

Case Study

Which factors influence the choice of abdominal flap used in breast reconstruction surgery?

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Key Learning Points / Commentary

The incidence of breast cancer has been progressively increasing to the current level where 1 in 8 women now develop the disease. The National Breast Screening Programme has enabled us to diagnose many breast cancers at a much earlier stage. Coupled with an improved understanding of the oncoplastic approach to breast cancer surgery, genomics, hormone and targeted therapies as well as chemotherapy we now anticipate better outcomes.

Despite the many advances in breast cancer there remains a significant cohort of women who are diagnosed with advanced forms of the disease that necessitates mastectomy i.e. the removal of all breast tissue. For many, reconstruction maybe immediately possible at the same time as mastectomy using either non-autologous (man-made) options such as breast implants and tissue expanders or autologous options using the latissimus-dorsi, abdominal or non-abdominal based flaps sited on thigh, buttock or lower flank tissue.

Abdominal based reconstructions have evolved from crude operative procedures in which large parts of the lower anterior abdominal wall were harvested while remaining attached to the feeding vascular supply. This 'flap' of tissue is then rotated upon the pedicle of vessels into the new location in the breast. Pedicled Transverse Rectus Abdominus Myocutaneous (TRAM) flaps were often complicated by under-perfusion of the transferred flap resulting in fat necrosis. There were also issues with abdominal wall bulges and hernias as a result of the loss of the rectus abdominus muscle.

With improvements in microsurgery the advent of free flap surgery was ushered in. Skin and fat were transplanted from the lower anterior abdominal wall using one of the rectus abdominus muscles and the perfusing artery and draining vein (donor-site). This free TRAM flap could be transplanted in the recipient-site after re-joining (re-anastomosing) the artery and vein using microsurgery. Aided by better anatomical knowledge, surgeons have been able to reduce the amount of rectus muscle sacrificed resulting in the muscle sparing-TRAM (MS-TRAM) and more latterly the deep inferior epigastric perforator (DIEP) flap which has no muscle included. The advantages of this muscle sparing approach are speedier recovery and reduced morbidity while maintaining operative cosmetic outcomes.

Keywords: breast, mastectomy, reconstruction, malignancy, flap, TRAM, DIEP

Introduction

Breast cancer affects 1 in 8 women.¹ The incidence of breast cancer often necessitates interventional procedures including mastectomy, in order to remove breast tissue that may contain cancer cells. Plastic surgical reconstruction of the breast is important for the patient due to the psychosocial impact that losing a breast may have. Flaps can be taken from the abdomen and relocated to replace the lost breast tissue. These flaps can either contain muscle or consist of purely skin and subcutaneous fat. Choosing a flap depends on the patient, and is influenced by their weight, amount of breast tissue and quantity of abdominal fat.

Case presentation

Mrs X is woman with an insubstantial past medical history that includes a tonsillectomy at the age of 17, with no further problems troubling her since. A fall in June 2013 had resulted in mild trauma which potentially led to the onset of osteoarthritis in both the left and right knees. This necessitated arthroscopic surgery to amend the problem in later years. Patient GE has no known drug allergies and was on no routine medications.

For work, she is employed as part of an administration team in a school, which she enjoys. She maintains an active lifestyle, walking ten miles every weekend without any problems from her previously arthritic knees. She lives

at home on her own, after the unfortunate passing of her husband, but has two daughters who she sees regularly.

She has a significant family history of breast cancer. Her mother was diagnosed and successfully treated ten years ago. Her sister passed away at the age of 65 from metastatic ovarian cancer, originating in the breast. The mother has not been genetically tested to see if there are any BRCA or other gene mutations. The daughter was tested but nothing significant was found.

Mrs X first presented to the clinical setting through a routine mammogram screening clinic in November 2017. She received a phone call a week later asking her to come back to the clinic as they had found changes in the mammogram from her last routine check three years before. She arrived at the clinic and as a result of her family history asked if it could be cancer, only to be told that it didn't appear to be anything to worry about as it was only 20mm in size. They took a biopsy which later revealed pre-cancer cells. Radiotherapy was recommended to shrink the lump and no chemotherapy was needed.

In January 2018, she was admitted to have a lumpectomy to remove the lump and was warned that 20% of patients require further surgery. In theatre it was realised that the lump was in fact 41mm. After the operation, further imaging revealed another lumpectomy would be needed. Again, she was warned that there was a 20% chance that further surgery would be required but agreed that this was the best decision going forward. After the next lumpectomy they realised that the cancer cells were still present in the breast tissue.

Mrs X then decided to undergo a left sided mastectomy to excise the area of abnormality. She was commenced on Anastrozole before undergoing surgery in May 2018. Anastrozole is an aromatase inhibitor and therefore prevents the conversion of androgens to oestrogens, and is used as an anti-breast cancer treatment.²

Mrs X underwent a left nipple-sparing mastectomy and immediate reconstruction using a free abdominal based flap. The mastectomy involved an elliptical incision to excise the previous lumpectomy scars and the underlying breast tissue. Meanwhile, the free abdominal flap was raised containing the skin and subcutaneous fat. This was classified as a deep inferior epigastric perforators (DIEP) flap since these were the vessels that were raised with the flap. In a DIEP flap, no abdominal wall muscle is taken (unlike a transverse rectus abdominis myocutaneous (TRAM) flap, which is also commonly used in breast reconstruction).³ The patient underwent a resection of the most medial part of the third rib cartilage, to reveal the underlying internal thoracic (or mammary) vessels. Cutting away the fibrous tissue surrounding this vessel allowed the surgeon to then anastomose the free flap onto these vessels.

The operation was a success and the flap remained well perfused in the days after the procedure. This was confirmed by the use of an external doppler device, which indicated adequate perfusion of the flap. She had a good urine output and her abdomen was soft, non-tender on the first day of recovery. The breast was also soft. On day two, she experienced vomiting as a result of patient-controlled

analgesia, which was required for mild abdominal pain. By the third day she had very little tenderness. The only noticeable medications that she was receiving were dalteparin for venous thromboembolism prophylaxis and laxatives for constipation. Six days after the breast reconstruction, Mrs X went home. She was discharged with a plastics dressings clinic appointment to see the breast reconstruction specialist nurses to assess her wounds. She also had an appointment with the consultant surgeon at 6 weeks after the reconstruction as a routine check-up.

Discussion

The operation clearly went as the surgeon would have hoped. It does raise the question as to why a DIEP flap was used rather than a TRAM flap. The TRAM flap used to be the gold standard for reconstructive breast surgery following a mastectomy. However, the DIEP flap has now taken on that status. It is important to start by looking at the key differences between both types of flaps.

There are four types of abdominal based flaps available for reconstruction. First is the pedicled TRAM flap. This involves an elliptical incision over the lower abdomen, in which skin, fat and rectus muscle are harvested and tunnelled up, while still connected to the superior epigastric pedicle vessels. This procedure does not require extensive dissection of the pedicle but is often associated with increased morbidity due to loss of abdominal strength, which may expose the patient to higher risk of bulging and herniation of abdominal contents.

The second option for breast reconstruction flap is the free TRAM flap, which is similar in composition to the pedicled TRAM flap, but the pedicle vessels are the deep inferior epigastric artery and vein. In this operative procedure, there is extensive dissection of the pedicle vessels down to the groin, where they are divided at their origin. This flap of tissue is transferred to the breast and the pedicled vessels are then anastomosed using microsurgery to the internal thoracic (or mammary) artery and vein. While this is a more complex procedure, the results are generally more successful as a free TRAM flap will have a better blood supply than the pedicled TRAM flap. There is also no tunnelling involved in a free TRAM flap, therefore there will be no upper abdominal bulge present.

The third abdominal based reconstructive option is a DIEP flap, which is similar to the TRAM flap, but no muscle is resected as sufficient perforating vessels can be isolated, without disturbing the rectus abdominis muscle. Intermediate between a DIEP flap and a TRAM flap is the muscle-sparing TRAM flap, which is the fourth type of abdominal based flap, where only part of the rectus abdominis muscle is harvested. Resecting less muscle results in reduced donor site morbidity due to reduced risk of herniation, bulging and shorter post-operative recovery time.⁴

There are several studies, which have been conducted that have sought to identify whether TRAM or DIEP flaps are more successful. Nahabedian et al looked at whether there was a difference between DIEP flaps or muscle-sparing free TRAM flaps, paying particular attention to recovery and the physiology of the flap. They used 177 women who had

undergone breast reconstruction. 89 had had a muscle-sparing free TRAM flap (65 unilateral and 24 bilateral), while 88 women had had a DIEP flap (66 unilateral and 22 bilateral). They then followed up on average two years later to identify different factors involved in the healing process. Fat necrosis occurred in 7.1% of muscle-sparing free TRAM flaps and 6.4% of DIEP flaps. Venous congestion occurred in 2.7% of muscle-sparing free TRAM flaps and 4.5% of DIEP flaps. Total necrosis occurred in 1.8% of muscle-sparing free TRAM flaps and 2.7% of DIEP flaps. An abdominal bulge was seen in 4.6% of patients who received a unilateral muscle-sparing free flap and 21% of patients who received a bilateral muscle-sparing free flap. This is compared to 1.5% in patients with a unilateral DIEP flap and 4.5% after a bilateral DIEP flap. They also recorded the ability of the women to perform a sit up. All unilateral DIEP flap patients were able to perform a sit up and 95% of bilateral DIEP flap patients could. 97% of unilateral muscle-sparing free TRAM flap patients could perform a sit up but only 83% of the bilateral muscle-sparing free TRAM flap cohort could.

These results suggest that there are no significant differences in the healing of the flap between muscle-sparing free TRAM flaps and DIEP flaps. This is because there is little difference seen in the percentage of women who have fat necrosis, venous congestion or flap necrosis between the two groups. However, it could be suggested that the abdominal recovery is worse for muscle-sparing free TRAM flaps. While these flaps do not involve removal of the whole rectus abdominis, some of the muscle is still taken. Therefore, the ability to perform a sit up two years on is reduced in the muscle-sparing free TRAM flap group compared to the DIEP flap group and a postoperative abdominal bulge is more commonly seen in the former group as well. While these results may be suggestive of DIEP flaps being better for abdominal recovery, the results were not statistically significant.⁵

Nahabedian et al also conducted another trial comparing DIEP flaps with all free TRAM flaps. However, this trial focused on whether different flaps were better for different patient situations. 118 women received free TRAM flaps, 93 of which were unilateral and 25 of which were bilateral. The DIEP flaps were used on 17 women, of which 14 were unilateral and 3 were bilateral. 7.7% of the free TRAM flaps necessitated return to the operating room, while this was 15% for the DIEP flaps. 3.5% of the free TRAM flaps had total necrosis, whereas this was 5% in the DIEP flaps. Mild fat necrosis occurred in 9.8% of the free TRAM flaps, as opposed to 10% in the DIEP flaps. There was mild venous congestion in 1.4% of the TRAM free flaps and a lower abdominal bulge in 6.8%. Venous congestion and abdominal bulging were not seen in the DIEP flap patients.

Interestingly though, the presence of fat necrosis in both DIEP and free TRAM flaps was related to the patient weight. The ability to perform a sit up post operation was related to both the patient's weight and the patient's age. The only statistically significant factor between the two flap types was that the incidence of abdominal bulge in women post breast reconstruction was lower in the DIEP flap.⁶

Conclusion

Breast cancer is disease that affects 1 in 8 women. Therefore,

screening tests are vital in order to identify such disease at the early stages so that preventative treatments can be used to reduce the chance of a malignancy metastasising. Such treatments include a mastectomy, where the breast tissue is removed to reduce the chance of cancer occurring by 90%.¹ Often breast reconstruction is required using a flap from the abdomen. The literature strongly suggests that a DIEP flap will leave the patient with stronger abdominal muscles and a lower incidence of abdominal bulging. Suitability for a free abdominal based flap is dependant on patient factors such as weight, quantity of abdominal fat and the volume of tissue required to symmetrise the breasts or patient desire. These factors must be taken into account, alongside the surgeon's preference, in order to make an informed decision about which flap suits the patient best.

Conflicts of interest

None.

Funding

None.

Consent

The publication of this study has not been consented by the relevant patient.

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