One-stage breast reconstruction techniques in elderly patients to preserve quality of life

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Abstract. – OBJECTIVE: The aim of this study was to review one-stage breast reconstruction techniques performed in elderly patients at our institution to identify the criteria of selection of each in terms of outcomes and quality of life.

PATIENTS AND METHODS: Patients older than 65 years who underwent one-stage breast reconstruction between January 2004 and July 2014 at our hospital were included. Patients and procedure-related data were collected from the medical records. In particular, patient's age, comorbidities and related ASA physical status, type of one-stage breast reconstruction technique, and criteria of selection were analyzed. Outcomes and results were also evaluated in terms of quality of life using the EORTC QLQ-C30 and -BR23 questionnaires 1 year after surgery.

RESULTS: A total of 840 women underwent breast reconstruction, of whom 138 elderly women received one-stage breast reconstruction. There were 118 cases (85.5%) of monolateral reconstructions and 20 cases (14.5%) of bilateral reconstructions, resulting in 138 breast reconstructions. These were performed with permanent inflatable expanders in the sub-muscular position (Group A, n= 50), with acellular dermal matrix and partial sub-muscular anatomic implant (Group B, n= 50), and with Braxon® acellular dermal matrix and anatomic implant with muscle-sparing technique (Group C, n= 38). The EORTC questionnaires showed the best results in Group C regarding the quality of life.

CONCLUSIONS: The elderly population is rapidly increasing, and 50% of all breast cancers occur in women older than 65 years; among them, only 2% undergo breast reconstruction. A major aspect of breast cancer treatment and subsequent quality of life is the opportunity for a post-mastectomy reconstructive surgery. As survival rates are improving, a larger proportion of patients live with the long-term consequences of their treatment, and breast reconstruction ensures a better quality of life. To increase the reconstruction rates, surgery should be one-stage, less invasive as possible, allowing rapid recovery, especially in elderly women, in whom comorbidities are often present with a higher anaesthetic risk. Our study highlighted that non-skin sparing mastectomy (SSM) and delayed reconstructions should be addressed with Becker implants; immediate reconstructions after SSM should be followed by acellular dermal matrix (ADM)-assisted implant reconstruction, preferring the wrap technique offers a better quality of life in elderly patients.

Key Words:
  Breast cancer, Breast reconstruction, Elderly patient, Quality of life, Acellular dermal matrix, Muscle sparing technique.

Introduction

In developed countries, breast cancer is the most common malignancy in women. It has been reported that > 50% of breast cancer occurs in elderly women[1-3].

Conventionally, the 'elderly' population has been defined as those with a chronological age of ≥ 65 years, with those from 65 to 74 years old being referred to as 'early elderly', and those over 75 years old as 'late elderly'[4].

Almost two-thirds of solid tumours occur in elderly patients[5]. Among them, breast cancer is largely represented, and women aged ≥ 70 years have the highest incidence and mortality rate from breast cancer.

Breast reconstruction after mastectomy in elderly women is considered to be controversial. Although many women older than 65 years are still active, vital, and healthy, they are often discouraged from proceeding with reconstruction after mastectomy by their general surgeon, family, and friends[3,6].

There is a paucity of information in the literature that focuses on quality of life issues after mastectomy with breast reconstructions in elderly women[3]. Otherwise, it has been demonstrated

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that many older patients with breast cancer have received treatments that are not generally considered appropriate care. Fortunately, this behaviour is currently changing, as people are living longer and healthier. Also, the survival rate for breast cancer is also improving in elderly patients; thus, a larger population of patients is living with the long-term consequences of their treatment[3,5]. For this reason, breast reconstruction should also be offered to elderly women to improve their quality of life.

In medical literature, few papers are focused on breast reconstructions in elderly patients, and the reported techniques are usually multi-steps as expander-implant, local, and free flaps[3,5,7]. We believe that to increase the reconstruction rates, surgery should be one-stage, as minimally invasive as possible, and allow rapid recovery. This is especially true in elderly women, in whom comorbidities are often present with a higher anaesthetic risk.

The focus of this paper was to review one-stage breast reconstruction techniques performed in the elderly patients at our institution to highlight the criteria of selection of each technique in terms of outcomes and quality of life preservation in this patient population.

Materials and Methods

Among the women with breast cancer undergoing mastectomy and breast reconstruction in our institution, only patients older than 65 years with one-stage reconstruction between January 2004 and July 2014 were included. Patients undergoing 2 or more stages of breast reconstructions (i.e. free flaps, expander/implant, and lipofilling) were excluded. Patient and procedure-related data were collected from the medical records. In particular, patient's age, co-morbidities and related ASA physical status[8], body mass index (BMI), contralateral breast appearance, eventual adjuvant therapy, type of one-stage reconstruction technique, and criteria of selection were analyzed. All patients were strictly followed up in the first year after surgery.

The occurrence of early postoperative complications, particularly hematoma, seroma, wound breakdown, implant or matrix infection, implant dislocation or rupture, delayed wound healing, and pathological scars was noted.

The occurrence of capsular contractures was assessed during successive follow-up visits using the Baker classification[9] and the mammary compliance scores using the Antoon Paar Mammary compliance system[10].

Breast appearance was also subjectively evaluated by the patients themselves 1 year after surgery using the Visual Analogue Scale (VAS), giving a score from 1 to 10 (1= severe asymmetry between the breasts, 10= excellent symmetry between the breasts). Moreover, an external panel of physicians evaluated the results obtained at the same time intervals with the same scale (VAS), comparing pre- and postoperative images.

The patients' quality of life was measured using standard questionnaires 1 year after surgery: EORTC QLQ-C30 for cancer patients (30 items) and EORTC QLQ-BR23 (23 items) specifically for breast cancer.

The EORTC QLQ-C30 questionnaire consists of 5 domains evaluating the patient's functioning (physical, role, emotional, cognitive, and social functioning) as well as 3 scales to evaluate disease symptoms (fatigue, nausea and vomiting, and pain); the last component is a scale for the self-assessment of quality of life. In addition, the questionnaire includes 6 questions assessing the symptoms (loss of appetite, dyspnoea, insomnia, constipation, and diarrhoea) and financial problems resulting from the disease[11].

The EORTC QLQ-BR23 questionnaire is dedicated to patients treated for breast cancer. It consists of 5 multi-question scales, 2 of which (i.e. body image and sexual functioning) assess the patient's functioning and 3 (i.e. systemic side effects, breast symptoms, and arm symptoms) assess the symptoms. In addition, there are 3 questions concerning the patient's interest in sex, future perspective, and upset from hair loss[12].

Higher scores for the global health status represented better health status. Higher scores in the functional domains represented better functioning in a specific aspect. Higher scores for specific symptoms were interpreted as higher intensity or incidence of such symptoms[11,12].

Results

During the study period, a total of 1,016 breast reconstructions were performed in 840 patients. Of these, 120 were defined as 'elderly patients' aged 65 to 81 years (median: 72 years) who underwent a one-stage breast reconstruction. Immediate reconstructions were performed in 84 patients (70%); the remaining 36 cases (30%)

had delayed breast reconstructions. There were 103 unilateral cases (85.5%) and 17 bilateral cases (14.5%), for a total of 120 single-stage breast reconstructions in the elderly patients.

Considering the physical status and eventual co-morbidities, 42 patients had an ASA II classification (smoker for < 10 years, and/or more than a minimal drinker, and/or obese, and/or well controlled diabetic, and/or with well controlled hypertension, and/or with mild lung disease), and 96 patients had at least 1 coexisting systemic illness configuring the ASA III classification (substantive functional limitations, ≥ 1 moderate to severe diseases, such as in those with implanted pacemaker, moderate reduction of ejection fraction, poorly controlled diabetes mellitus, end stage renal disease undergoing regularly scheduled dialysis, myocardial ischaemia, transient ischaemic attack, and smokers for > 10 years)[8]. Fifty patients (16 ASA II, 34 ASA III) underwent breast reconstructions with anatomical Becker implants (Mentor Corporation, Santa Barbara, CA, USA) in a sub-muscular position (Group A); fifty patients (14 ASA II, 36 ASA III) had breast reconstructions with acellular dermal matrix (ADM) and sub-muscular definitive implants (Group B); twenty (8 ASA II, 12 ASA III) patients underwent breast reconstructions using Braxon® ADM (Medical Biomaterial Products MBP GmbH, DE under the license of DECO med s.r.l., Marcon, Venice, Italy) and final implant with the muscle-sparing technique (Group C).

In Group A, BMI ranged from 23 to 29 kg/m^2 (mean: 25 kg/m^2); breast weight after mastectomy ranged from 180 to 670 g (mean: 280 g). In monolateral cases, 5 cases had a severe ptotic contralateral breast appearance, 25 had a mild ptotic appearance, and 14 had no ptotic appearance; in bilateral cases, the grade of ptosis was severe in 2 cases and moderate in 4. Twenty-eight patients underwent a neoadjuvant chemotherapy with mass tumour reduction, and 39 patients underwent an adjuvant therapy (chemotherapy in 15 patients, radiotherapy in 9, and both therapies in 15).

In Group B, BMI ranged from 23 to 32 kg/m^2 (mean: 27 kg/m^2); breast weight after mastectomy ranged from 190 to 600 g (mean: 260 g). In monolateral cases, 6 cases had a severe ptotic contralateral breast appearance, 28 had a mild ptotic appearance, and 12 had no ptotic appearance; in bilateral cases, breast ptosis was moderate in 2 cases, mild in 1, and absent in 1. Twenty-one patients underwent neoadjuvant chemotherapy, and 36 patients underwent an adjuvant therapy (chemotherapy in 16 patients, radiotherapy in 10, and both therapies in 10).

In Group C, BMI ranged from 24 to 30 kg/m^2 (mean: 27 kg/m^2); breast weight after mastectomy ranged from 160 to 580 g (mean: 270 g). In monolateral cases, 8 cases had a severe ptotic contralateral breast appearance, 4 had a mild ptotic appearance, and 1 had no ptotic appearance; in bilateral cases, breast ptosis was severe in 5 cases, moderate in 1, and mild in 1. Eight patients underwent neoadjuvant chemotherapy and 10 an adjuvant therapy (chemotherapy in 5 patients, radiotherapy in 4, and both therapies in 1).

Considering the technique of one-stage breast reconstruction and the criteria of its selection, the Becker implant in Group A was positioned in a complete sub-muscular pocket (under the pectoralis major muscle supero-medially, the serratus muscle sheet and fascia laterally, and the abdominal fascia inferiorly). After complete deflation, the implant was positioned inside the pocket and filled with saline as much as possible to allow pocket closure. Two closed suction drains were placed infero-laterally, with 1 inside the pocket and the other between the pocket and the mastectomy flaps (Figures 1 a-b). The inclusion criteria for this group were as follows: no previous radiotherapy, contralateral ptotic (30 cases) and non-ptotic breasts (14 cases), non-skin sparing mastectomy, immediate (14 cases) and delayed reconstructions (36 cases), and bilateral reconstruction (6 cases)[13].

After skin-sparing mastectomy (SSM) in Group B, the definitive implant was positioned in a partial sub-muscular pocket (supero-medially under the pectoralis major muscle). Direct-to-implant breast reconstruction involved a rectangular 6 cm × 16 cm piece of SurgiMend® ADM (TEI, Biosciences, Inc., Boston, MA, USA), suturing it to the inferior pectoralis muscle after its origin has been released from the chest wall, draping the ADM over the inferior surface of the chosen implant and suturing the ADM to the inferior and lateral chest walls. During surgery, the patient was placed in a sitting position to define the adequacy of the position of the inframammary fold and shape of the breast mound. One closed suction drain was placed infero-laterally between the ADM and the mastectomy flaps (Figures 2 a-b)[14]. The inclusion criteria for this group were as follows: no previous radiotherapy, an estimated mastectomy weight not exceeding 600 g, contralateral ptotic (28 cases) and non-ptotic breasts (12 cases), immediate reconstruction,
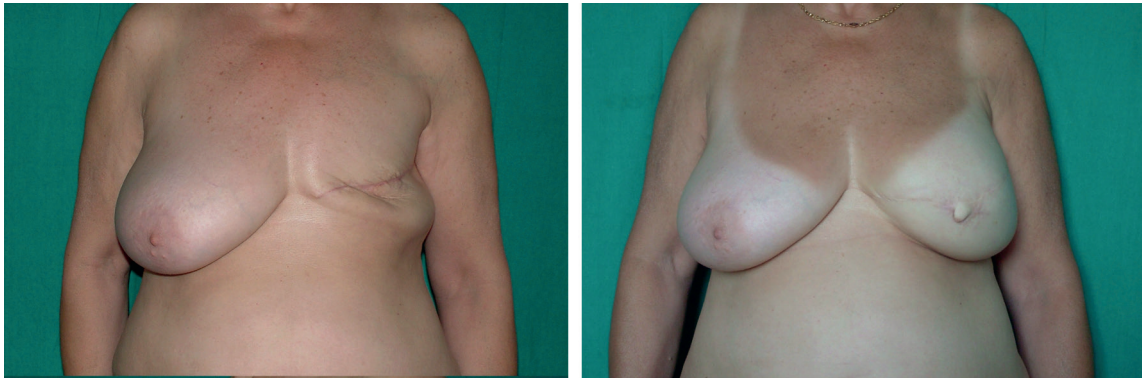
Figure 1. *(A)* Preoperative image of the outcomes of radical mastectomy of a 72-year-old patient. *(B)* Patient underwent a breast reconstruction with permanent inflatable expanders in a sub-muscular position (Group A) and nipple reconstruction with local flap 6 months later (1-year follow-up).

bilateral reconstruction (4 cases), and SSM leaving well-vascularised subcutaneous layers.

Pectoralis major muscle tumour infiltration or damage during mastectomy was an exclusion criterion for Groups A and B.

In Group C, the chest wall muscles were preserved, and the definitive implant was positioned directly under the mastectomy flaps after SSM and completely wrapped by the non-cross-linked Braxon® ADM. The membrane edges were sutured together around the breast implant. The ADM containing the implant was placed into the subcutaneous pocket securing it with apical, medial, and lateral absorbable stitches directly onto the underlying muscles. One closed suction drain was inserted in the inframammary fold, and the skin was closed in 2 layers[15] (Figures 3 a-c).

The inclusion criteria for this group were as follows: BMI of < 30 kg/m^2, no previous radiotherapy, an estimated mastectomy weight not exceeding 600 g, > 1 cm subcutaneous layer (measured by the pinch test on the upper and medial quadrants), immediate reconstruction, bilateral reconstruction, and SSM leaving well-vascularised subcutaneous layers.

Monolateral breast reconstructions were accompanied by a contralateral procedure immediately after the reconstruction in 28 cases (23.7%), whilst 90 cases (76.3%) had no contralateral breast adjustments. The 6 patients who underwent bilateral reconstruction with the Becker implant had the valve removed under local anaesthesia after complete implant expansion. Only 28 elderly patients (10%) required a second procedure to remove the dome, reconstruct the nipple-areola complex, and

Figure 2. *(A)* Image of a 67-year-old patient with ductal breast bilateral cancer. Right hematoma caused by trauma from biopsy. *(B)* This elderly woman underwent nipple skin sparing mastectomy and immediate breast reconstruction with Acellular Dermal Matrix and sub-muscular implant (1-year follow-up).
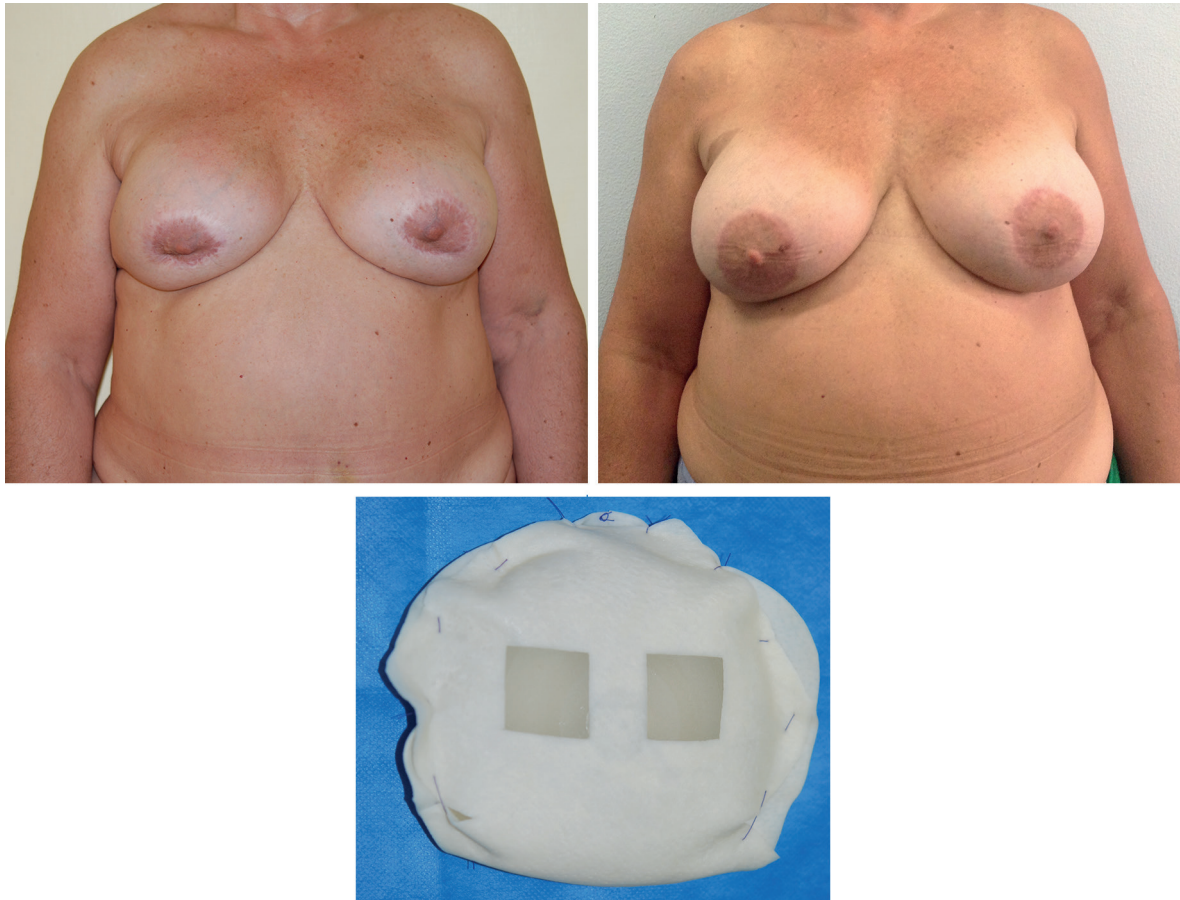
Figure 3. *(A)* Image of a 75-year-old patient with capsular contracture after nipple sparing mastectomy and reconstruction with sub-muscular implant 32 years ago. *(B)* Outcomes of capsulectomy and breast reconstruction with Braxon® Acellular Dermal Matrix and subcutaneous implant (18-month follow-up) (Group C). *(C)* Posterior view of the Braxon® Acellular Dermal Matrix with implant.

adjust the contralateral breast. None of the patients received postoperative irradiation.

Postoperative complications, including those related to the implant, occurred in 12 cases (8.7%; 4 cases from Group A, 6 from Group B, and 2 from Group C), related to wound healing, bleeding, seroma, and problems with the inflatable expanders. In the 6 cases in Group A (12%), inflation was not possible due to valve obstruction and displacement. All patients with valve problems from Group A underwent a second surgery under local anaesthesia to replace the filling port. In 2 cases each from Groups A (1.4%) and B (1.4%), the implant became infected and was removed.

The drains were removed between the second and fifth postoperative day in Group A (mean value: 3 days), between the fourth and tenth post-operative day in Group B (mean value: 6 days), and between the tenth and fifteenth postoperative day in Group C (mean value: 12 days).

According to the VAS, patient satisfaction was from adequate to good in Group A (between 3 and 10, mean: 6); similar data were obtained in Group B (between 4 and 10, mean: 8) and excellent data in Group C (between 9 and 10, mean: 9.8).

No significant capsular contracture (grade IV) was detected at the 1-year follow-up in all 3 groups, with the best results in Group C (Table I).

The mean hospital stay was 4 days (range: 3 to 7 days) for Group A, 3 days (range: 1 to 4 days) for Group B, and 2 days (range: 1 to 3 days) for Group C.

Breast evaluation by the external panel of physicians showed high results in 38 cases from Group A (scores between 6 and 10), 40 from Group B (scores between 7 and 10), and 15 from Group C (scores between 9 and 10); moderate results were found in 12 cases from Group A (scores between 2 and 6), 10 from Group B (scores between 1 and 5), and 5 from Group C.

Table I. Values of the capsular contraction following Baker classification.

| | Mammary compliance | Baker classification | | | |
	Range (mean)	Grade I	Grade II	Grade III	Grade IV
Group A	38.7-68.4 (48.6)	2 (3.6%)	33 (58.9%)	21 (37.5%)	0 (0%)
Group B	32.5-63.5 (42.2)	6 (11.2%)	32 (59.2%)	16 (29.6%)	0 (0%)
Group C	30.9-61.1 (40.7)	5 (13.1%)	24 (63.15%)	9 (23.6%)	0 (0%)

Table II. Quality of life (QLQ-C30).

| | Mean score | | |
| | Group A (no. = 50) | Group B (no. = 50) | Group C (no. = 38) |
Variable			
Global health status	47	48.5	54
Functioning domains	45.5	46	49.5
Symptoms	35	28	22

General results of the quality of life of the elderly women in the 3 groups are presented in Tables II and III.

Discussion

Currently, an increasing number of women with breast cancer undergo conservative breast surgeries. Fewer women, particularly those over 60 years of age, are opting for radical mastectomy. Cancer not only leads to body deformations and irreversible disabilities, but also affects the patient's emotional functioning[16]. Goin et al[17] presented data from clinical interviews with post-menopausal women who had undergone a mastectomy. They found that breast reconstruction decreases the mastectomized woman's feelings of dependence and mutilation, not only in young women, but also in older patients[3,17]. It has been reported that > 50% of breast cancer occurs in women older than 65 years[2]. However, only 2% of these patients will undergo breast reconstructions[18]. The older segment of our population is expected to increase. In 2000, ~13% of the US population was older than 65 years. By the year 2030, that elderly population is anticipated to increase to 20%. Actuarial data suggest that a patient who reaches the age > 65 years should live for another 15 years[3,19]. This population clearly has a notable life expectancy, and preserving their quality of life is essential in cases of breast cancer.

For this reason, we think that it is also important to offer breast reconstructions after mastectomy in elderly patients, with surgical techniques that preserve their quality of life. We also believe that to achieve this goal in elderly women, it is essential to use single-stage techniques.

Age is considered by some authors to be an independent risk factor for suboptimal surgical results. Although there are no clear lines separating youth from middle age or old age, there are documented changes in wound healing[20], infection rates[21], gastrointestinal anastomotic leak, cardiac index, and renal function related directly to patient age[22]. In the literature, numerous data demonstrate that the occurrence of complications related to implant and autologous tissue reconstruction does not differ among age groups[3,23-28].

Table III. Quality of life (QLQ-BR23).

| | Mean score | | |
| | Group A (no. = 50) | Group B (no. = 50) | Group C (no. = 38) |
Variable			
Functioning domains	61	63	71
Symptoms	42	39.5	29

However, we must consider patient satisfaction and the effects that surgery has on the quality of life in selecting the reconstructive techniques. We believe that in elderly patients, the main points to achieve to preserve the quality of life after mastectomy and breast reconstruction are low surgical invasiveness, one-stage procedure, early discharge, rapid recovery, and prompt return to routinely activities. Among the techniques studied, the muscle-sparing Braxon wrap technique has better satisfied these points.

In cases of monolateral reconstruction, we should consider that elderly women often have a ptotic breast, which would be very difficult to match using solely an implant-based reconstruction when searching for symmetry with the contralateral breast[29]. The Becker implant corrects mild forms of ptosis, leaving the implant over-expanded for at least 1 month and deflating it to match the contralateral breast size. ADMs, both in the direct-to-implant and wrap techniques, are used after SSM, in which the skin ptotic envelope is preserved and requires only to be correctly filled up with the properly shaped and sized implant. Thus, SSM combined with ADM-assisted implant reconstruction restores different forms of ptotic breasts, but requiring well-vascularised mastectomy skin flaps, estimated mastectomy weight not exceeding 600 g, and a minimum of 1 cm subcutaneous layer to cover the ADM.

Further, during the study period, the decision-making process on the type of single-stage reconstruction technique to be selected was influenced by the availability of the various medical devices. The Becker implant was available since the beginning, the SurgiMend® ADM since January 2012, and the Braxon® ADM since January 2014.

The use of permanent inflatable expanders is widely acknowledged as a useful technique for breast cancer patients undergoing simple or modified radical mastectomies; it eliminates the need to replace a temporary tissue expander with a breast implant, thus avoiding a second operation. In Group A of the present research, we used the shaped Becker device, which consists of an anatomical permanent inflatable expander that was inflated by at least 10% at the end of the operation. In this group, the quality of life evaluated with the time of discharge and the VAS was good. The main disadvantages of this technique are the placement of the filling tube, port requiring multiple outpatient inflation sessions (an average of 7 in our experience), and pain during upper limb

movements in the first postoperative month due to the sub-muscular implant positioning. Regarding the functionality of the shoulder and upper limbs, the synergistic action between the muscle groups indicates that the weakening of even a modest part can alter the function of the shoulder joint and significantly impact daily activities[30-32]. Moreover, the capsular contracture was higher in Group A than in the other 2 groups.

In Group B, one-stage breast reconstruction was achieved using the ADM to complete the sub-muscular pocket, in which the definitive implant was positioned. The goal of direct-to-implant reconstruction is to create a naturally appearing breast mound in a single-stage technique without compromising mastectomy flap viability. The ideal patient characteristics include a small to medium non-ptotic breast, good skin elasticity, and a planned small to medium prosthetic reconstruction as well as SSM techniques[14]. Advantages include the elimination of the second stage of traditional tissue expander/implant reconstruction, rapid return to work, and expedited administration of adjuvant therapy if required. Additionally, precise positioning of the implant and inferior support by the ADM may decrease the number of revision surgeries required. Direct-to-implant reconstruction is not suitable in patients with a very large breast skin envelope and is controversial in patients requiring adjuvant radiotherapies or in those with a history of chest wall irradiation[33]. Excessively thin mastectomy flaps are considered a contraindication to direct-to-implant reconstruction because the volume of the permanent implant may produce additional tension on the wound and lead to mastectomy flap necrosis. In the present paper, the quality of life was better in Group B than in Group A, considering that patients had breast restorations with only a single procedure without any further surgery. The capsular contracture rate in Group B was also less evident compared with that of in Group A; however, similarly to this group, the main evident disadvantage was the pain during the upper limb movements reported in the first postoperative month due to the sub-muscular position of the implant.

In Group C, the muscle-sparing Braxon wrap technique was used for the one-stage breast reconstruction. The main advantages of this technique are its good cosmetics, preservation of the pectoralis major muscle with reduced or absent muscular pain, and a comparable occurrence rate of other minor complications[13]. In our

case load, no patient reported pain in the first postoperative month. With this innovative muscle-sparing technique, patients do not require postoperative physiotherapy care. Our study proved this technique to be the preferred method to achieve painless breast reconstructions, with faster recovery and return to daily physical activities. Moreover, this technique, when applicable, should be preferred in elderly patients because it is less invasive, reduces operative time, and results in fewer complications compared to the detachment of the pectoralis major muscle for the creation of a sub-pectoral pocket. Further, the EORTC QLQ-C30 and BR23 questionnaires showed the best results in terms of global health status, functioning domains, and symptoms, demonstrating that this technique preserves the quality of life.

On the basis of our observations, we propose the following criteria of selection for single-stage breast reconstruction techniques in elderly patients: (1) non-SSMs should be reconstructed with Becker implants, and (2) delayed reconstructions without skin excess should be addressed to this type of reconstruction. Immediate reconstructions after SSM should be performed with implants combined with ADM, preferring the wrap technique for a better quality of life. We suggest using the wrap technique in elderly patients when possible (i.e. immediate reconstruction after SSM). However, further studies with longer follow-up periods are required to confirm the advantages of this novel breast reconstruction technique.

Conclusions

Breast reconstruction should be considered and proposed to elderly women using the least invasive technique that should be one-stage, with reduced hospitalization, rapid return to normal activities, good cosmetics, and improved quality of life. Our study showed that the muscle-sparing Braxon wrap technique can reach these goals better than the other techniques. Finally, we believe that single-stage minimally invasive techniques can increase the rate of breast reconstruction in the elderlies.

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