



# A Consensus Definition and Classification System of Oncoplastic Surgery Developed by the American Society of Breast Surgeons

Abhishek Chatterjee, MD, MBA<sup>1</sup>, Jennifer Gass, MD<sup>2</sup>, Krishnabhai Patel, MD<sup>1</sup>, Dennis Holmes, MD<sup>3</sup>, Katherine Kopkash, MD<sup>4</sup>, Lashan Peiris, MBBS (Lon)<sup>5</sup>, Anne Peled, MD<sup>6</sup>, Jessica Ryan, MD<sup>7</sup>, Mahmoud El-Tamer, MD<sup>8</sup>, and Julie Reiland, MD<sup>9</sup>

<sup>1</sup>Department of Surgery, Tufts Medical Center, Boston, MA; <sup>2</sup>Breast Health Center, Women and Infants' Hospital, Providence, RI; <sup>3</sup>Department of Surgery, John Wayne Cancer Institute, Santa Monica, CA; <sup>4</sup>Department of Surgery, NorthShore University HealthSystem, Evanston, IL; <sup>5</sup>Department of Surgery, University of Alberta (Misericordia Community Hospital), Edmonton, AB, Canada; <sup>6</sup>San Francisco, CA; <sup>7</sup>Catholic Medical Center, Manchester, NH; <sup>8</sup>Department of Surgery, Memorial Sloan-Kettering Cancer Center, New York, NY; <sup>9</sup>Avera Medical Group McHale Institute, Sioux Falls, SD

## ABSTRACT

**Background.** Several definitions of oncoplastic surgery have been reported in the literature. In an effort to facilitate communication regarding oncoplastic surgery to patients, trainees, and among colleagues, the American Society of Breast Surgeons (ASBrS) aimed to create a consensus definition and classification system for oncoplastic surgery.

**Methods.** We performed a comprehensive literature search for oncoplastic surgery definitions using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Following this, a consensus definition and classification system was created by the ASBrS.

**Results.** Overall, 30 articles defining oncoplastic surgery were identified, with several articles contradicting each other. The ASBrS definition for oncoplastic surgery defines this set of breast-conserving operations using volume displacement and volume replacement principles as: “Breast conservation surgery incorporating an oncologic partial mastectomy with ipsilateral defect repair using volume displacement or volume replacement techniques with contralateral symmetry surgery as appropriate”. Volume displacement is defined as closing the lumpectomy defect and redistributing the resection volume over the preserved breast, and is divided into two levels: level 1 (< 20%) and level 2 (20–50%). Volume replacement includes those

situations when volume is added using flaps or implants to correct the partial mastectomy defect.

**Conclusion.** The ASBrS oncoplastic surgery definition and classification system provides language to facilitate discussion and teaching of oncoplastic surgery among breast surgeons, trainees, and patients.

After skin cancer, breast cancer remains the most common cancer among women, with an estimated 3.5 million survivors as of 2015. The overall survival of breast cancer patients continues to improve annually, with 5-year overall survival estimates increasing from 84.6 to 90.9% over the previous two decades.<sup>1</sup> Accordingly, there is an increased emphasis on cancer survivorship, with both professional and accrediting organizations delineating guidelines for high-quality survivorship care.<sup>2,3</sup>

Historically, surgeons have long focused on decreasing surgical morbidity by embracing breast conservation and, more recently, sentinel lymph node biopsy, strategies that contribute to quality-of-life outcomes. With these accomplishments secured, in the new millennium, greater emphasis has been placed on the psychosocial outcomes of breast cancer surgery. An increasing appreciation of overall quality of life through a patient's appearance, satisfaction, and sexual function has been well-documented.<sup>4–7</sup> To this end, interest in oncoplastic breast-conserving surgery, as well as nipple-sparing mastectomy, has led to post-graduate training initiatives across the country, created by both professional organizations and industry. Increased awareness of oncoplastic surgery has led to increasing prevalence

in the US.<sup>8,9</sup> Additionally, there is an intensified interest among surgeons performing breast surgery to master oncoplastic surgical techniques, leading to increased breast-conservation rates, improved long-term cosmetic outcomes, and quality-of-life in survivorship.<sup>10</sup>

The oncoplastic approach aims to harmonize the oncologic resection with an aesthetic result.<sup>11–13</sup> Historically, oncoplastic techniques have included a range of operations performed by the breast surgeon alone using local tissue rearrangement to close a partial mastectomy defect, to a breast surgeon/plastic surgeon team using local flaps to fill in a very large partial mastectomy resection. Oncoplastic surgery delineates strategies for a partial mastectomy that address the tissue defect at the time of surgical resection. However, the lack of a consistent definition of oncoplastic surgery causes confusion among surgical trainees, practicing surgeons, and oncoplastic educators. Equally important, the lack of a consistent definition may be confusing to patients seeking breast cancer treatment.

As part of the American Society of Breast Surgeons (ASBrS) commitment to ensuring all patients undergoing breast surgery have the best survivorship outcomes, the ASBrS formed the Oncoplastic Surgery Committee (OSC) in 2016, tasked with performing a needs assessment and developing an educational plan. The committee consists of breast surgeons from all types of practices across the country demonstrating expertise in oncoplastic surgery. The committee first defined their mission statement, which was approved by the ASBrS board. Central to the committee's mission was a vision that oncoplastic surgical techniques be considered standard of care, and implemented, when appropriate, in patients undergoing breast cancer surgery. With several varying definitions of oncoplastic surgery present in the literature,<sup>14–16</sup> one of the first initiatives was to increase understanding of oncoplastic terminology. Therefore, it was decided that a formal consensus definition and classification of oncoplastic surgery needed to be accepted and disseminated. To accomplish this, the committee performed a comprehensive literature review to review the various definitions of oncoplastic surgery, and then, through consensus, to provide a scope of the definition of oncoplastic surgery and develop an ASBrS classification system for oncoplastic surgery.

## METHODS

A comprehensive literature review searching for original papers that defined oncoplastic surgery was performed. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were used for this literature review. These guidelines were established in

2009 to address the science of systematic reviews,<sup>17</sup> and include a 27-item checklist and a flow diagram that literature reviews follow.

A search of the PubMed electronic database was undertaken using the following terms: oncoplastic surgery, oncoplastic breast surgery, therapeutic mammoplasty, volume displacement surgery, volume replacement surgery, therapeutic mastopexy, and breast. Only journals published in the English language were included. Exclusion criteria included papers that did not define oncoplastic surgery or used previous definitions of oncoplastic surgery to describe their results, although these were used to locate primary definition papers in the review. This was supplemented by landmark articles provided by the authors. The final papers meeting our inclusion criteria, and their associated definitions, are listed in Table 1.

Key definition papers were identified, accumulated and reviewed. Committee members were allowed to submit additional papers or literature they felt defined oncoplastic surgery. At this point, a consensus definition and classification system (Table 2) was created and then confirmed by the committee chair. A committee-member vote on the consensus definition was taken in support of the definition and classification system chosen. Oncoplastic surgery was defined as “a form of breast-conservation surgery that includes oncologic resection with a partial mastectomy, ipsilateral reconstruction using volume displacement or volume replacement techniques, with possible contralateral symmetry surgery when appropriate”. The committee-member vote included three options with respect to the definition chosen: ‘no’, ‘abstain’, or ‘yes’. A ‘yes’ vote  $\geq 75\%$  was needed to define consensus. Past consensus decisions in breast surgery validated these cut-offs.<sup>18</sup> The committee prioritized choosing a definition for oncoplastic surgery and a classification system that should be <sup>1</sup> simple to explain to patients and understood among trainees and colleagues of oncoplastic surgery; and <sup>2</sup> generalizable to all oncoplastic surgery operations described as breast-conservation surgeries. These two requirements allowed the consensus definition of oncoplastic surgery to be universally explained to patients and taught to trainees interested in learning oncoplastic surgery.

## RESULTS

The PRISMA diagram delineating our literature review is demonstrated in Fig. 1. From the literature review, we identified 30 articles defining oncoplastic surgery that met our inclusion/exclusion criteria. From this review, an oncoplastic surgery definition was developed: “Breast conservation surgery incorporating an oncologic partial mastectomy with ipsilateral defect repair using volume

**TABLE 1** Literature review of articles defining oncoplastic breast surgery

Articles reviewed	Oncoplastic breast surgery definition
Anderson <sup>35</sup>	Oncoplastic breast surgery refers to large partial mastectomy combined with a volume replacement technique of partial breast-myocutaneous-flap reconstruction using the latissimus dorsi or transrectus abdominis muscles. Oncoplastic surgery is now used to describe several volume displacement operations in which the defect created by large partial breast excisions is covered by a breast-flap mastopexy closure
Andree et al. <sup>42</sup>	Oncoplastic breast surgery is defined as breast cancer surgery focusing on optimizing both oncologic and aesthetic outcomes irrespective of the type of surgery performed
Baildam et al. <sup>43</sup>	Oncoplastic breast surgery includes appropriate adequate surgery to extirpate the cancer, partial reconstruction to correct wide excision defects, immediate and delayed total reconstruction with access to a full range of techniques, correction of asymmetry of the reconstructed and contralateral unaffected breast
Bali et al. <sup>44</sup>	Oncoplastic breast surgery options consist of either parenchymal displacement surgery (such as therapeutic mammoplasty or mastopexy) or parenchymal replacement surgery (such as partial breast reconstruction with chest wall perforator flap)
Cali cassi et al. <sup>45</sup>	Oncoplastic breast surgery consists of large lumpectomy and remodeling techniques such as breast-reshaping by therapeutic reduction mammoplasty or volume replacement by local glandular flaps or regional/distant flaps.
Chauhan et al. <sup>46</sup>	Oncoplastic surgery includes the use of volume displacement (periareolar, superior and inferior pedicle techniques, quadrantectomy with glandular remodeling, and demo-glandular flaps) or volume replacement (latissimus dorsi myofascial or myocutaneous flap)
Clough et al. <sup>19</sup>	Uses a bi-level classification system of oncoplastic surgery techniques based on the amount of tissue excised and the relative level of surgical difficulty. A level I approach (< 20%) is based on dual-plane undermining, including the NAC, and NAC recentralization if nipple deviation is anticipated. No skin excision is required. A level I approach was indicated for up to approximately 20% tissue excision. Level II techniques allow for major volume resection > 20%. This included more complex procedures derived from breast reduction techniques
De Lorenzi <sup>47</sup>	Oncoplastic breast surgery includes two fundamentally different approaches: (1) volume replacement procedures, which combine resection with immediate reconstruction by using local flaps (glandular, fasciocutaneous, and latissimus dorsi mini-flaps); and (2) volume displacement procedures, which combine resection with a variety of different breast reduction and reshaping techniques, according to the location of the tumor
Emiroğlu et al. <sup>48</sup>	Oncoplastic breast surgery techniques are divided into two main groups—simultaneous volume displacement and breast volume replacement. Volume displacement includes glandular advancement flaps, radial technique, breast reduction, and mastopexy. Breast-volume filling includes the latissimus dorsi flap, subaxillary fat pad flap, and transfer of free tissues with pedicle or microvascular anastomosis
Franceschini et al. <sup>49</sup>	Oncoplastic surgery is a broad concept that can be used for several different combinations of oncological surgery and plastic surgery: excision of the tumor by reduction mammoplasty, tumor excision followed by remodeling mammoplasty, mastectomy with immediate reconstruction of the breast, and partial mastectomy with reconstruction
Hamdi et al. <sup>50</sup>	Oncoplastic breast surgery includes two major groups of reconstruction techniques—volume displacement and volume replacement
Hoffmann and Wallwiener <sup>51</sup>	Oncoplastic breast surgery refers to any surgical procedure in which the primary surgical treatment strategy involves plastic surgical techniques for partial or complete reconstruction of the breast, or for correction of surgical defects to the thoracic wall. These are separated into ablative and breast-conserving categories. Within these two categories, there is further stratification based on the complexity of the procedure. Ablative procedures include prosthetic reconstruction, local flap reconstruction, distant pedicled flap reconstruction, and free flap reconstruction. Breast-conserving procedures include mobilization > 25%, tumor-adapted mastopexy with local flap reconstruction, reduction mammoplasty, and pedicled/free distant flap reconstruction
Holmes et al. <sup>37</sup>	Oncoplastic breast surgery includes a wide range of volume displacement or volume redistribution procedures to optimize breast shape and volume following breast cancer surgery
Hu et al. <sup>38</sup>	Oncoplastic breast surgery is broadly divided into two different techniques:(1) volume displacement using glandular or dermoglandular redistribution of breast tissue into the resection site; and (2) volume replacement using autologous tissues from an extramammary site to compensate for volume loss after tumor resection
Kaviani et al. <sup>52</sup>	Oncoplastic breast surgery involves reconstruction of resection defects by volume displacement using adjacent breast tissue
Khayat et al. <sup>53</sup>	Three-level classification for oncoplastic breast surgery Level 1: Dual plane undermining, nipple undermining, glandular advancement and lumpectomy defect closure Level 2: Glandular rotations, skin excision, de-epithelialization and NAC recentralization, round block (Benelli) mastopexy, crescent mastopexy, racquet mastopexy, hemibatwing and batwing mastopexy Level 3: Reduction mammoplasty procedures with contralateral balancing procedures, Wise pattern reduction, vertical mammoplasty, V/J mammoplasty
Kopkash and Clark <sup>41</sup>	Oncoplastic surgery presumes breast conservation. Level I oncoplastic surgery involves resection of < 20% of the breast volume. Level II oncoplastic surgery involves resection of > 20% of the breast volume requiring mammoplasty techniques
Lebovic GS <sup>54</sup>	Oncoplastic breast surgery does not refer to any given procedure. Rather, it describes a surgical mindset in the approach of a patient facing various types of breast surgery
Macmillan and McCulley <sup>55</sup>	Oncoplastic surgery is classified into four main categories: simple wide local excision, therapeutic breast reduction, therapeutic mastopexy, and volume replacement
McCulley et al. <sup>56</sup>	Therapeutic mammoplasty techniques can be broadly divided into two categories: (1) wedge excision, involving wedge excision and a form of wedge closure; and (2) advancement flaps with nipple reconstruction
Mukhtar et al. <sup>57</sup>	Uses a bi-level classification for oncoplastic surgery. Level 1 oncoplastic surgery if 'oncoplastic closure' or local tissue rearrangement via raising parenchymal flaps was described in the operative report. Level 2 oncoplastic surgery if both significant parenchymal and skin resections were performed (usually consisting of reduction mammoplasty)

TABLE 1 continued

Articles reviewed	Oncoplastic breast surgery definition
Munhoz et al. <sup>59</sup>	Oncoplastic breast surgery includes volume displacement or replacement procedures, and sometimes includes contralateral breast surgery. The majority of reconstruction techniques are performed with one of six surgical options: breast tissue advancement flaps, lateral thoracodorsal flap, bilateral mastopexy, bilateral reduction mammoplasty, latissimus dorsi myocutaneous flap, and abdominal flaps
Perez <sup>58</sup>	Oncoplastic techniques are classified into two large groups: volume displacement procedures and volume replacement procedures. Volume displacement includes glandular rearrangement (advancement, rotation, or transposition flaps) and reduction mammoplasties. Volume replacement includes autologous tissue flaps to replace excised breast such as the latissimus dorsi flap
Pillariseti and Querci della rovere <sup>60</sup>	Oncoplastic breast surgery includes volume displacement and volume replacement techniques
Rainsbury <sup>39</sup>	Oncoplastic breast surgery involves reconstruction of resection defects either by volume replacement or volume displacement
Rancati et al. <sup>40</sup>	Oncoplastic breast surgery is classified into PMBR, conservative post-surgery reconstruction, and reconstruction of defects in the chest wall and in soft tissues secondary to surgical treatment of locally advanced breast cancer. PMBR includes immediate and delayed breast reconstruction. Conservative post-surgery reconstruction also includes immediate and delayed breast reconstruction
Urban <sup>61</sup>	Three tier classification: Class 1: Monolateral breast reconstruction techniques such as aesthetic skin incisions, de-epithelization of the areolar margins, glandular mobilization and reshaping techniques, purse string sutures for central quadrant reconstruction, and immediate breast reconstruction with temporary expanders. These do not require plastic surgery training Class 2: Bilateral procedures: immediate and delayed breast reconstruction with implants, lipofilling, breast augmentation, breast reduction, mastopexy, Grisotti flap, and nipple and areola reconstruction. Plastic surgery skills are required to do a good symmetrization Class 3: Mono or bilateral complex procedures involving autologous flaps (pedicled or free flaps), or a combination of techniques
Weber et al. <sup>62</sup>	Oncoplastic breast surgery classification with four categories of the key steps of the procedure: conventional tumorectomy, oncoplastic mastopexy, oncoplastic tumorectomy, oncoplastic reduction mammoplasty. (1) Conventional tumorectomy refers to procedures with glandular re-approximation or direct wound closure following tumorectomy (2) Oncoplastic mastopexy is defined by non-oncological skin resection. This includes circumareolar mastopexy, also referred to as donut or round block (Benelli) mastopexy, skin-to-fascia excision in the lower quadrants, such as triangle excision or V-mammoplasty, and nipple repositioning with or without the use of pedicles (3) Oncoplastic tumorectomy differs from conventional tumorectomy by its partial breast reconstruction technique. It consists of either the displacement of tailored glandular and dermoglandular flaps or volume replacement techniques, such as latissimus dorsi flap reconstruction (4) Oncoplastic reduction mammoplasty is defined by non-oncological breast tissue resection in addition to skin resection to reduce the volume of the breast for aesthetic reasons. It commonly includes nipple repositioning by the use of pedicles in combination with breast re-shaping with tailored flaps
Weber et al. <sup>18</sup>	The Clough bi-level classification is recommended for standard use in clinical practice for indicating, planning, and performing oncoplastic breast surgery. The Hoffmann classification is recommended for surgical reports and billing purposes
Yazar et al. <sup>63</sup>	Oncoplastic breast surgery is defined as the combination of reduction mammoplasty and mastopexy techniques with breast conserving surgery

NAC nipple–areola complex, PMBR post-mastectomy breast reconstruction

displacement or volume replacement techniques with contralateral symmetry surgery as appropriate”. This definition was strongly influenced by the paper by Clough et al.<sup>19</sup>

Of the nine members on the committee, 100% voted in favor of the proposed oncoplastic surgery definition and classification system, meeting the consensus requirement.

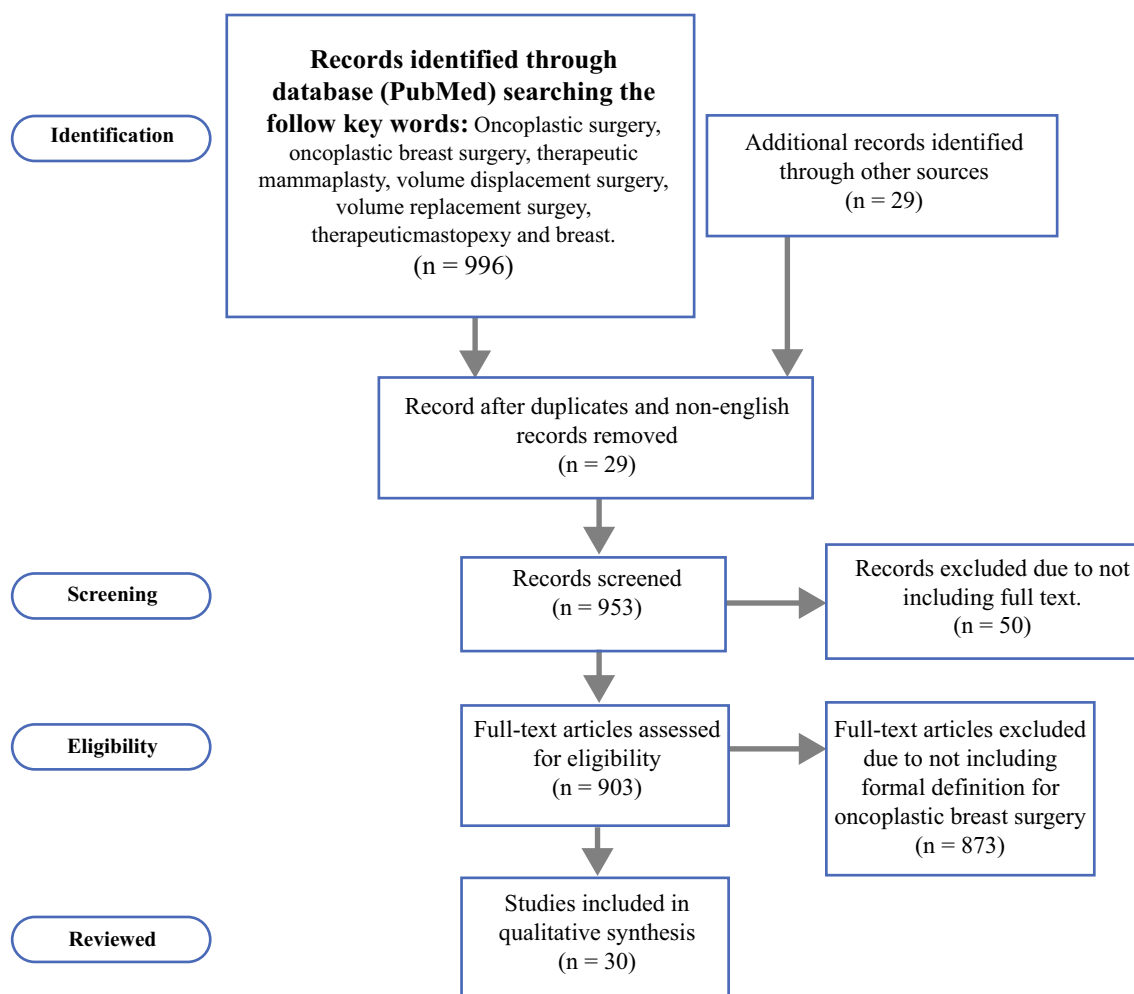
The oncoplastic surgery classification system that has been developed defines volume displacement as closing the lumpectomy defect and redistributing the resection volume over the preserved breast. It is divided into two levels: < 20% (which includes local tissue rearrangement, crescent mastopexy, and doughnut mastopexy) and 20–50% of breast tissue removed (which includes circumvertical mastopexy design and reduction mammoplasty). To further

incorporate all oncoplastic surgery operations, we chose to add ‘volume replacement’ to the oncoplastic definition for those situations when elsewhere tissue is recruited to fill the breast defect. This includes implant placement and local/regional flap reconstructions. The final definition and classification system approved by the consensus vote is described in Table 2. While the oncoplastic surgery definition focused on breast conservation, the committee wanted to stress the importance of adhering to strict oncologic and aesthetic principles when performing mastectomy operations. Examples of this are demonstrated when performing nipple-sparing mastectomies using aesthetically placed skin incisions or the use of VY tissue rearrangement designs to remove excess axillary skin when performing mastectomies without reconstruction.

**TABLE 2** Oncoplastic surgery definition

Oncoplastic surgery classification	
Volume displacement	Examples
Level 1: < 20% breast tissue removed	Local tissue rearrangement Crescent mastopexy Doughnut mastopexy
Level 2: 20–50% of breast tissue removed	Circumvertical mastopexy design Reduction mammoplasty designs (including free nipple graft)
Volume replacement	Examples:
> 50% of breast tissue removed	Implant-based reconstruction Local/regional flap reconstruction: thoracodorsal artery perforator, etc

Definition of oncoplastic surgery: A form of breast-conservation surgery that includes oncologic resection with a partial mastectomy, ipsilateral reconstruction using volume displacement or volume replacement techniques with possible contralateral symmetry surgery when appropriate

**FIG. 1** PRISMA flow diagram

## DISCUSSION

At its inception, breast-conserving surgery was the pursuit of improved survivorship outcomes for breast cancer patients; however, measuring aesthetic outcomes of cancer survivors lagged behind securing improved local control and overall survival. More recent research has provided measurement tools such as the BREAST-Q or the Likert scale that evaluate the aesthetic outcomes of breast cancer surgery. Both are validated scoring systems that measure how patients perceive their aesthetic and/or functional outcomes, and which could also be used to assess oncoplastic surgical outcomes.<sup>20,21</sup> The Institute of Medicine has called for improved assessment of the long-term consequences of cancer care.<sup>22,23</sup> As cancer surgeons, we have embraced measuring surgical morbidity. Understanding the breast as more than a 'modified sweat gland' has allowed surgeons to value the psychosocial consequences of breast cancer treatment. Preserving functional outcomes of the breast requires assessing the breast's role in self-presentation, intimacy, and sexuality. Oncoplastic surgery has gained traction across the continent, yet a standardized vocabulary to facilitate communication has not been uniformly accepted in North America.

The importance of defining and appropriately classifying oncoplastic surgery is superseded only by the rationale for oncoplastic surgery. In the US, the last decade has sustained an increased rate of mastectomy (often bilateral) operations paired with unclear reasoning from a patient's perspective.<sup>24,25</sup> Additionally, an unacceptably high percentage of women are dissatisfied with the appearance of their breasts after a traditional partial mastectomy.<sup>6</sup> In order to address this dissatisfaction, there have been reports of fat grafting or lipofilling partial mastectomy defects. Reports on oncologic safety specifically for partial mastectomy applications have been mixed and future research on this topic, looking at long term outcomes, is needed.<sup>26 27</sup>

Oncoplastic surgery combines an excellent oncologic outcome with improved aesthetic outcomes.<sup>28</sup> The advantages of oncoplastic surgery also lie in the oncologic realm where larger cancers can be removed using breast conservation, provided the patient has adequate breast volume to permit rearrangement.

Oncoplastic techniques are associated with a lower incidence of positive margins and fewer reoperations.<sup>28-30</sup> Beyond the surgical margin endpoint, oncoplastic surgery enables the breast surgeon to address both macromastia and ptosis, which may improve quality of life. A tailored oncoplastic surgical plan incorporates cancer resection with a patient's coexisting breast health. Breast reduction paired with oncologic partial mastectomy compares superiorly with reduction delayed to after completion of

radiotherapy, from the perspective of patient satisfaction and treatment-related costs.<sup>31</sup> As such, oncoplastic surgery has been shown to add value and is cost effective.<sup>10,32,33</sup>

The spectrum of oncoplastic surgery has been shaped by innovative leaders dedicated to improving survivorship outcomes for women. The ASBrS acknowledges these leaders in the field, without whom this publication would not exist. While some have defined techniques, others have prioritized teaching techniques. A brief, but not exhaustive, list includes Melvin Silverstein, Grant Carlson, Albert Losken, and Gail Lebovic from the US, and Werner Audretsch, Krishna Clough, Dick Rainsbury, Cicero Urban, and Douglas Macmillan from abroad.

The ASBrS's goal is for oncoplastic surgery to reach all surgeons performing breast surgery. This will require increasing the awareness of our surgeons, referring physicians, and, most of all, our patients. The ASBrS-sponsored Breast360.org provides a platform for patient-centered education, empowering patients to ask appropriate questions to ensure access to optimal, state-of-the-art techniques for their breast surgery. To this end, the ASBrS endorses the perspective that every surgery must account for the patient's breast size, lesion size, and location among all surgeons practicing breast surgery.

The goal is for breast surgeons to identify the procedures they are capable of safely performing independently, and recognize when plastic surgery expertise is appropriate.

The location of planned incisions is integral to oncoplastic surgery when choosing and communicating to the patient. Incisions made at the natural anatomic boundaries such as the inframammary fold, nipple areolar border, or axilla fossae can minimize visible scarring. After surgical resection, repair of the partial mastectomy defect and re-creation of a smooth breast contour is essential to every operation. When procedures decrease the breast skin envelope, simple or advanced techniques may be necessary to complete the aesthetic appearance of the breast. The most advanced level in oncoplastic surgery involves repairing a defect by recruiting tissue beyond the breast gland, requiring breast reconstructive surgery techniques.

While consensus definitions such as the one detailed in this study can help universalize language that improves communication and training, future implications using this definition could mean a spread of oncoplastic operations, possibly leading to improved breast surgery outcomes. The possibilities for evaluating these outcomes using patient-reported outcome measures or utility scores for cost-effectiveness analyses create for exciting future research endeavors.

## THE DEFINITION AND ITS APPLICATION

The consensus definition of oncoplastic surgery (Table 2) applies to a patient undergoing breast-conservation surgery. Before this consensus definition, there have been several, often contradictory, definitions in the literature, creating potential confusion among surgeons, trainees, and patients. Level 1 volume displacement is applicable with the removal of up to 20% of breast tissue, and level 2 is applicable with the removal of up to 50% of breast tissue. Often, especially in level 2 volume displacement oncoplastic surgery, a symmetry contralateral operation is performed using either mastopexy or breast reduction techniques to allow for symmetric breast form and nipple position. If more than 50% of the breast needs removal, then a volume replacement option may be preferred as the residual tissue volume is frequently inadequate, except in extreme cases.<sup>34</sup>

The consensus definition and classification system is uncomplicated and easy to teach and communicate with colleagues, trainees, and patients. It also helps the breast surgeon understand when to incorporate the assistance of the plastic surgeon. When designing educational courses, this definition schema allows operation techniques to be easily categorized. Levels of oncoplastic surgery can be correlated with difficulty of the technique, suggesting level 1 oncoplastic techniques be mastered first prior to pursuing level 2 techniques, which require more advanced skills. For the trainee, this definition can better guide course selection, as well as provide a better framework to categorize skill acquisition and assessment. Finally, this definition and classification system is generalizable to most oncoplastic surgery techniques described in the literature.

## THE DEFINITION AND CLASSIFICATION SYSTEM AS A GUIDE RATHER THAN A STRICT RULE

The committee was clear that this definition, with its associated classification system, should serve as a guideline in practice management and not as a hard and fast rule. To this point, the classification system is anatomically based rather than procedurally based. Keeping the classification system volumetrically based means surgeons have a choice of techniques based on the percentage of breast tissue being reconstructed. Example procedures are given but a definitive list is impractical.

The cut-off point of 20% separating levels 1 and 2 volume displacement oncoplastic surgery, and 50% separating volume displacement and volume replacement oncoplastic surgery, are fluid and should only serve as suggested planning guides. For example, in a woman with

a 3.5 cm breast cancer with significant macromastia, one oncoplastic surgical option is a Wise pattern reduction incision, which may remove more than 50% of the woman's breast. While not fitting clearly within the 50% cut-off, the individualization of a clinical treatment plan using volume displacement is reasonable here. Similarly, a woman with a smaller cancer that requires < 20% removal of breast tissue, but with significant grade 2 or 3 ptosis, may also be given the option of a level 2 volume displacement oncoplastic operation using mastopexy designs. Additionally, the ASBrS is not suggesting that every patient undergo oncoplastic surgery as this could result in excessive surgery in some circumstances. Specific locations of smaller cancers in the lower hemisphere of the breast may also benefit from oncoplastic interventions. For example, an approximate 10% defect at the 6 o'clock position inferior to the nipple areola complex may be better treated with a level 1 oncoplastic volume displacement reconstruction to avoid future retraction deformity (bird beak deformity).<sup>35,36</sup> The choice of surgery should always be individualized to a patient's cancer, breast, and personal priorities.

## THE UNIQUENESS OF THE AMERICAN SOCIETY OF BREAST SURGEONS CONSENSUS DEFINITION FOR ONCOPLASTIC SURGERY

The majority of definitions/classifications of oncoplastic surgery presume that oncoplastic surgery is a breast-conservation method.<sup>37-41</sup> This is further supported by international training programs in Europe that presume oncoplastic surgery is within the spectrum of breast-conservation surgery. The principles of oncologic surgery and plastic surgery still hold true in the spectrum of mastectomy operations, particularly in nipple-sparing mastectomy operations where the skin envelope, including the nipple, is preserved, the accurate removal of breast tissue is performed, and the improved ability for aesthetic reconstruction is possible. The Europeans created a consensus classification for oncoplastic surgery<sup>18</sup> that is similar to our classification; however, the difference between their consensus and the ASBrS consensus definition is the added description of volume replacement. Additionally, the European consensus definition supported other oncoplastic surgery definitions, citing that those definitions were better for either billing purposes or clinical research. The goal for the ASBrS was to support one clear definition that would best serve the breast surgeon in North America and could be used across other countries as desired. The consensus process focused on ease of communication between colleagues, patients, and trainees, rather than a billing application; however, the definition

will easily facilitate ethical billing. For example, a level 1 volume displacement oncoplastic surgery would use 14,000 Current Procedural Terminology (CPT) coding options, while a level 2 volume displacement oncoplastic surgery would use reduction mammoplasty or mastopexy CPT coding options. Lastly, for volume replacement options, associated CPT codes for implant insertion or flap transfers (depending on the flap chosen) can reasonably be used. Our process of performing a comprehensive literature review was an effort to respect the global multinational and geographical oncoplastic landscape, with consideration of all definitions described.

## CONCLUSIONS

Every patient undergoing breast surgery deserves to have an ideal oncologic outcome paired with the best aesthetic results possible. Oncoplastic techniques in breast surgery strive to deliver these endpoints. In this effort, the ASBrS defines oncoplastic surgery and classifies it into volumetrically described skill levels, adding options to the breast-conservation armamentarium. This classification should allow better communication among breast surgeons, patients, and trainees. Final oncoplastic surgical decision making depends on the cancer presentation and the surgical assessment, combined foremost with the patient's priorities. The oncoplastic approach should ensure that comprehensive treatment results in optimal survivorship, encompassing oncologic, functional, and aesthetic outcomes.

## REFERENCES

1. SEER Cancer Statistics Review, 1975–2015. National Cancer Institute. 2018 [cited 21 Sep 2018]. [https://seer.cancer.gov/csr/1975\\_2015/](https://seer.cancer.gov/csr/1975_2015/).
2. American College of Surgeons. Cancer Program Standards: Ensuring Patient-Centered Care (2016 edition). Chicago: American College of Surgeons; 2016. pp. 58–9.
3. American College of Surgeons. National accreditation program for breast centers standards manual. Chicago: American College of Surgeons; 2018. pp. 58–60.
4. McLaughlin S, Cornell L, Mussallem D. Sexual function and breast-specific sensuality remain important after breast cancer surgery. *Ann Surg Oncol*. 2017;24(12):3475–6.
5. Rojas K, Onstad M, Raker C, Clark M, Stuckey A, Gass J. The impact of mastectomy type on the Female Sexual Function Index (FSFI), satisfaction with appearance, and the reconstructed breast's role in intimacy. *Breast Cancer Res Treat*. 2017;163(2):273–9.
6. Gass J, Mitchell S, Hanna M. The psychosocial impact of surgical scars in survivorship: findings from a nationwide survey of women breast cancer survivors [abstract]. In: Proceedings of the 2017 San Antonio Breast Cancer Symposium; 5–9 Dec 2017; San Antonio, TX.
7. Aerts L, Christiaens M, Enzlin P, Neven P, Amant F. Sexual functioning in women after mastectomy versus breast conserving therapy for early-stage breast cancer: a prospective controlled study. *Breast*. 2014;23(5):629–36.
8. Carter S, Lyons G, Kuerer H, Bassett RJ, Oates S, Thompson A. Operative and oncologic outcomes in 9861 patients with operable breast cancer: single-institution analysis of breast conservation with oncoplastic reconstruction. *Ann Surg Oncol*. 2016;23(10):3190–8.
9. Jonczyk M, Jean J, Graham R, Chatterjee A. Surgical trends in breast cancer: a rise in novel operative treatment options over a 12 year analysis. *Breast Cancer Res Treat*. 2019;173(2):267–74.
10. Chatterjee A, Offodile AC II, Asban A, Minasian RA, Losken A, Graham R, et al. A cost-utility analysis comparing oncoplastic breast surgery to standard lumpectomy in large breasted women. *Adv Breast Cancer Res*. 2018;7(2):14.
11. El-Tamer M. Principles and techniques in oncoplastic breast cancer surgery. Singapore: World Scientific Publishing Co Inc.; 2012.
12. Kelsall J, McCulley S, Brock L, Akerlund M, Macmillan R. Comparing oncoplastic breast conserving surgery with mastectomy and immediate breast reconstruction: case-matched patient reported outcomes. *J Plastic Reconstr Aesthetic Surg*. 2017;70(10):1377–85.
13. Palsdottir E, Lund L, Asgeirsson A. Oncoplastic breast-conserving surgery in Iceland: a population-based study. *Scand J Surg*. 2018;107(3):224–9.
14. Clough K, Kroll S, Audretsch W. An approach to the repair of partial mastectomy defects. *Plastic Reconstr Surg*. 1999;104(2):409–20.
15. Masetti R, Pirulli P, Magno S, Franceschini G, Chiesa F, Antinori A. Oncoplastic techniques in the conservative surgical treatment of breast cancer. *Breast Cancer*. 2000;7(4):276–80.
16. Audretsch W, Rezai M, Kolotas C, Zamboglou N, Schnabel T, Bojar H. Tumor-specific immediate reconstruction in breast cancer patients. *Semin Plast Surg*. 1998;11(1):71–100.
17. Moher D, Liberati A, Tetzlaff J, Altman D. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg*. 2010;8(5):336–41.
18. Weber W, Soysal S, El-tamer M. First international consensus conference on standardization of oncoplastic breast conserving surgery. *Breast Cancer Res Treat*. 2017;165(1):139–49.
19. Clough K, Kaufman G, Nos C. Improving breast cancer surgery: a classification and quadrant per quadrant atlas for oncoplastic surgery. *Ann Surg Oncol*. 2010;17:1375–91.
20. Cohen WA, Mundy LR, Ballard TN, Klassen A, Cano SJ, Browne J, et al. The BREAST-Q in surgical research: a review of the literature 2009–2015. *J Plast Reconstr Aesthet Surg*. 2016;69(2):149–62.
21. Visser NJ, Damen TH, Timman R, Hofer SO, Mureau MA. Surgical results, aesthetic outcome, and patient satisfaction after microsurgical autologous breast reconstruction following failed implant reconstruction. *Plast Reconstr Surg*. 2010;126(1):26–36.
22. Institute of Medicine and National Research Council. From cancer patient to cancer survivor: lost in transition. Washington, DC: The National Academies Press; 2006.
23. McCabe M, Bhatia S, Oeffinger K, Reaman G, Tyne C, Wollins D, et al. American society of clinical oncology statement: achieving high-quality cancer survivorship care. *J Clin Oncol*. 2013;31(5):631–40.
24. Habermann E, Abbott A, Parsons H, Virnig B, Al-Refaie W, Tuttle T. Are mastectomy rates really increasing in the United States? *J Clin Oncol*. 2010;28(21):3437–41.
25. Tan M. Is there an ideal breast conservation rate for the treatment of breast cancer? *Ann Surg Oncol*. 2016;23(9):2825–31.
26. Petit J, Rietjens M, Botteri E, Rotmensz N, Bertolini F, Curigliano G, et al. Evaluation of fat grafting safety in patients with



- intra epithelial neoplasia: a matched-cohort study. *Ann Oncol*. 2013;24(6):1479–84.
27. Petit JY, Lohsiriwat V, Clough KB, Sarfati I, Ihrai T, Rietjens M, et al. The oncologic outcome and immediate surgical complications of lipofilling in breast cancer patients: a multicenter study—Milan–Paris–Lyon experience of 646 lipofilling procedures. *Plast Reconstr Surg*. 2011;128(2):341–6.
  28. De La Cruz L, Blankenship S, Chatterjee A, Geha R, Nocera N, Czerniecki B, et al. Outcomes after oncoplastic breast-conserving surgery in breast cancer patients: a systematic literature review. *Ann Surg Oncol*. 2016;23(10):3247–58.
  29. Losken A, Hart A, Chatterjee A. Updated Evidence on the oncoplastic approach to breast conservation therapy. *Plast Reconstr Surg*. 2017;140(5S Advances in Breast Reconstruction):14S–22S.
  30. Losken A, Dugal C, Styblo T, Carlson G. A Meta-analysis comparing breast conservation therapy alone to the oncoplastic technique. *Ann Plast Surg*. 2014;72(2):145–9.
  31. Munhoz A, Aldrighi C, Montag E, Arruda E, Brasil J, Filassi J, et al. Outcome analysis of immediate and delayed conservative breast surgery reconstruction with mastopexy and reduction mammoplasty techniques. *Ann Plast Surg*. 2011;67(3):220–5.
  32. Asban A, Homsy C, Chen L, Fisher C, Losken A, Chatterjee A. A cost-utility analysis comparing large volume displacement oncoplastic surgery to mastectomy with single stage implant reconstruction in the treatment of breast cancer. *Breast*. 2018;41:159–64.
  33. Chatterjee A, Asban A, Jonczyk M, Chen L, Czerniecki B, Fisher CS. A cost-utility analysis comparing large volume displacement oncoplastic surgery to mastectomy with free flap reconstruction in the treatment of breast cancer. *Am J Surg*. 2019;41:159. <https://doi.org/10.1016/j.amjsurg.2019.01.037>
  34. Silverstein M, Savalia N, Khan S, Ryan J. Extreme oncoplasty: breast conservation for patients who need mastectomy. *Breast J*. 2015;21(1):52–9.
  35. Anderson B, Masetti R, Silverstein M. Oncoplastic approaches to partial mastectomy: an overview of volume-displacement techniques. *Lancet Oncol*. 2005;6(3):145–57.
  36. Chatterjee A, Khakpour N, Czerniecki B. Oncoplastic surgery: keeping it simple with 5 essential volume displacement techniques for breast conservation in a patient with moderate to large sized breasts. *Cancer Control*. 2017;24(4):1–11.
  37. Holmes D, Schooler W, Smith R. Oncoplastic approaches to breast conservation. *Int J Breast Cancer*. 2011;2011:1–16.
  38. Hu J, Rainsbury R, Segaran A, Predescu O, Roy P. Objective assessment of clinical, oncological and cosmetic outcomes following volume replacement in patients undergoing oncoplastic breast-conserving surgery: protocol for a systematic review. *BMJ Open*. 2018;8(7):e020859.
  39. Rainsbury R. Surgery insight: oncoplastic breast-conserving reconstruction—indications, benefits, choices and outcomes. *Nat Clin Pract Oncol*. 2007;4(11):657–64.
  40. Rancati A, Gonzalez E, Dorr J, Angrigiani C. Oncoplastic surgery in the treatment of breast cancer. *Ecancermedicalscience*. 2013;7:293.
  41. Kopkash K, Clark P. Basic oncoplastic surgery for breast conservation: tips and techniques. *Ann Surg Oncol*. 2018;25(10):2823–28.
  42. Andree C, Farhadi J, Goossens D. A position statement on optimizing the role of oncoplastic breast surgery. *Eplasty*. 2012;12:e40.
  43. Baildam A, Bishop H, Boland G. Oncoplastic breast surgery: a guide to good practice. *Eur J Surg Oncol*. 2007;33 Suppl 1:S1–23.
  44. Bali R, Kankam H, Borkar N, Provenzano E, Agrawal A. Wide local excision versus oncoplastic breast surgery: differences in surgical outcome for an assumed margin (0, 1, or 2 mm) distance. *Clin Breast Cancer*. 2018;18(5):e1053–57.
  45. Caì Cassi L, Vanni G, Petrella G. Comparative study of oncoplastic versus non-oncoplastic breast conserving surgery in a group of 211 breast cancer patients. *Eur Rev Med Pharmacol Sci*. 2016;20(14):2950–4.
  46. Chauhan A, Sharma M, Kumar K. Evaluation of surgical outcomes of oncoplasty breast surgery in locally advanced breast cancer and comparison with conventional breast conservation surgery. *Indian J Surg Oncol*. 2016;7(4):413–9.
  47. De Lorenzi F. Oncoplastic surgery: the evolution of breast cancer treatment. *Breast J*. 2010;16 Suppl 1:S20–1.
  48. Emiroğlu M, Sert İ, İnal A. The role of oncoplastic breast surgery in breast cancer treatment. *J Breast Health*. 2015;11(1):1–9.
  49. Franceschin G, Magno S, Fabbri C. Conservative and radical oncoplastic approaches in the surgical treatment of breast cancer. *Eur Rev Med Pharmacol Sci*. 2008;12(6):387–96.
  50. Hamdi M, Sinove Y, DePypere H, Broucke VD, Vakaef L, Cocquyt V, et al. The role of oncoplastic surgery in breast cancer. *Acta Chir Belg*. 2008;108(6):666–72.
  51. Hoffmann J, Wallwiener D. Classifying breast cancer surgery: a novel, complexity-based system for oncological, oncoplastic and reconstructive procedures, and proof of principle by analysis of 1225 operations in 1166 patients. *MC Cancer*. 2009;9:108.
  52. Kaviani A, Sodagari N, Sheikhabaei S. From radical mastectomy to breast-conserving therapy and oncoplastic breast surgery: a narrative review comparing oncological result, cosmetic outcome, quality of life, and health economy. *ISRN Oncol*. 2013;2013:742462.
  53. Khayat E, Brackstone M, Maxwell J. Training Canadian surgeons in oncoplastic breast surgery: where do we stand? *Can J Surg*. 2017;60(6):369–71.
  54. Lebovic G. Oncoplastic surgery: a creative approach to breast cancer management. *Surg Oncol Clin N Am*. 2010;19(3):567–80.
  55. Macmillan R, McCulley S. Oncoplastic breast surgery: what, when and for whom? *Curr Breast Cancer Rep*. 2016;8:112–7.
  56. McCulley S, Durani P, Macmillan R. Therapeutic mammoplasty for centrally located breast tumors. *Plast Reconstr Surg*. 2006;117(2):366–73.
  57. Mukhtar R, Wong J, Piper M. Breast conservation and negative margins in invasive Lobular Carcinoma: the impact of oncoplastic surgery and shave margins in 358 patients. *Ann Surg Oncol*. 2018;25(11):3165–70.
  58. Perez R. Incision patterns in breast oncoplastic surgery. 2015. <http://hdl.handle.net/10902/7059>.
  59. Munhoz A, Montag E, Gemperli R. Oncoplastic breast surgery: indications, techniques and perspectives. *Gland Surg*. 2013;2(3):143–57.
  60. Pillarisetti R, Querci Della Rovere G. Oncoplastic breast surgery. *Indian J Surg*. 2012;74(3):255–63.
  61. Urban C. New classification for oncoplastic procedures in surgical practice. *The Breast*. 2008;17(4):321–2.
  62. Weber W, Soysal S, Fulco I. Standardization of oncoplastic breast conserving surgery. *Eur J Surg Oncol*. 2017;43(7):1236–43.
  63. Yazar S, Altunel D, Serin M, Aksoy Ş, Yazar M. Oncoplastic Breast Conserving Surgery: Aesthetic Satisfaction and Oncological Outcomes. *Eur J Breast Health*. 2018;14(1):35–8.