

Breast Reconstruction after Mastectomy

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ABSTRACT

Results of our analysis show as that breast reconstruction become a standard part of the care of female patients with breast cancer. We will analyse the factors that are important for the primary or secondary breast reconstruction after mastectomy, and also take a closer look on the most recent scientific advances on breast reconstruction and on the protocols regarding them. The breast is the most common site of cancer in Croatia women. Breast cancer is the first leading cause of cancer death among women today. The incidence of female breast cancer in Croatia estimates that approximately 2.200 news cases of female breast will be diagnosed every year. We retrospectively analysed data of 101 female patients undergoing reconstructive surgery for breast reconstruction after mastectomy at Division of Plastic Surgery and Burns, University Hospital Center Split and University Clinic of Plastic and Reconstructive Surgery, Innsbruck, Austria, between 1998 and 2008. For the purpose of outcome assessment, we performed the tree different type of questionnaire: (1) Personal/medical profile (Table 1), (2) Aesthetic assessment (Table 2), and (3) Psychosocial assessment (Table 3). The occurrence of main complications during breast reconstruction (partial necrosis of flap, hernia of donor site, pulmonary embolism, deep venous thrombosis, infection rate, hemathoma and seroma formation, and extrusion of expander/implant) during hospitalisation and follow up period until 6 post operatively were analysed with respect to use different type of reconstructive methods for breast reconstruction. The difference in complication between patients groups was evaluated by χ^2 -test. The level of significance was set up at $p=0.05$. Mann-Whitney test was used to compare the time from mastectomy to breast reconstruction, due to asymmetrical data distribution. The three main variables of this study were to identify significant risk factors, asses the aesthetic outcome, and patient satisfaction with performed different methods for breast reconstruction (LD flap with or without tissue expander and implant, pedicle and free TRAM flaps, and expander /implants only. These variables determined the current guidelines for early and late breast reconstruction after mastectomy such as patient data, age and own decision, relation ship between reconstruction and radiotherapy, and chemotherapy, and finally about breast preserving operation. The result should confirm that breast reconstruction after mastectomy is justified, especially in young women, as well as how essential is team work involved in breast cancer operation and breast reconstruction after mastectomy.

Key words: breast cancer, breast surgery, preserving breast operation, postmastectomy radiotherapy and chemotherapy, primary and secondary breast reconstruction, current guidelines for breast reconstruction after mastectomy

Introduction

Breast cancer is the most common malignancy in Croatia women. The incidence of breast cancer are raised in the last 20 years, especially in young group of age (<50 year old), and every woman has change to get breast cancer during her period of life. The breast cancer is carrier of 20% of death in women population, and the main cause of cancer in women between age 40 and 55¹. When

the cancer is localized to the breast, the 5 year survive is 97.3% and the observed survive rate is 79.5%. In Croatia raised incidence of breast cancer, especially in 70–74 and 45–50 groups of the age, but the mortality rate is going down in the past years². To form judgement about diagnosis and treatment of breast cancer we must include many statistical variables. The main epidemiology risk

factors are: positive family anamnesis, early menstrual cycle, and the late menopause, fertility, and pregnant in age over 35 years, radiotherapy, alcohol abuse, style of life, nutrition, habit, endogen factors such as estrogens and gene predisposition, and finally psychosomatic factors³. As a result of improved screening such as ultrasound of breast, mammography, clinical examination, and breast self examination monthly, enabled to as to perform the early diagnosis of pre malignant breast disease, and the better care of high risks group. The currently assumed that about 5% of breast cancer cases are caused by inherited condition⁴. Two defective genes (BRCA-1 and BRCA-2) have been identified as causing breast cancer. Chemo prevention has been very important issue as prognostic factor too⁵. Only 25% to 30% of breast cancer can be attributed to know risk factors. The major risk factors in breast cancer are: proliferative epithelial changes in the breast ducts, personal or family history of breast cancer, age over 50, nulliparous state or first child after age 30⁴. The main prognostic factors for develop breast cancer are: tumor size, differentiation and histopathology grade of breast cancer (normal, hyperplasia, hyperplasia with atypia, carcinoma *in situ* and invasive carcinoma), histopathology type of breast cancer, status of sentinel lymph nodes, hormonal markers, (oestrogen and progesterone), vascular invasion of tumor, angiogenesis, tumor necrosis and fibrosis, overall of DCIS, and molecular markers such as epithelial mucine-MUC-1, grow factor, enzymes and proteins, and Nottingham prognostic index (NPI)^{6,7}. Our main aim in future is to increase over survive rate of breast cancer for 5 to 10%.

Mastectomy is unfortunately a mutilating operation that, without reconstruction, causes deformity and changes women »Ego«. Most of the time this deformity is hidden with clothing, but it is deformity all the same. The general goals of breast reconstruction are to restore the missing form of the female breast, localisation, and size of the breast, so that women no longer need to wear an external prosthesis. Some another special requirements are applied from case to case. Depending on the success of breast reconstruction, they may look normal in a bathing suite or even, in low light, in the nude. When they look in the mirror, they no longer feel deformity. They feel feminine and attractive, and usually no longer need to go to support group for reassurance. The final of breast reconstruction is take place when women returned in every day style of life, to her family and work⁸. The quality of the breast reconstruction will depend not only on the surgeon skills but also on the amount of missing tissue, the patient general health conditions, the size of opposite breast, and technique of breast reconstruction. Additional radiotherapy, heavy smoking, chemotherapy, and obesity can all have a significant issue effects. Each patient is unique, and each operation is different. For most patients, successful breast reconstruction is possible and can usually be achieved. In the past 20 years have been dramatically changed diagnostic procedures for developing breast cancer, breast surgery, and operation procedures for breast reconstruction. From

Hasted historical operation »remove all you can to do«, breast surgery moved to direction of today »remove all what in necessary to do«. That means significantly reduced the extensive of breast cancer operations, which have been based on better diagnostics methods, puncture of breast tissue under control of ultrasound, NMR, mammography, a new method of loco regional treatment of breast cancer, and finally sentinel lymph nodes biopsy. Surgical protocol has been additional changed when radiotherapy and chemotherapy started to play an important role in primary treatment of the breast cancer⁹. Radical mastectomy and extensive radical mastectomy have become the historic operations, and total and modified radical mastectomy has been methods of choice, but they are still very radical operations. If we are looking in the future we can say that those operations should be archived, because of application of gene therapy, immunotherapy, and biological modification of tumor growing¹⁰. Currently the measure of a good breast reconstruction is a procedure that matches the remaining breast in dimension, position, and contour. Today combinations of the available procedures as living tissue, textured implants with cohesive, silicon gel, expanders and expander/implant devices, and combination of all are carried out to achieve the most aesthetic and functional breast reconstruction¹¹.

Oncologic principles in breast reconstruction

Breast cancer is a heterogenous group of conditions that can be divided into non invasive group of lobular carcinoma *in situ* (LCIS) and ductal carcinoma *in situ* (DCIS), and invasive cancers. The invasive carcinomas in 75% cases are infiltrating ductal carcinoma and in another 10% are lobular carcinoma and the rest are other subtypes: tubular, mucinous, medulary, metaplastic and ect¹². The main goals of multidisciplinary breast cancer management include the surgical remove of all tumor within the breast and axillary nodal basin, and the treatment of any residual microscopic tumor deposits with adjuvant systemic and radiation therapy. Although more coexisting disease and tumor factors also determinate the choice of operative procedure. These usually include the presence or absence of previous breast disease, the treatment that may have affected the breast tissue, strongly family anamnesis of breast cancer, genetic predisposition to this disease (BRCA 1 and BRCA 2 mutation), pathology characteristics of the primary lesion, extant of disease within the breast, regional nodes and distant sites.

Breast conserving surgery

It consisted of a partial mastectomy and lumpectomy with clear margins followed by breast irradiation. Relatively absolute contraindication to breast conservation treatments include large or advanced tumor that cannot be cleared with breast conserving surgery, prior history of irradiation to the breast or chest, and multiple primary tumors (multicentricity) within the ipsilateral breast. Oncoplastic techniques for breast conservation

may include ipsilateral breast reconstruction using local tissue and if necessary balancing contralateral breast reduction.

Prophylactic surgery

This term usually include following issues: (1) prophylactic oophorectomy to reduced risk of breast cancer in BRCA carriers, (2) prophylactic breast surgery which reduced risk of breast cancer at least 90% include: breast reduction, subcutaneous mastectomy, prophylactic total (simple or skin-sparing mastectomy), and contralateral prophylactic mastectomy. Most women choosing prophylactic mastectomy desire immediately reconstruction as opposed to delayed breast reconstruction. Women who undergo prophylactic mastectomy with reconstruction may require more psychological support than those women who have undergone mastectomy for breast cancer with or without complications. In addition a skin sparing mastectomy removes the NAC complex and all glandular tissue, along with any previous skin incision that was used to remove neoplastic breast disease. Thus the intent is to remove all amount of breast tissue as a total mastectomy but preserve the envelope of skin. The main advantages of this procedure are to allow immediate breast reconstruction with autologous living tissue, prosthesis implantation, bio dimensional anatomical permanent expander implants or combination of both. With nipple sparing and areola sparing mastectomies we are able to preserve additional tissue without secondary nipple reconstruction. The M.D. Anderson Cancer Group from Huston, USA found that only 3% of patient had tumor in the nipple areola complex¹³. The NAC is insensitive post-operatively and preservation of the NAC may have minimal practical benefits for most patients. So it is also reasonable to remove all breast tissue and NAC complex using circumareolar incision and to insert an autologous flap with the skin island which has some dimension as previous areola complex. This circular patch of skin can later be modelling and tattooed with nipple reconstruction. Management of the BRCA mutation carrier or high risk patient with skin sparing mastectomy was introduced into clinical practice several years ago and now is considered an oncologically safe surgical procedure. The prediction of breast cancer risk is based on the evaluation of two major groups of risk factors, non genetics, and inherited genetic factors. The more important non genetic factors are: age, hormonal risk factors (e.a. estrogen, progesterone, duration of active menstrual cycles, early menarche, late menopause, oophorectomy before age 35, nulliparity and age older than 30 at first birth, oral contraceptive, widespread of hormone replacement), race and ethnicity, environmental and lifestyle factors, family history. Inherited genetic factors include the two major breast cancer susceptibility genes, BRCA 1 and BRCA 2, and it is estimates at 85%. These clinical features should prompt discussion and referral to a familial/genetic program for assessment, counselling and potential genetic testing¹⁴.

Total mastectomy

Standard alternative to breast conserving surgery is total mastectomy with axillary dissection. When combined with immediate reconstruction, the ridge should form the inferior border of the dissection to allow symmetry and placement of the reconstructive breast. Laterally the dissection goes to the edge of latissimus dorsi (LD) muscle and included the axillary tail of Spencer. The additional dissection performed in the axilla and removed the lymph nodes of I/II axillary level for disease control with less morbidity. This procedure has been replaced with sentinel node biopsy for those who have node negative disease. The sentinel node dissection today is accurate procedure and axillary recurrence is uncommon with update treatment of early stage breast cancer. Advance in systemic adjuvant therapy for breast cancer have produced the great improvement in overall survival. It included endocrine, cytotoxic, and biological therapies. Today we have two current treatment protocols St. Galen conference¹⁵ and National Comprehensive Cancer Network (NCCN) Clinical Practice Quidelines¹⁶. Chemoprevention is defined as the use of natural or synthetic agents to impede, arrest, or prevent carcinogenic progression to invasive cancer. Tamoxifen and Raloxifen are selective estrogen receptor modulators whose are reduced breast cancer risk and reduced osteoporosis in postmenopausal women. Tamoxifen is known to increase risk of venous thromboembolism.

Types of breast reconstruction

There are two basic types of reconstructive breast operations those that use a breast implant and those use autologous, living tissue. Breast reconstruction can be performed immediately or delayed until weeks, months, or even years after mastectomy. Operative methods can be divided into the procedures after breast conserving surgery, and the procedures after mastectomy.

Breast conserving surgery are stilly performed under strictly indications as are unifocal breast cancer whose is until 4 cm in diameter or bifocal tumor in the one quadrant of the breast. Correlation between the size of tumor and the breast volume are one of very important variables. If we performed that type of operation every one must take care on oncoplastic security of operation, which included distance between incisions border and margins of tumor. Veronesi et al. set up hypothesis about that distance which must be sufficient¹⁷. Absolute contraindications for breast conserving surgery present loco regional, advance tumor, and inflammable breast cancer. Partial mastectomy followed by radiation therapy today is recommended as the treatment of choice for women with early-stage breast cancer, provided that the margins of resection are free of tumor. Kronowitz et al. in their review of 69 women who had correction of a partial mastectomy defect over a 12 year period found increasing number of breast cancer patients treated with partial mastectomy followed by radiation therapy, on approach referred to as breast conserving therapy¹⁸. After breast conserving surgery the risk of sub-optimal cosmetic results is in-

creased and more than 20 to 30 percent patients have poor cosmetic result, with deformities of the treated breast¹⁹. Breast conservation is currently performed in one of two ways, with lumpectomy or partial mastectomy. Lumpectomy is often sufficient for small tumors measuring less than 2 cm in which a 2 mm margin of clearance is sufficient. The contour abnormality appears in 5 to 10 percent of cases. Partial mastectomy is necessary for large tumor in which 1 cm margin of clearance is preferred. This results in a contour abnormality of the breast in 20 to 40 percent of cases. These deformities usually required reconstructive procedures to correct that include local dermoglandular tissue rearrangement, implants, mastopexy, free nipple-areola graft in cases of the central breast tumor, reduction mammoplasty and musculocutaneous flaps. This trend is also attributable to increased mammography screening and early detection of breast cancer recurrence. It is also attributable to the increasing use of preoperative chemotherapy in case of large operable and locally advanced breast cancer²⁰.

Breast reconstruction after mastectomy (simple, total or modified, radical) can be immediate, or primary reconstruction which has been performed while the patient is still under anaesthesia or delayed, or secondary reconstruction until weeks, months, or even years after mastectomy. Immediate operation offers many advantages over delayed. These advantages include reduced psychological trauma, greater convenience, safety, and superior cosmetic results due to preserving of the three dimensional skin envelope. It also reduced mortality rate and cost benefit because breast reconstruction is performed in the one operation. Unfortunately, immediately reconstruction is psychologically easier for the patient because when women awakens from general anaesthesia after mastectomy, surgeon performed breast reconstruction with living tissue or with expander/implant, and women does not have to live with the defect after breast cancer removed. This operation is more convenient, less expensive, and recovery is take place in same time. Finally, the aesthetic results tend to be better because some form of skin-sparing mastectomy can be performed, if breast reconstruction is to follow immediately. Immediate breast reconstruction is usually recommended for patients with clinical stage-I breast cancer and some patients with clinical stage-II breast cancer, who do not have an increased risk of required post mastectomy radiotherapy (PMRT). However, because of the inability first to detect nodal metastases in clinically node negative breast cancer patients before mastectomy, and secondly to precisely evaluate the presence of micro metastases intra operatively, PMRT is often not known until 1 week after surgery when final pathologic evaluation is complete. Unfortunately, the inability to know either preoperatively or intra operatively which women will or will not require PMRT has implication to the appropriate sequencing of reconstructive procedures²¹. From oncologic stand points of view the most common indication for mastectomy with immediate breast reconstruction included: prophylactic mastectomy in high risk group, the treatment of ductal carci-

noma *in situ* for extensive disease within the breast or patient choice, the treatment of early stage invasive breast cancer, and management for patients who develop a second primary or a local breast relapse after previous breast conserving treatment which include partial mastectomy and breast radiation. Secondary breast reconstruction is usually performed 3 to 6 months after mastectomy. This operation is usually reserved for women who will require PMRT. At MD Anderson Cancer Centre, Huston, USA, clinicians prefer not to use breast implant in patients who have received PMRT. The main reasons are appearance of acute problems with wound healing, the late problems with capsular contracture, and painful constriction on the chest wall. In these particular cases surgeons usually used living tissue (TRAM, DIEP SIEP and ect), combined with contralateral mastopexy to obtain symmetry²¹.

In delayed-immediate breast reconstruction as stage one, surgeons performed skin-sparing mastectomy with insertion of a filled textured saline tissue expander (Becker or Spectra) to preserve shape and dimensions of the skin envelope until the results of pathology are known²¹. After received finally results, patients who do not received PMRT undergo definitive breast reconstruction with TRAM or SGAP flap, LD flap with or without implants and permanent implant. But patients who require PMRT complete this therapy and then undergo skin-preserving delayed reconstruction. This operation is going on as 2 stages operations. The first we must deflate tissue expander. Two weeks after the completion of PMRT we inflated expander to the pre-deflation tissue volume and starting with skin preserving delayed reconstruction 4 to 6 months later with TRAM or SGAP flap and LD flap with implant. It is better to use living tissue flaps to avoid the problems associated with breast implants in irradiate chest and to obtain the better aesthetic result. The impact of axillary sentinel lymph-node biopsy have the great value today, and include complete level I and II axillary node dissection because additional node will be involved in up to 40% of such patients²². Intra operative examination of sentinel lymph node with frozen section analysis, imprint cytology, or both does not reveal all micro metastases. Patients with 50 years of age or younger, who had tumor larger than 2 cm, and women who had lymphovascular invasion detected in the initial biopsy specimen, were at high risk for axillary metastases. In the current approach to immediate breast reconstruction for patients at high risk of axillary involvement we must thinking how to avoid possibly compromising the vascular supplies to the reconstructed breast. If we performed micro vascular TRAM flap instead the most commonly used recipient vessels being the thoraco-dorsal artery and vein, the vascular pedicle may be connected to the internal mammary vessels in which way we avoid the potential for vascular injury of recipient vessels to the TRAM flap. Another confounding factor is the possible need for postoperative axillary radiation when the sentinel node is found to be positive. The stage of the breast cancer is also very important issue in reconstructive

planning. Patients with stage I breast cancer are considered to be at low risk for requiring PMRT and are good candidates for immediate breast reconstruction using any of the available approaches. Some patients with stage II breast cancer (age younger than 50 years, lymphovascular invasion in the initial biopsy specimen, and T2 tumor) have borderline elevated risk of requiring PMRT, and it is most difficult to formulate recommendations for adequate timing of breast reconstruction. The locally advanced cancer or stage III breast cancer has been the best candidate for delayed breast reconstruction. Breast reconstruction has not been found to delay diagnosis or decrease survival in patients who present with stage III group and late develop a local recurrence²³. Preoperative chemotherapy is being used with increasing frequency in breast cancer patients with stage II and III disease. As interval between chemotherapy and surgery increases, the impact on wound healing problems diminishes²⁴. Today, immediate breast reconstruction with TRAM flap can be performed safely in patients who receive preoperative chemotherapy, but in combination with smoking may significantly increase the risk of complications. The patients who underwent immediate breast reconstruction with tissue expander or subsequent permanent implants have not statistically significant differences in wound healing, wound infection or capsular contraction between the patients treated with adjuvant chemotherapy and those did not receive chemotherapy. Another surgeon compare the free TRAM flap with the pedicle TRAM flap in patients requiring postoperative chemotherapy with or without hormonal therapy, found that 29% of patients who underwent reconstruction with a pedicle TRAM had a delay in the start of chemotherapy, compared with only 14% of the patients who underwent reconstruction with a free TRAM flap²⁵.

Adjuvant radiotherapy followed mastectomy significantly reduced the risk of local recurrence. Meta analysis published by the Early Breast Cancer Trialists Collaborative Group found a two thirds reduction in the risk of isolated loco regional recurrences (LRR) with the addition of adjuvant radiotherapy (RT)²⁶. Because PMRT reduced the risk of LRR in a proportional manner, the greatest benefit is in patients at high risk of LRR. International consensus statements advocate adjuvant chest wall radiotherapy after mastectomy and systemic treatment in women at high risk of LRR. PMRT is generally not recommended in node negative mastectomy patient because of their low risk of LRR. If patient need PMRT the planning for immediate breast reconstruction became very complex procedure. There are two potential problems. First, an immediate breast reconstruction can interfere with the delivery of PMRT, and second, the radiotherapy can adversely affect on the aesthetic outcome of an immediate breast reconstruction. For that reasons it was published consensus statements regarding PMRT²⁶. Radiotherapy is currently recommend in patients with four or more positive lymph node or advanced tumor. On the other hand is some institution PMRT is routine used in patients with early stage breast cancer. Radiation

therapy often results in tissue erythema and edema that is followed with time by fibrosis, contracture, and telangiectasia formation (radiosclerosis). The decreased vascularity of radiated tissue may result in fat necrosis and diffuse calcification. The breast may develop retraction and contracture that superiorly dislocated breast relative to the chest wall. Incidence of unsatisfactory outcome after lumpectomy and radiation therapy is about 16% to 22%²⁷. The size of the breast compared to size of the excision is critical issue in determining the likelihood of distortion.

Quadrantectomy is more likely to result in aesthetic problems than more limited segmental excision. Minimal deformities after radiotherapy may be treated with local flaps, scar release, or tissue rearrangement. More extensive defects require excision of all scar tissue and replacement with new one. The majority of defects after lumpectomy or quadrantectomy and radiation therapy are easily treated with LD flap. This flap is well tolerated and has minimal donor site morbidity. TRAM flap is usually reserved for large defects. The flap base reconstruction should be delayed for 2–3 years after the surgical procedure until erythema, edema, fibrosis, and contracture have stabilized. The loco regional recurrences are significantly reduced with addition of adjuvant radiotherapy too. The risk of locally recurrence cancer in patients treated with breast conserving surgery and radiation therapy has been reported at level of 10–20% in ten years. The predictive factors for loco regional recurrence in the absence of radiotherapy are high grade of tumor, presence of necrosis in the tumor, presence of comedo carcinoma, and close or positive surgical margin. Unfortunately, radiation contributed to the complexity of these operations. Lumpectomy and quadrantectomy preserved nipple and areola complex but residual breast tissue, asymmetry and distortion of the breast can still occur. Today modified radical mastectomy is replaced with more conservative breast surgery. The 5 years survival rate in patients with partial mastectomy and radiation is not statistically different when compared with mastectomy alone in patient with early stage II and II breast cancer. The patients with early stages of invasive breast cancer have some outcome when they are treated with lumpectomy and radiation therapy or modified radical mastectomy²⁷. The 5 years incidence of in breast tumor recurrence was higher in lumpectomy and radiation patient than in quadrantectomy and radiation patients (8.1% versus 3.1%). The local recurrence depends of tumor margin, histology, radiation therapy, and patient age. In general, 10% to 30% of patients are dissatisfied with the aesthetic results after partial mastectomy²⁸. Radiation has profound effect on the residual breast tissue whose include fibrosis and retraction. Those changes usually have been appearance 1 to 3 years post radiation. Reconstruction of partial mastectomy defects can either be immediate or delayed, 6–12 months late, when deformities have been stabilized. Another option is delayed -immediate reconstruction when reconstruction is performed after final histopathology analyses, but before starting ra-

diation therapy. Finally, immediate breast reconstruction provides superior aesthetic outcome with the low rate of complications.

Several classifications schemes have been developed to stratified delayed breast deformities and suggest reconstructive options. The main clinical sings which determinate the reconstructive options in partial mastectomy are breast deformity, tumor recurrence and post irradiation pain. Patient who underwent either local tissue rearrangement or reduction mammoplasty of the irradiated breast had complication rate more than 50% and usually including wound dehiscence, and fat, skin and nipple necrosis²⁹. The aesthetic results are also poor. The contralateral breast is larger and more ptotic and surgeon mast performed reduction mammoplasty or mastopexy. The use of breast implant to reconstruct partial mastectomy defect is also problematic, because of appearance capsular contraction and infection in the radiated sites. The best choice for reconstruction of partial mastectomy defect is living, non irradiated flap such as LD and TRAM flaps. Defects located on the lateral side of the breast are best treated with loco regional flaps, such as LD myocutaneous or thoracodorsalis artery perforator (TDAP) flap. The defects located in other quadrants such as superior, central and inferior can be treated with LD or TDAP flaps. In infero-medial quadrant the best choice is some abdominal flaps.

Prosthetic reconstruction is most appropriate in patients who do not have sufficient autologous donor tissue in abdomen or buttock region and obese patients. The best candidates for prosthetic reconstruction are patients in whom breast volume is moderate, about 750 g, with minimal ptosis, and there is adequate and healthy soft tissue coverage over the prosthesis. Candidates with large and ptotic breast typically require reduction with mastopexy, but in case of bilateral prophylactic mastectomies symmetry is more readily achieved. Very important issue is patient preference too. The high risks patient with inherited predisposition genes such as BRCA 1 and BRCA 2 usually need bilateral prophylactic mastectomies³⁰. The main advantages of prosthetic reconstruction over autologous techniques are: a more simple procedure, use of adjacent tissue of similar colour, texture and sensation, without distant donor site morbidity, less scaring, operation times and better recovery, the psychological benefit, and leaving autologous tissue for a later time. In the past prosthetic breast reconstruction were done dominantly as one stage implant reconstruction. But today two stage expander/implant reconstruction or autologous tissue reconstruction have provide better outcome. Nevertheless, primary implant reconstruction still has their place in breast reconstruction. If breast volume or weight have been about 500 g or less, skin envelope is sufficient for covering all implants with skin and muscle. In delayed bilateral reconstruction operation could be done with saline or silicon implants if skin envelop are healthy and sufficient. If we performed immediate breast reconstruction in one operation it is riskier because of the stress that is placed on skin and muscle by perma-

nent implants filled with saline, silicon or both. The one stage adjustable implant with integrate or remote valve is also very popular too. The advantage of remote valve has been that the valve once it is removed, the device functions and appears like any other implant. AlloDerm as an acellular dermal matrix derived from human cadaver skin can be use as bioprothetic material to simulate total muscle coverage of the implant³¹. The last option should be two stages breast reconstruction with expander/implant device. Once the expansion process has been completed and adjacent radiation therapy or chemotherapy has been finished, the patient can return for an exchange of the expander to a permanent implant. In addition, prosthesis reconstructions in a patient who have large breast and significant ptosis more often require a contralateral reduction or mastopexy. As the second operation in all particular cases we must performed the nipple-areola complex (NAC) reconstruction.

The LD flap as living tissue can be use for immediate or delayed breast reconstruction. Classic LD musculocutaneous flap without implant usually is not enough for quality breast reconstruction and very often we must used their combination. Flap is harvested from the back, and it origin on the humerus must be dissect for better rotation and positioning on a chest wall. The main disadvantages of LD based reconstruction are visible scars on the back, different pigmentation of the back skin, and the anterior chest wall, and likelihood of persistent fluid collection at the donor site. The LD flap can be used in patients who would normally be a risk for complications associated with reconstruction using other flaps, such as TRAM flap. These complications include diabetes mellitus, hypertension, smoking, and obesity. All methods involving implants, however, was plagued by frequent capsular contraction. In that case, complete capsulectomy can restore a compliant soft tissue and provide for an aesthetic reconstruction breast. In expander/implant based breast reconstruction my appearance unnatural contours and overall poor result, and augmenting the soft tissue framework of the chest wall with LD flap can soften the contour of the mastectomy defect and improve the finally result after implant is placed. Compare with the TRAM flap there is less skin available for skin-envelope reconstruction with the LD flap and result could be unsatisfactory if this operation were used in such patient. Four to six month later, patient usually returns to surgery for expander remove with replacement by the permanent implant. Nipple areola complex/NAC can be reconstructed on a skin island immediate or during the second operation, with central skate flap and two opposing areola hemi flaps. In delayed reconstruction the skin island is inserted into defect created by opening the mastectomy scar and removing as much of the lower mastectomy flap as can be allowed.

Today the most often used flap for breast reconstruction is the TRAM flap³². Two major vascular classifications exist for TRAM flap blood supply. The most well known is that of Hartrampf, who divided the supply into four zone³³: many years later Ninković et al. renamed

Hartrampf's zone II with zone III, and Hartrampf's zone III with zone II based on venous congestion in flap³⁴. As result of these and similar studies, surgeons now centre the design of TRAM flap slightly higher on the abdomen just below the umbilicus rather than over the supra pubic area. Many of the vascular problems associated with the TRAM flap probably stem from venous congestion than from arterial insufficiency. To reduce flap necrosis pedicles and free flap surgeons increasingly use flap from ipsilateral side than on any cross middle tissue. When used a bipedicle flap for reconstruction, Hartrampf commonly splits the cutaneous island into two separate units to fill the infra clavicular and axillary hollows³³. The bipedicle TRAM is usually indicated in large volume reconstruction, patients with midline abdominal incision, smokers, obese patients, and patients with radiation injury to one pedicle. In generally pedicle TRAM flap breast reconstruction remains the first choice for autologous reconstruction, it is most cost effective method, and is readily used in more institutions. It provides excellent contour and softness in most cases and abdominal complications are few. Microvascular free flap from abdominal wall have become an increasingly popular operation in breast reconstruction today, especially when performed immediately after mastectomy, when recipient vessels for the microvascular anastomoses have been freshly dissected during the ablation. Compared with pedicle flap TRAM reconstruction, it appears that free tissue transfer is associated with lower incidence of partial flap necroses and fat necrosis especially when using the internal mammary artery and vein as recipient vessels for the anastomosis. The free TRAM flap has various degrees of muscle sparing, the deep inferior epigastric artery perforator (DIEAP or DIEP) flap, and the superficial inferior epigastric artery (SIEA) flap³⁵. In generally the main advantages of the free TRAM technique over pedicle TRAM transfers are following: All four zones of abdominal skin can be transferred reliably; the inferior vascular pedicle is bigger than the superior epigastric vessels on which the conventional flap is usually elevated; less muscle need be taken with the free flap; reducing the potential for functional impairment postoperatively; the skin island can be designed lower in the abdomen, and better shape of the new breast can be achieved without medial fullness from the tunnelled pedicle. In delayed reconstruction the dissection of axillary vessel is very difficult; the thoracodorsal artery frequently is small (<2 mm) and sometimes is found to have insufficient flow. From surgical point of view all types of the free TRAM flaps breast reconstruction are very reliable, but for DIEP and SIEA flaps surgeon must have great experience with microsurgery transfers. The potential complication of any type of breast reconstruction is skin flap necrosis and slough. As vast majority of patient with breast cancer now receive chemotherapy, surgeons have become more comfortable with the immediate breast reconstruction but if we compared the results of immediate breast reconstruction with expander/implant surgery, no significant differences can be found. Several authors have used a free GAP flap in postmastec-

tomy reconstruction, but it is secondary choice because of very hard harvesting, small length of the pedicle, and discrepancy in calibre between donor and recipient vessels increase³⁶. Slavin et al. studied 161 women who had immediate breast reconstruction by either TRAM or LD flap between 1982 and 1990. Recurrent tumor was observed in 17 patients (10.6%). All locoregional recurrences developed between the native skin and subcutaneous tissue adjacent to the mastectomy and flap site. There were now subpectoral recurrences. The authors conclude that from an oncologic viewpoint, musculocutaneous flaps for breast reconstruction is safe and do not delay diagnosis of locoregional recurrences of cancer³⁷. Reconstruction of NAC is the last step in breast reconstruction. The contralateral areola offers the best match of colour and texture, and it is the first choice for reconstruction. In some time, nipple reconstruction involves either nipple sharing from contralateral side, or ingenious transplantation of local tissue (Maltese cross design, modified skate flap, C-V flap, S flap, mushroom flap or double opposing tabs). Nipple areola saving (banking tissue) at the time of mastectomy for later reconstruction carries the potential risk of autotransplanting cancer cells to the breast. Today, skin and nipple areola complex sparing mastectomy (SNSM) are compatible with SSM in treating peripherally situated tumor³⁸.

Materials and Methods

From 1998 to 2008, a total of 101 post mastectomy breast reconstruction (BR) were performed by senior plastic surgeon in Department of Plastic Surgery and Burns, University Hospital Center Split, Croatia, and University Clinic for Plastic and Reconstructive Surgery, Innsbruck, Austria, for a cohort of 96 patients (fifth requires bilateral surgery). The three types of BR used with these patients were: (1) 75 free TRAM flaps, (2) 16 LD flaps (with or without expander/implant), and (3) 10 expander/implant procedure only. When necessary, patients have had appropriate adjustment of the contralateral BR (augmentation, breast reduction, or mastopexy). 75 patients have performed NAC reconstruction. The patients ranged from 25 to 74 years, with a main age of 50 years. Follow up was done at 6 months after completion of the surgical procedures. Of the 72 patients, 48 (66.6%) received pre reconstruction radiotherapy, and additional 9 (12.5%) received post reconstruction radiotherapy. In pre reconstruction period 45 patients received chemotherapy. For the purpose of outcome assessment, we performed the three different type of questionnaire: (1) Personal/medical profile (Table 1), (2) Aesthetic assessment (Table 2), and (3) Psychosocial assessment (Table 3). The retrospective analysis include data on the complications of BR methods, such as partial necrosis of flap, hernia of donor site, pulmonary embolism, deep venous thrombosis, infection rate, hemathoma and seroma formation, and extrusion of expander/ implant.

Statistical analysed data were presented as means (medians) and frequencies. The difference in complica-

TABLE 1

PATIENT QUESTIONNAIRE: PERSONAL/MEDICAL DATA

Patient general data
Age
Body mass index
Smoking
Diabetes
Steroids
Type of operation for carcinoma of breast/date
Postmastectomy radiotherapy (yes/no)
Type of reconstruction:
TRAM flap
LD flap with or without expander/implant
Expander/implant
Unilateral/bilateral
Immediate/delayed
Day of operation
Operative time
Number of operations
Complications:
Flap failure
Flap necrosis (>20%)
Flap necrosis (<20%)
Hemathoma
Infection
Deep venous thrombosis
Pulmonary embolism
Expander/implant problems

tions between patients groups was evaluated by χ^2 -test. The level of significance was set up at $p=0.05$. Mann-Whitney test was used to compare the time from mastectomy to BR, due to asymmetrical data distribution.

Results

The three main variables of this study were to identify significant risk factors, assess the aesthetic outcome, and patient satisfaction with performed BR procedures using four different methods such as free TRAM flap, LD flap with or without tissue expander/implant, and expander/implant only. Each of these analyses is discussed below.

Risk factors

With regards to occurrence risk factors we found statistically significant ($p<0.001$) development of complications (wound infection and cardiovascular failure) in obese patients especially with greater body mass index. The types of complications are classified according to the selected the three techniques for BR (Table 4). There were more statistically significant ($p<0.006$) complications in DIEP flap and expander/implant reconstruction. Similarly, the degree of association between age and risk

TABLE 2

PATIENT QUESTIONNAIRE: AESTHETIC ASSESSMENT

Shape with brassiere
I excellent
II good
III poor
Shape without brassiere
I excellent
II good
III poor
Contralateral match
I excellent
II good
III poor
Mobility
I normal movement
II less mobile
III immobile
Inframammary fold
I well defined and symmetrical
II well define and asymmetrical
III disturbed
Consistency
I soft
II firm
III hard
Overall result
I excellent
II good
III poor

of complication was not found to be statistically significant ($p<0.032$), but we found increased body mass index with advancement of age. Most of the women within this study were no smokers, however, no significant difference was found in smoking group ($p=0.75$). In groups of the patients who were received steroids we detected statistically significant risk of development complications ($p=0.015$). In free DIEP and SIEA flaps BR, the developing complication was significantly associated with postoperative radiotherapy ($p=0.016$). The some situation we were found in expander/implant group ($p=0.031$) too. We found great differences in total operative time regarding to three types of breast reconstruction which was not statistically significant ($p=0.395$). Patient with extensive reconstruction we additional prescribed prophylactic anticoagulation with Low Molecular Heparin in preoperative and postoperative period and systemic Cephalosporine antibiotics during five postoperative days. In the LD flap BR and expander/implant group we detected slightly more complications such as hemathoma, seroma, infection and extrusion, but it was not statistically significant ($p=0.449$).

TABLE 3
PATIENT QUESTIONNAIRE: PSYCHOSOCIAL ASSESSMENT

Satisfaction
satisfied
less satisfied
dissatisfied
Comfort with brassiere
I comfortable
II comfortable with minor adjustment
III uncomfortable
Effect on her sexual life
I improve
II unchanged
III deteriorated
Effect on social life
I improved
II unchanged
III deteriorated

Aesthetic outcome

The differences in overall results among three types of BR were not statistically significant ($p=0.44$). The consistency ($p<0.006$), movement ($p=0.013$), and shape with brassiere support ($p=0.336$), or without ($p=0.75$) of the reconstructed breast were closer to the natural breast in the free TRAM flap reconstruction and less in the expander/implant group ($p=0.36$) and ($p=0.29$, respectively). We not found any statistically differences between inframammary fold line ($p=0.29$) or contralateral matches ($p=0.058$). Finally we can conclude that the results of the three techniques for BR were equally acceptable.

Patient satisfaction

No statistically significant differences could be found in frequency distributions of patient satisfaction profile across the three different techniques for BR ($p=0.42$). The comfort with brassier was detected in all group of patients ($p<0.015$), because all patient were satisfied with own type of BR. Sexual life of the patients had not statistically significant differences in pre and post reconstruction time ($p<0.41$), but social life had found to be statistically significant improved in all type of BR ($p=0.015$).

Discussion

Today, mastectomy is an essential but disfiguring operation in breast cancer treatment, after which the breast mount can be reconstruct in primary or delayed procedure. In surgical praxis existed more different techniques for BR, such as the pedicle and free TRAM flaps, the pedicle LD flap combined with implant or without it, and expander/implant. The free TRAM flap was the first choice operation when living tissue was considered for

TABLE 4
RECONSTRUCTION AND COMPLICATIONS IN
101 CONSECUTIVE CASES

Free TRAM flap (n=75)	n	%
Failure	2	3
Partial necrosis >20%	3	4
Partial necrosis <20%	2	3
Hernia donor site	2	3
Pulmonary embolism	1	1
LD flap (n=16)		
Infection	2	3
Deep venous thrombosis	2	3
Seroma donor site	4	5
Expander/implant (n=10)		
Extrusion of implants	1	1
Infection	1	1
Deep venous thrombosis	1	1
Seroma	1	1

BR. It also has been demonstrated that this procedure provides the better blood supply in comparison with the pedicle TRAM flap^{33–35}. That is very important to be emphasized in the high risks group of the patients such as smokers and obese patients. The incidence of hemathoma and seroma formation can be reduced if we performed meticulous dissection of the flap, with a good haemostasis and drainage, and if used the guilty sutures for closure of donor site^{34,35}. The issue of radiotherapy on the chest wall as a possible risk factor was diminished by used of an autologous tissue³³. This type of tissue takes sufficient blood supplies and healthy new tissue over irradiated chest wall. The free TRAM flap can provide tissue simulating the consistency of the natural breast the more better than other types of BR. All other types of operation are also acceptable modalities for BR too. The symmetry of the breast in most of cases requires corrective procedure on the opposite breast, such as breast reduction, augmentation or mastopexy.

Because the expression of patient satisfaction in related both to the patients expectation and to her motive for performing reconstruction, the shape and symmetry of the new breast should always be the ultimate concerns of reconstructive surgeon. The physical comfort with or without brassiere and the natural movement of reconstructed breast over wide range of motion are additional argument for performing immediate or delayed BR. We must emphasize that all type of BR are very safe procedures from the oncoplasic point of view if operation is performed under the regular indications or patient own decision. Any degree of discomfort experienced by patient after BR may be reason for constant frustration and dissatisfied, and could serve constant reminder of whole traumatic experience with diagnoses, mastectomy and reconstruction. It also feels as they have an external prosthesis. After BR, the interpersonal relationship and social interaction of most patients improved significantly

because they could wear a different variety of clothing styles, and they felt more natural and balanced. The immediate BR with expander/implant is more difficult and more risky than delayed BR, with increased overall failure and capsular contraction¹⁸. TRAM and LD flaps for the BR has increased in popularity because of the superior aesthetic result that can be obtained with it as compared with expander/implant reconstruction³³. Unfortunately, all of these operations need very competent surgical team with great experience in microsurgery procedures.

Conclusion

Today, almost all women with breast cancer are likely to be offered breast conservation surgery or mastectomy and reconstruction. The options for BR have increased as the surgery for breast cancer has decreased. Most patients have multiple options for BR. The gross distortion

associated with the modified radical mastectomy is very rare. The vast majority of patients who choose BR usually are very satisfied with the performing surgery. Various studies have shown that up to one third of patients who undergo mastectomy without BR have significant emotional distress and sexual dysfunction. There are no disputes that BR has special benefit to the patient. The earlier advocates of BR felt that the patients should have lived through the defect created by the mastectomy and the use of a prosthesis prior reconstruction. The patient would value reconstruction more after having to deal with the ablation. Many studies show as that outcome in breast cancer patients depended on the biology of the tumor and not on the presence of a BR. The satisfaction rates with the reconstruction were similar in delayed and immediate BR patients, but some authors found that women with immediate BR were less anxious, less depressed, and less hostile than those who had delayed BR.

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REKONSTRUKCIJA DOJKE NAKON MASTEKTOMIJE

SAŽETAK

Rezultati naše analize pokazuju da je rekonstrukcija dojke postala sastavni dio suvremenog liječenja žena operiranih od raka dojke. Analizirat će se čimbenici bitni za izbor primarne ili sekundarne rekonstrukcije dojke nakon mastektomije, kao i svekoliki znanstveni napredak u rekonstrukcijama dojke, te protokoli za rekonstrukciju. Rak dojke je danas vodeći uzrok smrtnosti kod žena koje poboljevaju od raka. Incidencija raka dojke na godišnjoj razini u RH se kreće oko 2.200 novih slučajeva bolesti. Retrospektivno će se analizirati 101 pacijentica koje su u razdoblju od 1998. do 2008. godine bile podvrgnute rekonstrukciji dojke nakon mastektomije na Kliničkom odjelu za plastičnu kirurgiju i opekline, KBC Split i Sveučilišnoj klinici za plastičnu i rekonstruktivnu kirurgiju u Innsbrucku, Austrija. Za ocijenu konačnog ishoda liječenja napravljena su tri upitnika: 1. Upitnik o osobnim i medicinskim podacima, 2. Upitnik o estetskom ishodu liječenja, i 3. Upitnik o psihosocijalnim statusu. Pojavnost glavnih komplikacija nakon rekonstrukcije dojke (djelomična/potpuna nekroza režnja, kila na mjestu davajuće regije, embolija pluća, DVT, infekcija, pojava hematoma/seroma, i probijanje ekspandera/proteze kroz kožu) tijekom hospitalizacije, kao i tijekom 6 mjeseci oporavka nakon operacije, analizirat će se u odnosu na uporabu više različitih metoda rekonstrukcije dojki nakon mastektomije. Različitosti u pojavnosti komplikacija među više grupa pacijenata izračunat će se χ^2 -testom. Statistička značajnost će se računat će se na novou $p=0,05$. Mann-Whitnejev test je upotrebljen za uspoređivanje protoka vremena od mastektomije do rekonstrukcije dojke, a zavisi od asimetrične raspodjele podataka. Tri glavne varijable su čimbenici rizika, čimbenici estetskog ishoda rekonstrukcije i zadovoljstvo pacijenta s primjenom različitih metoda rekonstrukcije (LD režanj s/bez ekspandera ili proteze, peteljasti/slobodni TRAM, i samo ekspander/proteza). Te varijable najbolje determiniraju vrijeme i suvremeni protokol rekonstrukcije, a uključuju još i osnovne podatke o pacijentu, dob i osobni izbor vremena i metode rekonstrukcije, odnos rekonstrukcije i primjene radio i kemoterapije, te poštedne operacije raka dojke. Rezultati ove studije trebaju potvrditi da je rekonstrukcija dojke nakon mastektomije opravdana, osobito kod žena mlađe životne dobi, te naglasiti posebnu ulogu timskog rada u rekonstrukciji dojke nakon mastektomije.