Donor site reinforcement with TIGR® Matrix in patients undergoing free flap breast reconstruction

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Background

The lower abdominal donor site is recognized as the criterion standard for autologous breast reconstruction. Since the inception of the TRAM flap over four decades ago, more muscle- and fascial-preserving techniques have evolved with the advent of microsurgical free tissue transfer. Despite the growing prevalence of msfTRAM and DIEP techniques, hernia and bulge of the abdominal donor site remain as potential complications following breast reconstruction. [1, 2]

Many surgeons elect to utilize mesh to help reinforce the abdominal donor site so as to mitigate the risk of hernia and/or bulge. Early data from TRAM series suggested an improvement in hernia/bulge rate with the use of adjunctive mesh. The role of mesh and its possible attendant benefits in msfTRAM and DIEP techniques is less clear. [3]

Traditionally, permanent prosthetic mesh has been used for those who elect to utilize mesh reinforcement. Permanent prosthetic mesh has been associated with infection, extrusion, and chronic pain. Furthermore, most patients undergoing autologous reconstruction, generally prefer to avoid permanent prosthetic material implanted as a part of their surgery. [4]

More recently, resorbable synthetic meshes have been successfully utilized in the setting of ventral hernia repair and abdominal wall reconstruction. The mesh provides early support and tension off-loading while theoretically minimizing the aforementioned risks of a permanent mesh. [5]

The purpose of this study is to examine the techniques and clinical outcomes of TIGR® Matrix implementation in reinforcing the lower abdominal donor site in autologous breast reconstruction.

Methods

A retrospective review of records was performed on all patients whom underwent lower abdominally-based free flap breast reconstruction by a single surgeon from October 2021 to October 2023 (Table 1).

Table 1 - Demographics

Total no. patients	**55**
Mean age (range 30-71)	**49**
BMI (range 19- 49)	**30**
COPD	**0 (0%)**
Diabetes mellitus	**4 (7%)**
Hypertension	**18 (33%)**
Coronary artery disease	**0 (0%)**
Peripheral vascular disease	**0 (0%)**
Dyslipidemia	**6 (11%)**
Smokers (former)	**8 (15%)**
Smokers (current)	**2 (4%)**
Preop chemotherapy	**24 (44%)**
Postop chemotherapy	**2 (2%)**

Records were reviewed to ascertain patient demographics, comorbidities, timing of reconstruction, and post-operative outcomes. Routine postoperative office visits included a detailed physical examination by a single surgeon. Complications were calculated per patient as well as per donor site.

Donor site closure and reinforcement technique

Lower abdominally-based free flaps were harvested in a unilateral or bilateral fashion depending on the associated breast defect(s). When possible, muscle and fascia were spared in dissecting DIEP flaps. For patients with more diminutive perforator selection, a msfTRAM approach was utilized with care to only harvest the muscle and fascia necessary to incorporate adequate perforators for the flap.

Following flap dissection, the lower abdominal area was irrigated and the donor site was inspected for hemostasis. The anterior fascial edges were elevated off of the anterior rectus abdominis surface. TIGR Matrix was then cut as a vertical strip to span the length of the defect. Care was taken to minimize the width of the TIGR Matrix as excessive horizontal width can cause unfolding and redundancy of the mesh when the fascial edges are later reapproximated. The mesh was then inset using mattress 0 PDS suture. The mesh is inset in the plane between the rectus abdominis and the fascia (superficial to the muscle and deep to the anterior fascia) The mesh is inset superiorly, inferiorly, medially, and then laterally. The lateral fascia is typically more mobile therefore it is inset last so as to appropriately tension the mesh. Following inset of the mesh, the anterior fascia is then closed on top of the mesh with mattress 0-Prolene suture.

Fig. 1 "Left-sided msfTRAM donor site. TIGR Matrix cut into vertical strip. Inset of mesh is superficial to rectus abdominis muscle but deep to abdominal fascia"

Fig. 2 "TIGR Matrix is inset inferior first then cut to size with regard to vertical length"

Fig. 3 "TIGR Matrix cut to size and prepared for inset into superior extent of fascial defect"

Fig. 4 "TIGR matrix inset above muscle and below fascia. Inset is performed with mattress 0-PDS suture. Inset is performed medially first then laterally as the lateral fascia is more mobile"

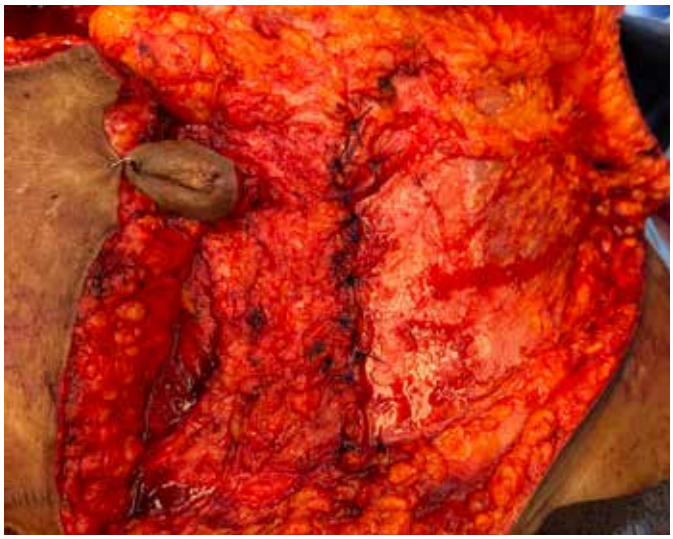

Fig. 5 "The abdominal fascia is then closed primarily over top of the TIGR Matrix using figure of eight 0-Prolene suture."

About TIGR Matrix

TIGR Matrix is a long-term resorbable surgical mesh made from synthetic polymers. It was first cleared by the FDA and introduced in the US in 2010 and has since been widely used for soft tissue reinforcement where weakness exist in general- as well as reconstructive and aesthetic plastic surgery. TIGR Matrix is a knitted mesh designed using two different resorbable materials, with different times of resorption, both having a long track record of clinical use in sutures and therefore well studied and documented. The first fiber, making up approximately 40% of the matrix by weight, is a copolymer of glycolide, lactide, and trimethylene carbonate. The second slow-resorbing fiber, making up approximately 60% of the matrix by weight, is a copolymer of lactide, and trimethylene carbonate. Both fibers degrade by bulk hydrolysis once implanted, resulting in a decreasing strength retention followed by mass loss of the fibers. While the first fiber is substantially degraded within 4 months, the second fiber provides strength and support for more than 6 months. Pre-clinical studies have showed that TIGR Matrix is resorbed and histologically absent within three years. [6,7]

The dual fiber design of TIGR matrix means that it has one set of mechanical characteristics at time of implantation but following resorption of the first fiber, TIGR Matrix is characterized by different mechanical characteristics, including significantly increased pliability and relative distension. This shift in mechanical behavior over time is intended to allow for a load transfer from the implant back to the native tissue, thereby gradually providing increased mechanical stimulation of soft tissue which could lead to more effective and functional tissue remodeling. In preclinical testing using a full thickness defect of sheep abdominal wall, TIGR Matrix generated more collagen content in the repair tissue and with a higher collagen I/III ratio than when using a permanent mesh product. Clinical studies performed both on applications in the breast and in the abdominal wall have shown that TIGR Matrix is rapidly and well-integrated with a low level of complications associated with its use.

Results

A total of 101 flaps were performed on 55 patients in the series. Therefore, 101 donor sites were examined. With regard to flap type, 91 (90%) DIEP flaps were included and the remaining 10 (10%) of reconstructions were msfTRAM flaps. The average patient age was 49 years. Average patient follow-up was 9 months.

One patient developed a hernia on the right-lower abdominal donor site which was successfully repaired in a subsequent operation. The patient who developed a hernia underwent a bilateral msfTRAM reconstruction. The overall rate of hernia/bulge was 1%. There were no cases of mesh infection or extrusion.

Discussion

The lower abdominal donor site is an ideal repository of soft tissue for many patients who desire autologous breast reconstruction. Hernia and bulge are accepted complications of the lower abdomen following free flap breast reconstruction. Careful dissection with muscle and fascia preserving techniques can help to minimize donor site morbidity. In addition to saving the maximum amount of muscle and fascia, care to avoid de-innervating the lateral border of the rectus abdominis muscle is paramount. [8]

Despite meticulous technique, hernia and bulge may still occur in a small subset of patients. Proper management of the donor site with mesh reinforcement can help to minimize the risk of hernia/bulge to an acceptably low rate. The use of mesh in abdominal wall reinforcement has been shown previously to improve outcomes in abdominal wall reconstruction and reinforcement of TRAM donor sites. Particularly given that many patients undergoing DIEP reconstruction have an elevated BMI and will have undergone adjuvant chemotherapy, the author believes mesh reinforcement is a helpful adjunctive measure in addition to primary fascial closure. Mesh helps to off-load tension on the closure of the fascial edges and bolster the repair in the critical wound healing period.

The author has undergone an evolution in donorsite management specifically in terms of suture and mesh selection. Prior to this series, patients were treated with polypropylene mesh and Ethibond® suture placement through the anterior fascia. The combination of a braided permanent suture and polypropylene mesh resulted in an unacceptable rate of granulomas, chronic foreign body reaction and mesh infection. The treatment of the aforementioned scenario included; long-term intravenous antibiotic therapy, interventional radiology percutaneous drain placement and ultimately reoperative excision of infected permanent mesh.

Since implementing TIGR Matrix and utilizing monofilament suture, there have been no recurrent issues with foreign body reaction or chronic mesh infection. Furthermore, the rate of hernia/bulge has remained low. The author's experience suggests that a low rate of hernia/bulge can be achieved without the use of permanent mesh and the associated downsides of a permanent prosthetic material. Other surgeons have implemented biologic materials as an alternative to permanent mesh. The author prefers TIGR Matrix, given the lower risk profile for poor integration and chronic seroma formation within the rectus complex (previously observed with dermal matrices). Additionally, TIGR Matrix is generally more cost effective than most allograft material. The only incidence of hernia/bulge in this series was a patient who required a bilateral msfTRAM. There has yet to be hernia/bulge in a more typical DIEP flap patient. [9]

Conclusion

TIGR Matrix is an effective adjunctive measure to help reinforce the lower abdominal donor site at the time of free flap breast reconstruction. Utilization of the mesh along with careful dissection and fascial closure, results in a low rate of hernia and bulge. Additionally, use of TIGR Matrix minimizes much of the additional risk typically seen with traditional permanent synthetic mesh.

For more information go to **www.tigrmatrix.com / www.novusscientific.com**

REFERENCES

[1] Scheflan , Hartrampf CR, Black PW. Breast reconstruction with a transverse abdominal island flap. Plast reconstr surg. 1982; 69:908-909.

[2] Gill PS, Hunt JP, Guerro et al. A 10-year retrospective review of 758 DIEP flaps for breast reconstruction. Plast reconstr surg. 2004;113:1153-1160.

[3] Rossetto LA, Abla LE, Vidal R, et al. Factors associated with hernia and bulge formation at the donor site of the pedicled TRAM flap. Eur J Plast Surg. 2010;33:203-208.

[4] Shubinets V, Carney MJ, Colen DL et al. Management of infected mesh after abdominal hernia repair: systematic review and single-institution experience. Ann Plast Surg. 2018;80:145-153.

[5] Talwar AA, Perry NJ, McAuliffe PB et al. Shifting the goalpost in ventral hernia care:5-year outcomes after ventral hernia repair with poly-4-hydroxybutyrate mesh. Hernia. 2022;26:1635-1643.

[6] Pompei S, Evangelidou D, Arelli F, Ferrante G. The use of TIGR matrix in breast aesthetic and reconstructive surgery: Is a resorbable synthetic mesh a viable alternative to acellular dermal matrices?. Clin Plast Surg. 2018;45:65-73.

[7] Lewis R, Forman B, Preston M, Heidel E, Alvoid-Preston B, Ramshaw B. The use of novel synthetic resorbable scaffold (TIGR matrix) in a clinical quality improvement (CQI) effort for abdominal wall reconstruction (AWR). Hernia. 2022;26:437-445.

[8] Shubinets V, Fox JP, Sarik JR, Kovach SJ, Fischer JP. Surgically treated hernia following abdominally based autologous breast reconstruction: prevalence, outcomes, and expenditures. Plast Reconstr Surg. 2016;137:749-757.

[9] Patel KM, Shuck J, Hung R, Hannan L, Nahabedian MY. Reinforcement of the abdominal wall following breast reconstruction with abdominal flaps: a comparison of synthetic and biological mesh. Plast Reconstr Surg. 2014;133:700-707.