Immediate Reconstruction: General and Oncological Considerations

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27.1 Introduction/Historical Background

Reconstruction of the breast has been an aspiration for over 100 years. The first article was published by Czerny in 1895 and concerned the transplantation of a large lipoma to replace a breast removed for benign disease [1]. Since then, the search for alternatives to reconstruct the breast has continued relentlessly. Fat grafts from several sources were used, but they atrophied relatively quickly, failing to provide a durable recreation of the breast mound. Fat and dermal grafts were then used, and less shrinkage occurred but still usually failed to achieve an adequate breast size. Although there were some isolated attempts, at the beginning of the last century, to use muscular and musculocutaneous flaps, they were not successful and were rapidly dismissed mainly due to the focus on radical resection (as defended by Halstead) in this period [2]. As a result of the Halsted paradigm for breast cancer spread in the first half of the twentieth century, mastectomies became even more radical, and interest in immediate reconstructions declined. Furthermore, it was believed that autologous tissues could hide a local recurrence, and therefore attempts to reconstruct the breast were discouraged in general [3]. Although some further trials were described at the beginning of the twentieth century, it was only during the 1960s and 1970s that breast reconstructions were considered again in a positive light, but as delayed operations in the large majority of the cases. In 1978 however the latissimus dorsi flap was reintroduced by Bostwick and Scheflan for one-stage breast reconstructions [4].

The development of silicone breast implants during the 1960s gave a great boost to immediate reconstructions. Initially these were just put underneath the mastectomy flaps, with a high rate of capsular contracture and extrusion. The two-stage reconstruction evolved rapidly to help reduce these problems and progressively gained popularity [3, 5]. Often, implants were integrated into breast reconstruction with a latissimus dorsi flap to enhance the final volume of the breast mound. In 1984 Becker introduced a dual chamber silicone implant that could be filled with saline in an inner chamber in an attempt to reduce the need for a second operation and to better mould the shape of the reconstructed breast [6].

The gradual ascendency of Fisher's theory of breast cancer as a systemic disease rather than Halstead's principle of radical local control led to a much lesser radical approach to cancer surgery. Ultimately this led to the acceptance of breast-conserving treatment and skin-sparing approaches to mastectomy. Along with the acceptance of skin-sparing techniques, other technical developments and refinement of anatomically stable implants in the 1990s and the introduction of new devices such as acellular dermal matrices (ADMs) and meshes for implant coverage, in the last 5–10 years, greatly reduced the need for two-stage breast reconstructions.

Autologous reconstruction with myocutaneous flaps became an established reconstructive technique during the 1980s when Hartrampf transferred a horizontal skin island from the lower abdomen on a vascular pedicle within the rectus abdominis muscle [7]. This technique, in contrast to the autologous latissimus dorsi flap, had the potential to provide substantial fatty tissue volumes while providing rewarding cosmetic results. However, it required a long operating time and was associated with higher complication rates.

Despite a huge number of studies, mainly retrospective, the quality of evidence supporting the use of immediate breast reconstruction versus delayed is still of a relatively low level. D'Souza and colleagues performed a systematic review to assess the effects of immediate versus delayed breast reconstructions following mastectomy for breast cancer. The results of this study demonstrated that only one randomized trial was available at the time of the review. A generalized inadequacy of outcome evaluation (in terms of cosmetic outcome and psychosocial well-being) was reported. The authors concluded that the evidence base for immediate reconstruction is presently of poor methodological quality (a single RCT with flaws and a high risk of bias) which precludes confident decision-making [8]. This Cochrane review reports study results up until 2011. In the ensuing 5 years, the materials and techniques have grown exponentially but with little application of scientific rigor. In the absence of good-quality randomized data, it is vital that a critical evaluation of the current evidence, even if retrospective, is undertaken. It is unlikely that randomized trials will take place due to the extreme difficulty of randomization between immediate and delayed reconstruction due to lack of surgical and patient equipoise.

27.2 Indications and Contraindications for Immediate Breast Reconstruction

27.2.1 Indication for Immediate Breast Reconstructions and Overview of Current Guidelines

International guidelines on the oncological treatment of breast cancer regarding indications and contraindications for reconstructive surgery are reviewed below, although, as mentioned above, they are based on low-level evidence.

The Physician Data Query (PDQ) is a comprehensive source of cancer information from the National Cancer Institute [9]. The summaries reported in this database are comprehensive and evidence based and deal with topics that cover most of the aspects of cancer care, screening and prevention. In the chapter for health professionals, it is stated that «for patients who opt for a total mastectomy, reconstructive surgery may be performed at the time of the mastectomy (i.e., immediate reconstruction) or at some subsequent time (i.e., delayed reconstruction)». No other specific information on the timing of the reconstruction is provided. Some details on surgical techniques (implants or flaps) are available, but no data on the surgical or oncological safety of immediate reconstruction are reported.

The National Comprehensive Cancer Network (NCCN) guidelines provide complex decisional algorithms for the majority of known cancers. These are continuously updated and revised to reflect new data and clinical information that may add to or alter current clinical practice standards. The NCCN guidelines for breast cancer in chapter BINV-H 2016 [10] discuss the principles of breast reconstruction. It is clearly indicated that patients should have proper information and that breast reconstruction can be performed soon after mastectomy. However, timing is not subject to clear indications and contraindication with the exception of an absolute contraindication for IBR in the setting of inflammatory breast cancer [11].

In Europe, the European Society for Medical Oncology (ESMO) guidelines from 2015 [12] contain general recommendations for the treatment of invasive breast cancer and are not very detailed regarding both the timings and specific procedures for reconstructive surgery, except in favouring autologous reconstruction in the setting of postmastectomy radiotherapy.

In the UK, two groups have been working to establish guidelines and standards for breast reconstruction: the Association of Breast Surgery (ABS) and the British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS). In 2012 they produced guidelines for best practice for oncoplastic breast reconstruction [13]. These guidelines are very specific and not only help in establishing the indications for breast reconstruction but deal in great detail with the technical aspects of breast reconstruction and also with complications and outcomes.

From the analysis of these guidelines, it is concluded that immediate breast reconstruction can and should be offered to the majority of patients in whom mastectomy is indicated or preferred, with the exception of patients with inflammatory breast cancer or in the presence of severe comorbidities where prolongation of surgical time would increase risks. However, patients should be made aware of the possible influence on aesthetic outcomes and morbidity if postmastectomy RT is needed and consideration given to autologous reconstruction, where outcomes may be better following flap irradiation, in these cases [14].

27.3 Surgical and Oncological Safety

One of the most frequent questions about breast reconstruction regards safety.

Immediate breast reconstruction may require more complex procedures, with longer operating times, and therefore can be associated with a higher risk of complications. If complications occur, extra time may be needed to recover and to start adjuvant treatments. If the start of adjuvant treatments is delayed, would this longer interval impact on patient outcomes in terms of both disease-free survival and overall survival?

Fisher and colleagues evaluated wound complications, other medical complications and wound infections using bivariate and multivariate analyses to identify predictors of outcome in two subgroups of patients from the ACS-NSQIP datasets who underwent either mastectomy and immediate reconstruction with a tissue expander (TE) or mastectomy alone [15]. They confirmed that IBR using tissue expansion (TE) was not associated with a greater risk of wound (3.3% vs. 3.2%, $P = 0.855$), medical (1.7% vs. 1.6%, $P = 0.751$) or overall (9.6% vs. 10.0%, $P = 0.430$) complications. The study reported an association with a higher risk of deep wound infections (2.0% vs. 1.0%, $P < 0.001$) and unplanned reoperations (6.9% vs. 6.1%, $P = 0.025$). A logistic regression analysis failed to demonstrate significantly associated independent risk of wound, medical or overall complications with the addition of TE reconstruction.

A further study by Jagsi and colleagues [16] extended the observation period up to the first 2 post-operative years and reported on postmastectomy complications in a sample of 14,894 women treated by mastectomy from 1998 to 2007 who underwent immediate autologous reconstruction ($n = 2637$), immediate implant-based reconstruction ($n = 3007$) or no reconstruction within the first 2 postoperative years ($n = 9250$). Wound complications were diagnosed in 2.3% of patients without reconstruction, 4.4% patients with implants and 9.5% patients with autologous reconstruction ($P < 0.001$). In conclusion, an extended period of observation revealed an increase in the complication rate in the population undergoing IBR.

It has been suggested that this slightly higher complication rate associated to immediate breast reconstruction might generate delays in the administration of adjuvant treatments and as a consequence have an impact on the oncological outcomes of breast cancer patients. A systematic review by Xavier Harmeling and colleagues [17] investigated the impact on immediate reconstruction in terms of delay in time to chemotherapy (TTC). Fourteen studies were included, representing 5270 patients who had received adjuvant chemotherapy, of whom 1942 had undergone IBR and 3328 mastectomy only. Only one study identified a significantly shorter mean TTC, four studies found a significantly delay of 6.6–16.8 days and seven studies found no significant difference. In conclusion, the authors confirmed that IBR does not necessarily delay the start of adjuvant chemotherapy to a clinically relevant extent.

Hamahata and colleagues [18] confirmed a slight increase in the time to treatment in a subgroup of patients undergoing IBR (61.0 ± 10.5 days in IBR group and 58.0 ± 12.3 days in non-IBR group). The post-operative complication rate was 10.0% in the IBR group and 6.1% in the non-IBR group. These results have been confirmed by Eck and colleagues [19] who observed that patients who underwent immediate breast reconstruction did not have a delay in adjuvant treatment when compared to patients with no reconstruction (41 days vs. 42 days, $P = 0.61$). However, complicated cases can have a small but significant impact on the adjuvant treatment start date (47 days vs. 41 days, $P = 0.027$).

In 2012 a meta-analysis from Gieni and colleagues [20] investigated local control rates after IBR. Ten articles were

considered suitable for inclusion. Data including recurrence rates, cancer stage, type of mastectomy and reconstruction, adjuvant treatments and duration of follow-up were reviewed. The odds ratio (OR) for recurrence of breast cancer for mastectomy with IBR as compared to mastectomy alone was 0.98 (95% CI, 0.62, 1.54). This meta-analysis demonstrated no evidence for an increased frequency of local breast cancer recurrence with IBR compared with mastectomy alone.

Another study by Eriksen and colleagues [21] confirmed no differences in terms of local control between 300 patients who underwent breast reconstruction compared to a second cohort of matched patients identified from the Regional Breast Cancer Register of the Stockholm-Gotland healthcare region treated with mastectomy alone (8.2% in the IBR group and 9.0% in the control group or, in the regional recurrence rate, 8.2% versus 9.7%). The authors also reported no significant differences in the timing of adjuvant treatments.

Risk factors for complications were extensively investigated by Fischer [22] in a large review of the ACS-NSQIP 2005–2011 dataset of patients who underwent immediate breast reconstruction either with implants or autologous tissues. A «model cohort» of 12,129 patients was randomly selected from the study cohort to derive predictors. Weighted odds ratios derived from logistic regression analysis were used to create a composite risk score and to stratify patients. The remaining one-third of the cohort ($n = 6065$) was used as the «validation cohort» to assess the accuracy of the risk model. A risk score was created with stratification of patients into four subgroups based on their total risk score ($p < 0.001$): risk categories were low (0–2, risk = 7.14%), intermediate (3–4, risk = 10.90%), high (5–7, risk = 16.70%) and very high (8–9, risk = 27.02%). This score by Fisher may therefore be of value for the identification of patients at high risk who may be better served by avoiding or delaying breast reconstruction until the end of adjuvant treatments or until modifiable risk factors have been recovered, i.e. smoking, obesity, etc. It may also be valuable in patient counselling.

To conclude, and based on the available evidence from the literature, immediate breast reconstruction is generally safe when surgical complications are minimized by careful case selection, choice of procedure and consideration of the wider cancer treatment pathway. Correct selection of patients may help to stratify those high-risk individuals more prone to complications which may delay the time to adjuvant treatment with a potential subsequent impact on outcomes.

27.4 Integration of Adjuvant and Neoadjuvant Treatments

27.4.1 Effects of Neoadjuvant Chemotherapy on IBR

Preoperative chemotherapy is a good tool to reduce the size of cancer that otherwise should be treated by mastectomy. However, some patients may be poor responders and still require mastectomy after treatment. This may raise concerns when considering immediate breast reconstruction: immunosuppression may theoretically contribute to higher infection rates or other postsurgical sequelae. The impact of neoadjuvant chemotherapy on immediate breast reconstruction was investigated in a meta-analysis by Song and colleagues [23] who confirmed that neoadjuvant chemotherapy did not increase the overall rate of complications after immediate breast reconstruction (odds ratio [OR] = 0.59; 95% confidence interval [CI] = 0.38–0.91). At the same time, no increase in hematomas and seromas was reported, and the risk of expander or implant loss was not higher among patients after neoadjuvant chemotherapy (OR = 1.59; 95% CI = 0.91–2.79). The large majority of patients included in this meta-analysis had an implant-based reconstruction. Only two studies reported on autologous tissue-based reconstructions. Both studies confirmed no association between total flap loss and preoperative chemotherapy.

The same conclusion was published by Abt reporting for the American College of Surgeons National Surgical Quality Improvement Program 2005–2011 databases [24] about the short-term morbidity in patients undergoing mastectomy with and without breast reconstruction. This study included a population of 19,258 patients (22.4%) treated by immediate breast reconstruction, with 820 (4.3%) receiving neoadjuvant chemotherapy (NAC). After multivariate analysis and adjustment for confounding factors, NAC was independently associated with a lower overall morbidity in the immediate tissue expander reconstruction subgroup (OR, 0.49; 95% CI, 0.30–0.84), confirming also the safety of NAC in this subgroup of patients.

There are however also some studies reporting a higher rate of failure, specifically related to the use of expander/implants [25], but unfortunately these studies are mainly retrospective and don't allow firm conclusions to be drawn.

Analysis of the existent body of evidence regarding the use of NAC and subsequent immediate breast reconstruction after mastectomy concludes that there is no proof that immediate reconstruction should be contraindicated in patients who were submitted to NAC.

27.4.2 Effects of Adjuvant Chemotherapy on IBR

This topic is discussed above, and the evidence suggests little impact of IBR on the timing of adjuvant chemotherapy and suggests that it has no negative impact on wound healing or infection rates. In fact, adjuvant chemotherapy usually only starts when wounds are completely healed. There is the exception of expansion, but even there the rate of complications is very low [26].

One area of continued uncertainty is the safety of commencing adjuvant chemotherapy in patients with «red breast» syndrome as a consequence of the use of acellular dermal matrices. Whether this impacts on rates of implant loss and longer-term cosmesis is not yet known, and research is urgently needed in this area [27].

27.4.3 Effects of Adjuvant Radiotherapy on IBR

The indications for postmastectomy radiotherapy have increased recently due to a demonstrated increase in overall survival in a recent large meta-analysis. This not only found benefit in the long-established indication of more than three nodes but also found a survival benefit for thoracic wall irradiation in cases with 1–3 positive axillary nodes [28]. According to the latest St. Gallen consensus of 2015, the exception to the use of RT should only be in patients with very good tumour biology [29].

Radiotherapy has an inevitable effect on tissues and may generate chronic inflammation of the subcutaneous tissues resulting in long-term fibrosis, atrophy, retraction, ulcers and telangiectasia that are usually classified using the SOMA scale [30]. These changes may compromise the results of immediate breast reconstructions both with tissue expanders/implants and autologous tissues. However, radiotherapy techniques have greatly improved in the last decade, with better targeting, reducing skin doses and better schedules. Consequently severe reactions (ulceration and telangiectasia) are much less common, but fibrosis still occurs and may impact on reconstruction outcomes.

In many countries, radiotherapy is still regarded as either a relative or absolute contraindication for immediate breast reconstruction due to the well-documented problems associated with this combination.

In the last 5 years, several systematic reviews and meta-analyses have clarified the effect of radiotherapy on breast reconstruction paving the way for more confidence when this option is considered by both the doctor and patient.

A systematic review by Lam and colleagues [31] about the effects of postmastectomy adjuvant radiotherapy on immediate two-stage prosthetic breast reconstruction compared the outcomes of those who had radiotherapy after placement of a tissue expander and after the second surgical stage. The primary endpoint of this study was the reconstruction failure rate with implant loss. Secondary endpoints were the rate and degree of capsular contracture and aesthetic outcomes. A significantly higher reconstruction failure rate after immediate two-stage prosthetic breast reconstruction was reported in comparison to patients who did not have radiotherapy. Interestingly the authors commented that their conclusions were based on a lower level of evidence as no randomized controlled trials were identified, and only one prospective, non-randomized, multicentre trial was found. Despite these considerations, there is a clear trend indicating that radiotherapy increases the failure rate of two-stage breast reconstructions.

A further systematic review by Berbers and colleagues [14] identified five subgroups of patients according to the timing and type of reconstructions (autologous tissue based after RT, permanent implant after RT, autologous tissue before RT, permanent implant after RT and overall).

The authors reported a very large variation in complication rates and in cosmetic outcome between groups. A higher complication rate and revision rate were associated with implant-based reconstruction performed in previously radiotherapy-treated patients. Less fibrosis was reported when radiotherapy was performed first. Implant failure occurred more often if applied after radiotherapy (odds ratio (OR) 3.03 [1.59–5.77]). No differences in the complication rates for autologous tissue according to the timing of radiation were demonstrated.

This study follows a previous meta-analysis form Barry and colleagues [32]. In keeping with other reports, patients undergoing PMRT and BR are more likely to suffer morbidity compared with patients not receiving PMRT (OR = 4.2; 95% CI, 2.4–7.2 [no PMRT vs. PMRT]). Autologous reconstruction is associated with less morbidity in the RT setting (OR = 0.21; 95% CI, 0.1–0.4 [autologous vs. implant-based]). PMRT has a generally detrimental effect on BR outcome.

These results suggest that when immediate reconstruction is undertaken in women likely to be advised to have PMRT, an autologous flap results in less morbidity when compared with implant-based reconstruction [33] (Figs. 27.1 and 27.2).

Fig. 27.1 Right nipple-sparing mastectomy with immediate reconstruction with latissimus dorsi and implant with post-operative radiotherapy – capsular contracture

Fig. 27.2 Right immediate TRAM flap reconstruction with post-operative radiotherapy

According to the current evidence, radiotherapy has a consistent negative impact on breast reconstruction, and patients should be thoroughly informed of this risk. If the decision is to proceed with the reconstruction, an autologous tissue-based intervention has a higher probability of success. As an alternative, a two-stage (radiotherapy with expander inflated) or an immediate-delayed reconstruction (in case of doubts regarding the need for radiotherapy) would also be considered a possible option. Delaying reconstruction should always be discussed, but patients' preferences should always be respected once they are fully aware of the possible consequences.

More recently acellular dermal matrices (ADMs) have become increasingly popular in implant-based breast reconstruction. ADMs are products derived from human or animal dermis which has been treated to remove the cellular (antigenic) components. ADMs provide an extra layer of coverage and support for breast implants, particularly over its lower lateral parts. They are used in expander/implant-based breast reconstruction after mastectomy. Radiotherapy seems to have a negative impact in reconstruction with expander/implant and ADMs, but evidence is of very poor quality, and some recent studies start to suggest a decrease in capsular contracture with the use of ADMs [34].

27.5 Impact of Immediate Breast Reconstruction on Quality of Life

While the oncological aspects of breast cancer surgery have been extensively investigated, quality of life after mastectomy and reconstruction have received less attention although the development of good-quality QoL instruments specific to breast cancer outcomes has improved our understanding of these issues considerably in the past decade.

There are now a number of breast-specific QoL tools which have been validated to varying degrees [35]. Among those which have been adequately validated, three (EORTC QLQ BR-23, FACT-B, HBIS) focus on non-surgical treatment issues; the BIBCQ does not address aesthetic concerns after breast reconstruction, and only one, the BREAST-Q, was specifically developed for use in patients undergoing mastectomy and reconstruction. Another tool developed on behalf of EORTC is currently undergoing a process of validation [36].

Using these tools, QoL comparisons have been made between mastectomy and BR versus breast conservation, mastectomy alone versus mastectomy plus reconstruction and skin-sparing versus non-skin-sparing techniques. These are reviewed below.

Heneghan and colleagues [37] reviewed a prospectively collected database in order to evaluate the differences in terms of quality of life between breast-conserving surgery and skin-sparing mastectomy followed by immediate reconstruction. Questionnaires specific for breast cancer were employed (EORTC QLQ B23/B30, FACT-B) to assess patient-reported QoL outcomes. Interestingly both cohorts achieved similar scores in each of the scales used for comparison reporting no significant differences. The authors concluded that skin-sparing mastectomy and immediate breast reconstruction can safely be offered to patients requiring mastectomy with similar outcomes to those who undergo breast-conserving surgery.

This observation was confirmed by a recent [16] survey from the SEER database [16]. They evaluated 1450 patients (963 underwent breast-conserving surgery, 263 mastectomy without reconstruction and 222 mastectomy with reconstruction). They measured quality of life using the FACT-B questionnaire and two measures of patient-reported satisfaction including cosmetic outcomes: one was applied to all patients and one specifically to patients who received breast reconstruction (both derived from existing validated tools). No significant differences in well-being by surgery type were observed when comparing mastectomy plus no reconstruction, breast conservation, and mastectomy and immediate breast reconstruction, except that there seemed to be a greater improvement in physical well-being by the time of the follow-up survey for patients who received mastectomy with breast reconstruction. Among patients receiving mastectomy with reconstruction, radiation receipt was associated with inferior scores for patients receiving implant reconstruction plus radiation therapy. Autologous reconstruction cases fared better. In conclusion, this study confirms that immediate breast reconstruction generates QoL scores not dissimilar from breast-conserving surgery and confirmed the positive role of autologous reconstruction in mitigating the deleterious effects of radiotherapy.

Skin-sparing mastectomies preserving more of the skin envelope and sometimes the nipple have been evaluated in the context of QoL and cosmesis [38, 39]. Patient satisfaction and nipple-areola sensitivity after bilateral prophylactic mastectomy and immediate implant breast reconstruction have been evaluated using the BREAST-Q questionnaire [39]. Interestingly, satisfaction with the (reconstructed) nipple-areolar complex was similar after skin-sparing mastectomies (SSMs) and nipple-sparing mastectomies (NSMs). Nipple-areola complex sensitivity was lower in the NSM group (mean score, 1.9; 95% confidence interval, 1.5–2.3) compared with the control group – reconstructed nipple (mean score, 4.7; 95% confidence interval, 4.6–4.9; $P < 0.01$).

Psychosocial and sexual well-being after NSM has also been studied [40] using the BREAST-Q. These results partially contradict the previous study. Two groups of patients (with nipple preservation/without nipple preservation) belonging to a prospectively maintained database were evaluated in multivariate linear regression analysis that controlled for potential confounding factors. Nipple-sparing mastectomy patients reported significantly higher scores in the psychosocial ($p = 0.01$) and sexual well-being ($p = 0.02$) domains compared to SSM patients. There was no significant difference in the BREAST-Q domains relating to physical well-being, satisfaction with the breast or satisfaction with outcomes between the NSM and SSM groups.

In conclusion, quality of life after immediate breast reconstruction can be evaluated effectively using several validated tools. Modern reports confirm good results after immediate reconstruction and outcomes comparable to those of breast-conserving surgery. Postmastectomy radiation may compromise patient's satisfaction, but this negative impact can be diminished with the choice of autologous reconstructions.

Autologous reconstructions are more stable regarding long-term aesthetic outcomes, while implant-based reconstructions tend to decay in the medium to long term. Patients should be correctly informed about these results in order to make a fully informed choice. The benefits of nipple preservation are less well defined with some studies reporting advantages for nipple reconstruction after skin-sparing mastectomy and other studies reporting an increase of physical and sexual well-being with nipple preservation.

27.6 Evaluating Aesthetic Outcomes in Postmastectomy Reconstruction

It is a generalized concept that mastectomy and immediate reconstruction have a better aesthetic outcome than mastectomy with delayed reconstruction. This is probably due to the fact that usually patients submitted to immediate reconstruction have smaller and less aggressive cancers with a lesser need for radiotherapy, and also in this subgroup are the majority of prophylactic mastectomies.

However, as in breast-conserving surgery, there is no standardized objective way of evaluating cosmetic outcomes [41], and in the great majority of cases, cosmetic results are not recorded.

The breast cancer conservative treatment cosmetic results (BCCT.core) software [42] was developed for the evaluation of breast cancer-conserving surgery, and it is not validated for use in breast reconstruction cases. However, objective features like asymmetry and colour differences can be determined even in mastectomy and reconstruction patients.

There is a major need to develop objective tools that will allow us to make meaningful comparisons between techniques allowing the identification of factors that can have a real impact on outcomes [42].

27.7 Decision Algorithms for Postmastectomy Reconstruction Selection

This spectrum of choices and all the factors previously discussed can make the final decision about reconstruction very difficult. Decision algorithms have been widely used to help to make informed selection across a range of breast cancer treatment choices with perhaps the most widely used relating to the decision to have chemotherapy or not (e.g., Adjuvant! Online). Usually in reconstructive surgery, decision algorithms are based on a combination of morphological, clinical characteristics and patients' preferences [43].

Factors used in the decision process are acquired during the first consultation after cancer diagnosis. The morphological characteristics (height, weight, thoracic perimeter, breast cup size and degree of ptosis) of the patients should be recorded. Breast volume and ptosis can be precisely calculated using models like the ones described by Longo [44] and Kim [45]. With these factors, a simple decision algorithm can help doctors and patients to make more informed decisions (Fig. 3).

The advantage of using decision algorithms is not only to support choices based on more objective factors but also to increase patient engagement in the decision-making process [46]. Medical language is complex, and sometimes patients struggle to understand straightforward medical concepts [47]. For this reason, the use of booklets, photographs and videos of diverse surgical techniques can be very helpful, if the patient feels comfortable and expresses interest to have

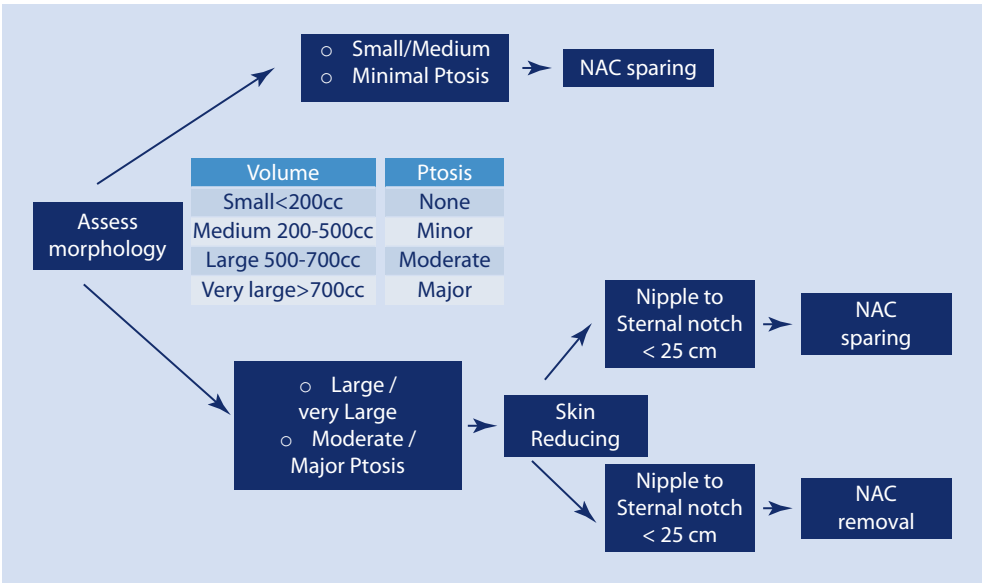

Fig. 27.3 Decision tree regarding type of mastectomy (skin sparing or nipple sparing) considering volume and ptosis

this type of information. This is normally done during a second or third visit once the complexity of emotional responses engendered by the initial visit has abated somewhat.

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27.7.1 Surgical Decision in Patients with Small- and Medium-Sized Breast and Minimal/No Ptosis

In patients with small to medium breast volumes and minimal to moderate ptosis, preservation of the breast skin envelope is usually possible and may include the nipple-areolar complex if oncologically appropriate to do so (nipple preservation is contraindicated in women with tumours close to the nipple, usually defined as less than 10 mm). Reconstruction of the breast mound may be achieved in a variety of ways depending on the patient's preferences and the availability or otherwise of autologous donor sites. Depending on the patients' wishes, a contralateral adjustment can be performed in a single stage or as a second stage. Sub-muscular implant reconstructions are less suitable for moderate breast size and moderate ptosis cases where the use of an ADM may be preferable to augment the implant pocket.

27.7.2 Surgical Decisions in Patients with Large and Ptotic Breasts

In these patients, skin preservation is technically challenging, and several approaches have been described in this situation like the one used by Nava and colleagues [48, 49]. This is a modification of type IV skin-sparing mastectomies as described by Carlson [50] that uses a de-epithelialized dermal adipose flap sutured to the pectoralis major and the fascia of the serratus anterior as a component of a compound pouch in which a permanent implant could be easily allocated (dermal sling technique). The final inverted T scar resulting from this method may be symmetrized by a wise pattern breast reduction or mastopexy on the other side. Nipple-sparing skin-reducing mastectomy is indicated in patients with large or medium breast volumes, but only moderate ptosis. When breast ptosis is significant, the ability to safely preserve the nipple-areolar complex without necrosis is reduced. In those cases, a careful discussion with the patients of a possible free nipple graft in the setting of no postmastectomy radiotherapy or resection of the nipple-areolar complex with a delayed nipple reconstruction should be advised.

27.8 Conclusions

Immediate breast reconstruction has become widely available in modern breast practice with good oncological safety, enhanced cosmesis and quality of life and few absolute contraindications. Radiotherapy does impact on outcomes but should be considered as a relative, rather than an absolute, contraindication. Patients should be fully aware of the consequences before choosing between immediate and delayed breast reconstruction.

In cases of planned immediate breast reconstruction where postmastectomy radiotherapy is likely to be offered, an autologous flap-based reconstruction should be the preferred option. If the patient selects an implant-based reconstruction, a two-stage reconstruction with an expander inflated during radiotherapy and an immediate/delayed reconstruction are also possibilities. The benefits of ADMs in the radiotherapy setting are still unclear, and evidence suggests that while the risks may be lower, radiotherapy is still associated with inferior outcomes.

Measures of quality of life and cosmetic outcomes are fundamental to the assessment of reconstructive surgery. The BREAST-Q questionnaire is a valuable and validated option which is simple to use. Regarding cosmetic outcome, there is no validated tool for the evaluation of immediate breast reconstruction results, but the use of the BCCT.core software can help to evaluate simple values like asymmetry in a standard and simple way.

The use of decision trees with the inclusion of the more important factors involved in surgical technique selection can help doctors and patients to make a safer and better informed choice.

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