially inset with transrectus abdominal sutures placed. (E) Direct supported repair. Note the minimized skin elevation with preservation of soft tissue and skin perforators to maintain skin vascularity. (F) Postoperative photo 1 year after the procedure. (G) Postoperative CT scan 1 year after the procedure. The cPTFE mesh can be seen as a faint white line behind the rectus muscles.

with no evidence of hernia recurrence on his CT scan at 1 year or at follow-up 20 months after surgery (Fig. 2A–G).

**Case 2.** A 39-year-old female with Crohn's disease had a bowel resection and diverting ileostomy, complicated by the development of a 6-cm midline ventral hernia. Her ileostomy takedown was performed through a midline incision, and a direct supported retrorectus repair using cPTFE was performed. She had an uneventful postoperative recovery with no evidence of recurrent hernia formation at 1 year on CT scan and physical examination (Fig. 3A,B).

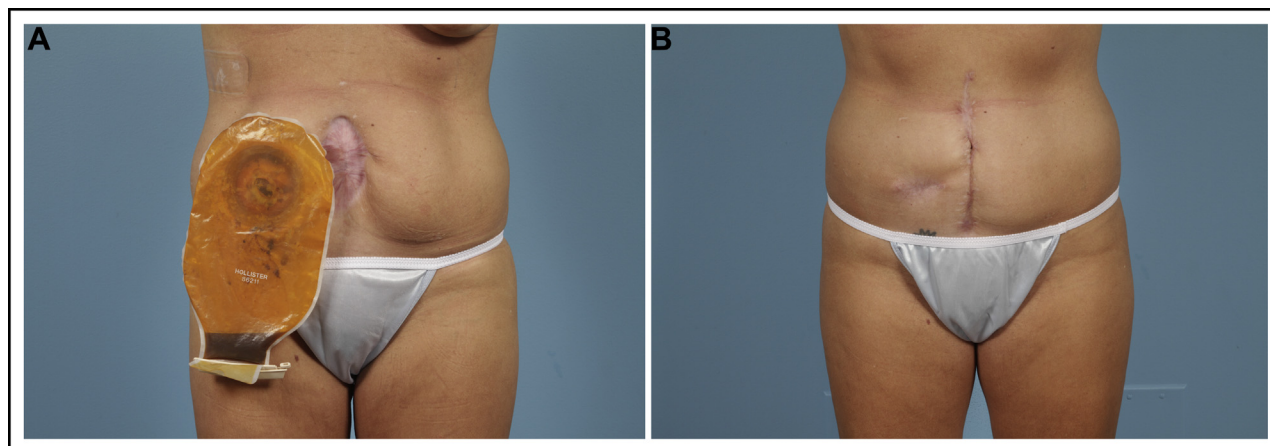
**Case 3.** A 56-year-old female with a history of breast cancer and prior transverse rectus abdominis myocutaneous flap breast reconstruction developed an infection of the polypropylene mesh onlay used to close defect caused by harvest of the entire right rectus muscle. The patient was taken to the operating room in 2008 for removal of the polypropylene mesh, and a suture closure of the abdominal wall defect was performed. Cultures demonstrated *Staphylococcus aureus* resistant to oxacillin but sensitive to Bac-trim and clindamycin. The patient then developed an 8.5 cm hernia at this location along with renewed drainage. She was taken to the operating room for removal of any additional polypropylene mesh and repair of the fascial defect with intra-abdominal cPTFE mesh. She had an uneventful course until 9 months later when she developed a small sinus tract and an apparent seroma around the unincorporated mesh seen on CT scan (Fig. 4A). She was taken to the operating room for removal of the cPTFE

mesh. The wrinkled unincorporated cPTFE was removed easily, and a “fibrous rind” was present at the base of the wound to contain the bowel (Fig. 4B,C). A piece of unincorporated polypropylene mesh thought to be from the original procedure was discovered and removed. Scar was reapproximated superficial to the fibrous rind with sutures to reinforce the abdominal wall and has remained intact with 2 years of follow-up. Wound cultures demonstrated the same bacterial profile as the original cultures taken.

## Results

A total of 10 patients participated in this study (Table 1). Ages ranged from 37 to 76 years. Four patients were female and 6 patients were male. The majority of the patients had premorbid conditions including prior visceral transplantation (2), prior malignancy, Crohn's disease, smoking (4), and diabetes. Average BMI was 28 with 4 patients having a BMI greater than 30. The reasons for the noted contamination included bowel repair (5), exposed mesh (3), or skin wounds and local contamination (2). Five patients had a repair of a recurrent ventral hernia. For the 8 patients with linea alba hernias, the average transverse separation of the medial aspect of the rectus muscles was 10.7 cm. Nine of the 10 patients were followed for the full year after the procedure. One patient was in jail at the time of his final scheduled clinic visit.

Mean total surgery time for these cases was 199 minutes: 227 minutes for the cases with general surgery and 2 attendings,



**Figure 3** (A) A 39-year-old female with Crohn's disease, diverting ileostomy, and midline ventral hernia. (B) One-year postoperative photo after cPTFE direct supported repair.

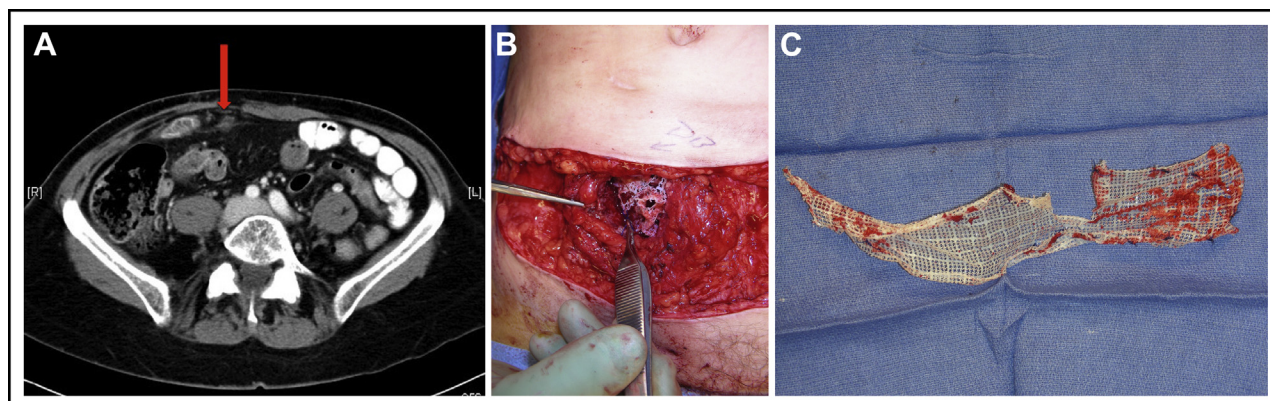
and 175 minutes for the single surgeon when no bowel work was required. Mean length of stay was  $8 \pm 3.8$  days.

There were no SSIs within the 30-day period after surgery. There was 1 SSO (10%) of a small hematoma located in the lateral incision for performance of a components release. This hematoma was drained in the office. Patients had several early postoperative medical complications including an superior mesenteric vein thrombosis and pulmonary embolism, chronic renal failure from antibiotics given at an outside hospital (resolved), and a 2-week postoperative oxygen requirement for Case presentation number 1 of a massive hernia present for over 20 years with loss of domain. Complications for these patients over the year of follow-up included a late mesh removal as will be described, a transient bowel obstruction at 4 months that cleared overnight with bowel rest, and an inguinal hernia not contiguous with the cPTFE hernia repair.

The 9 patients still with mesh were followed from 12 to 28 months (mean 18 months). All 8 patients who received 1 year follow-up CT scans demonstrated well-placed flat mesh, without any fluid collections or hernias. The incarcerated patient was examined by his local physician and did not have any drainage or hernia at 1 year. The final patient

had recurrent drainage from her midline suture line at 7 months. This drainage was initially treated with oral antibiotics. However, the failure of this drainage to resolve led to an early CT scan that demonstrated wrinkling of the mesh and perimesh fluid (Fig. 4A). At the time of her cPTFE mesh placement, the senior surgeon was unable to perform an en bloc resection of her contaminated polypropylene mesh, and instead had piecemeal removal. The salvage surgery to remove the infected cPTFE mesh was notable for its ease. As hypothesized by its PTFE material composition, a fibrous rind encapsulated the infected mesh. The mesh was straightforward to remove by simply following the draining skin sinus down to the mesh and widely opening the tissues superficial to it. Prolene sutures still holding the mesh were cut, and the mesh came out with blunt dissection (Fig. 4B,C). Individual bowel loops were not noted, as they were held in place by the fibrous rind. The cavity wall surface was gently debrided, a drain was placed, and the fascia and skin was closed. While a hernia in this patient is expected to develop, at the patient's last office follow-up the rind had not yet softened to demonstrate a recurrent hernia.

Patient-reported outcomes of fatigue, movement, and overall sense of well-being improved in these patients in



**Figure 4** (A) CT scan 7 months after placement of cPTFE demonstrating wrinkling and perimesh fluid. (B) Intraoperative photograph of removal of infected cPTFE in a prior transverse rectus abdominis myocutaneous flap donor site. The mesh is wrinkled. A fibrous rind exists on the deep aspect of the cavity to contain the viscera. (C) The explanted MotifMESH. Note the lack of tissue ingrowth.

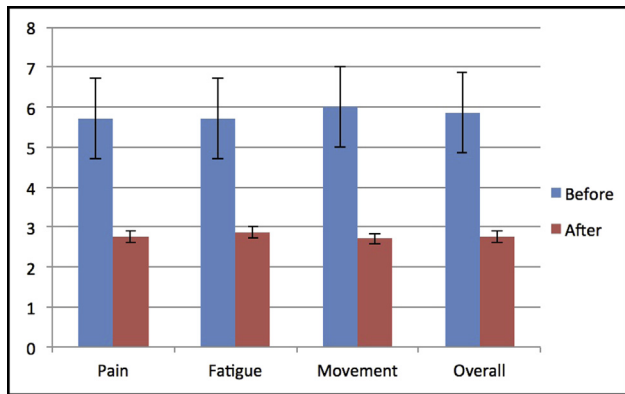
**Table 1** Patient and procedure characteristics

Patient	Age (years)	Male sex	Hernia width (cm)	Preoperative notes	Prior infection	Procedure	Length of stay (days)	SSIs at 30 days	Postoperative complication(s) including SSOs up to 1 year
1	56	No	8.5	Transverse rectus abdominis myocutaneous flap breast reconstruction with polypropylene mesh to repair the abdominal defect became infected years after the procedure. A large piece of mesh was removed but retained mesh segments led to persistent drainage and infection	Yes	Through the transverse incision of the TRAM flap, the infected polypropylene mesh was removed with incisional hernia repair with intra-abdominal MotifMESH	5	0	9 months after the procedure, a small sinus tract developed. The MotifMESH was removed and at that time, a small portion of retained polypropylene mesh was discovered. The fascial defect was closed primarily
2	76	Yes	15	20- to 30-year history of massive midline hernia despite prior prosthetic repair attempts. New diagnosis of colon cancer	No	Right hemicolectomy, bilateral components releases, incisional hernia repair with intra-abdominal MotifMESH	7	0	Right upper lobe PE on POD 5, treated with supplemental oxygen
3	59	Yes	22	Prior open abdomen treated with split thickness skin grafting. Developed an enterocutaneous fistula. ECF taken down and hernia repaired with internal and external components releases and biologic mesh bridging repair	Yes	Bilateral components releases, repair of enterotomy, spanning MotifMESH hernia repair	6	0	None
4	54	Yes	6.5	Chevron incision for orthotopic liver transplant developed a hernia which was repaired by the transplant team with polyester coated mesh. This mesh became infected, started draining, and the patient developed a large hernia	Yes	Removal of infected mesh, repair of the Chevron incisional hernia with intra-abdominal MotifMESH	5	0	None
5	51	Yes	7.5	Kidney transplant patient, prior ventral incisional hernia repair with mesh complicated by infection of the mesh and recurrent hernias	Yes	Removal of infected mesh, retrorectus MotifMESH hernia repair	6	0	None
6	29	Yes	5.7	Diverticulitis s/p laparoscopic sigmoidectomy complicated by open abdominal wound, bowel stricture, umbilical hernia	Yes	Exploratory laparotomy, small bowel resection with anastomosis, excision of cutaneous wound, ventral hernia repair with intra-abdominal MotifMESH	7	0	None

7	63	No	8	Metastatic leiomyosarcoma resection complicated by small bowel obstruction requiring exploratory laparotomy and small bowel resection. This was complicated by a wound infection	No	Exploratory laparotomy, small bowel resection with anastomosis, cholecystectomy, intra-abdominal MotifMESH hernia repair	16	0	SMV thrombosis on POD 10 requiring IV heparin treatment
8	39	No	6.2	Crohn's disease with ileostomy and incisional hernia	No	Ileostomy take down, retrorectus MotifMESH ventral hernia repair	10	0	None
9	51	No	7.3	Prior distal pancreatectomy for neuroendocrine tumor with postoperative diabetes and a recurrent incisional hernia complicated by an infected seroma surrounding the mesh	Yes	Abdominoplasty (transverse skin incision for access), removal of previously placed mesh, bilateral components releases, intra-abdominal MotifMESH hernia repair	6	0	None
10	37	Yes	12	Prior Ivor-Lewis esophagectomy complicated by an incisional hernia and open skin wounds of the abdomen	Yes	Excision of abdominal skin wounds, bilateral components releases, intra-abdominal MotifMESH hernia repair	6	0	
Mean	51.5		9.9				7.4		
Median	52.5		7.8				6		
Total		6/10			7/10			0 SSIs	2 SSOs

ECM = enterocutaneous fistula; IV = intravenous; PE = pulmonary embolism; POD = post operative day; SMV = superior mesenteric vein; SSI = surgical site infection; SSO = surgical site occurrence; TRAM = transverse rectus abdominis myocutaneous.



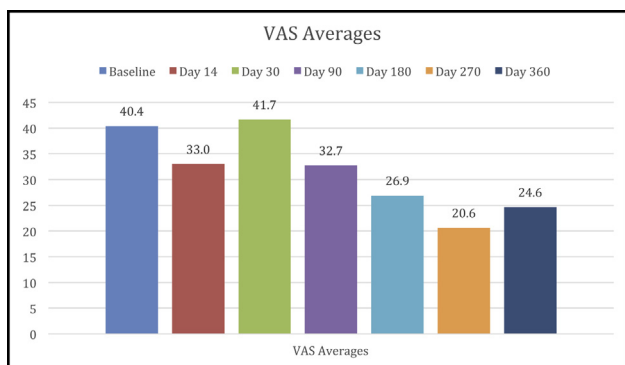


**Figure 5** Patient-reported outcomes for fatigue, movement, and overall sense of well-being before and 1 year after surgery on a 10-point scale.

comparison with their own preoperative assessment on a 10-point grading scale (Fig. 5). A 10-point visual analog scale for pain demonstrated a steady decline in patient-reported pain over the year after surgery (Fig. 6).

## Comments

All strategies for treatment of the patient with a VHWG Class 3 or 4 ventral hernia have significant potential drawbacks and complication rates. Closure of the wound preoperatively is a straightforward approach, but it often requires a second procedure, delays final resolution of the clinical problem, and is not always possible when there is exposed mesh. Patients in need of bowel surgery and with a pre-existing hernia can undergo an abdominal wall suture closure either with or without components release, but the long-term hernia rate will be at least 1 in 4 and possibly much higher.<sup>11</sup> Direct repairs supported with bioprosthetic mesh held great promise for a solution to this problem, as the bioprosthetics were touted to be resistant to contamination through the process of incorporation.<sup>6</sup> The VHWG specifically recommended the use of bioprosthetics in these cases, as the risk of SSO with permanent meshes was thought to be prohibitive. However, bioprosthetic utility



**Figure 6** Patient-reported outcome for pain using a 10-point visual analog scale vs time from the procedure.

has not achieved its initial promise. The Repair of Infected or Contaminated Incisional Hernias study of single-stage treatment of clean-contaminated and contaminated cases with a non-cross-linked porcine dermis had a 66% SSO rate, a 30% SSI rate, and a 28% hernia rate at 2-year follow-up.<sup>12</sup> This small series compares favorably to a recently published multicenter series by Carbonell et al<sup>4</sup> on the use of lightweight polypropylene in similar cases. Operative times were shorter (199 vs 247 minutes), length of stay similar ( $8.0 \pm 3.8$  vs  $8.7 \pm 8.1$  days), and cPTFE had a lower 30-day SSI (0% vs 11%). The surgical techniques of the 2 series were quite different, with this study performing anterior components releases when necessary and often placing the mesh intra-abdominally, while the comparison study predominantly performed posterior releases to achieve soft tissue coverage of a retrorectus placed mesh. Most importantly, both trials demonstrated the ability to place mesh in these clinical situations with low rates of removal. In this cPTFE trial, one mesh was removed (10%), while in the Carbonell series there was a mesh removal rate of 4%, and a hernia rate of 7%.<sup>3</sup> The difficulty in removing the mesh in the Carbonell paper was not addressed.

Condensed PTFE placed into potentially contaminated or contaminated fields in this small series of patients demonstrated low complication rates. SSI within 30 days was 0%, while SSO for the 1-year study period was 20% with 1 office treated hematoma and 1 delayed mesh infection requiring removal. While an aspect of this generally favorable study may be patient selection, both the mesh and the manner of its implantation may also be important. MotifMESH has a particular design with pores 2,400 microns in size. Pores greater than 1,000 microns are thought to avoid bridging scar<sup>13</sup> and to promote incorporation rather than encapsulation.<sup>14</sup> Tissue incorporation associated with macroporosity is important in the prevention of infection and the clearance of bacteria.<sup>15</sup> Condensed PTFE is a hydrophobic material, with this material property thought to be important in the avoidance of a bacterial biofilm.<sup>16</sup> In comparison with expanded PTFE (ePTFE), cPTFE demonstrates significantly less bacterial adherence.<sup>15,16</sup> Unlike the more common ePTFE, cPTFE has a smooth surface and does not have any microporous "pits." These pits increase the surface area of ePTFE, and perhaps potentiate the ability of bacteria to adhere and "hide" from adjacent macrophages.<sup>17</sup> Its overall performance was judged favorably in an independent evaluation of infection, shrinkage, and bowel adherence in comparison with other synthetic and bioprosthetic meshes when placed into a contaminated rat abdominal wall.<sup>14</sup> Condensed PTFE is thin (.15 mm), soft, and compact without the weaving of fibers of standard meshes. This decreases its surface area in comparison with woven multifilament meshes and with ePTFE.<sup>18</sup> The total amount of foreign material surface area may have a direct correlation to late infection. One property shared by cPTFE and ePTFE is the minimization of significant bowel adhesions as demonstrated in rat and porcine models.<sup>19–21</sup> This is



important for instances when the cPTFE mesh is placed intra-abdominally and possibly adjacent to the abdominal viscera. The positive results of this study are all the more important, considering the issue that the responses to foreign materials in humans may be quite different to the tissue reactions to biomaterials in other species.<sup>22</sup>

Technical aspects of performance of the procedure may also have contributed to the overall success of abdominal wall reconstruction in these clean-contaminated and contaminated cases. Maintenance of skin vascularity is emphasized, as this has been shown to decrease wound complications. No specific patient preparation is required, such as glycemic control or antibiotic baths, as the focus is instead on removing unhealthy tissue such as scar or excess abdominal skin that would lead to potential complications. The total amount of cPTFE mesh is limited intentionally (only a 7.5 cm wide mesh), as it is logical that a greater surface area of foreign material will require a greater healing effort of the body to incorporate, require larger tissue flaps for placement, and provide more places for bacterial adherence. The outer edges of a narrow mesh wrinkle less than the outer edges of a wide mesh placed snugly against the curved contours of the abdominal wall. Mesh wrinkles may predispose the patient to late bowel erosions and skin extrusions. Only enough mesh is placed to effectively distribute forces across the repair site and to decrease suture pull-through.<sup>23</sup> Finally, it is a well-described phenomenon that rigidly fixed implants in well-vascularized tissue beds do not become infected.<sup>24</sup> The “quilting” of the narrow mesh to the undersurface of the abdominal wall with up to 40 transabdominal wall sutures surgically fixes the mesh in a manner distinct from other techniques of mesh fixation.

Analysis of the 1 surgical failure is as important as the appreciation of the 9 successfully treated patients. The 1 patient who required her mesh removed demonstrated important properties of MotifMESH that facilitated the diagnosis and treatment of the infection. This one patient was the only one to have delayed drainage, and the only patient to have wrinkled mesh on follow-up CT scan (Fig. 4A). The ability to “see” the mesh on CT scan because of its composition facilitated the diagnosis that the mesh was not incorporated unlike the other patients with flat meshes seen on CT. The unusual postoperative appearance of the mesh on imaging along with the drainage led to the surgical exploration, revealing the wrinkled mesh encapsulated by an outer scar or rind (Fig. 4A–C). Contractile properties of the scar tissue caused the mesh to buckle or wrinkle. The importance of the retained polypropylene mesh as the likely source for infection cannot be minimized. The infection likely contributed to the poor integration of the mesh. The mesh removal procedure lasted 80 minutes and did not require any bowel dissection. When ePTFE becomes infected, the tissue response is to create a fibrous rind.<sup>19</sup> The fibrous rind developed with this case of cPTFE as well. The fibrous rind has enough strength to contain the bowel and it obviates the need to reconstruct the abdominal wall in the inflamed

field. In senior author’s opinion, a central advantage of the use of MotifMESH mesh in clean-contaminated and contaminated cases is the ease of the salvage procedure of mesh removal if necessary. This one case was far different from the surgical removal of infected polypropylene meshes performed by the senior author that mandated bowel dissections and a means to contain the viscera. It is interesting that in the larger series of Carbonell where 4 meshes were removed surgically, there was no mention of the difficulty involved in their removal.<sup>12</sup>

Patients overall reported decreased pain and fatigue after these procedures. This probably relates to the reduction of total body inflammation in some patients, and to the treatment of their hernias in others. Improvement in movement and overall sense of well-being was also noted. Restoration of more normal abdominal wall compliance may explain the improved pain and movement scores. These 4 issues undoubtedly trend together and reflect successful abdominal wall reconstruction.

## Conclusions

In summary, this small prospective series of cPTFE ventral hernia repairs provides surgeons with an additional method for treating patients with clean-contaminated and contaminated ventral hernias. The properties of the mesh facilitated the handling of these challenging cases.

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