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Oncoplastic Breast-Conserving Surgery in Low- and Middle-Income Countries: Training Surgeons and Bridging the Gap

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Abstract

Purpose of Review Breast cancer treatment in low- and middle-income countries involves a series of limitations. On the other hand, oncoplastic surgery has been well established in these countries as an alternative to mastectomy, offering oncologic safety while preserving the natural contours of the female breast. The aim of this review is to discuss recent studies and analyses involving oncoplastic surgery in low- and middle-income countries.

Recent Findings Although major differences remain between low- and high-income countries with respect to science, this same pattern is not reflected in oncoplastic surgery. This is explained by the fact that this technique is associated more with the nature of the surgical training provided than with the availability of financial resources.

Summary In low- and middle-income countries, oncoplastic surgery may contribute towards reducing inequalities and improving the management of breast cancer treatment, providing adequate oncologic results even when financial resources are limited.

Keywords Breast cancer · Breast-conserving surgery · Oncoplastic breast surgery · Low- and middle-income countries · Breast reconstruction

Introduction

Oncoplastic breast surgery combines breast reconstruction techniques and breast-conserving surgery (BCS) with the aim of maintaining oncologic safety and preserving the natural shape of the female breast [1, 2••, 3]. This surgery encompasses a wide spectrum of reconstruction techniques, ranging from simple remodeling of the breast parenchyma to advanced techniques of mammoplasty. Oncoplastic surgery enables extensive tumor excision, thus allowing BCS to be performed in patients with large tumors (> 5 cm) or multifocal disease who would previously have been candidates for a mastectomy [4–6].

Although breast cancer incidence rates have increased in most regions of the world, disparities continue between developed and developing countries, where the incidence of the disease is lower [7, 8]. Conversely, mortality rates from the disease are higher in low- and middle-income countries (LMICs), possibly as a result of difficulties related to diagnosis and treatment [7, 8].

Therefore, oncoplastic surgery could contribute towards reducing inequalities and could be useful in the management of breast cancer, providing adequate oncologic results even when financial resources are limited.

Current Situation in LMICs

In LMICs, BCS has become the surgical treatment of choice for women with early breast cancer [9•, 10]. When followed by radiotherapy, the oncologic outcome with BCS is similar to that achieved with mastectomy, with benefits in terms of esthetics and quality of life [11, 12••]. However, in these

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countries, lesions tend to be locally advanced at diagnosis, theoretically imposing limitations on conventional BCS techniques [10, 13, 14].

Several studies have confirmed the expansion of oncoplastic surgery in LMICs over the past 20 years [1, 10, 15]. In Brazil, a large retrospective cohort study reported that the overall rate of breast reconstruction in users of the public healthcare system increased from 15% in 2008 to 29.2% in 2014 [9•]. Nevertheless, considering that breast reconstruction is guaranteed by law in Brazil to all women meeting the established clinical criteria [16], this rate could be considered modest and still far from ideal. Likewise, in LMICs, reconstruction rates generally fail to reach 50% even in hospital-based study reports [11, 17••, 18].

Finally, inequalities between the various developing countries regarding access to oncoplastic surgery and the technical capability of their surgeons are noteworthy [10, 17••, 19•]. In some referral centers for oncology treatment, even in regions with sparse financial resources, these reconstruction techniques are offered to all patients submitted to BCS, including the possibility of symmetrization of the contralateral breast, with volume reduction in the case of large breasts and breast ptosis correction [1, 16, 18]. In Mozambique, the first description of oncoplastic breast surgery was only published in 2016 and was part of an international collaboration with surgeons from the USA and Brazil [20].

The Relevance of Esthetics

According to the International Society of Aesthetic Plastic Surgery, breast augmentation is the most common esthetic procedure worldwide [21]. The ranking of the top eight countries for cosmetic procedures includes four LMICs (Brazil, Mexico, Colombia, and Thailand), which are responsible for almost 20% of all esthetic procedures worldwide [21]. These data, obtained in a population without breast cancer, show the relevance of physical appearance both in the overall scenario and in developing countries.

In the majority of LMICs, individuals tend to expose greater areas of their bodies as a consequence of the tropical climate and higher temperatures. Therefore, esthetic factors become more relevant. In some cases, fear of losing their breasts may explain why some women delay seeking medical help after discovering suspect breast lesions [10]. Public awareness policies on breast reconstruction could dissipate myths on breast cancer treatment and increase rates of early diagnosis of the disease.

However, this scenario varies with the cultural idiosyncrasies of each population. In India, for example, esthetic demand is lower than that found in other LMICs. In a retrospective analysis of 472 oncoplastic surgeries performed in a referral center in Delhi, there were only two cases of areola-papillary complex grafts and no cases of symmetrization of the contralateral breast. This could be explained by the conservative nature of Indian society in which such procedures are generally considered unimportant [15].

Certain physical characteristics that are highly prevalent in LMIC populations such as overweight and body dissatisfaction may also affect breast reconstruction rates following breast cancer [22, 23]. In addition, many women have large breasts, with breast hypertrophy and high levels of ptosis [20]. Mastectomy without reconstruction may lead to body image distortion, sexual dysfunction, and orthopedic problems including postural abnormalities and back pain. Due to the financial limitations of this population, in many cases, breast cancer surgery may be that woman's only chance of accessing a cosmetic breast procedure such as bilateral reduction mammoplasty (Fig. 1).

Breast asymmetry and the other sequelae of breast cancer surgical treatment may also exert a negative effect on quality of life, body image, and other psychological domains [24, 25]. Therefore, the possibility of offering adequate cancer treatment while preserving self-esteem and personal self-confidence may soften the psychological blow of breast cancer diagnosis and treatment.

Differences Between Low- and High-Income Countries

The Gap in Terms of Science

The difference between low- and high-income countries stretches beyond the economic factor. In LMICs, there are relatively few researchers in relation to the high number of clinical problems and the high disease burden. Nevertheless, many researchers from those countries emigrate to developed countries in search of better work conditions and new opportunities in research [26].

In recent years, there has been a global increase in scientific production related to oncoplastic surgery [27, 28]. However, around 85% of publications on breast reconstruction originate in Europe or North America, reflecting the inequality of scientific production as a function of the surgeons' geographic location [27]. Most of the published papers are retrospective cohort studies, case series, or non-systematic reviews [27, 28], which do not depend, theoretically, on major financial investment. Table 1 shows the results of a search in the PubMed database to identify papers published between 1980 and 2016 using the terms "reconstructive breast cancer surgery" and "oncoplastic breast cancer" [29].

Still, the scientific gap related to oncoplastic surgery is less than that seen in areas such as clinical oncology and translational medicine. This may be explained by the minimal financial requirements needed to perform the techniques usually

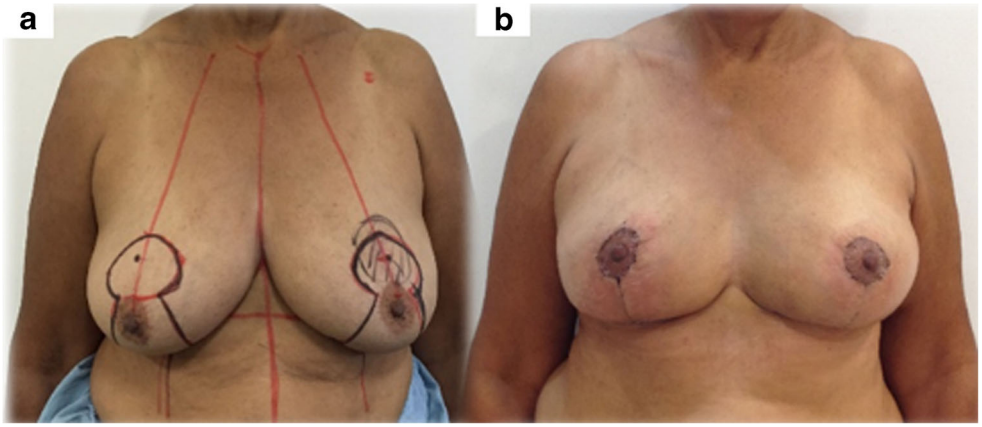

Fig. 1 Bilateral reduction mammoplasty in a patient with left breast cancer and high levels of ptosis. **a** Preoperative marking. **b** Fifteen postoperative days

Table 1 Description of search in Pubmed database to identify papers published between 1980 and 2016 using the terms "reconstructive breast cancer surgery" and "oncoplastic breast cancer"

Publications on breast reconstruction		*n*	%
Year	1980*	0	0
	2016*	109	7.1
Specialty (first author)	Plastic surgeons	1035	68.1
	Breast surgeons	447	29.4
	Radiologists	26	1.7
	Unknown	12	0.8
Breast reconstruction	Total	1197	78.8
	Partial (oncoplasty)	324	21.2
Mean impact factor	2.44 (± 5.08)		
Mean of citations per paper	3.67 (± 5.85)		
Language	English	1380	90.8
	French	35	2.3
	German	31	2.0
	Others	75	4.9
Global continent	Most represented countries		
America	USA	612	40.3
	Canada	37	2.4
	Brazil	22	1.4
Europe	Italy	124	8.2
	England	116	7.6
	France	89	5.9
	Germany	68	4.5
Asia	Japan	62	4.1
	China	21	1.4
Oceania	Australia	36	2.4
Africa	Turkey	16	1.1
Total		1521	100.0

A total of 2786 abstracts were retrieved. Of these, 1521 papers met the inclusion criteria

Adapted from Freitas-Junior R, et al. [29]

*Correlation coefficient: $y = 3.84$, $R2 = 0.79$, $p < 0.01$

applied in oncoplastic surgery, together with the broad availability of human resources and the increase in training for surgeons in developing countries [17••, 19•]. On the other hand, research into new biological agents and advanced molecular biology techniques requires considerable financial investment, making the scientific gap still more significant.

The Gap in Terms of Surgeons

Currently, being a doctor requires profound theoretical knowledge and practical expertise. Patients in general are also aware that the care provided by a specialist is usually better than that provided by a general practitioner, thus stimulating professional sub-specialization [17••, 19•]. In the case of breast reconstruction, however, there are geographical differences regarding the basic training of the surgeons involved, a category that includes breast surgeons, plastic surgeons, and oncologic surgeons [10, 19•].

In the USA, breast surgery is not a procedure universally done by specialists; often, general surgeons are responsible for oncologic procedures and plastic surgeons perform breast reconstruction [17••]. Conversely, in countries such as Sweden and the UK, the training of breast surgeons and plastic surgeons has now been integrated, an initiative that has benefitted the local population and the surgeons themselves [10, 17••, 28].

In developing countries, however, this process of integration is not always harmonious. In Brazil and Argentina, for example, consolidating breast reconstruction by breast surgeons has generated and continues to generate protests from plastic surgeons [18, 19•]. Although these professionals work together in some centers, this is not the case in the majority of institutes [17••]. Consequently, the Brazilian Society of Mastology stresses the importance of a curriculum that encompasses the principal oncologic and esthetic principles during surgeons' training, an initiative that has progressed satisfactorily in most training centers in the country [17••].

Socioeconomic limitations and other restraints associated with cancer treatment experienced in the majority of LMICs also require the surgeon to be skilled in managing available resources. In Argentina, for example, the restricted availability of surgical theaters was highlighted as the principal reason for the high rate of breast reconstruction with prostheses reported in a study with 222 local surgeons [18]. Likewise, lack of radiotherapy units, as found in several regions around the world, also increases the rate of mastectomy and decreases the possibility of BCS and oncoplastic surgery [10, 20].

Moreover, access to plastic surgeons tends to be limited in LMIC, which may affect a series of underserved women. Therefore, the presence of other surgeons trained in breast reconstruction can reduce this gap, avoiding unnecessary mastectomies and providing satisfactory cosmetic results [10]. In this respect, the question of competence should be a prerequisite for performing oncoplastic surgery, emphasizing the need for professional training and continued medical education.

How to Increase Access

The Breast Specialist

One of the major differentials in relation to LMICs was the creation of breast care as a medical specialty. In Europe, the use of the term *senology*, with a clear French influence, has spread throughout the continent. In Latin America, the term used is *mastology*, with the specialty having been well established for decades in most of the countries [17••]. In Brazil, medical students complete a 3-year residency period for gynecology and obstetrics or a 3-year period for general surgery, receiving specific training in mastology during a further 2-year period of their medical residency. This training focuses on the epidemiology, screening, and diagnosis of breast diseases, as well as on surgical treatment and reconstructive/oncoplastic surgery. This has been one of the major differentiating factors in increasing breast reconstruction rates among underserved women in Brazil [9•, 17••]. Furthermore, the routine use of oncoplastic techniques and breast reconstruction in formal residency training has led to increased interest in the specialty and, principally, in increasing access to breast reconstruction in the LMICs that have adopted this perspective.

Another relevant aspect involves reducing the bureaucratization involved in medical audits related to obtaining authorization to perform oncoplastic surgery. In countries such as Brazil and Argentina, every breast reconstruction surgeon has access to an extensive list of pre-authorized surgical procedures. This allows him/her to perform any breast reconstruction procedure, including the insertion of prostheses and extensive myocutaneous flap surgery. In Brazil, the authorization process was simplified to a similar extent both in the public and private healthcare systems, allowing competent breast surgeons to perform the most appropriate technique for each situation.

Training the Surgeons

Breast surgeons not adequately trained in oncoplastic surgery during their medical residency fail to offer this option to their patients, denying them this state-of-the-art locoregional breast cancer treatment. In recent years, however, this has changed. In Europe, for example, a recent survey involving 671 professionals who perform breast surgery found that 77% of respondents had undergone some additional training in oncoplastic surgery [30].

In Brazil, training in breast cancer surgery is based on a period of medical residency, with the possibility of additional courses following specialization. In a recent analysis of all breast specialists who graduated from residency in 2015 and 2016 in Brazil, around 70% considered themselves capable of performing partial breast reconstructions. However, this rate of surgical confidence drops significantly when residency training is incomplete [17••]. Therefore, it is crucial to increase theoretical knowledge, ensure access to different techniques, and encourage experiences to be shared among all the professionals involved in the breast reconstruction process, particularly among breast specialists and plastic surgeons.

Training Tools

The surgical training process is complex, but basically follows the "example and repetition" concept. This combination of theoretical and practical knowledge also requires a large number and variety of cases, sufficient financial resources, and skilled professors, as well as adherence to bioethics and high standards of patient safety [30, 31]. Therefore, the development of effective and safe tools such as illustrative videos and digital libraries of theoretical content with which to train breast surgeons is important.

The process of training using cadavers remains an extremely useful and realistic methodology that is used in Canada and other industrialized nations [32]. However, in most developing countries, this possibility is bureaucratic and onerous. This has recently stimulated the development of artificial models that simulate human tissues, allowing training in a wide range of reconstructive techniques [31, 33]. The porcine model is another option due to the anatomical similarity between pigs and humans, its widespread availability, and the fact that this model tends to be less costly [34]. Recently, new digital platforms and virtual simulators have included breast reconstruction in the portfolio of surgical training [35], further facilitating expansion of this training process.

The Brazilian Society of Mastology has conducted a nationwide training program, promoting extension and

postgraduate courses that combine theoretical classes and hands-on procedures in real patients under the supervision of renowned national and international professors [19•, 36] (Fig. 2). These courses are usually organized in modules of 10–19 months' duration [19•]. In other countries such as Croatia, additional training in breast reconstruction lasts for 2 years, which may discourage general surgeons [10]. Nevertheless, governmental and institutional support constitutes an essential step in increasing the knowledge and practice of oncoplastic surgery.

Developing New Techniques

The consolidation of conservative surgical treatment and the increased global experience in breast reconstruction has stimulated the development of new surgical techniques and the adaptation of traditional techniques in various clinical settings [37, 38]. This has allowed for oncoplastic surgery to be expanded worldwide [39•]. In LMICs, the increase in oncoplastic indications and surgical techniques may have led to a reduction in the number of patients who have no other choice but to undergo mastectomy without reconstruction.

In this respect, the crucial role of surgeons from developing countries is noteworthy. In Brazil, for example, Paulinelli et al. described an adaptation to the classic standard oncoplastic mammoplasty, which those authors referred to as "geometric compensation" [38]. Other Brazilian authors have described the surgical feasibility and oncologic safety of BCS with immediate autologous fat grafting reconstruction [37], and reconstruction using the latissimus dorsi muscle with immediate fat grafting [40]. There are broad indications for these techniques. In addition, the learning curve is short, and few additional financial resources are required, unlike the use of free omental flap harvested by endoscopy [41] or microsurgery [18], for example.

Future Challenges

Challenges regarding oncoplastic surgery in LMICs include the need to standardize the nomenclature and surgical indications. This challenge is particularly relevant in view of the wide diversity of techniques and individual factors that can affect the overall outcome in each case. Instituting tumor boards and consensus meetings with the various professionals involved in treatment may aid in this decision-making [2••].

Secondly, the need to expand and improve training in oncoplastic surgery merits emphasis. In a recent survey of 708 surgeons in the USA, a lack of teaching material was cited as one of the principal barriers to learning in oncoplastic surgery [42]. Therefore, the facilities obtained with globalization and recent technological advances could contribute towards reducing the gap between developed and developing countries.

The expansion of scientific knowledge represents another basic step towards consolidating oncoplastic surgery in LMICs. Likewise, collaborative international studies and prospective registries with data on oncoplastic surgery could contribute to knowledge generation regarding these techniques, and their utility even in situations where financial resources are limited. In Brazil, the recent increase in publications on oncoplastic surgery is due principally to the consolidation of hands-on courses in breast reconstruction, which encourage scientific production among students [17••, 19•, 27, 28].

Finally, and no less important, the patient's opinion must be taken into consideration and all the biopsychosocial aspects

Fig. 2 Brazilian experience in the training of breast surgeons. **a** Practical course of oncoplasty organized by the Brazilian Society of Mastology. **b** Professors and experts in breast reconstruction discussing clinical cases during the Brazilian Oncoplasty Congress. **c** Demonstration of surgical techniques for breast reconstruction during scientific events in Mastology

involved in each case respected. In LMICs, the poor education level of the underserved population may add to their difficulty in understanding the surgical options available and affect their decision-making [43]. Therefore, the breast reconstruction specialist should be capable of ensuring that the patient has all the necessary information regarding her treatment in each clinical situation.

Conclusions

There are still considerable differences in science between LMICs and high-income countries. This difference does not follow the same pattern when the subject is oncoplastic surgery, which is more closely associated with the surgeon's training rather than the availability of financial and technological resources. Nonetheless, adding the economic factor to the diverse characteristics of the population in each region results in significant geographical differences in breast reconstruction at the local level.

Currently, international collaboration may function in favor of developed countries, since LMICs have shown a surprising facility for training professionals and developing new surgical techniques. When integrated, this knowledge can be transferred to surgeons in developed countries, thus greatly benefitting patients in these regions, bridging this gap.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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