

Preoperative Assessment of the Breast Reconstruction Patient



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KEYWORDS

- Preoperative assessment • Breast reconstruction • Autologous reconstruction
- Implant reconstruction • Adjuvant therapy • Shared decision-making

KEY POINTS

- Breast reconstruction must be performed in a multidisciplinary environment.
- Optimal patient satisfaction is achieved by aligning patient goals and expectations with likely outcomes given present risk factors.
- Thorough patient assessment will facilitate individualized counseling and selection of appropriate reconstructive options using a shared decision-making approach.

BACKGROUND

It is estimated that more than 300,000 women are diagnosed with breast cancer in the United States every year.¹ Risk factors associated with the development of breast cancer are both environmental and heritable with an estimated 5% to 10% of all breast cancers attributed to germline mutations in breast cancer-associated genes such as BRCA.² A breast cancer diagnosis can be not only life-altering but also has profound and long-lasting emotional sequelae.³ In addition, for patients who forego or are not candidates for breast conservation therapy (BCT), mastectomy may represent a daunting challenge to their feminine self-image and psychosocial well-being.^{4–8} On the contrary, breast reconstruction has been associated with improved quality of life following mastectomy in both the immediate and delayed setting.^{9–13}

When breast reconstruction is considered, it must be approached in a thoughtful and deliberate manner. Fundamentally, to optimize therapeutic outcomes, from an oncologic and reconstructive standpoint, a multidisciplinary approach with effective collaboration is paramount.^{11,14} Medical,

surgical, and radiation oncologists, as well as reconstructive surgeons, anesthesiologists, diagnostic radiologists, and physical therapists form the essential components of a well-staffed breast cancer care team. Although outcomes germane to health-related metrics such as overall and disease-free survival must be rigorously pursued and maximized, quality-of-life measures play an equally valuable role in a comprehensive therapeutic framework. Facilitated by widely accepted and used patient-reported outcome measures such as the BREAST-Q,^{15,16} the reconstructive surgeon is uniquely positioned to guide patients through a shared decision-making process¹⁷ for selecting the optimal reconstructive modality founded on evidence-based patient satisfaction and quality of life.

To properly counsel a patient through an individualized reconstructive algorithm, not only is an accurate assessment of their previous and/or anticipated oncologic treatments critical, but also an understanding of the patient's preferences, values, and reconstructive goals. Based on this information, a more productive and educated discussion can take place in an effort to identify the reconstructive modality that most

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safely and effectively achieves these goals. For example, a woman with early-stage breast cancer and an active, supportive family, and a strong desire to minimize the possibility of repeated surgeries throughout her survivorship period would be guided toward autologous reconstruction. Alternatively, a busy professional with a thin body habitus and a history of augmentation mammoplasty may be better suited for alloplastic reconstruction.

Although patient satisfaction is closely associated with surgical outcomes,^{18–21} setting appropriate expectations is key to properly frame the patient's perspective throughout their reconstructive experience. In addition, aligning expectations between the patient and potential immediate and long-term reconstructive outcomes will promote the maintenance of productive communication between the patient and reconstructive team, especially if complications arise along the reconstructive journey. With a more thorough and granular mutual understanding of expectations following breast reconstruction, patient satisfaction and perception of outcomes are maximized.

Shared Decision-Making

Shared decision-making occurs when the health care professional and patient work *together* to make a health care decision that is best for the patient. The optimal decision takes into account evidence-based information about the available treatment options, the provider's knowledge and experience, and patient factors including their values and preferences.

The "information exchange"²² that occurs between the patient and physician is very different to the paternalistic approach traditionally witnessed during surgical training. The "Informative" approach to decision-making provides the patient with comprehensive information, but, unlike shared decision-making, does not consider the patient's values or preferences (Fig. 1). Shared decision-making also incorporates the biological, sociologic, and psychological factors the patient brings to the table.

Access to the health information on the Internet and via social media is changing the patient's role in health care. Patients are increasingly advocating for themselves and seeking to become more involved in their health care decisions, and to some extent even experts in their own care. Less than half of patients undergoing mastectomy make a high-quality breast reconstruction decision based on their self-reported desires.²³ "High quality" is defined as "having knowledge of at least 50% of the important facts and undergoing

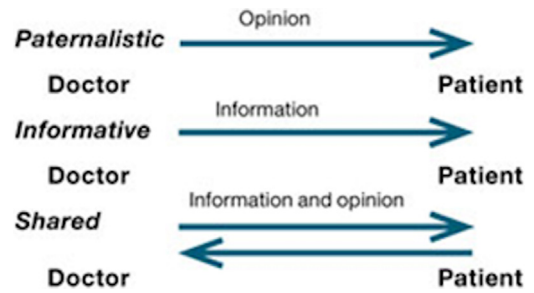


Fig. 1. Types of decision-making. (From Dinwoodie M. Consent and shared decision making. 2014. Accessed June 1, 2022. <https://www.medicalprotection.org/newzealand/casebook/casebook-january-2014/consent-and-shared-decision-making>.)

treatment concordant with one's personal preferences."

Studies across several medical and surgical specialties show shared decision-making offers several benefits:

- Improves patient education
- Decreases patient anxiety
- Decreases decisional conflict
- Helps set appropriate patient expectations
- Improves patient buy-in and satisfaction
- Improves patient outcomes

In addition to being a very effective and ethical approach to patient interaction and treatment planning, shared decision-making also facilitates the delivery of high-quality, patient-centered care. Improving patient outcomes and satisfaction can also create extremely positive secondary effects on the surgeon's practice from a marketing perspective. Happy patients can be very effective advocates for a specific procedure and the whole practice.

The SHARE approach (Fig. 2) breaks down shared decision-making into a simple five-step process²⁴: Patient-focused, evidence-based decision aids (eg, Breast Advocate® App) can greatly facilitate the shared decision-making process and provide the opportunity for patients to research their options at their own pace, including before the initial consultation. This arms the patient with comprehensive baseline knowledge and allows for more of the consultation time to be allocated toward addressing specific concerns and customizing the treatment plan, rather than reviewing basic information. Digital aids also allow patients to review relevant information repeatedly outside of the clinic setting.

Decision aids improve decision-related outcomes for many breast cancer treatment decisions including surgery, radiotherapy, endocrine

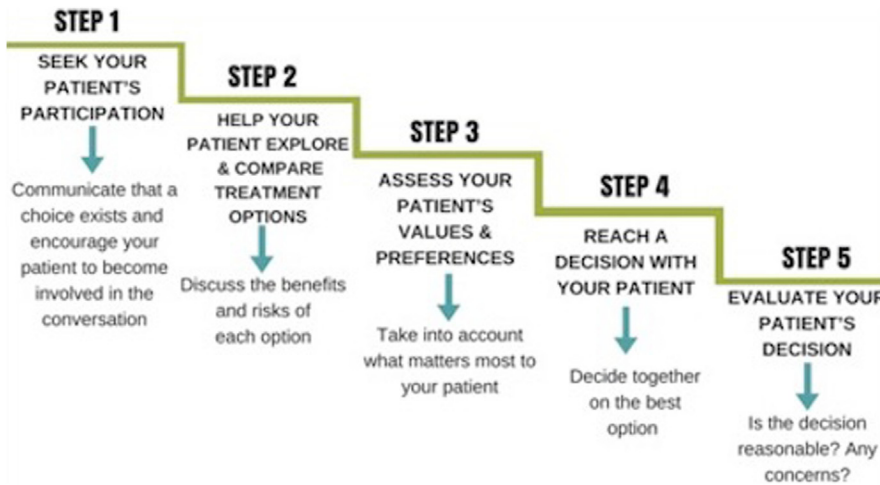


Fig. 2. The SHARE Approach. (Content last reviewed October 2020). Agency for Healthcare Research and Quality, Rockville, MD. <https://www.ahrq.gov/health-literacy/professional-training/shared-decision/index.htm>.

therapy, and chemotherapy.²⁵ Specifically for women considering breast reconstruction, decisional aids also improve patient satisfaction with information and perceived involvement in the decision-making process, and reduce patient-reported decisional conflict.²⁶

Patient Preoperative Assessment

General health and medical conditions

A thorough preoperative assessment should begin with an evaluation of the patient's general health and medical conditions. In our practice and supported by previous data,^{27,28} breast reconstruction is offered to patients regardless of chronologic age. Although there is no consensus on best practices to assess health fitness or frailty in more senior populations, scoring tools have been developed and are best used in collaboration with a proper anesthesia assessment.²⁸ Presence of cardiac comorbidities and diabetes should be determined, severity assessed, and optimized through appropriate referrals. Women with diabetes are more likely to experience higher overall complications, surgical complications, and a prolonged hospital stay following breast reconstruction.²⁹ In our practice, based on previous studies,³⁰ a hemoglobin A1C of 7% represents the upper acceptable limit for patients to undergo any breast reconstruction procedure. History of deep venous thrombosis, pulmonary embolism, spontaneous abortions/miscarriages, or familial bleeding tendencies warrants referral for coagulopathy evaluation. If present, free flap breast reconstruction should be strongly reconsidered³¹ and only performed if the patient truly understands and accepts the increased risk of flap loss. In the

presence of coagulopathy, in collaboration with Hematology consultants, an anticoagulation protocol beyond standard peri-operative prophylaxis should be incorporated to mitigate the thrombotic risk. History of or symptoms consistent with autoimmune connective tissue disease should be determined. Although the association between silicone breast implants and connective tissue disease has been unfounded by large-scale clinical studies, debate is ongoing regarding the possible development of a broader symptom complex referred to as "breast implant illness."^{32,33} Although patients with connective tissue disease may be better served with autologous reconstruction, increased risk of wound and pulmonary complications, as well as, venous thromboembolism have been reported.³⁴

Active tobacco use should be assessed and immediate cessation encouraged. In our practice, tobacco abstinence of at least 6 weeks is required before any form of breast reconstruction is undertaken, as previous studies have reported a clear association between tobacco use and operative complications.^{35,36} Body habitus should be assessed and stratification of surgical risk communicated to patients clearly.³⁶ Based on previous studies, there is a linear correlation of surgical morbidity to increasing body mass index (BMI).³⁶ In light of this, in our practice, a BMI of 40 is the absolute upper acceptable limit for candidacy for all breast reconstruction, including deep inferior epigastric perforator (DIEP) flaps. Nevertheless, all patients are encouraged to make appropriate diet and life-style changes to minimize their surgical risk based on body habitus.

Multidisciplinary Oncologic Considerations

Accurate assessment of the patient's tumor and nodal status is critical in determining, not only potentially appropriate reconstructive modalities, but possibly also the sequence of reconstructive procedures. Close communication with other members of the multi-disciplinary team is critical at this point to ensure a thorough diagnostic workup that enables proper patient assessment from a reconstructive perspective. For example, percutaneous axillary lymph node biopsy should be advocated for patients with questionable lymph node enlargement on diagnostic imaging to more accurately determine the existence of nodal metastasis neoadjuvantly which would influence recommendations for postmastectomy radiation (PMRT) using current national comprehensive cancer network (NCCN) guidelines.³⁷ Although some centers have reported excellent outcomes following PMRT in the setting of immediate autologous reconstruction,³⁸ for patients with inflammatory, locally advanced (T3) cancers, and/or metastatic nodal disease at the time of diagnosis, delayed reconstruction following PMRT is routinely advised.

Skin/nipple-sparing mastectomy promotes optimal cosmetic outcomes due to the preservation of the native skin envelope.³⁹ As such, tumor location plays a critical role in determining the possible location of mastectomy incisions as well as candidacy for nipple preservation.³⁷ Strategic planning of mastectomy incision location will ensure optimal cosmetic outcome (and nipple neurovascular function,⁴⁰ if applicable) while providing the breast surgeon with adequate exposure for glandular resection. In addition, adequate exposure will facilitate visualization of the glandular-subcutaneous plane promoting appropriate and uniform mastectomy flap thickness.

Prior history of partial mastectomy (lumpectomy) as a component of BCT needs to be determined. The location of a prior lumpectomy incision will also determine the most appropriate completion mastectomy incision to be used to mitigate perfusion disturbances to the residual mastectomy flaps. If immediate free flap reconstruction is undertaken with internal mammary vessel exposure in the setting of previous BCT, due to observed disruption of normal breast lymphatic drainage to the axilla, internal mammary lymph node biopsy should be performed to more comprehensively assess surgical staging.^{41–43}

As an integral component of systemic oncologic treatment, cytotoxic chemotherapy may be administered before or after surgical extirpation with similar oncologic outcomes. If chemotherapy is administered neoadjuvantly, mastectomy and

immediate breast reconstruction can be performed safely⁴⁴ and is recommended within 4 to 6 weeks of chemotherapy completion, barring prolonged hematologic suppression, to prevent decreased overall, and possibly, disease-free survival.^{45–48} If need for adjuvant chemotherapy is anticipated, due to its myelosuppressive effects, probability of surgical complications such as infection and delayed wound healing should be considered. Although episodes of infection or delayed wound healing in the setting of autologous reconstruction are undesirable, most can be managed conservatively without need for delays in adjuvant treatments. On the contrary, in alloplastic reconstruction, adjuvant chemotherapy has been associated with unplanned surgical intervention in approximately 30% of cases with reconstructive failure as high as 22% in the form of implant/tissue expander loss.^{49,50}

As approximately 25% of women diagnosed with breast cancer possess the HER-2 + subtype,⁵¹ HER-2-directed monoclonal antibody therapy, as a relatively recent advancement in systemic adjuvant treatment, may also impact the timing of reconstruction. HER-2 + patients with breast cancer are unique in their continued need for targeted antineoplastic therapy after conventional cytotoxic chemotherapy has been completed. Typically, these patients received HER-2 directed therapy for up to 12 months.⁵² Although increases in breast reconstruction complications have not been associated with ongoing use of Trastuzumab (Herceptin, Genentech Inc.) alone, increased risk of wound breakdown and infection has been reported with concurrent use of Pertuzumab (Perjeta, Genentech Inc.).⁵² As newer therapies become more common in clinical use combining HER-2-directed immunotherapy with cytotoxic agents, such as TDM-1 (Kadcyla, Genentech Inc.), close communication with medical oncology is critical to adequately assess potential reconstructive risk.

Similar to HER-2-directed therapy, adjuvant hormonal therapy is prolonged and typically overlaps with reconstructive procedures. Owing to the increased risk of venous thromboembolism and reported microvascular flap complications,⁵³ estrogen receptor antagonists (ie, Tamoxifen) should be withheld for 2 weeks before and after surgery if free flap reconstruction is undertaken. On the contrary, aromatase inhibitors can be safely continued peri-operatively during reconstruction.⁵⁴

History of or anticipated need for adjuvant radiation plays a critical role in determining reconstructive options. Radiation exposure produces fibrosis, elastosis, and vascular intimal thickening impacting reconstructive outcomes. Certainly, in

patients with loss of the skin envelope from the previous mastectomy without reconstruction and PMRT, re-establishing an adequate skin envelope via tissue expansion is fraught with limitations. In such cases, previous studies have reported 50% overall complication rates with tissue expander or implant loss in 40% of patients.⁵⁵ Further underscoring the prolonged effects of radiation, patients requiring salvage/completion mastectomy due to local recurrence or newly diagnosed genetic predisposition for breast cancer in the setting of the previous BCT, alloplastic reconstruction overall complications are only slightly better, ranging between 35% and 70% with 13% reconstructive failure.^{55,56} On the contrary, replacement of the absent skin envelope and breast mound with autologous tissue in patients with a previous history of radiation is a more viable and durable option.^{57,58} There is currently no consensus as to the optimal timing of free flap reconstruction after radiation.^{59,60} In our practice, free flap reconstruction has been safely undertaken any time after resolution of the acute phase of radiation injury,⁶¹ generally coinciding with 3 months following completion of radiation.

In cases where the need for PMRT is preemptively known, the traditional and most evidence-based safe approach has been to offer reconstruction in a delayed fashion. Although patients undergoing delayed reconstruction may suffer from temporary loss of an integral component of perceived femininity, recent patient-reported outcome studies supporting this approach have shown the similar health-related quality of life and satisfaction between delayed and immediate reconstruction patients once autologous reconstruction is ultimately completed.¹³ Nevertheless, a shifting emphasis toward offering immediate reconstruction despite a known need for PMRT is evolving. Contrary to traditional standards, in a recent series from 2000 to 2010, immediate implant reconstruction with PMRT increased from 27% to 52%⁶² despite well-documented high complication rates.^{63,64} Alternatively, with state-of-the-art radiation regimens, recent studies have reported acceptable outcomes after immediate autologous reconstruction followed by PMRT.^{38,65,66} Certainly, close collaboration with radiation oncology is imperative in this setting, especially if PMRT is necessary soon after reconstruction (<3 months) or directed at the internal mammary nodal chain.⁶⁷

Although initially conceived as a method to offer immediate reconstruction for patients where the need for PMRT was unknown, a delayed-immediate approach⁶⁸ where the immediate placement of a tissue expander followed by PMRT is

ultimately converted to autologous reconstruction may be an attractive option for some patients. This approach maintains the skin envelope while eliminating the long-term potential for implant malposition and capsular contracture associated with alloplastic reconstruction and may reverse radiation-induced changes to the skin envelope and chest wall through a well-vascularized autologous flap.⁶⁹

Alloplastic Reconstruction

Implant-based reconstructive techniques are a highly popular method of breast reconstruction⁷⁰ due to multiple factors including technical simplicity, short convalescence, and elimination of donor sites. In addition, the development and availability of biologic and prosthetic scaffolds as adjuncts to implant-based reconstruction have facilitated improved cosmetic outcomes⁷¹ with decreased pain while potentially mitigating capsular contracture.⁷² Proper patient selection is imperative in alloplastic reconstruction with recognition of systemic risk factors such as high BMI, poorly controlled diabetes mellitus, and active tobacco use as mentioned previously. Ideal candidates are women with a paucity of available autologous tissue undergoing immediate reconstruction with small to moderate-size breasts with good skin quality following bilateral mastectomies without the need for PMRT. Breast dimensions especially breast diameter, breast height, and inframammary fold (IMF)-nipple distance are used to determine optimal tissue expander/implant sizes. Preoperative asymmetry in breast size, shape, footprint, IMF, and nipple position are critically important to assess and document with open patient discussion regarding limitations of cosmetic outcomes based on present asymmetries. Correction of nipple malposition following nipple-sparing mastectomy and implant reconstruction may be challenging but feasible with acceptable outcomes.^{73,74}

The decision of whether to perform subpectoral versus prepectoral implant reconstruction may be influenced by individual patient characteristics. In patients who engage their pectoralis muscles frequently through vigorous exercise or occupation, prepectoral tissue expander/implant placement should be strongly considered to eliminate distressing animation deformities and muscle spasms seen with subpectoral implant position. However, if skin quality or anticipated mastectomy flap thickness is suboptimal or irregular, a subpectoral plane may mitigate, to some degree, contour irregularities. In addition, in the subpectoral plane, an underlying implant is better protected,

minimizing exposure risk if wound dehiscence occurs at the mastectomy incision due to poor perfusion. If mastectomy flap perfusion is significantly compromised, avoiding implant placement altogether is strongly advised. A preoperative discussion with the patient in preparation of this possibility is highly critical to avoid patient-developed resentment due to an unanticipated setback. Delayed placement of a tissue expander or implant may be subsequently undertaken once mastectomy flap perfusion is reestablished through delayed conditioning.

Oncologically, if close proximity or involvement of the pectoralis is suspected preoperatively, pre-pectoral implant placement should be avoided so as to not obscure surveillance physical examinations or imaging over a high-risk area.⁷⁵ If the possibility of PMRT has not been eliminated and implant reconstruction is undertaken definitively, pre-pectoral tissue expander/implant placement has shown promising results in the setting of post-reconstruction radiation⁷⁶ with the theoretic advantage of eliminating implant displacement due to pectoralis contracture.

Single-stage direct-to-implant (DTI) reconstruction has evolved into a viable alternative to a traditional two-stage (tissue expander followed by a permanent implant) approach. Facilitated by the use of acellular dermal matrices, DTI reconstruction may be performed in either the subpectoral or prepectoral plane. If DTI reconstruction is being considered, the mastectomy surgeon must reliably deliver well-perfused mastectomy flaps of consistent thickness. Equally important, achieving a hand-in-glove relationship between the implant construct and overlying mastectomy flaps is essential for the optimal cosmetic outcome and elimination of dead space potentiating seroma formation and infection.⁷⁷ In patients where these two requirements are not certain, a traditional two-stage approach is preferential. Patients undergoing mastectomy with a history of subpectoral augmentation mammoplasty with a relatively small amount of breast parenchyma may be ideal candidates for DTI reconstruction in the subpectoral plane if no or only minor changes in net breast volume are desired.

Autologous Reconstruction

Autologous, especially abdominal-based, reconstruction is widely considered “the gold standard” providing a soft, warm, and enduring breast mound with high patient satisfaction. If selected at the conclusion of a shared decision-making process, breast-specific physical assessment is identical as previously mentioned for immediate

reconstruction candidates. For patients undergoing delayed reconstruction, location of the mastectomy scar, quality of the residual mastectomy skin including possible radiation changes, presence of any skin lesions, chest wall, or axillary masses concerning cancer recurrence must be assessed. Although irregularities in skin quality are more readily obscured with an underlying autologous tissue flap compared with a prosthetic device, replacement of damaged or poor quality residual mastectomy skin with the cutaneous portion of the autologous flap should be considered. Similarly, underscoring the flexibility of an underlying autologous flap in relation to the native breast skin envelope optimizing cosmetic outcome, nipple-areolar complex ptosis can be reliably corrected following nipple-sparing mastectomy.⁷⁸

The preferred donor site for autologous reconstruction is the infraumbilical abdomen due to the close resemblance of tissue consistency relative to the breast, the volume of harvestable soft-tissue, length and size of the pedicle vessels, subsequent improved abdominal contour, and low donor-site morbidity when performed as a perforator (DIEP) flap.⁷⁹ When evaluating the abdomen, skin quality, abdominal soft-tissue excess, and previous abdominal incisions are inspected in relation to the anticipated flap borders and volume needs. In patients with breast volume or skin needs beyond a hemiabdominal flap, stacked flaps must be considered.^{80,81} Lower midline and/or Pfannenstiel incisions are commonly encountered in the typical breast cancer patient population and do not usually preclude successful flap harvest. Similarly, suction-assisted lipectomy is common in this patient population and is considered a relative contraindication for abdominal-based reconstruction. In our practice in general, preoperative abdominal CT angiogram is used selectively but required in patients with multiple open abdominal surgeries, a history of infraumbilical suction-assisted lipectomy, and/or laparoscopic bladder suspension or inguinal hernia repair. Although operative times have not been decreased in our practice and others⁸² by the use of preoperative computer-assisted tomography angiogram (CTA), valuable anatomic data beyond presence and location of perforators can be assessed.⁸³ Certainly, MR angiogram is an acceptable alternative imaging modality for the assessment of relevant anatomic features. Presence of rectus diastasis, as well as incisional and umbilical hernias requires assessment and repair integrated into abdominal donor-site closure. The anticipated final location of the abdominal scar upon closure is reviewed with the patient to set

appropriate expectations related to improvement in abdominal aesthetics.

In patients where abdominal soft-tissue is not sufficient or harvestable due to low BMI or a prohibitive surgical history such as previous abdominoplasty, respectively, alternative donor sites require assessment. Gluteal (gluteal artery perforator [GAP] flap), flank (lumbar artery perforator [LAP] flap), medial (transverse upper gracilis/ vertical upper gracilis [TUG/VUG] flap), posterior (profunda artery perforator [PAP] flap), and lateral (lateral thigh perforator [LTP] flap) thigh-based donor sites are selected based on location of relative soft-tissue excess, prior incisions, or suction-assisted lipectomy. Owing to the anatomic variability of vasculature in these alternative donor sites, preoperative CTA or MRA is necessary. In patients where thoracodorsal vessel-based reconstruction is being considered on the side of previous mastectomy with axillary lymph node sampling, not only is posterior trunk soft-tissue excess assessed but also latissimus function determined by voluntary contraction. If the latissimus does not contract on command, thoracodorsal nerve injury is suspected and patency to the thoracodorsal vessels requires assessment with CTA.

For patients undergoing free flap breast reconstruction, the internal mammary vessels are the preferred recipient vessels due to ease of exposure and optimal flap positioning. Although the right internal mammary vein is invariably of sufficient caliber for primary venous outflow, the left internal vein is significantly smaller⁸⁴ and may be unusable in up to 20% of cases,⁸⁵ especially if left-sided radiation has been delivered. Consideration for alternative venous outflow channels must take place preoperatively. The thoracodorsal vein is readily accessible within the same operative field; however, sacrifice eliminates the potential use of the latissimus as a backup flap if free flap failure occurs. Alternatively, the cephalic and external jugular veins are viable and reliable options if the internal mammary veins are inadequate.⁸⁶

SUMMARY

Breast reconstruction plays a vital role in improving the quality of life following mastectomy. Through a multidisciplinary approach, optimal oncologic and reconstructive outcomes are promoted. A thorough review of the patient's preferences, reconstructive goals, medical and surgical history, as well as oncologic treatments will facilitate a shared decision-making process optimizing perceived outcomes. Both alloplastic and autologous reconstruction require thorough evaluation and consideration.

CLINICS CARE POINTS

- Breast reconstruction should take place in a multidisciplinary environment.
- Patient preferences and goals must be assessed and considered, and appropriate expectations established.
- Relevant medical and surgical history must be assessed.
- Previous or anticipated oncologic treatments must be considered.
- Implant-based reconstruction has meaningful benefits, but important limitations.
- Autologous reconstruction is considered the "gold standard" but requires thorough consideration.

DISCLOSURE

Dr M.T. Chrysopoulou is the founder of Toliman Health, creators of the Breast Advocate ® App.

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