

BREAST RECONSTRUCTION

IVAN MILAS, ZVONIMIR ZORE, ANDREJ ROTH, TOMISLAV OREŠIĆ, DOMAGOJ ELJUGA,
MIRKO GULAN, ILIJA GUTEŠA and MLADEN STANEC

Department of Surgical Oncology, University Hospital for Tumors,
University Hospital Center Sestre milosrdnice, Zagreb, Croatia

Summary

Breast cancer is most common cancer in women in Croatia. It is a leading cause of death in women with malignant disease. Breast cancer treatment causes anxiety in women also because of the fear of losing one or both breasts. This disease has a psychological impact effect and increasing number of women decide to undergo reconstruction. There has been a substantial progress in reconstructive techniques in last two decades. This article summarizes short history, development and today's state of the art of reconstructive possibilities. As well as, advantages and disadvantages of reconstructive techniques that help us choose the right timing and the right type of reconstruction. The final goal of breast reconstruction is oncological safety and women's satisfaction with the outcome.

KEY WORDS: *breast cancer, autologous breast reconstruction, alloplastic reconstruction, breast reconstruction*

REKONSTRUKCIJA DOJKE

Sažetak

Karcinom dojke je načešći maligni tumor kod žena u Hrvatskoj. On je i vodeći uzrok smrti kod žena oboljelih od malignih bolesti. Njegovo liječenje izaziva jedan od najvećih strahova kod žena a to je gubitak jedne ili obje dojke. Tako se radi pogubnog psihološkog učinka ove bolesti sve veći broj žena odlučuje za rekonstrukciju. Zadnjih dvadesetak godina pratimo izraziti napredak u rekonstrukcijskim tehnikama, bilo vlastitim tkivom bilo ugradbenim materijalima. Ovaj članak nam daje kratki povjesni razvoj i današnji pregled o mogućnostima rekonstrukcije. Također, pregled prednosti i nedostataka rekonstrukcijskih tehnika, koje nam mogu pomoći u izboru, vremena i načina rekonstrukcije. Krajnji cilj rekonstrukcije dojke treba biti, onkološki siguran zahvat kojime je žena zadovoljna.

KLJUČNE RIJEČI: *rak dojke, rekonstrukcija vlastitim tkivom, rekonstrukcija stranim tkivom, rekonstrukcija dojke*

INTRODUCTION

In 2012, 2 557 new cases of breast cancer in the Croatia were diagnosed (1). Approximately, one in eight women in Croatia will develop breast cancer in their lifetime. Breast conservation surgery is an excellent treatment option for many women with cancer, but a large percentage of these women are unhappy with the final cosmetic result. In addition, mastectomy continues to play a major role in the treatment algorithm of breast cancer.

As a result, women are frequently faced with the decision of whether to undergo reconstruction. In most cases, mastectomy offers a good local control, avoids irradiation and in case of reconstruction provides a good aesthetic result. An increasing number of women also ask for prophylactic mastectomy.

Firstly, due to genetic testing for *BRCA1* and *BRCA2*, and secondly, due to the increase in frequency of contralateral prophylactic mastectomy in patients who have undergone mastectomy for

unilateral disease (2,3). This has led to an increased number of mastectomies, as well as, an increasing number of reconstructive procedures performed annually.

The mastectomy defect can be devastating for woman, both physically and psychologically. Numerous studies have documented the significant improvement in self-confidence and mental health following breast reconstruction (4,5).

Skin-sparing mastectomy (SSM) with immediate breast reconstruction (IBR) was first reported by Toth and Lappert in 1991 and is generally acknowledged to be a method that can achieve both a radical cure and excellent cosmetic outcome (6). Recently, nipple-sparing mastectomy was introduced, which combines SSM with preservation of the nipple – areolar complex. However, the procedure is still controversial, and there is a lack of general consensus for which breast cancer patients it is best suited, apart from indication for prophylactic mastectomy for hereditary breast cancer.

Options for reconstruction include autologous reconstruction with numerous flaps or alloplastic techniques such as tissue expander/implant. Surgeon who advice which type of reconstruction perform has to know advantages and disadvantages of both techniques. No one procedure is superior to the others in all circumstances; however, certain patients clearly benefit from careful procedural selection. Although certain articles have reported similar satisfaction following either autologous or alloplastic reconstruction, some recent reports suggest improved satisfaction with autologous options (7). In the planning of breast reconstruction, open dialogue between surgeon and patient is mandatory. Patients presenting to an oncoplastic or a plastic surgeons are usually well informed about their options. Some of them have discussed the options with a surgical oncologist, gather information on Internet, or discuss the possibilities with other patients. In short, patients coming for breast reconstruction are well informed.

AUTOLOGOUS BREAST RECONSTRUCTION

History

Last hundred years numerous techniques have been used for autologous breast reconstruction.

That techniques included the pectoralis turnover and successive tubed transfers from the contralateral breast. It is important to mention Tanzi latissimus dorsi myocutaneous flap that was commonly used for closure of radical mastectomy between 1900 and 1925 (8). One of the most important contributions to autologous breast reconstruction was the introduction of the pedicled transverse rectus abdominis myocutaneous (TRAM) flap procedure by Hartrampf et al. in 1982 (9). This technique remains the most common method of autologous breast reconstruction. The first reported use of free tissue transfer for breast reconstruction was by Fujino et al. in 1976 (10).

Free tissue transfer has increased because of increased familiarity with microvascular techniques, especially after 1990s. Examples of these include the free TRAM flap, the deep inferior epigastric perforator (DIEP) flap, and the superficial inferior epigastric artery (SIEA) flap. Although autologous approaches remain less common than alloplastic reconstruction, using a patient's own tissue has some distinct advantages. Autologous reconstruction has the benefit of replacing *like with like*, which in turn contributes to an improved feeling of restoration of the self after mastectomy (11). Many women do not want a synthetic implant serving as a reminder of their breast cancer. In addition, methods using abdominal donor region have benefit for woman because of concomitant abdominoplasty which is included. The disadvantage is the possibility of catastrophic complete flap loss and necessitating further surgery. Furthermore, autologous reconstruction is a more demanding operation, with longer recovery time and potential for donor-site morbidity.

Timing

Autologous reconstruction can be safely performed in either an immediate or delayed fashion with respect to the mastectomy. Immediate reconstruction has several advantages. Like alloplastic reconstruction, patients benefit from needing only one operation, and most surgeons find that immediate reconstruction is easier to perform, with a more predictable mastectomy skin flap envelope. The skin-sparing mastectomy has also had the greatest aesthetic improvement for autologous reconstruction. Moreover, precise planning of the location of the skin island can be designed on the abdomen before transfer, thus improving the effi-

ciency and precision of the operation. Generally, delayed reconstruction should not be undertaken sooner than 6 months after mastectomy because of immature scar formation; however, there is no temporal limit. Delayed reconstruction requires reelevation of the skin flaps, which are often scarred and less compliant. The mastectomy scar should be excised completely, and if radiation injury is evident, this should be excised as well. Scarred or irradiated skin can result in inadequate ptosis and poor symmetry over time.

Types of reconstructions

The TRAM flap is the most common method of autologous breast reconstruction. This elegant method provides the best chance to obtain symmetry with the opposite breast. This flap, when performed after skin-sparing mastectomy, yields the best-looking reconstruction. The TRAM flap differs from every other myocutaneous flap in that it is more tenuous and requires much more surgical respect. Complications such as necrosis of the flap and development of a lower abdominal hernia can be a problem (12). There are many variations of the TRAM flap, which is why it is so versatile and can meet the demands of both the patient and the reconstructive surgeon. TRAM flaps are categorized by their blood supply. Pedicled TRAM flaps is known as conventional TRAM flaps (vs. free). These flaps are supplied by musculocutaneous perforating branches formed by the deep superior epigastric artery and vein. The TRAM flap operation is an excellent alternative for reconstruction of bilateral mastectomy defect.

The free TRAM flap is a microsurgical procedure in which the deep inferior epigastric artery and vein are used as the axial pedicle, offering several distinct advantages (better blood supply, less damaged of rectus muscle and less donor site morbidity, no need tunneling and there is no epigastric *bulge*).

The DIEP flap is a true perforator flap. The rectus muscle is left intact and the inferior epigastric vessels are dissected free by splaying the muscle fibers temporarily, following the perforators down to their origin. Two rows of perforators are typical. Although the perfusion zones of these perforators largely overlap, they are not the same (13).

The SIEA flap is another modification that uses the superficial vessels rather than their deep



A



B



C

Figure 1. Nipple-sparing mastectomy/periareolar and lateral incision. A: A 56-year-old patient with invasive ductal carcinoma of the left breast (2 cm); The patient underwent a left nipple-sparing mastectomy with a periareolar and lateral incision, lymph node dissection and immediate reconstruction with latissimus dorsi myocutaneous flap. Biopsy of right breast showed benign lesion. B: Lateral view a one year later. C: dorsal view a one year later



A



B

Figure 2. Nipple-sparing mastectomy/periareolar and horizontal incision. A: A 50-year-old patient with an invasive ductal carcinoma and lobular carcinoma in situ in the right breast (1.2 cm) and a familial history of breast cancer; Nipple-sparing mastectomy preoperative planning was based on a bilateral through a central approach and immediate reconstruction with implant (Mentor 245 cc), free nepple areola complex transfer, and exesive skin reduction. Intraoperative frozen sections demonstrated nipple-areola complex free of tumor. B: One year postoperative appearance with a very good outcome

counterparts. The same lower transverseskin island is used to create a breast mound. Themajor benefit of this flap is that the anterior abdominal-wall fascia is never violated, leaving a completely intact fascia and muscle. Because of the shortcomings of a tenuous pedicle, the flap harvest is limited to only half of the transverse abdominal skin island. In fact, in a large percentage of patients, this pedicle is not of sufficient size to support a flap (14,15).

The latissimus dorsi (LD) myocutaneous flap remains a solid option for autologous breast reconstruction. It can be used alone or in combination with silicone breast implants, whereby the flap provides coverage and an implant provides volume. In Croatia this flap is typically used for initial reconstruction of smaller breast. LD flap serves nicely as a salvage flap in cases of previous flap failure or extruded expander/implant.

Other free autologous choices include gluteal flaps (inferior or superior), which may also be performed as perforator flaps for a longer pedicle, the transverse upper gracilis flap, the lateral thigh flap, and the Rubens flap. Typically considered backup options, these flaps are used in patients who have undergone a previous TRAM flap procedure and develop a contralateral breast cancer or in patients who desire an autologous breast reconstruction but have inadequate abdominal tissue. Free gluteal flaps, although generally reliable, often lead to a firmer, less pliable breast mound as a result of the innate quality of the skin and subcutaneous tissue (16).

ALLOPLASTIC BREAST RECONSTRUCTION

History

The use of prosthetic devices for breast reconstruction began in 1963 when Thomas Cronin and Frank Gerow promoted the first silicone implant, paving the way for today's silicone and saline prototypes (17). Along with development of implants, tissue expanders have also become an integral part of breast reconstruction. This modality was designed in 1976 and was first used in breast reconstruction six years later by Chedomir Radovan. With a gradual 6-week expansion, he could recover lost tissue and match a reconstructed breast to a large contralateral normal breast (18). Today, breast implants and tissue expanders have an important role in breast reconstruction and they come in various textures, shapes, and sizes, therefore a surgeon is able to choose the most appropriate model for each patient.

Types of reconstructions (implants, expanders, ADM)

Prosthetic breast reconstruction is still one of the most frequently employed reconstructive

techniques in eligible patients. It is also the least demanding of all reconstructive techniques. The placement of immediate, permanent implants at the time of mastectomy requires sufficient amounts of uncompromised skin. Implants which can be used are categorized by their filler substance (silicone vs. saline), surface (textured vs. smooth), shape (round vs. anatomic), and size. They can be placed subcutaneously, partially submuscular (dual plane), or completely submuscular. Prosthetic breast reconstruction is best suited to women with small breasts with minimal ptosis, or to women that will undergo bilateral skin sparing mastectomies. If unilateral reconstruction is planned, it is essential to warn a patient that a contralateral procedure will be needed in order to reach symmetry.

Patients with potentially unfavorable outcomes include obese women with large breasts, patients with connective tissue disorders, smokers, and patients with prior breast radiotherapy. A large study of 884 patients found that smoking, obesity, hypertension, and age over 65 were independent risk factors for perioperative complications after expander/implant breast reconstruction (19).

However, alloplastic reconstruction is often the most tempting option because of its decreased recovery times compared to autologous breast reconstruction, absence of donor site scars, and fewer complications. A relatively common complication of implant-based reconstruction is capsular contracture, classified by Baker. Patients without capsular firmness are classified as Baker grade I; those with palpable and firm but nonvisible and nonpainful capsules are classified as Baker grade II. Baker grade III capsules demonstrate visible distortion of the implant; Baker grade IV capsules cause pain (20).

Studies generally report that submuscular prostheses cause fewer contractures. The new generation silicone gel implants, however, demonstrate much lower capsular contracture rates than earlier implants (21,22).

Other common method in breast reconstruction technique is tissue expansion, which involves expansion of the breast skin and muscle using a temporary tissue expander. A few months later, the expander is removed and the patient receives either microvascular flap reconstruction or the in-

sertion of a permanent breast implant. This type of breast reconstruction requires two separate operations. This procedure gives a surgeon a possibility to overexpand the skin, which can be used for natural ptosis of the breast in secondary procedure when permanent implant is used and to precisely position new inframammary crease. Tissue expansion is procedure of choice when a secondary prosthetic reconstruction is planned.

Acellular collagen dermal matrices (ADM)

In the last decade, many centers have started to use biologic acellular collagen dermal matrices to reinforce inframammary crease, control pectoralis muscle release, resurface and reshape implant pockets, to cover and support the inferior aspects of the tissue expander, reducing expander or implant migration, maximizing utilization of mastectomy skin flaps, facilitating greater intraoperative expander fill with a concomitant reduction in the number of expander fills. Indication for the use of acellular dermal matrices in breast surgery has expanded to include primary implant-based reconstruction, aesthetic breast surgery, revision breast surgery, and nipple reconstruction.

Because of the high cost of dermal matrix, it is still not used in centers in Croatia.

Despite their popularity, an ongoing concern is the risk of complications, particularly seroma, skin necrosis, infection, and failed reconstruction with expander or implant loss. An increased rate of these complications has been reported in some recent studies that have questioned the benefit of acellular dermal matrix use (23,24,25).

Implants and radiation therapy

One of the main concerns when proposing breast reconstruction with implants/expanders is the possibility that some patients will have to undergo radiation therapy. It is well known fact that radiation therapy is the main cause of complications in a form of high incidence of capsular contracture and higher percentage of revision surgery (26). Therefore, careful patient selection is mandatory when attempting to perform prosthetic reconstruction, especially in the setting of planned postoperative irradiation. In those circumstances, the option could be to postpone a reconstruction after adjuvant treatment and to perform a second-

ary reconstruction either with prosthesis alone or with addition of placement of myocutaneous transposition flap over the implant.

Kronowitz proposed in 2004 a new algorithm for patients that might be the candidates for post-mastectomy radiation therapy. This protocol, the delayed-immediate prosthetic breast reconstruction protocol, was initiated at M. D. Anderson Cancer Center. It is used for patients with invasive breast cancer at increased risk for requiring post-mastectomy radiation therapy, whether this therapy is needed is not decided until after mastectomy and review of the permanent sections.

Delayed-immediate breast reconstruction is a two-stage approach. In the first stage, mastectomy is performed and a saline-filled tissue expander is placed to preserve the initial shape and thickness of the breast skin flaps and the dimensions of the breast skin envelope. In patients who do not require postmastectomy radiation therapy, second stage (definitive breast reconstruction) is performed within 2 weeks after mastectomy.

In patients who do require postmastectomy radiation therapy, the tissue expander is deflated before the start of therapy to create a flat chest wall surface and after the completion of postmastectomy radiation therapy, the expander is re-inflated to permit *skin preserving* delayed reconstruction (27).

In Croatia, plastic surgeons perform both oncologic and reconstructive procedures on breast, therefore, it is much easier to plan a reconstructive procedure and to anticipate corrections that should be done during surgery in order to reach oncological safety and aesthetic superiority. This concept of being oncologic and plastic surgeon in one person is becoming more popular in western Europe and US.

CONCLUSION

Incidence of breast cancer and overall better survival rates stress quality of life as an additional factor in deciding on therapy. In past two decades oncoplastic breast surgery developed a variety of procedure when chosen according to local situation and patients wishes can substantially reduce impact of this disease on personal perception without compromising the oncological principals which makes them more frequently used.

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Author's address: Ivan Milas, School of Medicine, University of Osijek and Department of Surgical Oncology, University Hospital for Tumors, University Hospital Center Sestre milosrdnice, Ilica 197, 10000 Zagreb, Croatia; e-mail: ivan.milas@kbcsm.hr