Quadrantectomy with oxidized regenerated cellulose ("QUORC"): an innovative oncoplastic technique in breast conserving surgery

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Oncoplastic surgery of the breast has generated great excitement over the past years and has become an integrated component of the surgical treatment of breast cancer.
Oncoplastic procedures (OPP) associate the best surgical oncologic principles to achieve wide tumor-free margins with the best principles of plastic surgery to optimize cosmetic outcomes. Thanks to oncoplastic techniques, the role of breast conserving surgery (BCS) has been extended to include a group of patients who would otherwise require mastectomy to achieve adeguate tumor clearance.
However, even with the use of OPP, cosmetic outcomes may result unsatisfying when a large volume of parenchyma has to be removed, particularly in small-medium size breasts. Recently, it has been proposed the use of ORC (Oxidized Regenerated Cellulose) as a reconstructive biomaterial to optimize the aesthetic results after OPP.
The aim of this article is to describe the standard pattern of an innovative surgical oncoplastic technique with ORC, that we have called "QUORC" (QUadrantectomy with Oxidized Regenerated Cellulose), to improve cosmetic results and minimize the possible postoperative complications.

KEY WORDS: Breast cancer, Cosmetic results, Oncoplastic surgery results, Oxidized regenerated cellulose, QUORC

Introduction

Breast conserving surgery (BCS) combined with postoperative radiotherapy has become the gold standard of locoregional treatment for the majority of patients with early-stage breast cancer, offering equivalent survival and improved body image and lifestyle scores as compared to mastectomy [1,2]. In the era of early diagnosis and effective neoadjuvant therapies, BCS can be offered to over two-thirds of breast cancer patients.
The goals of BCS are to ensure a complete removal of the tumor with adequate surgical margins while preserving the natural shape and appearance of the breast. In some cases, achieving both goals may be quite challenging and as the need to secure an oncologically safe resection is the first priority, BCS may lead to unsatisfying cosmetic results [3-8]. In the effort to overcome this difficulty and expand the use and efficacy of BCS, oncoplastic procedures (OPP) have been introduced in recent years gaining widespread attention both among surgeons and patients [9-14]. These procedures associate the

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best principles of surgical oncology with the best principles of reconstructive surgery to optimize oncologic safety and cosmetic outcomes.
OPP are characterized by more aesthetic skin incisions, use of enlarged resection patterns, careful reshaping of the gland, eventually by repositioning of the nipple-areola complex to the center of the breast mound, and symmetrization procedures on the controlateral breast to improve cosmesis.
Recently, it has been propose the use of Oxidized Regenerated Cellulose (ORC) as a reconstructive biomaterial to optimize the aesthetic results after OPP [15-18].
In this article we describe the standard pattern of an innovative oncoplastic technique with ORC, that we have called "QUORC" (Quadrantectomy with Oxidized Regenerated Cellulose), used to improve aesthetic outcomes.

Surgical Technique

In our surgical Breast Unit, over the last 7 years in performing OPP we have started to use oxidized regenerated cellulose (ORC) (Tabotamp fibrillar®, Johnson & Johnson; Ethicon, New Brunswick, NJ, USA) as a reconstructive biomaterial to facilitate the healing of the residual cavity and reduce the risk of unfavorable cosmetic outcomes [15].
Depending in the size and location of the tumor and the volume and shape of the breast as previously reported [9-11], different OPP have been used including glan-

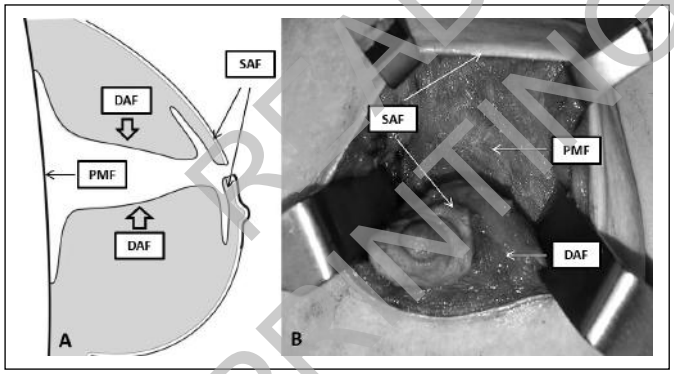

Fig. 1: Intraoperative picture of patient undergoing right supero-lateral quadrantectomy (specimen dimension 9 cm x 7 cm x 3.5cm) and right axillary clearance and left excisional biopsy in the infero-lateral quadrant (specimen dimension 8 cm x 5 cm x 2.5 cm) Both sides were accessed via periareolar incisions according to round-block technique. A, After complete tumor excision, adequate reshaping of the gland is performed by dissecting the residual breast parenchyma from the pectoralis major fascia (PMF) and then from the superficial subcutaneous tissue for approximatively 2 cm. With this dissection, two opponent superficial advancement flaps (SAF: i.e. skin, subcutis) and two opponent deep advancement flaps (DAF: i.e. breast parenchyma) are obtained. B, Residual cavity after quadrantectomy and adeguate reshaping of gland.

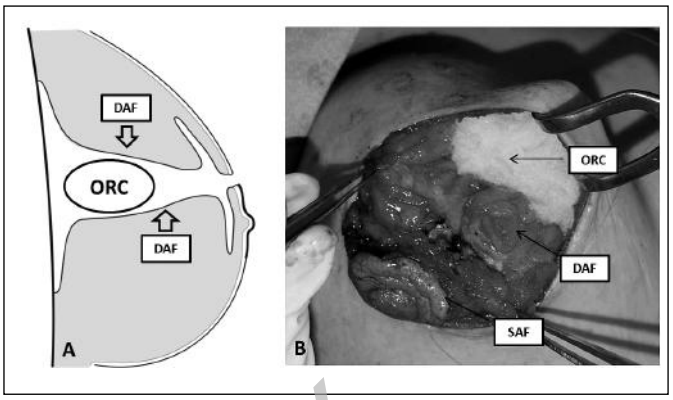

Fig. 2: (**A**) Five separate layers of ORC (Tabotamp fibrillar) are placed in the residual cavity, topping the pectoralis major muscle. (**B**) ORC placed on the pectoralis major muscle to fill the cavity.

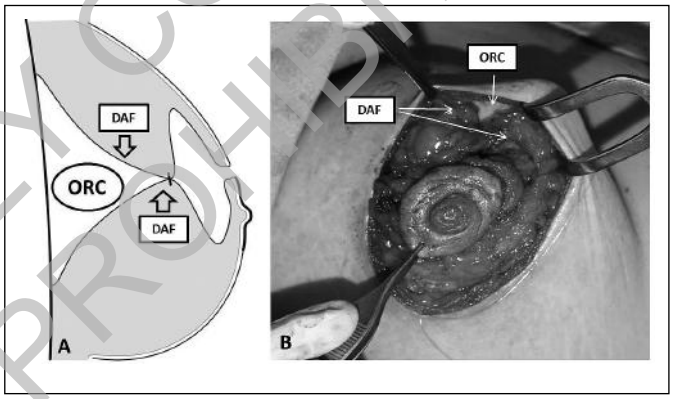

Fig. 3: (**A**) ORC is completely covered by advancement of the two deep glandular flaps, sutured with absorbable 2-0 sutures. (**B**) The two deep glandular flaps advanced and sutured to cover ORC.

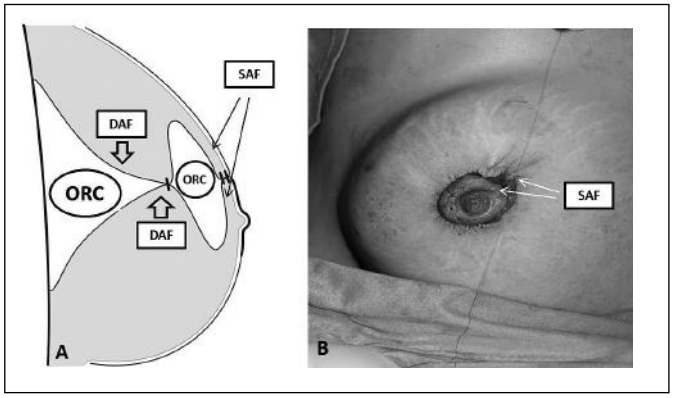

Fig. 4: (**A**) Two additional layers of ORC are covered by advancement of the superficial skin-subcutis flaps closed with a continuous absorbable 3-0 suture. (**B**) ORC covered by sutured skin-subcutis flaps.

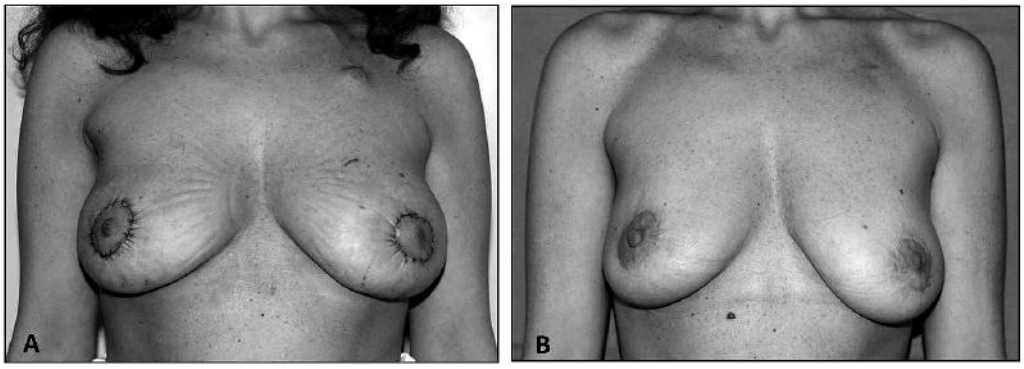

Fig. 5: (**A**) Cosmetic result after four weeks. (**B**) Nine-month follow-up picture after right breast radiotherapy.The breast mound and contour is preserved.

dular reshaping procedures, "round block" procedures, mammoplasty reduction procedures, central quadrantectomy procedures, inframammary fold procedures and batwing mastopexy procedures.

Our surgical technique of QUadrantectomy with Oxidized Regenerated Cellulose (QUORC) follows a standard pattern.

After complete tumor excision, adequate reshaping of the gland is performed by dissecting the residual breast parenchyma from the pectoralis major fascia and then from the superficial subcutaneous tissue for approximatively 2 cm.

With this dissection, two opponent superficial advancement flaps (i.e. skin, subcutis) and two opponent deep advancement flaps (i.e. breast parenchyma) are obtained (Fig. 1 A, B).

Major vascular perforators between the pectoralis muscle and residual parenchyma are preserved to minimize the risk of ischemic injury to the latter.

After careful control of the haemostasis, five separate layers of ORC (Tabotamp fibrillar) are placed in the residual cavity, topping the pectoralis major muscle (Fig. 2 A, B). ORC is completely covered by advancement of the two deep glandular flaps, sutured with absorbable 2-0 sutures (Fig. 3 A, B). Two additional separate layers of ORC (Tabotamp fibrillar) are then placed on the surface of the approximated glandular flaps and covered by advancement of the superficial skin-subcutis flaps closed with a continuous absorbable 3-0 suture (Fig. 4 A, B). Skin is then closed using non-absorbable 3-0 suture (Fig. 5 A, B).

Discussion

Oncoplastic surgery of the breast has become an integrated component of the surgical treatment of breast cancer. OPP associate the best surgical oncologic principles to achieve wide tumor-free margins with the best principles of plastic surgery to optimize cosmetic outcomes. Thanks to oncoplastic techniques, the role of BCS has been extended to include a group of patients who would otherwise require mastectomy to achieve adequate tumor clearance. However, even with the use of OPP, cosmetic outcomes may result unsatisfying when a large volume of parenchyma has to be removed, particularly in small-medium size breasts.

Recently, it has been proposed the use of ORC as a reconstructive biomaterial to optimize the aesthetic results after OPP [15-18].

ORC is a well-known haemostatic biomaterial with antimicrobial properties. It is a sterile absorbable fibrous material prepared by the controlled oxidation of regenerated cellulose. After ORC has been saturated with blood, it swells into a brownish or black gelatinous mass which aids in the formation of a clot, thereby serving as a haemostatic adjunct in the control of local haemorrhage [19-23]. In addition to its local haemostatic properties, ORC exhibits *in vitro* bactericidal properties against a wide range of Gram positive and Gram negative organisms including aerobes and anaerobes [24,25]. Due to its morphology it can be used at any surgical site as it can easily and rapidly adapt to any surface.

Our preliminary results on the use of ORC with reconstructive aims in breast surgery indicate a positive role for ORC in preventing post-surgical breast deformities [15].

Tanaka et al. reported improved cosmetic outcomes after breast conserving surgery with the use of ORC in 94 breast cancer patients treated at the Osaka Medical College Hospital (Osaka, Japan). Evaluation of cosmetic outcomes, performed by three staff surgeons at least 2 months after surgery using the scoring system (0–12 points) of the Japanese Breast Cancer Society, documented very positive results, with a mean score of 9.5 (3-12 points) and 71 patients (75.5%) categorized as "Excellent" (≥ 11 points) or "Good" (8–10 points), and only one patient (1.1%) as "Poor" (≤ 4 points) [17].

Rassu et al presented their early experience on breast cancer patients treated with BCS and reshaping procedures aided by the use of ORC. With a limited follow-up of 6 to 8 months, the Authors reported improved aesthetic outcomes in this new subset of patients [18].

The positive role for ORC in preventing post-surgical breast deformities could be explaned through a triple action:

– A mechanical action: ORC acts as a filler material that limits the volume defect created by the surgical resection and at the same time it interposes itself between the pectoralis major fascia and the skin avoiding skin-to-fascia adhesion.
– A riparative action: ORC seems to stimulate fibrogenesis in the first postoperative weeks and to favour riparative processes by inhibition of metallo-proteasis, absorption of free oxygen radicals and metallic ions as well as stabilize some growth factors [26-32].
– A fibrogenesis action: ORC idrolytic products seems to have chemocinetic stimuli on human fibroblasts favouring their migration and fibroblastic activity [27,30,33].
These actions culminate in the creation of a three-dimensional structure that acts as a permanent filler, thus allowing a definitive reconstruction of the defect and avoiding unpleasant cosmetic outcomes.
As concerns postoperative complications, in our series, we noted a 10% rate of allergic skin reactions with irritation, redness, itching, swelling, rash, and hives in the mammary region, successfully managed with steroids and antihistamine medications. In addition, we experienced a significant seroma in the site of ORC placement in 45% of our patients [15]. This seroma that appears in the early postoperative period as consequence of redundant ORC digestion, normally resolved within few weeks with repeated percutaneous aspirations, but in two cases it was followed by the formation of an abscess in the residual cavity that required surgical drainage [15,16,34].
Tanaka et al. report a 18% rate of allergic reaction with the use of ORC, mainly presenting as acute dermatitis and eczema, and one case of exudation followed by wound dehiscence [17].
These postoperative complications is possible that may depend by the quantity (number of separate layers of ORC) and modalities of application of ORC [35].

Conclusion

As the use of ORC has been reported to be useful as a reconstructive biomaterial in oncoplastic breast surgery, we describe the standard pattern of an innovative surgical technique with ORC, that we have called "QUORC", to optimize cosmetic results and minimize the possible postoperative complications.

Riassunto

La chirurgia oncoplastica della mammella ha generato grande entusiasmo negli ultimi anni ed è diventata una componente integrante ed essenziale del trattamento chirurgico dei tumori del seno. Le tecniche oncoplastiche associano i migliori principi della chirurgia oncologica con i migliori principi della chirurgia plastica per ottenere margini indenni da malattia ed al tempo stesso ottimizzare i risultati estetici.
Grazie a queste procedure, il trattamento conservativo della mammella è stato esteso ad includere un gruppo di pazienti che altrimenti richiederebbero una mastectomia per ottenere radicalità oncologica.
Tuttavia, anche con l'uso delle procedure oncoplastiche, gli esiti cosmetici possono risultare insoddisfacenti nei tumori di voluminose dimensioni in cui è necessario eseguire ampie exeresi parenchimali in particolare in seni di medio-piccole dimensioni.
Recentemente, è stato quindi proposto l'uso di Cellulosa Ossidata Rigenerata come biomateriale ricostruttivo per ottimizzare i risultati estetici dopo chirurgia oncoplastica. Lo scopo di questo articolo è quello di descrivere il modello standard di una innovativa tecnica oncoplastica con cellulose ossidata, che abbiamo denominato "QUORC" (QUadrantectomy with Oxidized Regenerated Cellulose), grazie alla quale sembra possibile migliorare i risultati estetici e ridurre al minimo le possibili complicanze post-operatorie.

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