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# Versatility of the transverse rectus abdominis flap for the reconstruction of large skin defects in breast cancer

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**Abstract:** Objective: To demonstrate the versatility of the transverse rectus abdominis flap in the thoracic reconstruction after the mastectomy for locally advanced breast cancer. Method: Two clinical cases are described between July and September 2022 with locally advanced breast cancer, which met the inclusion criteria. Results: The patients evolved satisfactorily at 30 postoperative days with a good aesthetic and functional result. The clinical case number 1 presented epidermolysis, fat necrosis, and dehiscence as a complication, with the subsequent resolution and follow-up. Conclusion: The transverse rectus abdominis muscle cutaneous flap is widely described for the breast reconstruction but not for the thoracic reconstruction, the latter option being an excellent choice for the reconstructions with autologous tissue, generating coverage of large defects without tension and with an acceptable aesthetic result; thus obtaining good coverage of the chest wall in the large chest defects.

**Key words:** cancer; flap; muscle cutaneous; abdominal rectus; reconstruction; breast

## 1 Introduction

For women, the mammary gland represents a symbol of femininity, fertility, and sexuality, which is why large oncological resections have an impact on these patients' self-esteem and quality of life. Thoracic integrity plays a fundamental role, which is why there is a need for adequate coverage of these defects, especially when the patient is indicated for adjuvant radiotherapy after mastectomy [1]; hence the importance of timely chest reconstruction, a procedure that would have a positive impact on the patient's self-esteem and quality of life while avoiding delays in adjuvant treatment, thus reducing the chances of relapse and disease progression [2].

However, breast reconstruction poses a challenge for plastic and reconstructive surgeons, especially when large breast defects are present. Currently, several surgical techniques are available for breast reconstruction: breast implants, breast tissue expanders, local flaps (such as the thoraco-epigastric flap), deep inferior epigastric perforator (DIEP) flap, latissimus dorsi muscle-skin flap, and transverse rectus abdominis myocutaneous (TRAM) flap, the latter first described in 1982 by Hartrampf et al. [3].

Forty years after its initial description, the pedicled TRAM flap remains an important pillar in autologous breast reconstruction. Its main advantage, which has been widely described, is the coverage of large defects and the good breast volume it provides [3].

The focus of this article is to demonstrate the usefulness of the TRAM flap in the thoracic reconstruction of large

post-mastectomy defects.

## 2 Method

Descriptive study, based on prospective research and a clinical case study. The descriptive nature of the study delves into the particularities of a group of subjects and areas of interest [4] in this specific work, inherent to thoracic reconstruction in two [2] patients, in order to document the behavior and evolution of the medical phenomenon.

With regard to clinical case studies, the individuals in this case are people who, using surgical techniques accredited by the scientific and academic community in the field of medicine, were treated to improve their physical, psychological, and sociological conditions [5]. Initially, the prospective modality contributes to the progress of the participants through observation and evaluation.

Both patients received neoadjuvant treatment, and one [1] of the patients had bilateral invasive ductal carcinoma. The cases were discussed in a multidisciplinary meeting with the breast pathology and plastic and reconstructive surgery departments.

Inclusion criteria

§ Female patients between the ages of 30 and 50.

§ Patients diagnosed with locally advanced breast cancer.

§ Patients who agree to participate in the study and sign the informed consent form.

§ Patients with a medical history at the Padre Machado Cancer Hospital.

Lxclusion criteria

§ Patients who do not meet the inclusion criteria.

§ Patients with hematological diseases affecting microcirculation.

§ Heavy smoking.

§ Previous surgeries (Pfannenstiel incision).

§ BMI >30 kg/$m^2$.

2.1 Transverse rectus abdominis myocutaneous flap

This is a type III flap according to the Mathes and Nahai classification [6], as it has two dominant vascular pedicles. Its upper pedicle comes from the superior epigastric artery, a direct branch of the internal mammary artery. Its lower pedicle comes from the deep inferior epigastric artery, a branch of the external iliac artery.

The vascularization of the dermal fat tissue comes from perforating musculocutaneous vessels that cross the anterior rectus sheath and penetrate the subcutaneous cellular tissue, with the highest concentration in the peri-umbilical region.

Prior to surgery, the patient is marked while standing. The anatomical landmarks are marked: the midline, anterior axillary line, xiphoid process, costal margin, anterior superior iliac crests, rectus abdominis, and lower pedicle entrance. The skin island is then marked, depending on the size of the defect. To mark the skin island, a line is drawn from the umbilical scar to both iliac crests and from there a straight line to the pubic symphysis. This island is divided into four segments and numbered according to the zones described by Hartrampf et al. [3] (Figure 1).

2.2 Surgical technique

Case 1

Under general inhalation anesthesia, operating room protocol, the first surgical stage was performed by the breast pathology service, consisting of a modified Madden right radical mastectomy, resulting in a 25 cm x 22 cm defect (Figure 2). In the second stage, the skin was incised in a supra-abdominal buttonhole incision down to the pubis with the fat beveled upward in order to preserve the maximum number of peri-umbilical perforators. The incision was made from

lateral to medial until reaching the rectus sheath, dissected superiorly until reaching the costal margins and xiphoid process, creating a subcutaneous tunnel (Figure 3), which subsequently allowed the passage of the flap. An incision was then made just in the midline of the left rectus sheath. At the lower level, the deep inferior epigastric artery was located and ligated. The rectus abdominis muscle was immediately detached and released at its lower end for transfer to the defect. A buttonhole incision was made in the umbilical scar to preserve its irrigation and avoid detachment. The flap was then lifted, and a Greek guard suture was performed with 3-0 polyglactin 910 in the rectus muscle to achieve hemostasis. The donor area was initially closed with a polypropylene mesh anchored to the remaining aponeurosis. An aspiration drain is placed, the dermal-fat flap is initially synthesized with cardinal points, the location of the horizontal scar is marked, and a horizontal incision is made to attach it to the dermal-fat flap (Figure 4).

In the breast region, after passing the myocutaneous flap, a round block is performed in order to reduce the size of the defect and make it circular. The suction drain is placed, and then the flap is fixed with polyglactin 910 2-0 from the muscle to the fascia, then subcutaneous tissue, subdermis, and skin. It is covered with paraffin gauze, gauze, and micropore adhesive.

Case 2

Under general inhalation anesthesia, operating room protocol, first surgical stage performed by the breast pathology service, a modified Madden radical mastectomy is performed on the right side plus a Forrest radical mastectomy on the left side, resulting in a 16 cm x 11 cm defect in the right breast. and a 20 cm x 19 cm defect in the left breast. The skin is incised in a supra-abdominal buttonhole incision down to the pubis with the fat beveled upward in order to preserve the maximum number of peri-umbilical perforators. The incision was made from lateral to medial until reaching the rectus sheath, dissected superiorly until reaching the costal margins and xiphoid process, creating a subcutaneous tunnel that would later allow the passage of the flap. An incision is then made right in the midline of the sheath of each rectus muscle at the lower level, and the deep inferior epigastric artery on each side is located and ligated. The rectus abdominis muscle is then detached and released at its lower end bilaterally for transfer to the defect. A buttonhole incision was made in the umbilical scar to preserve its irrigation and avoid detachment, and both myocutaneous flaps were elevated. A Greek guard suture was performed with 3-0 polyglactin 910 to achieve hemostasis, and the donor area was initially closed with a mesh of polypropylene anchored to the remaining aponeurosis. An aspiration drain is placed, the dermal-fat flap is initially synthesized with cardinal points, the location of the horizontal scar is marked, and a horizontal incision is made to attach it to the dermal-fat flap.

In the breast region, after passing the myocutaneous flap, a round block is performed in order to reduce the size of the defect and make it circular. A suction drain is placed, and then the flap is fixed with polyglactin 910 2-0 from the muscle to the fascia, subcutaneous cellular tissue, subdermis, and skin. It is covered with paraffin gauze, sterile gauze, and micropore adhesive.

## 3 Clinical histories

Case 1

A 44-year-old female patient who reports the onset of her current illness in August 2019, presenting with a palpable lump in her right breast, for which she visits her doctor. After radiological studies and a core needle biopsy (10/25/2019) and negative studies for distant disease, she was classified as: grade II T4BN1M0 stage IIIB invasive ductal carcinoma; HER2 tumor phenotype. Neoadjuvant treatment and subsequent surgical resolution were decided upon.

She received neoadjuvant chemotherapy with adriamycin plus cyclophosphamide for 4 cycles, followed by paclitaxel for 4 cycles (she completed only two cycles due to an adverse reaction: hypotension, urticaria, and phlebitis on 11/26/2020)

and docetaxel for 4 cycles is indicated, followed by trastuzumab (14 cycles), gemcitabine plus carboplatin for 6 cycles. In view of local progression (increase in tumor size) during the pandemic period, a third line of treatment with capecitabine for 6 cycles is indicated.

Figure l. Preoperative marking clinical case 1


Figure 2. Clinical case 1. Intraoperative, defect after oncological resection

Figure 3. Clinical case 1. Intraoperative, subcutaneous tunnel to the xiphoid process and costal margin

Figure 4. Clinical case 1. Intraoperative, elevation of the myocutaneous flap

Figure 5. Final surgical specimen (modified radical mastectomy)

A Madden-type modified radical mastectomy was performed on the right breast on July 11, 2022 by the breast pathology service, followed by immediate reconstruction with a contralateral transverse rectus abdominis myocutaneous

flap by the plastic surgery service. The patient progressed satisfactorily during the first 72 hours, however, epidermolysis developed (Figure 6), which progressed to fat necrosis and dehiscence on the seventh postoperative day, with dehiscence of the lateral edge of the flap. A culture was taken, daily dressings were applied, the wound was debrided, and the edges were approximated with 3-0 nylon (Figure 7), with complete wound healing 35 days postoperatively (Figure 8).

A biopsy of the surgical specimen was received with a postoperative diagnosis of invasive ductal carcinoma, ypT4BN2M0. The patient was referred to the Medical Oncology and Radiotherapy service, with subsequent follow-up by the Breast Pathology, Plastic and Reconstructive Surgery, and Medical Oncology services.

Figure 6. Clinical case 1. Postoperative 72 hours, epidermolysis of the lateral edge of the flap

Figure 7. Postoperative 12 days, debridement plus synthesis of lateral edge of flap (ambulatory operating room)

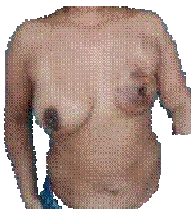

Figure 8. Clinical case 1. Postoperative 35 days

Clinical case 2

42 year-old female patient admitted to the SOH in November 2021 with a diagnosis of synchronous bilateral breast cancer: 1. Adenocarcinoma of the right breast cT4bN1M0. 2. Adenocarcinoma of the left breast T4bN1M0 Luminal A. She was referred to the Medical Oncology Service, which began treatment with neoadjuvant chemotherapy: adriamycin and cyclophosphamide 4 cycles + 12 cycles of paclitaxel from December 28, 2021, to May 2, 2022.

Discussed in a multidisciplinary meeting and surgically intervened on August 22, 2022, where a right Madden modified radical mastectomy and left Forrest modified radical mastectomy were performed, placement of a port catheter plus immediate reconstruction with bilateral TRAM unipedicle myocutaneous flap (Figure 10).

Postoperative diagnosis: synchronous bilateral invasive ductal carcinoma: 1. Right breast cancer, ypT2N2aM0, ST IIIB 2. Left breast cancer, ypT4bN2aM0, stage IIIB. Referred to medical oncology and radiotherapy services, with follow-up by the Breast Pathology, Plastic and Reconstructive Surgery, and Medical Oncology services.

Clinical case 2: patient progresses without complications 19 days postoperatively (Figures 12-14).

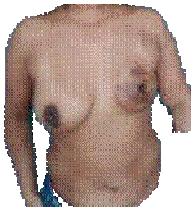

Figure 9. Clinical case 2. Preoperative

Figure 10. Clinical case 2. Intraoperative: right Madden-type radical mastectomy defect measuring 16 cm x 11 cm, left Forrest- type modified radical mastectomy defect measuring 20 cm x 19 cm

Figure 11, 12. Clinical case 2. Immediate postoperative period

Figure 13, 14. Clinical case 2. Postoperative 27 days

## 4 Discussion

In 1979, Holmström [7] first described a free abdominal musculocutaneous flap for breast reconstruction. In the same year, Robbins [8] described the same flap, but in a pedicled form, which was later popularized by Hartrampf et al. [3] in 1982 with their publication in *Plastic and Reconstructive Surgery* as the transverse rectus abdominis muscle flap, abbreviated as TRAM. In the same year as Hartrampf et al. [3], Gandolfoy et al. [9], an Argentine plastic surgeon, published his version of the TRAM in the *British Journal of Plastic Surgery*.

The TRAM flap is a type of reconstruction that is rarely used worldwide. It is widely described for breast reconstruction, which has continuously evolved. It was formerly designed on the rectus muscle contralateral to the affected breast or chest wall, but it has now become clear that ipsilateral rotations are as easy to design as contralateral rotations, and that the ipsilateral design creates less perixiphoid protrusion [10].

The ipsilateral unipedicle TRAM flap allows for less tension on the pedicle than the contralateral TRAM flap, as well as generating a fold over the muscle itself, which prevents venous congestion. Another advantage is that the thickest portion of the skin flap at the peri-umbilical level remains at the lower pole, generating greater projection of the upper pole [9]. This is related to what was described by Robins [8], where the greatest distal necrosis of the flaps occurs in the contralateral flaps, which was evident in our case.

In the work of Casado et al. [11] on DIEP flaps, as well as in that of Román et al.[12] on TRAM flaps, post-mastectomy reconstructions were performed at a later date, meaning that the defects were initially closed by direct closure. This differs from our study, in which the two patients underwent immediate reconstruction due to the impossibility of direct closure given the size of the resulting defects.

We can see how, in comparative studies of thoracic reconstruction techniques, the TRAM flap, as published by Yueh et al. [13], is a useful and accessible option for breast reconstruction with no difference in satisfaction when compared to other techniques such as the DIEP flap. This type of technique has also been described and used in other centers as a common tool for thoracic reconstruction [14].

Delays and interruptions in adjuvant treatment decrease the overall survival of patients. Even the number of days of interruption is confirmed as an independent prognostic factor for disease progression, regardless of tumor size and lymph node involvement, as reported by González et al. [2].

The pedicled TRAM flap, whether unilateral or bilateral, is an effective autologous tissue reconstruction option for the chest, providing good coverage of the chest wall in large defects, while also providing breast volume and projection, directly improving the patient's self-esteem and quality of life, and avoiding delays in adjuvant treatment by generating myocutaneous coverage over the chest defect. an obvious benefit for patients with locally advanced breast cancer who require adjuvant radiotherapy.

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## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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