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# Ventral Hernia Repairs: 10 year Single Institution Review at Thomas Jefferson University Hospital

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## **Abstract**

**Background** Definitive repair of recurrent ventral hernias using abdominal wall reconstruction techniques is an essential tool in the armamentarium for general and plastic surgeons. Ramirez<sup>1</sup> et al describes the “component separation” technique to mobilize the rectus-abdominus internal oblique and external oblique flap to correct the defect. The recurrence rate of incisional hernias increases to 20% after gastric bypass or extensive weight loss.<sup>2</sup> The incidence of ventral hernias after failed recurrent hernia repair increases to 40%.<sup>3</sup> It has been reported that utilizing the sliding myofascial flap repair technique, the recurrence rate was reduced to 8.5%.<sup>4</sup>

**Materials and Methods** This retrospective institutional study reviews 10 years of myofascial flap reconstruction 1996-2006 at TJUH. Several techniques and prosthetic materials (alloderm, permacol, vicryl, composix) were used in our institutional review by multiple surgeons in this time period. Our goal is to identify risk factors (i.e. smoking, diabetes, obesity, size of defect, peripheral vascular disease, enterocutaneous fistula, infection) that predict or categorize patients that are at increased risk for failure of primary repair, measure the

complication rates (i.e. infection, recurrence, seroma, hematoma) and evaluate the techniques and long term effectiveness of several prosthetic materials.

**Results** Three thousand twenty ventral hernia repairs were performed at TJUH between 1996 and 2006. Two thousand three hundred eighty three approximated the rectus abdominus primarily and of these 645 utilized a component separation technique. The recurrence rate for component separations was 18.5% and 83% for primary repairs. The average follow up was 5.49 years. Statistically significant risk factors ( $p < 0.05$ ) for recurrence were obesity ( $\text{BMI} > 30 \text{ kg/m}^2$ ), age  $> 65$  years, male gender, preoperative infection and postoperative seroma.

**Conclusion** Myofascial flaps are a safe, reliable therapy for recurrent ventral hernias that addresses the population of patients that have failed conventional primary closure and reduce the recurrence rates greater than 40 percent to 18.5 percent in the carefully selected patient population.

## **Introduction**

Postoperative incisional hernias remain a common complication of abdominal surgery. “Any abdominal wall gap with or without bulge in the area of a postoperative scar perceptible or palpable by clinical examination or imaging” is an accepted definition of an incisional hernia.<sup>5</sup> Recurrent ventral hernias after open suture repair can occur with a reported frequency of 31-49%.<sup>6</sup> The adjunctive use of a prosthetic material to the repair appears to attenuate this rate to 0-10%.<sup>6</sup> Despite the great morbidity associated with incisional hernia, no consensus exists on the best means for treatment.<sup>5</sup> Ramirez and colleagues<sup>1</sup> first described the use of a bilateral, innervated rectus abdominus-internal oblique muscle flap that is transposed medially to repair

the central abdominal wall. Subsequent work has since validated the use of this technique to reduce the incidence of postoperative hernia.<sup>1,3,5,7</sup>

Our group first reported on the relative success of the sliding rectus abdominus myofascial flap in 1996.<sup>4</sup> The technique of midline advancement and onlay mesh reinforcement is illustrated in Figure 1 and Figure 2 respectively.

Recurrence of herniation was found in only three of the 35 patients, a failure rate of 8.5%. In the current retrospectively review, 3028 ventral hernia repairs were performed. As illustrated in figures 1 and 2, the external oblique fascia was released without violating the posterior rectus sheath. Only the midline anterior rectus sheath was reinforced with the midline onlay. Release of the posterior rectus sheath for additional advancement in the underlay or interposition techniques was not utilized in this series. Two thousand three hundred eighty three approximated the rectus abdominus muscle primarily and of these 645 cases utilized the component separation technique. Thirty eight percent of the primary repairs failed. Early in the study period these recurrences were treated with replacement of the prosthetic mesh and subsequently had a high failure rate. None of the repairs were staged with tissue expanders. Of the 645 component separations, 100 were performed for recurrence, yielding a failure rate of 18.3%. Eighty five (84.7%) percent of the recurrence were in the midline. The statistically significant factors (p-value <0.05) for recurrence were obesity (BMI>30 kg/m<sup>2</sup>), age>65 years old, male gender, postoperative seroma and preoperative infection. The future goal of this study is to stratify these risk factors that predispose patients to failure of a primary repair in order to reduce the number of operations, morbidity, and medical cost.

## **Materials and Methods**

A retrospective chart review was conducted after obtaining IRB approval from the Thomas Jefferson University Hospital review board. A database was constructed using ICD-9 and CPT codes from October 1996 thru October 2006. Patients were selected if they had a primary large hernia defect or a recurrent ventral hernia repair during this time interval. The majority of cases were performed in conjunction with a general surgeon. The mesh material composition and placement were independent variables that were selected by the surgeon based on previous infection, tissue approximation at the midline, amount of tension and respiratory function. If the positive inspiratory pressure (PIP) increased by more than 10 mmhg or if it was greater than 35 mmhg, an interposition graft was considered. If the approximation of flaps did not significantly change the PIP, an onlay allograft was placed for reinforcement. In those cases that had previous allograft dermis failure, porcine xenograft was substituted as reinforcement and to reduce the tension on the primary repair. Extensive enterolysis, infected prosthesis or enterocutaneous fistulas were addressed primarily by the general surgeon. Enterocutaneous fistulas were managed based on standard protocols for high or low output fistulas. Nutrition was optimized preoperatively and skin protection was utilized with ostomy appliances. Prior to the hernia repair, all fistulae were resected with establishment of the continuity of the bowel. Prosthetic materials synthetic, biologic, absorbable, non-absorbable (alloderm, vicryl, goretex, kugel, composix, polypropylene, and permacol) were incorporated into the repairs to reduce tension and provide reinforcement. During the study the use of goretex decreased tremendously along with composix, kugel patch and permacol which were FDA recalled toward the termination of the series. All drains were removed postoperatively after the output was less than 30 ml/day.

All charts were reviewed retrospectively. Bivariate analysis, using Chi-square statistical analysis, was performed on the data using the SAS Release 9.2 statistical software program. The

mean follow up by the plastic surgeon and general surgeon was 5.49 years. The comorbidities analyzed on the patients age, gender, previous surgeries, preoperative fistula/infection, specifics of repair, and occurrence of complications, smoking history, intraoperative enterotomy, history of obstruction, dehiscence, evisceration, radiation and immunosuppression.

## **Results**

All patients in this study had an abdominal incisional hernia. The rate of recurrence after sliding myofascial flaps was 18.3%. The recurrence rate after failed primary closure was 38%. A total of 545 myofascial advancement flaps were performed after failed primary closure and 100 (18.3%) recurred. Age >65 years (65% of patients,  $p=0.0075$ ), BMI>30 kg/m<sup>2</sup> (62%,  $p=.001$ ), previous infection (6%,  $p=.0034$ ), male gender (47%,  $p=0.0234$ ) and postoperative seroma (4%,  $p=.0002$ ) were significant risk factors for recurrence.

Sixty eight percent of these recurrences had a BMI >30 kg/m<sup>2</sup>. Fifty eight of the recurrences had an onlay mesh: 38 synthetic, 20 biologic. No statistical significance was demonstrated for recurrence based on the type of mesh utilized (Table 1). However, the gortex mesh had a higher incidence of postoperative seroma and mesh infection.

Postoperative complications encountered were: hematoma (0.8%), seroma (5%), infected mesh (1.8%), enterocutaneous fistula (<1%). The average follow up was 5.49 years. The overall recurrence rate in the series was 18.3 percent (n=100) among all surgeons.

## **Discussion**

Abdominal wall reconstruction for large defects can be a daunting task for the reconstructive surgeon. The largest recorded defect in this series was 896 cm<sup>2</sup> with an



interposition mesh repair. All defect sizes were not recorded in the medical records. Achieving the goals of repairing the defect, maintaining the abdominal domain and an acceptable cosmetic result is challenging. Ramirez, et. al introduced the component separation technique which mobilizes the rectus abdominus medially to repair a large defect.<sup>4</sup> The advantage of the sliding myofascial advancement flap is that large defects can be repaired by separating the external oblique fascia without significant scarring or skin laxity that was obtained by techniques developed by Wangenstein or Ger and Duboys respectively.<sup>7</sup> It has been reported that each external oblique muscle can be advanced 2 to 4 cm after release, and the rectus muscle and overlying sheath can be advanced 3 to 5 cm after detachment from the posterior sheath with a bilateral advancement of up to 20 cm.<sup>9</sup> The repair we utilized is based on the compound flap of the rectus abdominus muscle with its attached internal oblique-transverse abdominus muscle unit advanced to the midline to recreate the linea alba.<sup>4</sup> For the morbidly obese patients, it is paramount to maintain the “right of domain” of the abdominal cavity to minimize pulmonary compromise. Peak inspiratory pressures were measured intraoperatively and at the completion of the closure. Postoperative ventilatory support was provided only if the peak inspiratory pressure was >40 cm H<sub>2</sub>O in order to maintain pulmonary function.

Our retrospective review from January 1996 to December 2006 yielded a total 645 abdominal wall reconstructions with or without prosthetic reinforcement. All patients received preoperative antibiotics with 30 minutes of incision. Sequential compressive devices were placed prior to anesthesia induction. The use of nonabsorbable mesh is minimized due to its association with adhesions to intraabdominal viscera, enterocutaneous fistula formation and intolerance to contamination and subsequent infection.<sup>8</sup> Onlay biologic prosthetics were implemented to reduce tension on the midline rectus abdominus suture imbrication, in clean and contaminated cases and

provide reinforcement to the repair. During this study some of the materials utilized were recalled or taken off the market (i.e. permacol, goretex, kugel patch, and composix). This has a confounding effect on our results but was not statistically evaluated.

The goals of abdominal wall reconstruction are to restore the function and integrity, provide stable skin and soft tissue coverage, maintain a tensionless coaptation and preserve the vasculature and innervation.<sup>3</sup> Our study revealed that since our prior study, the recurrence rate has changed from 8.5 % to 18.3% and the complication rates have not changed with any significant error. The increase in recurrence and seroma formation is secondary to applying this technique to a patient population with attributable comorbidities, such as age, history of infection or seroma, male gender and obesity. According to our algorithm, if the recurrence didn't not have a onlay mesh, an only allograft was place. If the failure was secondary to allograft failure, a porcine xenograft was utilized for reinforce the repair. All failures utilized permanent suture to imbricate the midline and onlay mesh.

There are several weaknesses in our study. A retrospective study is only as good as the available medical records. In some circumstances, all the data was not collected on every patient, so a detail analysis could not performed. During the study period, several of the mesh types were withdrawn from the market. We did not incorporate this into our statistical analysis but continued to analyze the data as synthetic vs. biologic. Over the course of the ten years, many of the general surgeons began utilizing a variety component separation techniques based on the severity of the fascial defect. The plastic surgeons in this study consistently used the modified component separation technique described above. A randomized prospective multi-institutional study needs to be performed to utilize multivariate linear regression on the type of material, size

of the fascial defect, and comorbidities to facilitate the creation of a dependable algorithm for complex hernias.

## **Conclusion**

The incidence of incisional hernias has been an accepted complication in reportedly 11 percent of laparotomy patients. Failed primary ventral hernia repair and gastric bypass surgery increases the incidence of ventral hernias almost fourfold. It has been reported that a BMI > 30 kg/m<sup>2</sup> was implicated in hernia recurrence and wound infection.<sup>3</sup> Component separation techniques should be incorporated early in the algorithm for hernia repair because the failure rate increases with each operation. Our retrospective study revealed that over a ten year period 645 myofascial abdominal advancement flaps were performed at our institution. During this period, the recurrence rate after sliding myofascial flaps has increased to 18.3% compared to the prior study. The average follow up was 5.49 years. Biologic (permacol (porcine xenograft), alloderm (acellular cadaveric dermis) and synthetic materials (polypropylene, kugel, and goretex) were selectively incorporated to reinforce the acquired abdominal defects. There was no statistical significance for recurrence with respect to the type of mesh utilized. However, the goretex mesh had a higher incidence of postoperative seroma and infection requiring mesh removal. The statistical significant risk factors for recurrence are BMI > 30 kg/m<sup>2</sup>, male gender, postoperative seroma, previous infection and age > 65 years old. Sliding myofascial flap advancement is a safe, reliable and useful technique that reduces the rate of recurrent ventral hernias, avoids additional donor site morbidity and utilizes autologous tissue repair.

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