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Original Research Article

Algorithm postmastectomy breast reconstruction secondary to breast cancer in a reference center in Mexico City

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ABSTRACT

Background: Postmastectomy breast reconstruction represents a challenge for the plastic surgeon. Contemporary techniques offer numerous options, the reconstructive procedure performed depends on the individual profile of each patient, but will also be influenced by the surgeon's preoperative analysis of their individualized risk profile.
Methods: Descriptive, longitudinal, and retrospective study. The reconstructed patients with breast cancer sequelae in the period from May 2023 to May 2024 were included. Based on the review of the literature and the experience of our center, a proposal for a breast reconstruction algorithm was formulated to standardize the ideal surgical treatment according to the case.
Results: 119 patients were reconstructed using the algorithm to decide the ideal surgical management. Breast reconstruction was performed in 3 stages: the first stage [1st BRS] (119 patients) consisted of a tissue expander, breast implant ± acellular dermal matrix or autologous pedicled flaps after the mastectomy; in the 2nd BRS (68 patients) the expander was replaced with an implant with or without contralateral symmetrization; and finally in the 3rd BRS (18 patients), the reconstruction of the nipple-areola complex ± neurotization, autologous fat transfer and scar remodeling was performed.
Conclusions: The algorithm proposed in this paper provides a guide for making decisions about ideal surgical management according to the clinical characteristics of each subgroup of patients to be reconstructed, improving results by making them reliable and predictable, which positively impacts patient's quality of life.

Keywords: Breast cancer, Breast reconstruction, Alloplastics, Flaps

INTRODUCTION

In Mexico, according to statistics from the Global Cancer Observatory (GLOBOCAN) 2022, the incidence of new cancer cases was 195,499 of which 29,929 (15.3%) were breast cancer, which ranked first. In turn, the National Health and Nutrition Survey (ENSANUT) 2022 reported a national incidence of 27.64/100 000 inhabitants ≥20 years, with a mortality of 7,888 cases, which represents 9.0%. Of these cases, 99.4% occurred in women (7,838) and 0.6% occurred in men (50).[1,2]

With an increasing number of women diagnosed with breast cancer and increasing survival, it is essential to keep reconstructive surgical management up to date. All women undergoing a mastectomy should be counselled about their breast reconstruction options.

Breast reconstruction techniques can be grouped generically according to whether they are based on the use of alloplastic materials (breast expanders and implants), whether they use only autologous tissues or a combination of both. The decision to perform one or the other will depend on a series of factors such as the presence of

radiotherapy (RT), physical characteristics, preferences and expectations of the patient, preference, and experience of the surgeon, and availability of the appropriate infrastructure in the hospital.[3-5]

The timing of breast reconstruction is classified into two types: immediate and delayed; immediate reconstruction is performed simultaneously with the mastectomy, the advantages include: better aesthetic results because there is no scar, fibrosis, and/or tissue retraction, the inframammary fold is preserved and the skin pocket with the alloplastic returns to its shape and projection natural, which translates into better symmetry with the healthy side; by achieving greater symmetry, the need for surgery in the healthy breast is reduced, with which the reconstruction can be done in many cases in a single time and therefore with a lower economic cost, in addition to the psychological benefit for the patient who at no time during the process sees herself mastectomized.[3-7] However, there are also disadvantages, such as the risk of postoperative necrosis of the skin covering and hardening of the reconstructed breast in case of undergoing radiotherapy. On the other hand, delayed reconstruction is performed weeks, months, or years after the mastectomy and adjuvant treatments. The advantages described are the possibility of completing the histopathological study, and therefore defining the need for adjuvant treatment before reconstruction, avoiding the problems associated with radiotherapy, both in a reconstruction with alloplastics and with autologous tissues, and the complications related to the vascular suffering of mastectomy flaps; disadvantages include the need for a greater number of surgeries, as well as scarring, fibrosis, and skin retraction after radiotherapy.[3-9]

The objective of our study is to propose an algorithm, based on the evidence and clinical experience of a national reference center that provides a useful guide for making decisions about ideal surgical management of patients with sequelae of breast cancer according to the clinical characteristics of each subgroup, improving results by making them reliables and predictable.

METHODS

A descriptive, longitudinal, and retrospective study, in which the clinical records of patients treated for breast cancer sequelae in the Plastic and Reconstructive Surgery service at the Breast Diseases Institute (FUCAM AC-CDMX) in the period from May 2023 to May 2024. The study was approved by the institutional review board (IRB) and informed consent was obtained from each patients.

Inclusion criteria comprised complete medical records of adult patients treated at this hospital with a diagnosis of breast cancer sequelae. Exclusion criteria included medical records of adult patients with a diagnosis of breast cancer sequelae with incomplete records or lacking necessary information.

The sample size for this study was determined by including all patients with a diagnosis of breast cancer sequelae who received treatment at our hospital. In this approach, the entire population of patients with breast cancer sequelae at the specified hospital was considered, eliminating the need for a specific sample size calculation.

Information was collected from patient records on the electronic system. We analyzed the demographic data, clinical characteristics, surgical treatment, evolution, and complications.

A descriptive analysis of the variables was conducted using measures of central tendency (mean, median) and percentages for qualitative variables.

Based on the review of the world literature and the experience of our center, a proposal for a breast reconstruction algorithm was formulated that includes the clinical variables to be considered in a patient with breast cancer sequelae, to standardize the ideal surgical treatment according to the case.

RESULTS

The study included 119 patients who were candidates for breast reconstruction by the Plastic and Reconstructive Surgery Service; 100% were women, in the age range of 26 to 78 years (mean: 49 years). Right breast cancer was the most prevalent with 57 cases (47.89%) versus 50 patients with left breast disease (42.01%) and 12 bilateral cases (10.10%). Of the total new cases, 76 (63.86%) 76 (63.86%) previously underwent total mastectomy with lymphatic mapping and sentinel lymph node dissection (SLND); 24 (20.17%) underwent total skin- and nipple-sparing mastectomy with SLND, and 19 (15.97%) of deferred cases had a history of modified radical mastectomy (MRM) ± radical axilla dissection (Table 1).

In general, breast reconstruction is performed in 3 stages: the first stage [1st BRS] (119 patients) consists of the placement of a tissue expander, breast implant ± acellular dermal matrix or autologous pedicled flaps after the mastectomy; in the second stage [2nd BRS] (68 patients) the expander is replaced with an implant with or without contralateral symmetrization; and finally in the third stage [3rd BRS] (18 patients) the reconstruction of the nipple-areola complex ± neurotization, autologous fat transfer, and scar remodeling is performed.

We describe the proposed breast reconstruction algorithm used as a guide in our reference center for making decisions about the ideal surgical management according to the clinical characteristics of each subgroup of patients (Figure 1).

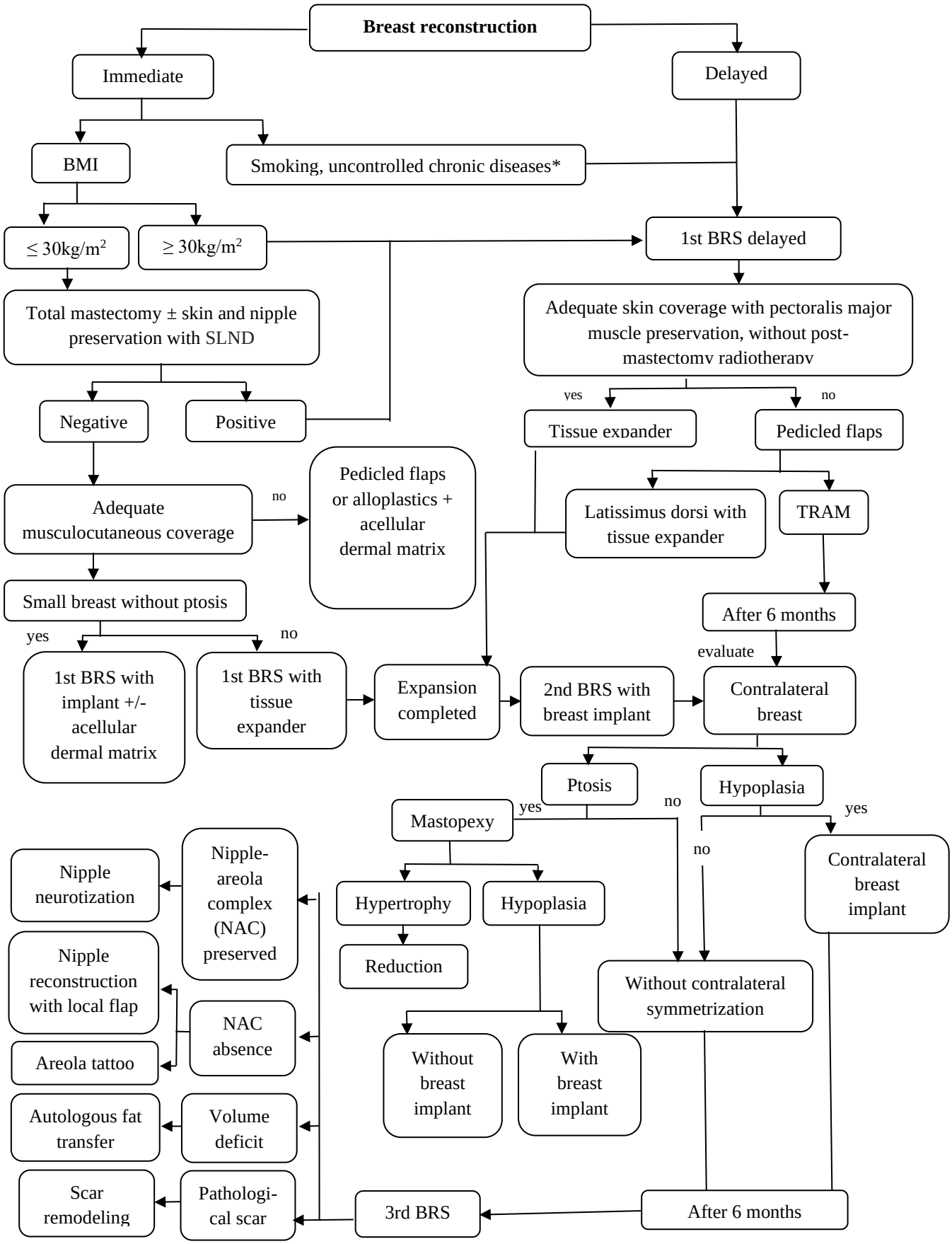

Figure 1: Algorithm postmastectomy breast reconstruction secondary to breast cancer.
*Diabetes mellitus, systemic arterial hypertension, hypothyroidism, autoimmune diseases

Table 1: Demographic characteristics and results.

Demographic characteristics	N	Percentages (%)
Gender		
Women	119	100
Men	0	0
Breast cancer side		
Right	57	47.89
Left	50	42.01
Bilateral	12	10.10
Type of mastectomy		
Mastectomy with lymphatic mapping and sentinel lymph node dissection (SLND)	76	63.86
Total skin- and nipple-sparing mastectomy with SLND	24	20.17
Modified radical mastectomy (MRM) ± radical axilla dissection	19	15.97
Breast reconstruction stage		
First	119	100
Second	68	57.14
Third	18	15.12

DISCUSSION

Breast reconstruction is a key factor in improving the quality of life after mastectomy, however, subsequent complications can cause significant morbidity. This is why selecting the ideal surgical procedure and timing for each patient plays a crucial role in achieving good results with a lower rate of complications in the short and long term.[3-5]

McCarthy et al studied the probability of developing complications in expander/implant reconstructions and found that smoking, obesity, hypertension, and age over 65 years are independent risk factors for perioperative complications after breast reconstruction. There is controversy as to whether obesity is a contraindication for immediate breast reconstruction; it has been seen that it is not, however, these patients have a higher risk of suffering complications.[10] As previously described, Hou et al in a comparative study, observed that obesity is significantly associated with higher rates of post-reconstruction infections, wound, and perfusion complications, which then leads to higher total and complication-related healthcare costs among obese patients.[11,12]

On the other hand, it is important to remember that the indications for post-mastectomy radiotherapy are currently expanding; radiotherapy induces tissue damage that can be classified as acute or chronic. The spectrum of acute injury includes erythema, edema, scaling, hyperpigmentation, and ulceration. The chronic lesion involves skin atrophy, dryness, telangiectasia, depigmentation, and dyschromia. In the breast, it causes chronic fibrosis of the skin and subcutaneous tissue, this risk factor has been described in multiple studies that negatively affects the results and increasing complications more than any other in implant-based reconstruction.[13]

Based on the evidence, in the first evaluation appointment at the Plastic and Reconstructive Surgery service of a patient with breast cancer, a clinical history is taken in which the main questions are: the current phase reconstruction, age, smoking, treatment, and control of comorbidities (diabetes mellitus, systemic arterial hypertension, hypothyroidism and autoimmune diseases), previous surgeries, surgical and medical treatment proposed or previously done by the oncology service emphasizing radiotherapy as an adjuvant treatment, as well as preferences and patient expectations. Subsequently, a directed physical examination is performed, in which the body mass index (BMI), and characteristics of the breast with cancer and the contralateral breast are relevant, highlighting the quality of the skin, musculocutaneous coverage, nipple-areola complex, ptosis, hypoplasia, hypertrophy, and asymmetries, as well as soft tissues and scars in the chest, back and abdomen.

Considering all the history and clinical variables mentioned previously, the decision is made to perform immediate versus delayed reconstruction. The criteria for a patient to be a candidate for first-stage immediate 1st BRS (100 patients; 84.03%) are: normal BMI (≤30 kg/m^2), comorbidities treated and controlled, not being a smoker, as well as negative result in the SLND in the intraoperative study of the mastectomy (Figure 2).

Figure 2: Patient underwent total skin- and nipple-sparing mastectomy with negative SLND + immediate 1st BRS with bilateral tissue expanders, (A) pre-surgery, breasts with hypoplasia without ptosis; and (B) 1 year postoperative after 2nd BRS with implant.

On the other hand, patients with a high BMI (≥30 kg/m^2), untreated and/or controlled comorbidities, smokers, a positive SLND result in the intraoperative study of the mastectomy, and a history of radiotherapy are candidates for delayed 1st BRS (19 patients; 15.96%).

The next step is determining the best reconstructive surgical option for the patient. Breast reconstruction techniques can be using alloplastic materials (breast expanders and implants), autologous tissues, or a combination of both.

Prosthetic reconstruction was first described by Cronin and Gerow in 1963, silicone gel breast implants have been used primarily in delayed reconstruction, their use in immediate reconstruction after a mastectomy was also described in the 1970s. The situation changed in 1982 when Radovan reported the use of tissue expanders, which are placed in the breast after mastectomy and gradually expand to elongate the musculocutaneous coverage, this has greatly contributed to expanding the indications for the use of silicone gel breast implants for breast reconstruction.[5-8]

Options for breast implant or tissue expander coverage include full submuscular coverage with the pectoralis major, pectoralis minor, serratus anterior, and rectus abdominis fascia; this coverage is resistant to problems such as necrosis of the mastectomy dermo-epidermal flap. However, there are disadvantages, such as lower pole insufficient expansion of the breast and pain during expansion. Recently, the use of scaffolds for full submuscular coverage has been described. Such scaffolds include absorbable materials and biological materials such as acellular dermal matrices that are mainly used to cover the inferolateral portion. However, the use of scaffolds increases costs as well as risks of infection and seroma, therefore caution should be taken.[7,15]

Autologous tissue has long been considered the cornerstone of radiated tissue breast reconstruction. Compared to implant reconstruction in the setting of prior radiation, the risk of reconstructive loss is reduced by 92%. This group of techniques has the great advantages of the absence of foreign bodies and the elimination of potential complications associated with the use of implants. On the other hand, the transferred tissue behaves more in line with the evolution and variations of weight and the consistency of the reconstructed breast is more natural than that obtained with implants. As disadvantages, reconstruction with flaps is technically more difficult, requires longer operating time, there is morbidity in the donor area and generally also requires longer hospitalization and recovery time.[13-16]

In 1982, Hartrampf et al described breast reconstruction using a transverse rectus abdominis myocutaneous flap (TRAM), which has been the technique of choice for autologous breast reconstruction in many centers; the main disadvantage of the TRAM flap is the weakness it produces in the abdominal wall with the potential risk of functional limitation and development of hernias. In 1989, Koshima and Soeda reported that a skin flap could be obtained from the deep inferior epigastric artery without sacrificing the rectus abdominis muscle. This skin flap, known as the deep inferior epigastric artery perforator flap (DIEP), has gained popularity in the field of breast reconstruction and currently represents the most widely used flap in breast reconstruction, however, it requires a microsurgical learning curve, and the appropriate equipment and infrastructure to make it.[6,13,14]

The latissimus dorsi flap was first described as a myocutaneous flap by Tansini in 1906. It is indicated mainly in patients with poor-quality local tissues, mainly after receiving radiotherapy. This technique provides good-quality muscle and skin on the back, but it is almost always necessary to add a prosthesis to achieve the appropriate volume. Other flaps used for breast reconstruction are the superficial inferior epigastric artery free flap (SIEA), superior gluteal artery (SGAP)/inferior gluteal artery perforator (IGAP) flap, and lumbar artery perforator flap. These flaps are alternatives when the abdominal flap or latissimus dorsi flap cannot be used for some reason.[4,13,14]

Taking into consideration the evidence and experience, in immediate reconstructions after mastectomy, the vascular status of the dermo-epidermal flaps, the pectoralis major muscle integrity, as well as the presence of ptosis and the size breast to be reconstructed are clinically evaluated; if there is adequate coverage and in small-sized breasts without ptosis or with a low degree of ptosis, the placement of a round or anatomical microtextured submuscular implant with acellular dermal matrix (3 patients; 3%) (Figure 3) or without acellular dermal matrix is performed (2 patients; 2%); otherwise, when there are significant size changes, very big or very small native breast volumes, asymmetry, or if the vascularity of the skin coverage is deficient, as occurs in the majority of cases in our center (92 patients; 92%), a submuscular tissue expander is placed; in selected cases, it is assessed whether the patient has breast hypertrophy and it can be complemented with reduction mastopexy. One month postoperatively, expansion begins with monthly outpatient sessions until approximately 120% (overexpansion) of the desired breast volume. The duration of this stage is determined by the size expander and the soft tissue permissibility of the treated breast, as well as the characteristics of the contralateral breast to achieve symmetry, the main is 6 months. In special cases of aggressive tumors such as phyllodes tumors that invade the pectoralis major muscle, require adjuvant therapy, or present a significant coverage defect, autologous flaps are chosen, in the first instance the latissimus dorsi myocutaneous flap (3 patients; 3%).

Delayed reconstructions are generally based on autologous pedicled flaps such as the latissimus dorsi myocutaneous flap with tissue expander (11 patients; 57.89%) (Figure 4) and the TRAM flap (3 patients; 15.78%) (Figure 5). Appropriate flap selection is multifactorial and based on patient and oncologic factors. These factors include patient comorbidities, body habitus/donor tissue availability, cancer stage, and the need for postoperative adjuvant radiotherapy, as well as the risk of cancer in the contralateral breast.

Figure 3: Patient with an adequate vascular status of the dermo-epidermal flaps and integrity of the pectoralis major muscle after a total skin- and nipple-sparing mastectomy with negative SLND, (A) pre-surgery, small breasts without ptosis; and (B) 3 months postoperative after 1st immediate BRS with submuscular implants + acellular dermal matrix.

Figure 4: Patient with a history of left MRM + RT and right total mastectomy without RT, (A) pre-surgery, absence of right breast with adequate musculocutaneous coverage; absence of left breast with poor musculocutaneous coverage as a sequel to RT. 1st BRS was performed with right delayed expander and latissimus dorsi flap with left expander; and (B) 15 days postoperative after 3rd BRS of bilateral NAC.

In selected cases of patients with mastectomy sequelae, but have adequate dermo-epidermal flaps and pectoralis major muscle preservation, without a history of radiotherapy; they are offered the option of a tissue expander (5 patients; 26.31%) and the same expansion protocol is followed as patients with immediate reconstruction (Figure 4).

Once the tissue expansion is completed or after 6 months of the reconstruction with an autologous flap, the second stage of breast reconstruction is performed with the removal of the tissue expander and implant placement (68 patients) in the mastectomized breast; according to contralateral breast characteristics and the patient's preferences, it may or may not be complemented with symmetrization, so it is necessary to evaluate the contralateral breast. Based on its characteristics, we have 4 options: do not perform contralateral symmetrization, in cases of adequate size breast without ptosis or the patient's lack of desire for surgery on the healthy breast (10 patients; 14.70%); implant placement in the contralateral breast (13 patients; 19.12%), in case of having a hypoplastic breast without ptosis; periareolar or inverted T mastopexy with implants (7 patients; 10.29%), in breasts with hypoplasia and ptosis (Figure 6); and periareolar or inverted T mastopexy without implants (38 patients; 55.89%) in cases with ptosis, optimal breast volume and/or no desire for implant placement by the patient.

Figure 5: Patient with a history of right MRM + RT, (A) pre-surgery, absence of right breast with poor musculocutaneous coverage as a sequel to RT, without desire for symmetrization; and (B) 6 months postoperative after delayed reconstruction with TRAM.

Figure 6: Patient with a history of total mastectomy with negative SLND + 1st immediate BRS with tissue expander, (A) Pre-surgery, breasts with hypoplasia and ptosis; and (B) 15 days postoperative after 2nd BRS with mastopexy with contralateral implant.

The process culminates with the third stage of reconstruction (18 patients), which occurs approximately 6 months after the last surgical procedure. This includes nipple reconstruction, a simpler procedure from a technical perspective but considered among the most important from an aesthetic perspective. The creation of the nipple-areola complex will allow the reconstructed breast mound to truly resemble the natural breast. Among the options are the composite nipple graft, local dermo-epidermal flaps with skate, star, CV, CH, arrow, double-opposed periareolar, S, and spiral designs, among others. Furthermore, to improve long-term projection results, the use of cartilage grafts, fat grafts, acellular dermal allografts, alloplastic grafts, and hyaluronic acid have also been described, without consistent long-term results.[4,7,8]

On the other hand, the main challenges of areola reconstruction are recreating the pigmentation and texture typically associated with a native areola. The most commonly used techniques involve the use of skin grafts, tattoos, and/or a combination of these two techniques. The skin graft is preferably performed immediately or at the time of nipple reconstruction. Tattooing usually occurs 6 to 8 weeks after nipple reconstruction.

Fat grafts are used in breast reconstruction to correct depressed deformities, fill volume deficits, and improve asymmetry. The retention of a fat graft is greatly influenced by the condition of the graft bed and the purified fat, with integration rates ranging between 20 and 80%.[4]

Management must be individualized; in patients with the absence of the nipple-areola complex (13 patients; 81.25%), reconstruction of the nipple is performed with a local flap, the most used are the CH flap (7 patients; 53.84%), and the star flap (6 patients; 46.15 %) with a high safety profile and long-term projection, to improve satisfaction results, sensory neurotization can be performed (1 patient; 5.55%). At 3 months postoperatively, reconstruction of the areola with tattoo is suggested, since it is the option that presents the lowest risk of complications and high long-term satisfaction rates (Figure 7). Other procedures performed at this stage are autologous fat transfer (16 patients; 88%), generally in the upper pole to have a better cleavage, symmetry, and transition from the reconstructed breast to the thorax; if there is pathological scar such as keloid or hypertrophic scars, once there is no improvement after the application of intralesional steroids, massage and silicone sheets, they are remodeled (3 patients; 16.66%).

In the postoperative period, follow-up is after 10 days to remove sutures and drains, then after one month, 3 months, 6 months, and annually. During the reviews, the quality and vascularity of the reconstructed tissues, healing, the status of the implants and/or tissue expanders, as well as complications are evaluated; among which are the implant and/or tissue expander exposure (6 patients; 5.04%), which imply the need to remove the alloplastic material; hematoma requiring drainage (1 patient; 0.84%) vascular suffering from autologous flaps that leads to their remodeling (1 patient; 0.84%), pathological scars (5 patients; 4.20%) that require the application of sheets silicone, intralesional steroids and/or remodeling.

Figure 7: Patient with a history of total mastectomy with negative SLND + reconstruction with alloplastics and contralateral symmetrization without implant. A-B) 6 months postoperative after 3rd BRS with local nipple flap in CH + right areola tattoo.

Limitations

The retrospective nature of the study design poses inherent challenges, including potential selection bias and incomplete documentation in medical records. The reliance on data from a single institution and the short follow-up may limit the generalizability of the findings to a broader population.

CONCLUSION

Postmastectomy breast reconstruction represents a challenge for the plastic surgeon. Contemporary techniques offer numerous options, the reconstructive procedure performed depends on the individual profile of each patient, but will also be influenced by the surgeon's preoperative analysis of their individualized risk profile. The algorithm proposed in this paper, based on the evidence and clinical experience of a national reference center, provides a useful guide for making decisions about ideal surgical management according to the clinical characteristics of each subgroup of patients to be reconstructed, improving results by making them reliables and predictable, which has a positive impact on patient´s quality of life.

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