Review Article

Oncoplastic breast surgery in Europe

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Abstract: Oncoplastic breast surgery (OPS) has become an integral part of breast cancer surgery for both breast conservation and mastectomies. In recent years, the emphasis on early detection and the advances in systemic and locoregional therapy has improved prognosis leading to an increased focus on survivorship and quality of life issues including patients' short and long-term aesthetic appearance as a key part of the surgical management. There is a significant variation across Europe in the type of specialist performing breast cancer surgery and the provision of OPS as such. In the traditional model, breast cancer care was provided by gynecologists in some countries, general surgeons, surgical oncologists, and breast surgeons in others. However recently, surgeons throughout Europe have extended their skill-base to include level 1 and 2 OPS and implant- and pedicle-flap based breast reconstruction. For breast surgeons to become proficient in these techniques, a standardized level of training and expertise is needed. The European Society of Mastology (EUSOMA) set standards for a specialist health professional in the field of breast cancer, the European Union of Medical Specialists (UEMS) examinations and the global curriculum that was developed by the American Society of Surgical Oncology (SSO) and the European Society of Surgical Oncology (ESSO) aims to improve standards of OPS practice across Europe. The new generation of breast surgeons, therefore, should be equipped with the necessary skill set to provide high quality OPS while keeping abreast of novel technologies and techniques aiming to provide patients with excellent long-term quality of life.

Keywords: Oncoplastic breast surgery (OPS); surgical training; breast reconstruction

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Introduction: evolution of oncoplastic breast surgery (OPS) in Europe

In the Halstedian era, the first significant change towards OPS in Europe came in July 1981 when Umberto Veronesi and his team published the Milan I trial. Veronesi *et al.* reported no difference in disease-free or overall survival between Halsted radical mastectomy and quadrantectomy and axillary lymph node dissection, which was sustained with 20-year follow-up (1,2).

This was the first randomized trial showing that breast conserving surgery (BCS) resulted in an equal survival rate, with far less deformity and morbidity compared to radical mastectomy. Thereafter, there was a gradual shift from radical mastectomy to BCS and radiotherapy in selected cohort of patients. However, breast surgeons further pushed the boundaries of the indications for BCS in the pursuit of improving cosmesis while maintaining good oncological outcomes. This led to a paradigm shift from the Halstedian era of radicalism towards the oncoplastic surgical era of conservatism. The term oncoplastic surgery was coined shortly after that (3). The techniques initially described the use of mammoplasty techniques for breast cancer surgery especially for lower pole tumors, which had the highest risk of deformity following large volume resections (4). The application of these techniques was later extended to

include all breast quadrants (5).

The oncoplastic techniques used today in BCS include local parenchymal remodelling, volume displacement or volume replacement techniques to reconstruct the surgical defect. The two main approaches for OPS are described as level 1 or level 2 based on the extent of breast tissue and skin excised and whether the nipple is repositioned. Level 1 procedures are less complicated, involving minimal glandular resection and volume displacement. The excision defects in Level 1 techniques are repaired using simple tissue approximation where contour deformities and breast asymmetry are less likely. Level 2 OPS includes removing more than 20% of the breast tissue, normally requiring significant glandular displacement or even formal breast volume reduction and nipple relocation or volume replacement. This comprises a variety of techniques for different tumor sizes and locations.

OPS initially focused on breast conservation, however over the years, applying oncoplastic principles to mastectomy and whole breast reconstruction was deemed just as important. The ability to perform a more considerate mastectomy became a prerequisite skill of an oncoplastic breast surgeon. The surgeon's knowledge of the full range of conservative mastectomy techniques, their indications and all available breast reconstruction options in different oncological scenarios offers the patient both the best aesthetic outcomes without affecting the oncological safety. The concept of oncoplastic surgery was further extended to include appropriate scar placement, procedures for symmetrisation, nipple reconstruction, tattooing and lipomodelling (6).

Current practice in Europe

In recent years, there has been increased patient awareness and patient demand for good aesthetic outcomes in breast surgery. The advances in early detection, systemic and locoregional therapy have improved prognosis prolonging survival in patients with breast cancer with the highest survival in the northern part of Europe (7). This has led to the focus on patients' survivorship and quality of life issues including the satisfaction with breast and body image (8). In many countries across Europe, OPS has become an integral part of in breast cancer surgery for both breast conservation and mastectomies and the initial concerns among clinicians around the oncological safety surrounding OPS has become less of a concern (9).

OPS procedures are performed significantly more in specialist cancer centres and these rates were also noted to be highly variable between surgeons (5). But even in the specialised centres most cases require only a simpler operation without the need for a more complex procedure to maintain breast shape and volume. In France, one of the leading teams in OPS lead by Clough, reported that 13.9% of patients with breast cancer received level 2 OPS, either upfront or after neoadjuvant treatment. Majority of these patients, up to 78% had volume displacement techniques used in their OPS procedures with unilateral mammoplasty and 22% of patients had an immediate symmetrisation surgery (10). In the UK, OPS procedures are well established in most units where an excision of more than 20% of the breast volume, often referred to as a partial mastectomy and reconstruction (PMR) has been described as an alternative to mastectomy. A survey study in the UK showed that 39% of breast surgeons offered PMR and reconstruction. This was also noted to be carried out more frequently by larger breast units, typically as a one-stage procedure mirroring the practice in the specialized centers France (11).

The boundaries of OPS have been pushed even further and the term extreme oncoplastic surgery was first coined by Silverstein *et al.* in 2015. This refers to OPS in patients who, in most physicians' opinions, require a mastectomy (12). These breast cancers are generally large, greater than 5 cm, multifocal or multicentric tumours and most of these patients would normally be offered a mastectomy with many requiring post-mastectomy adjuvant radiotherapy. This concept has been adopted in many centres across Europe and recent studies show promising long-term oncological results for patients without compromising local control (12-15). The rates for revision surgeries and complications differ based on the techniques used for the partial defect reconstruction (13). From an overall quality of life perspective, extreme oncoplastic surgery seems to be a better option than the combination of mastectomy, reconstruction, and radiation therapy (16). There is now a global shift into accepting that conservation is something to be considered even in the case of multiple ipsilateral cancers (17). Large scale studies are however required to validate these preliminary results such as the ACOSOG Z11102 (Alliance) in the USA and the ANTHEM Study in the UK, in order to disseminate these techniques routinely as a safe option for these patients (18-21).

The use of chest wall perforator flaps (CWPFs) in cases of PMR or extreme oncoplastic surgery is increasing and there is a worldwide appetite to know more about

these operations as this is becoming the preferred volume replacement method for partial breast reconstruction (22-27). The main driver for using these flaps is improved aesthetics with little need for contralateral symmetrisation surgery and reduced donor site morbidity. The most used CWPFs are the lateral intercostal artery perforator flaps (LICAP), lateral thoracic artery perforator (LTAP), thoracodorsal artery perforator (TDAP) and the anterior and medial artery perforator flaps (AICAP and MICAP). The use of local pedicle flaps has extended the range of indications for BCS, filling defects in all quadrants, reducing mastectomy rates and the associated revision and symmetrising procedures (22).

Whole breast reconstruction following total mastectomy is now routinely offered widely across Europe. In most European countries, breast reconstruction is covered by public health insurance (28). However, an ESPRAS Survey study suggests that the type of reconstruction offered in Europe was influenced by the geographic location and therefore shows high degrees of variability within the region (28). Despite the European Society of Mastology (EUSOMA) guidelines recommending a rate of 40% of immediate breast reconstruction (IBR) following mastectomies, the majority of countries within Europe fail to achieve this (28). It was reported that in Europe, the majority of countries showed a national IBR rate of under 40% (28). In some countries local guidelines on reconstruction have been formed to improve the reconstruction rates. In the UK, for example the National Institute for Health and Care Excellence (NICE) guidelines recommend that all women should have access to reconstruction (29). However, despite this, the National Mastectomy and Breast Reconstruction Audit (NMBRA) reported only 31% of patients undergoing mastectomies had breast reconstruction (30).

A UK study conducted between 2007 and 2014 identified the annual number of IBR increased from 2,182 (14.9%) in 2007 to 3,753 in 2013 (24.7%) (31). In France the IBR rate was 16.1% on average (32). The Netherlands have a breast reconstruction rate of 17% and 42% respectively for invasive cancers and ductal carcinoma in situ (DCIS) (33). In Spain, a study showed that the overall IBR rate was 22% (34). However, many countries in Europe report significant variation in the use of IBR between hospitals and regions. The recent NMBRA in the UK demonstrated variation in the practice of IBR across the UK, with rates ranging from 10% to 43% (35). This was similar to the Netherlands (0–43% for invasive breast cancer and 0–74% for DCIS) (33). The overall IBR rates in Europe are unfortunately far less compared to the rates achieved in the USA, reported at 63% in 2007 (36).

There has been a paradigm shift in Europe on the type of whole breast reconstruction over the years. Autologous flaps were initially thought to be the 'gold standard' technique with predictable outcomes and long-term durability (37). However, implant-based reconstruction has become an increasingly attractive choice for patients given the reduced perioperative surgical morbidity and faster recovery. Surgeons are also drawn by the overall simplicity; the low complication rate and short hospital stay. In the UK, implant-based techniques have increased, accounting for more than half of all breast reconstructions carried out (31).

Implant-based breast reconstruction was accelerated by the development of acellular dermal matrices (ADMs) and synthetic meshes (38). Initially, the implants were placed in a partly subpectoral plane, created by dividing the lower insertions of the pectorals major muscle. A mesh was sutured then between the lower and lateral free border of the pectoralis muscle and the chest wall as an extension of the subpectoral pocket. This allowed a definitive fixed-volume implant to be placed under the muscle at the time of surgery, avoiding the need for tissue expansion and a second procedure. The resulting cosmetic outcomes were also better through improved lower pole projection (39). More recently, prepectoral techniques have been introduced where the implant, fully or partially wrapped in a mesh, is placed on top of rather than under the pectoralis major muscle (40). This 'muscle-sparing' technique have been shown to be postoperatively less painful and reduce the potentially distressing implant 'animation' seen when the pectoralis muscle contracts (41).

In terms of pedicled autologous flaps, traditionally the musculocutaneous latissimus dorsi (LD) flap was favoured for whole breast reconstruction or significant partial breast volume replacement. It was commonly used as a safe and viable alternative to the deep inferior epigastric perforator (DIEP) flaps, the advantage being that it did not require microsurgical expertise. It offers a natural and aesthetically satisfying results with low complication rates and short postoperative hospital stay. However, the LD flap has certainly run its course and fallen out of favor among many surgeons. With the advances in implant-based reconstruction techniques and devices, the LD has become increasingly less popular especially when for most LD flap reconstructions, an implant would have to be used anyway to achieve adequate breast volume. Furthermore, donor

site morbidity from LD reconstruction surgeries including reduction in shoulder strength led to surgeons moving away from this technique (42).

Breast symmetry is one of the most thrived aesthetic outcomes of OPS. With increasingly larger volume excisions as part of level two OPS or even extreme OPS with no volume replacement, glandular remodelling is often achieved using breast reduction techniques. Consequently, the other breast would also have to be reduced to match the cancer resection side. Some patients with smaller breast opting for mastectomies and reconstructions may also decide to have a contralateral augmentation usually using implants. Overall, the rates of symmetrising procedures are high across Europe. In over 81% of cases, all women are offered symmetrisation, including breast reduction, mastopexy, implant-based augmentation, augmentation mastopexy, and lipofilling funded by the public health care system (28). The number of operations for secondary aesthetic corrections is not limited in most countries (78%). Lipofilling is offered as an option for the correction of post-BCS contour defects in most European countries for a selected patient population (28).

The timing of the symmetrisation procedures is still a matter of debate, as both have their benefits and challenges. Immediate contralateral surgery spares the patient from an additional operation and hopefully leaving the patient with an immediate symmetrical result which would improve quality of life significantly and is therefore more cost efficient. However, the affected breast may need to undergo further oncological treatment such as adjuvant radiotherapy which could affect the final post radiotherapy shape and volume. A delayed surgical approach on the other hand could therefore potentially take into account these anomalies. Furthermore, immediate contralateral surgery increases the risks of peri-operative complications which could delay the start of adjuvant therapy. Also, immediate contralateral operations require more resources and time, therefore could pose a challenge for units delivering cancer care service provision. In publicly funded healthcare systems breast units are under a significant amount of pressure to maximize theatre utilization and efficiencies which poses a further challenge on the justification of symmetrisation surgery.

OPS in Europe

The practice of OPS varies significantly across Europe. One of the main variations observed is the speciality of the surgeon performing OPS. In the traditional model, breast cancer care is provided by general surgeons and gynaecologists in some countries and surgical oncologists or specialist breast surgeons in others. In many countries, all the implant-based breast reconstructions after mastectomies were traditionally performed by plastic surgeons. However recently, breast surgeons throughout Europe have extended their skill-base to include level 1 and 2 OPS including implant- and pedicle-flap based breast reconstruction. This shift has been supported by the EUSOMA with the introduction of a successful framework of certification to audit and accredit breast cancer treatment centres (43). However, this formal accreditation with EUSOMA requires staffing levels that most of the breast units in Europe still lack and to become compliant would incur significant costs.

A UK survey study demonstrated a significant shift in clinical practice between 2010 and 2015 where an increased proportion of general and breast surgeons in the UK were performing therapeutic mammoplasties (TMs) (7). This showed a corresponding reduction in the number of TMs performed as a joint case with or solely by the plastic surgeons. The proportion of general and breast surgeons performing breast reduction or mastopexy, LD reconstruction and autologous fat grafting also rose significantly for both breast cancer and non-breast cancer related cases.

It is becoming increasingly clear that the modern breast surgeons must be equipped with a wide range of surgical expertise and oncological knowledge. Therefore, to ensure a very high quality of comprehensive breast cancer care, this should no longer be provided by a generalist, but by a surgeon subspecialized in breast surgery (44). There is evidence that surgeon specialization is associated with both enhanced survival outcomes (up to 8% improvement at 10 years) and higher levels of patient satisfaction (45,46). There is also evidence that higher caseloads correlate with better outcomes, again, supporting breast specialization at both surgeon and hospital level (47,48). To achieve and maintain the required level of skills, there needs to be adequate training, certification, and ongoing re-accreditation to ensure practitioners keep up to date with the dynamic practices within this discipline.

Standardization of OPS techniques across different clinicians, centres and countries is difficult to achieve given that OPS is tailored to each individual patient based on disease and patient factors and patient choice. Many surgeons worldwide also use different nomenclature for the OPS operations. The standardization in nomenclature

in OPS will improve scientific comparability and clinical applicability of OPS (49). Therefore, a standardized breast surgical curriculum and training program could encourage national and international standardization of OPS worldwide.

Some countries in Europe are ahead in breast subspecialization and standardization in practice where breast specific training programs, curriculum and examinations have been established. However, many other countries lag far behind. Therefore, many women in Europe still receive care from a non-breast specialist and may be denied the full range of modern treatment options and consequently may suffer inferior outcomes. Breast cancer survival outcomes across the EU are highly variable, ranging from 74% 5-year survival in Eastern Europe to 85% in northern Europe (7). The cause of this variability is complex, however the inconsistency of breast surgical training in Europe could be a significant contributing factor. This variability is not only reflected in the differences in breast screening, but also breast awareness, variations in health service funding and access to the latest treatment modalities.

Training as an oncoplastic surgeon in Europe

In some European countries, OPS was traditionally considered to be within the remit of plastic surgeons, however, given its increasing demand, breast surgeons have over time developed and adopted oncoplastic surgical skills as part of their daily practice. This drive has led oncoplastic breast surgeons in some countries to shift their practice towards breast subspecialization and correspondingly reducing their provision of emergency general surgery support.

Oncoplastic skill acquisition has posed a challenge to many already trained breast surgeons. With new developments in surgical practice, surgeons tend to seek out training from innovators and then subsequently disseminate the new techniques to colleagues and trainees. Most trained consultants have had to undertake additional training under the mentorship of another colleague in the same unit or a different unit to facilitate this process. As techniques become more established and standardized, formal training opportunities such as oncoplastic fellowships, clinical courses, and higher degrees have become more readily available.

EUSOMA has set the standards for the minimal theoretical and practical knowledge required to be certified as a specialist health professional in the field of breast cancer (50). Despite the existence of these training standards, there is still a lack of standardization of training in breast surgery across Europe. This was reflected in a recent European Society of Surgical Oncology (ESSO)-EUSOMA survey which was sent out to 3,000 surgical breast oncologists across Europe that demonstrated that breast surgical training was not standardised across Europe. Only 20% of all physicians had undertaken an accredited breast fellowship and 12% of surgeons were noted to be treating fewer than 25 cases per year and only a third of surgeons self-identifying as breast specialists (51).

Majority of current surgical trainees desire dedicated time in subspeciality training, for example with fellowships (52). However, fellowships, degrees and diplomas are costly, both in terms of time and expenses incurred. Access may be limited for some trainees given that it may require a period of training away from home or even abroad. In 2002, the United Kingdom Training Interface Group (TIG) pioneered the first structured training program fellowship in OPS. These fellowships were offered to breast and plastic surgical trainees for advanced oncoplastic training at various established oncoplastic centres. Such training is valuable and is thought to have contributed to the increased rates of reconstruction surgery seen in the UK following its introduction (53). In France, there is a well-established oncoplastic surgery training program which usually follows the completion of training in gynaecology with no formal examination. In Germany, all surgeons who treat breast cancer in a certified centre must treat at least 50 primary cases per year. However, across all European countries the majority have no specific training system for breast surgery (39).

There has been an attempt in improving the breast surgical curriculum worldwide. The European Union of Medical Specialists (UEMS) formally recognized breast surgery as a subspecialty interest with the introduction of a framework of examinations assessing knowledge skills and aptitude, leading to a specialist certificate in Breast Surgery (54). The examination syllabus complements the global curriculum that was developed by the American Society of Surgical Oncology (SSO) and the ESSO in a textbook providing a contemporary evidence-based practice in breast cancer surgery. This qualification is now favoured by many trainees in Europe and is improving standards of practice including OPS across countries Europe (55).

Increasing modern training resources are available to breast trainees. Learning through podcasts and webinars add a crucial dimension to advance and subspeciality

learning for breast surgeons internationally.

The future of oncoplastic surgery

The scope of OPS continues to broaden worldwide, and it is crucial breast surgeons keep abreast with new techniques and technology. Minimally invasive surgery has become increasingly more popular in breast surgery. It is used mainly in nipple sparing mastectomy (NSM) and the early published studies have revealed promising results. However, the learning curve is somewhat steep.

The use of endoscopic techniques to perform NSMs in breast cancer patients was demonstrated to be feasible and safe (56). Furthermore, the use of the robot to perform NSMs have shown lesser overall complication rates compared to conventional open NSMs in cohort studies and randomized controlled trials (RCTs) (57). The robotic mastectomy however has been shown to have additional costs not only because of the costs of the robot but also given the additional theatre time (58,59). Therefore, additional larger trials are still needed to guide the role and indication of minimally invasive surgery and its oncologic outcomes in breast cancer patients.

Breast tissue engineering (TE) is the new paradigm in breast reconstruction surgery. A small number of teams around the world are investigating a breast TE options and techniques. Conventional breast TE concepts are based on seeding a scaffold with the patients' own stem cells. This could be a novel technique for breast reconstruction however still very much at its infancy. Clinical viability of many of these approaches needs to be determined with proof of concept studies and eventually clinical research however appear to be a promising development for the future of OPS (60).

Conclusions

OPS has become integral part of breast cancer management minimizing long-term aesthetic defects, with the aim to improve patients' quality of life outcomes. OPS surgery is now available across Europe however, variation in its practice based on the regional, historical, cultural, and health-economic backgrounds still exist. Over the last four decades, there has a significant shift in the requirements of skills sets of a breast surgeon in Europe with increased commitment to cross-specialty plastic surgical training and increasing focus on standardization of OPS across countries. For breast surgeons to achieve this, a standardized level of training, expertise and practice across Europe is needed. The EUSOMA set standards for a specialist health professional in the field of breast cancer, the UEMS examinations and the global curriculum that was developed by the SSO and the ESSO aims to improve standards of OPS practice across Europe and establish a standardized practice across internationally. The new generation breast surgeons therefore should be equipped with the necessary skills to provide high quality OPS while keeping up to date with novel technologies and techniques aiming to provide patients with excellent long-term quality of life.

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Footnote

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