The technique and benefits of angiographic embolization of inferior epigastric arteries prior to Pedicle TRAM flap breast reconstruction

Alysse J Sever, MD¹, Chirag Patel MD¹, Yahya Albeer MD, FRCS¹, Vigen B. Darian MD²

¹Department of Interventional Radiology, Henry Ford Hospital, 2799 West Grand Blvd, Detroit, MI, USA
²Department of Plastic Surgery, Henry Ford Hospital, 2799 West Grand Blvd, Detroit, MI, USA
Alysse Sever, MD

• No relevant financial relationship reported
Pedicle TRAM Flap procedure:
Lower abdominal skin, fat and one of the rectus muscle are transferred to the mastectomy site and contoured to reconstruct the breast [10].
Transverse Rectus Abdominis Musculocutaneous (TRAM) flap

- Is the most frequently used autologous flap procedure for breast reconstruction.
- Although the gold standard, less reliable in patients at high risk of ischemic compromise [1].
- A surgical delay procedure involving ligation of the deep inferior epigastric artery (DIEA) and vein has been shown to augment flap vascularity and improve outcome in high risk patients.
The superficial and deep inferior epigastric arteries arise from the external iliac and common femoral arteries respectively.
DIEA ligation/embolization renders the tissue partially ischemic to undergo neovascularization [8].

Both surgical delay and angiographic delay has been described in literature [2].

Flap loss, fat necrosis, and skin necrosis develop secondary to flap ischemia [8].
Purpose:

- To determine whether delay by selective arterial embolization is comparable to traditional surgical delay, and superior to non-delayed TRAM flaps, in terms of both success rate and negative postoperative outcomes such as flap loss and skin or fat necrosis.
Procedure:

- Several weeks prior to mastectomy with TRAM flap
- Right common femoral artery access
- Pelvic angiogram performed in the first few cases.
- Catheterization of the internal mammary arteries not performed

Pelvic angiogram performed to assess the anatomy
Procedure:

- External iliac angiogram performed in ipsilateral anterior oblique projection using RUC catheter.
DIEA catheterized with a Progreat 2.4 microcatheter and double angle Glide GT microwire.

DIEA angiogram followed by embolization using Tornado microcoils.

DIEA Angiogram performed to identify the size and course of this vessel.
Procedure Continued:

- At least 3 {3/2, 4/2, or 5/2 (mm/mm)} tornado Micro coils used to embolize the DIEA.
- Repeated for the other side.

Post embolization of the bilateral DIEAs post coiling with three tornado microcoils.

Injection of contrast into the left Ext. iliac artery to ensure complete occlusion.
Material and Methods:

- Retrospective chart review of 12 patients who underwent Pedicle TRAM flap breast reconstruction after selective embolization of bilateral DIEA.

- Data analyzed to display the spectrum of post-operative outcomes.

- Compared to historical controls of surgical delayed and non-delayed procedure.
Statistical Analysis

- Assessed for ischemic risk factors: DM, smoking, BMI, and HTN.
- Fisher exact statistical test for comparison to historical surgical outcomes of surgical delayed and nondelayed flaps.
- Data analyzed using SAS statistical software.
Results:

- Between 2013-2015, 12 patients.
- Mean age: 55.25 years.
- Technically successful in all patients with no reported complications.
- One patient had a small area of flap skin necrosis.
- No patients had partial or total flap loss.
- 16.7% (2/12) patients had clinically significant fat necrosis.
Rates of Clinically Significant Fat or Skin Necrosis

<table>
<thead>
<tr>
<th>Clinical significance of fat or skin necrosis rates</th>
<th>Pedicled TRAM Without Delay</th>
<th>Pedicled TRAM With Surgical Delay</th>
<th>Pedicled TRAM With Angiographic Delay</th>
</tr>
</thead>
</table>

TRAM indicates transverse rectus abdominis musculocutaneous
Chi square analysis using the Fisher exact method

Fat or skin necrosis (2/12) (16.7%) was statistically different from the non-delayed group (12/45) (26.7%) [9], with a risk difference of -31.9% and a p-value of 0.03.

Statistically similar to surgical delay (12/88) (13.6%) [3].
Fat necrosis was deemed clinically significant if painful, visually apparent, or caused breast asymmetry.

Incidental small areas of fat necrosis were seen on mammograms.
Discussion:

- Angiographic delayed procedure is similar to surgical delay and better than non-delayed procedure.

- Advantages of selective arterial embolization include quicker recovery, less pain, no need for general anesthesia, and lower cost [3].

- Avoidance of potential surgical complications such as cellulitis, wound infection, and seroma [4].

- If angiographic delay can be reliably performed with comparable results to surgical delay and less morbidity, then angiographic delay can become the standard of care for TRAM flap procedures.
Initially only used in high risk ischemic patients, recent trials show improved complication rates for all patients [6].

Ischemic risk factors: smoking, obesity, prior radiation therapy, and/or diabetes.

Our patients were selected regardless of ischemic risk factors; however these were retrospectively reviewed and documented.

Smoking is the most significant risk factor in the development of fat necrosis [3].
Conclusion:

- Angiographic delay is comparable to surgical delay at reducing ischemic complication post Pedicle TRAM flap breast reconstruction with decreased postoperative morbidity.

- Advantages include less hospital stay, less pain, no general anesthesia and lower cost.

- It is a reasonable safe alternative to the surgical delay with less morbidity, and is better than non-delayed TRAM flap procedures.
Acknowledgements:
- The authors acknowledge Matt Sever, MS, for his help with statistical analysis.

References: