

Plastic and Reconstructive Surgery Advance Online Article

DOI: 10.1097/PRS.00000000000009931

Abdominal Wall Reconstruction with Retrorectus Self-Adhering Mesh: A Single-Center Long-Term Follow-up

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Keywords: Ventral hernia, Abdominal wall reconstruction, Retrorectus plane, ProGrip mesh, post-operative pain management, self-adhering mesh

Disclosures: Dr. Janis receives royalties from Thieme and Springer Publishing. Dr. Khansa, Ms. Bashian and Mr. Daoud have no relevant financial disclosures.

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ABSTRACT

Introduction: Mesh repair has been demonstrated to be superior to suture alone in ventral hernia repair. In a previous short-term pilot study, we found lower postoperative narcotic requirements with self-adhering mesh. The aim of this study is to follow-up on that pilot study, using long term data.

Methods: This is a retrospective review of a prospectively collected database. All patients who underwent ventral hernia repair with retrorectus mesh and who had at least 12-months follow-up were reviewed. Comparisons were performed between patients who received self-adhering mesh and those who received transfascially-sutured mesh, using matched-pair analysis, examining perioperative outcomes, surgical-site occurrences (SSOs), and hernia recurrence/bulge.

Results: Forty-two patients were included in the study, with 21 patients undergoing repair with transfascially sutured mesh and 21 patients receiving self-adhering mesh. Average length of follow-up was 1,078 days. There were no significant differences between the two groups in baseline characteristics. Patients receiving self-adhering mesh had significantly shorter surgery, and a shorter hospital length-of-stay. They also had a tendency towards lower narcotic requirements. There were no significant differences in the rate of SSOs, hernia recurrences, or bulge between the two groups.

Discussion: This long-term study shows that self-adhering mesh in ventral hernia repair results in similar long-term outcomes to transfascially-sutured mesh, with shorter surgery, shorter length-of-stay and a tendency towards improved pain control. These findings mirror the known advantages of self-adhering mesh in inguinal hernia repair. Further research is needed to study the incidence of chronic pain and the cost-effectiveness of self-adhering mesh.

INTRODUCTION

In patients undergoing laparotomy, as many as 10 percent develop ventral hernias, and the risk increases with each additional repair.¹ One of the most important goals of hernia repair is achieving reliable and durable reconstruction. However, hernia repairs have 10-year recurrence rates as high as 54 percent.^{2,3} Utilizing mesh to reinforce each reconstruction during repair has been consistently shown to reduce the risk of recurrence by as much as 50 percent.⁴⁻⁶ In addition, obtaining musculofascial reapproximation has been shown to reduce the risk of hernia recurrence compared to bridged repairs.⁷ Therefore, mesh-reinforced primary repair is the gold standard for ventral hernias.^{8,9}

Synthetic mesh repair is frequently used for tissue reinforcement to help decrease recurrence rates, and the optimal position for placement is usually in the retrorectus position (Rives-Stoppa technique), which places the mesh in a well-vascularized and protected plane between the posterior rectus sheath and the rectus abdominis muscle.^{10,11} Albino *et al* have demonstrated that the retrorectus plane results in the lowest risk of hernia recurrence and surgical-site occurrences, and confirmed these findings in a more recent study published in 2018.^{7,12}

Meshes can be fixated using a variety of techniques. For open hernia repair, transfascial sutures are effective, but are time-consuming and have the potential of entrapping nerves and causing chronic pain. Self-adhering mesh is a novel option that offers high tensile strength and the potential for decreased pain. ProGrip (Covidien, Dublin, Ireland) is a macroporous polyester sutureless self-gripping mesh with resorbable polylactic acid microgrips, allowing it to easily adhere to the fascia without the need for sutures. It has been shown to have superior grip strength to both laparoscopic staples and fibrin glue at 5 days and 2 months.¹³ Multiple studies, including

from our practice at The Ohio State University Wexner Medical Center, have demonstrated positive outcomes with self-adhering mesh, but there remains a significant gap in the literature on the long-term outcomes of patients who receive self-adhering mesh.^{14, 15} The purpose of the current study is to analyze the long-term outcomes of patients who underwent ventral hernia repair using self-adhering mesh in the retrorectus plane, compared with those who underwent transfascially sutured mesh in the same plane.

METHODS

Institutional review board approval was obtained. All patients were reviewed who underwent ventral hernia repair with retrorectus mesh by the same surgeon, and who had at least 12-month follow-up.

To ensure similar baseline patient characteristics between the two groups, each patient with self-adhering mesh was manually matched with a patient who had transfascially sutured mesh, who was similar with regards to Kanters grade, smoking status, presence of obesity/diabetes mellitus/hypertension, hernia size (within 10 cm²) and body mass index (within 2 kg/m²).

Patients were classified according to their Kanters grade.¹⁸ Grade 1 patients were those with no history of wound infection and no significant comorbidities. Grade 2 patients included those with comorbidities, such as smoking, obesity, COPD, diabetes mellitus, or a prior history of wound infection. Grade 3 patients included those with clean-contaminated, contaminated and dirty wounds. Synthetic mesh is usually appropriate for Kanters grade 1 and most Kanters grade 2 patients, but generally not for grade 3 patients, who are usually better candidates for alternatives such as biologic mesh. Hernia defect size was determined utilizing the hernia width and length from computed tomography imaging pre-operatively.

The two groups were compared in regards to surgical-site occurrences (SSOs,) hernia recurrence, and bulge. SSOs included infection (any suspected or confirmed surgical-site infection requiring antibiotics or surgery), seroma (any serous fluid collection without evidence of infection), hematoma (any instance of bleeding requiring return to the operating room), dehiscence (any skin separation 5mm or greater), skin necrosis (any instance of full-thickness skin necrosis that required debridement), mesh infection (any instance of suspected or confirmed mesh infection requiring antibiotics or explantation) and enterocutaneous fistula. Hernia recurrence was defined as any palpable defect in the fascia confirmed by CT scan. Bulge was defined as any area of palpable fascial weakness or convexity without evidence of fascial separation. CT scan was obtained in all patients with suspected hernia or bulge for confirmation. In addition, narcotic use, hospital length-of-stay, and surgical time were compared between the two groups.

Follow-up included regular office visits with physical exam performed by the senior author at 2 weeks, 6 weeks, 3 months, 6 months, 1 year, and yearly thereafter. The follow-up schedule was modified as needed in cases of complications requiring close monitoring

Statistical analyses included matched-pair analysis and the Mann-Whitney U test, using Minitab 16 (Minitab Inc., State College, Penn.) with $p \leq 0.05$ considered statistically significant.

Surgical techniques

The patient optimization and surgical technique have been previously described in detail.¹⁵⁻¹⁷ Briefly, in patients undergoing self-adhering mesh, the retrorectus plane is developed, with care not to injure the deep inferior epigastric vessels or the delicate posterior rectus sheath inferior to the arcuate line. If there is undue tension on the posterior sheath closure at that point, either minimally invasive anterior components separation²⁸, or posterior components separation

is performed²⁹. The posterior rectus sheath is then closed with #0-looped polyglyconate. The self-adhering mesh is then trimmed to size, folded lengthwise, inserted using a no-touch technique, and unfolded. The anterior rectus sheath is then repaired using #0-looped polyglyconate³⁰ (See Video, Online Supplementary Material 1, which demonstrates *in vivo* self-adhering mesh insertion).

In patients undergoing placement of sutured mesh (the control group), the dissection of the posterior rectus sheath and components separation (when needed) is performed as described above. Eight equally-spaced #1-polyglyconate U-stitches were then pre-placed in the mesh about 1cm away from its edge. A laparoscopic suture passer was then used to pass these sutures through the abdominal wall in a percutaneous, transfascial fashion. After tying the sutures, the anterior rectus sheath was closed as described above.

RESULTS

The study included 42 patients, 21 of whom underwent ventral hernia repair with retrorectus self-adhering mesh, matched to 21 patients who received retrorectus transfascially-sutured mesh. All patients underwent surgery between 2013 and 2019, over the same time period by the same surgeon. There were no significant differences between the two groups in baseline characteristics (**Table 1**). In patients who received self-adhering mesh, hernia total area ranged from 12cm² to 285.6cm², with an average area of 87.3cm². In patients who received transfascially sutured mesh, hernia total area ranged from 20 cm² to 286 cm², with an average of 93.7 cm².

Table 2 demonstrates post-operative outcomes of the two cohorts. There was a tendency towards lower narcotics usage with self-adhering mesh (66.6 vs. 240.2 Morphine Milligram Equivalent Daily Dose (MEDD), p=0.4), with no statistically significant differences in the proportion of patients who developed SSOs, hernia recurrences, or bulge. On average, total time

of surgery was approximately 100 minutes shorter in patients who received self-adhering mesh compared to those who received transfascially-sutured mesh (311 minutes vs. 411 minutes, $p=0.03$). In addition, the average hospital length-of-stay was approximately 3 days shorter in patients who received self-adhering mesh compared to those who received transfascially-sutured mesh (5.1 days vs. 8.4 days, $p=0.05$).

DISCUSSION

In a previous study, our group showed favorable outcomes with the use of self-adhering mesh in the retrorectus position. Our previous study included 26 patients, with a mean follow-up of 463 days, and found that patients receiving self-adhering mesh required significantly lower doses of narcotics than patients receiving transfascially-sutured mesh. Both groups had low rates of SSOs and hernia recurrences

In the current study, we have included 42 patients with a much longer follow-up period (1,078 days). There were no significant differences in complications between the two groups. Most notably, our long-term results demonstrate that self-adhering mesh has a similar incidence of SSOs compared to sutured mesh, and equivalent durability, with similar rates of hernia recurrence. Sutureless self-gripping mesh has the advantage of significantly shorter surgery and hospital length-of-stay, with a trend towards lower narcotic usage.

This study represents the longest term follow-up to date on the use of self-adhering mesh for ventral hernia repair and demonstrates that there is no increase in complication or recurrence rate when compared to transfascially-sutured mesh.¹⁵ These results are similar to what has been described for inguinal hernia repairs. Multiple meta-analyses on the use of self-adhering mesh in inguinal hernia repairs have shown no increase in complications compared to traditional sutured mesh.^{6, 19} There is conflicting evidence on the effect on self-adhering mesh on chronic groin pain

in inguinal hernia repair, but most studies suggest decreased pain compared to sutured mesh.^{20, 21} In inguinal hernia repairs, self-adhering mesh results in shorter operating time, but the increased cost of the self-adhering mesh may partially offset this advantage. The durability of both types of mesh was found to be similar, with no difference in recurrence rates at 24 months of follow-up.^{14, 22, 23}

The use of self-adhering mesh is a potential strategy to decrease pain in the postoperative period. In our original pilot study, we observed a reduction in the average daily MEDD in the hospital in patients receiving self-adhering mesh compared to those receiving transfascially-sutured mesh. In the current study, there was a similar trend, but this was not statistically significant. One important limitation of the current study is our inability to measure outpatient narcotic usage, as our statewide database which houses this data with accuracy (based on postoperative prescriptions written and filled) does not permit data interrogation as a matter of policy.

The biomechanical properties of self-adhering mesh are favorable. Self-adhering mesh in rats has been showed to have significantly greater strength of incorporation than a hernia stapler and fibrin glue.²⁵ Another study found self-adhering mesh to have less displacement around an abdominal defect in swine than fibrin glue and absorbable laparoscopic tacks.

Moreover, the large decrease in operating room time and hospital length of stay that was observed with self-adhering mesh utilization may translate to a more cost-effective option compared to sutured mesh and should be investigated in future studies²⁶. Future studies should also focus on quality of life and the presence of chronic pain.

There are some limitations to the current study. The relatively small number of subjects in the study likely causes underpowering. The use of self-adhering mesh is limited to patients

who are good candidates for synthetic mesh; therefore, we do not use self-adhering mesh in contaminated or infected fields. Consequently, our results are limited to patients with Kanters grades 1 and 2 and are not generalizable to the most complex patients in grade 3. In addition, in order to be able to use self-adhering mesh in the retrorectus position, the surgeon must be able to fully close the posterior rectus sheath, which can further limit the patients that can benefit from this technique.^{8, 10}

CONCLUSION

This study is the first to look at long-term outcomes of patients who underwent ventral hernia repair with self-adhering mesh, and to compare long term complications in this cohort with patients who received transfacially sutured mesh. Notably, self-adhering mesh has no significant difference in long-term complication rates compared to transfacially-sutured mesh and results in shorter surgery time and decreased length-of-stay. More research is needed to understand whether self-adhering mesh may reduce chronic pain, improve quality of life, and reduce overall costs.

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TABLES AND FIGURES LEGEND

Table 1: Baseline patient demographics

Table 2: Postoperative outcome comparison for patients treated with transfascially sutured mesh or Progrid self-adhering mesh

LEGEND OF ONLINE-ONLY SUPPLEMENTARY MATERIALS

Online Supplementary Material 1: Video demonstrates *in vivo* self-adhering mesh insertion.

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Table 1: Baseline patient demographics

	Transfascial Sutures		Self-adhering		p	
	n	%	n	%		
Total	21		21			
Comorbidities						
HTN	6	28.6	7	33	1	
COPD	0	0	2	9.52	0.49	
Diabetes	3	14.3	1	4.76	0.60	
Active smoker	9	42.9	8	38.1	1	
Former smoker	1	4.8	2	9.52	1	
BMI (kg/m ²) [Median (IQR)]	29.19 (27.09-33.76)		29.35 (25.93-33.49)		0.9	
Hernia total area (cm ²) [Median (IQR)]	68.4 (29.9-135.0)		72 (30.5-121.7)		0.8	
Postoperative follow Up (days) [Median (IQR)]	1300 (954-1700)		1631 (975-1998)		0.7	
Kanters grade						
1	8	38.1	11	52	0.54	
2	13	61.9	10	48	0.54	
3	0		0	0		
Surgical details						
Epidural placed	10	47.6	11	52.4	1	HTN stands for
Components separation						
Anterior	6	28.6	7	33.3	1	
Posterior	9	42.9	4	19	0.18	
Mesh type						
ProGrip	0	0	21	100		
Polypropylene	21	100	0	0		
Multimodal analgesia	19	90.5	17	81.0	0.66	

hypertension; COPD, chronic obstructive pulmonary disease; BMI, body mass index; VHWG, Ventral Hernia Working Group; IQR , interquartile range

Table 2: Postoperative outcomes of the two groups

	Transfascial Sutures		Progrip		p
	n	%	n	%	
Total	21		21		
Length of surgery (minutes) [Median (IQR)]	543 (411-675)	-	364 (306-423)	-	0.03
Hospital length of stay (days) [Median (IQR)]	8.3 (5.6-11.6)	-	5.1 (3.8-6.8)	-	0.05
Opioid use (MEDD) [Median (IQR)]	39.0 (21.6-71.4)	-	41.0 (23.1-83.5)	-	0.4
SSOs	4	19	6	28.6	0.72
Soft tissue infection	3	14.3	3	14.3	1
Seroma	0	0	1	4.8	1
Hematoma	0	0	1	4.8	1
Dehiscence	0	0	0	0	1
Skin Necrosis	0	0	2	9.5	0.49
EC Fistula	0	0	0	0	1
Mesh Infection	1	4.8	0	0	1
Hernia recurrence	3	14.3	2	9.5	1
Bulge	1	4.8	1	4.8	1

MEDD stands for Morphine Equivalent Daily Dose; SSO, Surgical Site Occurrences; IQR, interquartile range