

Current Trends in Breast Reduction

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ABSTRACT

Results of our study describe the long term effects of reduction mammoplasty. Many women with excessively small or large breasts have an altered personal self-image and often suffer from low self-esteem and other psychological stresses. This procedure is designed to reduce and reshape large breasts, and since the size, shape, and symmetry of a woman's breasts can have a profound effect on her mental and physical well-being it is important to observe the patient's long-term outcome. Currently, breast reduction surgery is safe, effective and beneficial to the patient. In Croatia, reduction mammoplasty is often excluded from the general health care plan. The distinction between »reconstructive« versus »cosmetic« breast surgery is very well defined by the American Society of Plastic Surgeons Board of Directors. Unfortunately, the Croatian Health Society has yet to standardize such a distinction. There is an imperative need for evidence-based selection criteria. We retrospectively analyzed data of 59 female patients suffering from symptomatic macromastia who underwent reduction mammoplasty over a 16 year period (1995 until 2011). Our aim was to compare and contrast the various techniques available for reduction mammoplasty and to determine, based on patient outcome and satisfaction, which technique is most suited for each patient. The results of our study generally reinforce the observation that reduction mammoplasty significantly provides improvements in health status, long-term quality of life, postsurgical breast appearance and significantly decrease physical symptoms of pain. A number of 59 consecutive cases were initially treated with the four different breast reduction techniques: inverted-T scar or Wise pattern breast reduction, vertical reduction mammoplasty, simplified vertical reduction mammoplasty, inferior pedicle and free nipple graft techniques. The average clinical follow-up period was 6-months, and included 48 patients. The statistical analysis of the postoperative patient complications revealed a significant positive relationship in regards to smoking. The majority of these complications were wound related, with no significant relationship between patient complications and variables such as age, BMI, ASA score, resection weight of breast parenchyma, nipple elevation, duration of surgery, and type of pedicle. The higher number of complication correlated with a lower volume of parenchyma resection ($\rho = -0.321$). Overall satisfaction with the new breast size (79%), appearance of the postoperative scars (87%), overall cosmetic outcome score (91%), overall outcome (100%), psychosocial outcome (46%), sexual outcome (85%), physical outcome (88%), satisfaction with preoperative information data (92%), and finally satisfaction with overall care process (96%) was calculated. As expected, the physical symptoms disappeared or were minimized in 88% of patients. Each method of breast reduction has its advantages and disadvantages. The surgeon should evaluate each patient's desires on the basis of her physical presentation. Breast reduction surgery increases the overall personal and social health; not only for the patient, but for their family and friends as well. It is an imperative that every surgeon is aware of this, in order to provide the highest level of care and quality to their patients.

Key words: breast hypertrophy, breast reduction surgery, operative techniques, outcome results, patient satisfaction, and quality of life

Introduction

Breast reduction or reduction mammoplasty is an operation designed to reduce and reshape large breasts. This surgical procedure has become well perfected with respect to safety and predictable aesthetic results¹. Since the size, shape, and symmetry of a woman's breasts can have a profound effect on her mental and physical well-being, it is imperative that the surgeon is aware of this and approaches every surgery seriously and with care. Many women with excessively small or large breasts have an altered personal self-image and often suffer from low self-esteem and other psychological stresses. In addition, women whose breasts are abnormally large, in proportion to their body structure, are frequently limited in their choice of clothing and lifestyle. A woman's breast size also affects her mood, behavior, and career choice, personal and professional life in many different ways².

Many women³ seek medical consultation for the surgical relief of the symptoms associated with breast hypertrophy. Discomfort associated with large breast can include symptoms which present as: painful bra strap grooves, ulceration from bra straps cutting into shoulders, chronic rash of the inframammary fold (IMF), upper and lower back pain, neck and shoulder pain, paresthesia of the arms and hands, headaches, painful kyphosis, and breast tenderness. They also have difficulty performing various physical exercises and daily activities; participating in sports or simply finding well-fitting bras or clothes⁴. Currently, there are no definite guidelines which define the exact size at which breast enlargement becomes pathologic. The definition of symptomatic breast hypertrophy should focus on the degree of symptomatology and not necessarily the degree of breast hypertrophy. After breast reduction surgery, patients enjoy a totally new positive outlook towards life and pursue activities that were previously difficult or impossible. Breast reduction surgery significantly contributes to a woman's quality of life, positively influencing her psychological and physical attitude⁵.

The history of breast reduction techniques primarily involves the need for a reliable method to transpose the nipple-areola complex (NAC) without complete amputation and subsequent grafting. While most of the operations performed in the late 1800s and early 1900s were to correct ptosis, various types of skin and glandular excisions were also performed. These procedures were used to suspend the breast into a higher position on the chest wall without true NAC transposition. Wise⁶ in 1956 described a pattern for preoperative breast marking which allow for the accurate and reproducible resection of the parenchymal tissue with minimally associated complications and satisfactory breast form. This technique remains popular among surgeons today. Strombeck⁷ in 1960 described a horizontal dermal bi-pedicle flap for nipple transposition in which the innervations to the NAC through lateral attachments are maintained. Afterwards, this technique was altered and perfected by many who developed a variation of this horizontal dermal bi-pedicle flap. McKissock⁸ described vertical bi-pedicle

flap, Weiner⁹ a superior based flap, Orlando and Guthrie¹⁰ a superomedially based flap, while Courtiss¹¹ and Georgiade¹² used inferiorly based flaps in their procedures. Numerous reports during the last two decades have documented the efficiency of the inverted-T scar methods⁶. The advantages of this technique include its applicability to the wide spectrum of breast sizes and shapes, its ability to match the contra-lateral breast precisely and its relatively high postoperative predictability. The largest concern regarding the use of this technique is the possibility of the long-term loss of shape and »bottoming out« of the breast. The final shape of the breast ultimately depends on the initial skin envelope design and the new location of the NAC. These two factors determine the volume of resection and ultimately, the shape of the breast. The internal medial and superior fixation sutures of the inferior pedicle may assist in shaping the breast mount, although bottoming out usually occurs from inadequate glandular resection and the reliance on a fairly tight lower pole closure to maintain projection. This unfortunately can lead to scar widening.

The vertical reducing mammoplasty technique has been increasing in popularity as a method to reduce the length of the cutaneous scars¹³. This technique, described by Lassus¹⁴ and further developed by Lejour¹⁵ has gradually become a more accepted alternative to the traditional inverted-T scar methods⁶. Key features of the vertical-scar technique include skin excision in only one direction; this enables a reduction in scar burden, central vertical glandular excision and contributes to the improved postoperative shape by narrowing the breast while maximizing its projection. Unfortunately, this method is probably best suited for patients with moderate hypertrophy who require a reduction of less than 800 grams. Larger volume reductions are also possible with this method although they usually require secondary revisions of excess redundant skin from the base of the vertical scar. The difficulty of moving the NAC over greater distances has been solved by a modification of the pedicle design. A lateral or medial pedicle allows the NAC to be transposed superiorly with greater ease¹⁶. Recently, current trends in the development of breast reduction surgery include minor refinements in the classic inverted-T scar technique with the increased use of the vertical scar reduction mammoplasty technique¹⁷. The identification and the description of the common, basic principles responsible for the success of all modern reduction techniques must include the importance of the breast blood supply and the unique relationship between the glandular tissues with the skin envelope¹³.

Once the diagnosis of a breast deformity is made, a 4-step surgical approach is used for the breast reduction. The first step includes the reduction of breast parenchyma and the adjustment of the skin envelope. Secondly, the amputation of the base of the breast is performed in the aim to improve the proportion between the breast and body profile. The third step involves the development of the medial and lateral flap (or wings) to improve breast contour. Lastly, correctly positioning the

NAC is crucial using the various pedicle techniques such as the superior, inferior, or lateral pedicle flap to achieve favorable results. The benefits of the latter, which include reduced scar burden and improved long-term projection of the new breast is a more attractive technique, although this method itself has proved to be somewhat intuitive and more challenging to the surgeon¹. Recent techniques have involved the use of suction lipectomy, either alone or combined with surgical excision of the glandular tissue¹⁹. Reduction mammoplasty by either surgery or liposuction proportionately reshapes the enlarged, sagging breasts of a patient with macromastia or gigantomastia. Which specific reduction mammoplasty procedure to be performed is determined by the volume of breast parenchyma needed to be resected from each breast and the degree of breast ptosis present's. The incision pattern and the skin-envelope tissue area to be removed determine the location and the size of the surgical scars. The final shape and contour of the reduced breast is determined by the remaining breast tissue and it is imperative that the skin and glandular tissue pedicle maintains proper innervations and blood supply¹³. Unfortunately, a flat breast deformity with inadequate breast projection may result following breast mammoplasty due to the lack of centrally located breast parenchyma. Most authors recommend placing the nipple 18–23 cm from the suprasternal notch. This distance will result in the nipple being placed at or very slightly above the IMF level. One of the most challenging obstacles following surgery is the correction of a nipple that was placed too high. Regardless of the flap orientation the nipple will have adequate circulation as long as the pedicle is not subjected to excessive crowding, folding or torsion¹⁹. The development of large, deformed breasts usually occurs postpartum, after gaining weight, at menopause, and may occur at any age. Macromastia is the consequence of adipose tissue hypertrophy (over-development), rather than mild gland hypertrophy. Macromastia can be manifested as a unilateral or bilateral condition, occurring in combination with sagging or breast ptosis. This is determined by the degree of nipple descent below the IMF. Unfortunately, many women have a genetic predisposition for developing large breasts and this can be potentiated by pregnancy, weight gain or both. There also iatrogenic conditions such as post mastectomy and post lumpectomy asymmetry that could contribute to the development of large breasts. Although the exact pathophysiology of breast hypertrophy is unknown, this condition is thought to be the result of an abnormal response to circulating estrogens²⁰. Hypermastia typically begins with the hormonal changes associated with puberty and pregnancy. Contrary to popular belief, the breast enlargement primarily consists of expanding fibrous and fat tissues, while the glandular elements remain quite small²⁰. Ductal hyperplasia may also play a role in the etiology of breast hypertrophy²¹. The main reason for this condition is the increased sensitivity of mammary tissue to estrogen although Kupfer and Dingman²² also suggest a familiar pattern to this disease. Hormonal suppression has been found to be ineffective in the management of gi-

gantomastia and currently, the mainstay of treatment is radical surgery which can include free nipple grafting in order to obtain an adequate reduction²³. The recurrence of gigantomastia, a recognized risk particularly among pregnant women often warrens a secondary operation. A female's breast size in relation to her physical proportion may have a profound effect on the musculoskeletal system. Such patients frequently complain of neck and shoulder discomfort, headaches, back pain, persisting rashes, a heavy anterior chest, and occasionally paresthesia predominately on the ulnar side of the arm and hands. Breast reduction surgery is contraindicated if the patient is lactating, has recently ceased lactating, or if her breast contains unevaluated tissue substrate with unidentified micro-calcifications. Other surgical contraindications include systemic illness and any patient who is unable to understand the operative limitations and possible complications associated with breast surgery.

There are many different surgical methods available to the surgeon. The inferior pedicle, anchor or Wisa pattern inverted -T scar methods are the most commonly performed breast reduction operative techniques in the United States for the previous two decades¹³. Inverted-T scar reduction methods are extremely versatile since both the skin envelope and glandular volume can be reduced in a single fashion with great precision. Generally, the inferior pedicle (central mound) insures a blood supply from an inferior, centrally based attachment to the chest. These skin pedicles maintain the innervations and vascular viability of the NAC, which produces a reduced sensitive breast while maintaining function and lactation capability²⁴. The condition for conventional T scar breast reduction can safely be extended to cases of more severe macromastia without resorting to free nipple-graft techniques. The advantages of this technique include the ability of preserving nipple sensation and avoiding depigmentation or incomplete take of nipple and areolar grafts. Certain, disadvantages include a longer operative time, larger final breast sizes, and a potential complication resulting from having to fold a longer inferior pedicle. The drawbacks of these techniques include an extensive scar pattern, the propensity for hypertrophic scar formation, and poor long-term shape, have encouraged the development of alternative techniques, such as vertical reduction mammoplasty and pure circumareolar methods. The breast reduction performed with the vertical scar technique usually produces a well projected new breast with short incision scars and NAC elevated by means of a pedicle (superior, medial, lateral) that maintains the biologic and functional capacity of the NAC. Despite its advantages, this method is more intuitive and inherently less precise than the inverted -T scar methods due to the central and posterior nature of the glandular resection during the procedure. Even in experienced hands, the vertical scar method is probably best suited to patients with moderate hypertrophy requiring a reduction of no more than 800 g. Large volume reductions are also possible with this method but they tend to require secondary revisions to excise redundant skin at the base

of the vertical scar¹³. Periareolar techniques accomplish breast reduction and reshaping via an incision around the areola alone. The most common difficulty with periareolar surgery has been found to be a flattening of the breast shape with a loss of nipple/areola projection with widening of the scars and the areolas. Benelli's »round block« technique²⁵ in which a permanent pursestring suture is placed may help prevent the scar and areola spread. The horizontal scar method best applies to a patient whose over-sized breasts are too large for the vertical incision technique. The potential disadvantage is the possibility of developing box-shaped breast with tick incision scars, especially at the IMF⁷. The free nipple graft technique transposes the NAC as a tissue graft without a blood supply, without skin and glandular pedicle. The therapeutic advantage to this is that a greater volume of the breast tissue can be resected which produces a proportional breast. Certain disadvantages include a breast without a sensitive NAC or without lactation capability. This method is reserved for a patient with the high risk of tissue ischemia, a diabetic patient, a smoker, a patient with over-sized breasts that have an approximate NAC to IMF measure of 20 cm, or a patient with macromastia who requires the extensive resection of the breast tissue²⁶. Liposuction-only methods reduce breast tissue and are usually applied to patients who have over sized breasts requiring the removal of a medium volume of breast tissue. It is also used for patients who cannot be under extended general anesthesia. Many plastic surgeons believe that fat tissue should neither be suctioned from nor added to breast tissue because of oncologic concerns²⁷. Reduction mammoplasty in adolescents is also a very demanding procedure and concerns about hormone-induced hypermastia, possible sensory alterations, difficulties with breastfeeding, interference with mammography, and other changes created by reduction surgery compel many plastic surgeons to delay reduction mammoplasty until the patient is at least 20 years of age. Younger women considering reduction mammoplasty should be thoroughly informed about the potential complications of surgery (breast ptosis and a change in breast shape after pregnancy). McMahan and colleagues²⁸ investigated 48 women who have had reduction mammoplasty as teenagers (mean age of surgery was 17, 8 years). Overall, 94% of patients were satisfied with the results of their surgery. The most common complaint was the presence of prominent scars (60%), and sensory deficits (35%). It has been shown that patients who undergo breast reduction surgery have a lower risk of developing breast cancer²⁹. Although routine histological analysis of tissue samples is still required, due to the possibility of the presence of asymptomatic breast cancer. In 27,500 women in Ontario, Canada who had reduction mammoplasty, 0.06% (95% confidence interval 0.03% to 0.09%) was found to have invasive carcinoma⁵. The decrease in detection of occult cancer in breast reduction specimens in recent years has been explained by the advancement of early cancer detection, improvements in patient education, a younger group population undergoing surgery, and more detailed preoperative screening procedures⁵.

Materials and Methods

A retrospective cohort study of 59 patients suffering from symptomatic macromastia underwent bilateral reduction mammoplasty in our Department for Plastic Surgery and Burns over a 16 year period (1995 until 2011). The vast majority of our cases were operated in our hospital while three cases were treated in an outpatient clinic. Seven patients had gigantomastia and they have been documented to have the following characteristics: distance from nipple to sternal notch longer than 32 cm and more than 1000g of breast tissue was resected *per* breast. The demographic information collected included age, number of patients, weight, health status, body mass index (BMI or Quetelet's index which analyzed relationship between height and weight), the patient's medical history, presence of co-morbidity, preoperative anesthesia – ASA I-III status, sternal notch to nipple and sternal notch to IMF measurements, total parenchyma removed, and smoking habits. The long-term results of reduction mammoplasty from 48 patients were obtained after a follow-up period of 6 months. The possibility of nipple-areola necrosis as well as other tissue necrosis or the appearance of an infection post operatively was analyzed separately. Preoperatively, every patient was given an intravenous antibiotic (Cephalosporin-Ketocef 1.5 g) over three days as well as deep venous thrombosis prophylaxis with low molecular heparin administered subcutaneously-Fraxyparin 0.6 IU or Clexan 0.6 IU. Specific surgical data that was collected included the surgical technique used, the amount of parenchyma resection (weight), the length of operation, and pathohistological analysis of the breast tissue samples. Any complications encountered were documented as either minor or major. Potential minor complication include seroma formation, hematoma, the soft tissue infection, dog-ear requiring revision, changes in nipple sensation, and small incisional breakdown or delayed healing of less than 2 cm. Major complication included large incisional breakdown or delayed healing of greater than 2 cm, nipple-areola necrosis, loss of nipple sensation, deep vein thrombosis, pulmonary embolism, myocardial infarction, or death.

Patient data was collected by reviewing previous medical records up to at least six months following surgery. 48 patients were interviewed and asked questions related to specific areas: result and outcome satisfaction, psychosocial outcome, sexual outcome, physical outcome, and their overall satisfaction with the procedure³⁰. In our study, the method selection included four types of the breast reduction techniques. The first is a vertical bipedicle technique by McKissock⁸ which is based on Wisa keyhole pattern for preoperative marking⁶. The second is the inverted-T scar breast reduction with central or inferior pedicles, the third is the vertical scar techniques by Lejour¹⁵ and Ruth Graf's inferior central-glandular technique³¹. The fourth technique used was the free nipple-graft technique²⁶. Unfortunately, it is very difficult to accurately compare the results for those different reduction mammoplasty methods, even when the same opera-

tion is performed by the same surgeon, as was in our cohort study.

Preoperative marking (inverted-T, Wisa pattern, vertical scar technique, inferior central-glandular technique, and free nipple graft technique) was performed with the patient in a standing position. A cooling blanket and intravenous antibiotics were applied prior to surgery. During the procedure, the creation of an adequate breast pedicles and skin envelop was first completed followed by the excision of the breast parenchyma, by knife or electrocautery. Final closure was achieved with a combination of interrupted 2–0, 3–0 and 4–0 intradermal Vicryl sutures followed by running 3–0 and 4–0 Monocril or PDS sutures. Drains were installed in all cases. Following drain removal, the patient was additionally fitted with a soft, supportive bra for the next three or four weeks.

Statistics

Due to the small size and Kolmogorov-Smirnov test, only non-parametric test were used in our statistical analysis. The Chi-square test with Yates correction for small samples was used in the categorical data analysis. Quantitative data was analyzed with Mann-Whitney U test. The Spearman correlation coefficient was calculated between total parenchyma removed and the number of complications observed. Binary logistic regression model was used to assess the impact of several different clinical predictors in the possibility of the patients presenting with any complications. All P values below 0.05 were considered significant. Statistical software STATISTICA version 10.0 was used in the data analysis.

Results

Fifty-nine consecutive cases of inverted-T scar technique or Wisa pattern breast reduction, vertical reduction mammoplasty, simplified vertical reduction mammoplasty, inferior pedicle technique, or free nipple graft were evaluated. It was observed that 58 cases involved

bilateral reduction whereas one case was unilateral due to congenital Poland syndrome asymmetry. Representative cases are illustrated in Figures 1 to 3. The mean patient age was found to be 47 years (range, 24 to 74) and the majority of the patients in our sample group were between the ages of 26 to 35 years (39%). Body mass distribution was separated into 5 groups, with the majority having a BMI between 31 and 35 (39%) (Table 1). The average presurgical distances measured from sternal notch to the nipple was 28 cm (range, 21 to 41 cm) (Table 4). It was found that thirteen patients smoked (22%). A patient's ASA score was distributed into 3 groups with 48 (81%) found to be in group ASA I (Table 1). The average clinical follow-up period was 6-months, and included 48 patients (81%) (Table 9). The total average parenchymal resection volume was found to be 1057 g (range, 360 to 2060 g) (Table 5), although the most common resection weight was between 1001 and 1500 g (58%) (Table 1). The average duration of breast reduction surgery was 111 minutes, with a range between 56 and 160 minutes (Table 5). The finally pathohistological analysis of the breast tissue samples not found any positive result of the breast cancer in the sample material. The most common type of breast reduction surgery performed was the pedicle technique. This technique uses a variety of related designs in which the goal is to raise the nipple-areola into a higher position while leaving these tissues attached to a portion of the underlying breast tissue (Table 7). It was observed



Fig. 2. Inferior pedicle technique (Inferior-central dermoglandular pedicle technique).

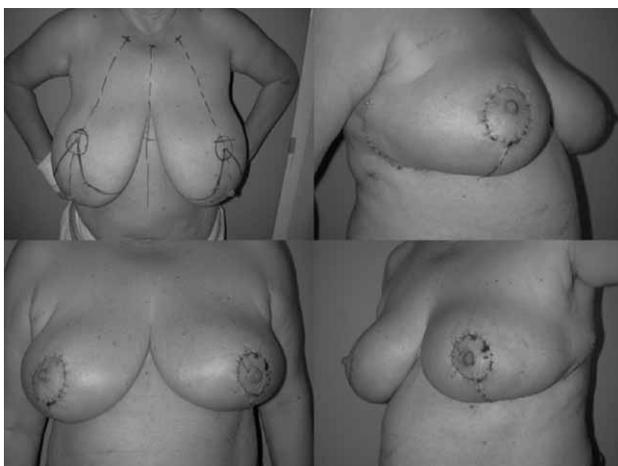


Fig. 1. Inverted T-scar technique (Vertical bi-pedicle technique).

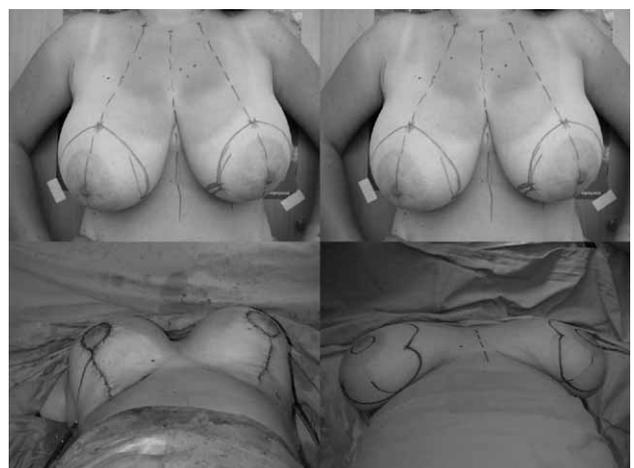


Fig. 3. Vertical reduction mammoplasty (Supero-medial dermoglandular pedicle technique).

that out of the 59 patients in our study, minor complications occurred in 27 (45.8%) patients. Specific minor complications included 9 seromas (15.3%), 3 hematomas (5.1%), 4 soft tissue infection (6.8%), 3 patients with dog-ears which required revision (5.1), 5 delayed healing wound <2cm (8.5%), and 3 cases presented with hypertrophic scarring (5.1%). It is important to recognize that

TABLE 1
DESCRIPTIVE STATISTICS OF INVESTIGATED SAMPLE REGARDING SOCIO-DEMOGRAPHIC AND CLINICAL PARAMETERS

		N	%
Smoking	No	46	78.0
	Yes	13	22.0
Follow-up	No	11	18.6
	Yes	48	81.4
Age (groups)	<25	5	8.5
	26–35	20	33.9
	36–45	23	39.0
	46–55	8	13.6
	>56	3	5.1
BMI (groups)*	<25	5	8.5
	26–30	15	25.4
	31–35	37	62.7
	36–40	1	1.7
	>40	1	1.7
ASA score †	1	48	81.4
	2	8	13.6
	3	3	5.1
Sterna notch to nipple distance (groups)	20–25	5	8.5
	26–30	42	71.2
	31–35	9	15.3
	36–40	2	3.4
	>40	1	1.7
Nipple elevation	5–7 cm	49	83.1
	8–10 cm	6	10.2
	9–15 cm	4	6.8
Total parenchyma removed	<500 g	5	8.5
	500–1000 g	13	22.0
	1001–1500 g	34	57.6
	1501–2000 g	5	8.5
	>2000 g	2	3.4
Type of pedicle	Vertical bi-pedicle	43	72.9
	Superomedial pedicle	6	10.2
	Inferior pedicle	6	10.2
	Free nipple graft	4	6.8
Duration of surgery	<60 min	1	1.7
	61–90 min	4	6.8
	91–120 min	41	69.5
	>120 min	13	22.0

* BMI, body mass index (kg/m²)

† ASA score, American Association of Anesthesiologist score

TABLE 2
DESCRIPTIVE STATISTICS OF MAJOR AND MINOR COMPLICATIONS

		N	%
Minor complications	Without	30	50.8
	Decreased sensation	2	3.3
	Serom	9	15.3
	Hematom	3	5.1
	Infection	4	6.8
	Dogear	3	5.1
	Delay healing <2cm	5	8.5
	Hypertrophic scars	3	5.1
Major complications	Without	46	77.9
	Diminished nipple sensation	4	6.7
	Delay healing >2cm	3	5.1
	Nipple areolar necrosis	2	3.4
	Fat necrosis	1	1.7
	Pulmonary embolism	1	1.7
	Infarct	1	1.7
DVT	1	1.7	

DVT, Deep vein thromboses

all of the patients received prophylactic doses of antibiotic (Cephalosporin-Ketocef 1.5 g) which began preoperatively and continued postoperative over a course of two days. Also, deep venous thrombosis prophylaxis with low molecular weight heparin was administered subcutaneously-Fraxyparin 0.6 IU or Clexan 0.6 IU. Nine major complications (15.3%) occurred during this study. It was found that only 3 patients had delayed healing wound which was greater than 2 cm in length (5.1%). NAC necrosis occurred in 3 cases (3.4%), two of which were smokers and/or diabetics while one had a complication with the NAC blood supply. Fat necrosis occurred in 1 patient who was diabetic and one pulmonary embolism was seen in a previously healthy patient. This was diagnosed 7 days after an uncomplicated 1250 g breast reduction. A therapeutic dose of 30 million IU of Heparin, divided into 6 doses was administering in the ICU. One patient postoperatively suffered from an acute myocardial infarction and one developed a DVT. Both patients were treated in the ICU (Table 2). The χ^2 analyses of postoperative patient complications revealed a significant positive relationship in regards to smoking (p=0.003). The majority of these complications were wound related and it was found that there was not a significant relationship between patient complications and variables such as age, BMI, ASA score, resection weight of breast tissue, sterna notch to nipple distance, nipple elevation, duration of surgery, and type of pedicle (Table 3). Logistic regression analyses showed that the main clinical predictors for an increased risk of developing complications were smoking (p=0.008; OR 61.92), lower volume of removed parenchyma (p=0.007; OR 0.98), and a longer duration of the operation (p=0.019; OR 1.05) (Table 6). Spearman's rho

TABLE 3
DIFFERENCES BETWEEN PATIENTS WHO HAD ANY COMPLICATIONS AND WITHOUT COMPLICATIONS: χ^2 TEST

		Any complications (minor and major)				p
		No N=26		Yes N=33		
		N	%	N	%	
Smoking	No	25	96.2	21	63.6	0.003
	Yes	1	3.8	12	36.4	
Age (groups)	≤25	0	0.0	5	15.2	0.137
	26–35	8	30.8	12	36.4	
	36–45	14	53.8	9	27.3	
	46–55	3	11.5	5	15.2	
	≥56	1	3.8	2	6.1	
BMI (groups)	≤25	1	3.8	4	12.1	0.211
	26–30	9	34.6	6	18.2	
	31–35	14	53.8	23	69.7	
	36–40	1	3.8	0	0.0	
	≥40	1	3.8	0	0.0	
ASA score	1	22	84.6	26	78.8	0.394
	2	2	7.7	6	18.2	
	3	2	7.7	1	3.0	
Sterna notch to nipple distance (groups)	20–25	1	3.8	4	12.1	0.698
	26–30	20	76.9	22	66.7	
	31–35	4	15.4	5	15.2	
	36–40	1	3.8	1	3.0	
	>40	0	0.0	1	3.0	
Nipple elevation	5–7 cm	23	88.5	26	78.8	0.183
	8–10 cm	3	11.5	3	9.1	
	9–15 cm	0	0.0	4	12.1	
Total parenchyma removed	≤500g	1	3.8	4	12.1	0.408
	500–1000g	5	19.2	8	24.2	
	1001–1500g	15	57.7	19	57.6	
	1501–2000g	4	15.4	1	3.0	
	≥2000g	1	3.8	1	3.0	
Type of pedicle	Vertical bi-pedicle	20	76.9	23	69.7	0.868
	Superomedial pedicle	2	7.7	4	12.1	
	Inferior pedicle	2	7.7	4	12.1	
	Free nipple graft	2	7.7	2	6.1	
Duration of surgery	≤60 min	0	0.0	1	3.0	0.082
	61–90 min	2	7.7	2	6.1	
	91–120 min	22	84.6	19	57.6	
	≥120 min	2	7.7	11	33.3	

correlation coefficient was calculated between the total volume of resected parenchyma and the number of observed complications. The higher number of complications correlated with a lower volume of parenchyma resected ($\rho = -0.321$, $p = 0.013$). The outcome analyses of 59 patients undergoing reduction mammoplasty have shown significant improvements in six groups of stan-

dardized outcome measures. After a 6 month patient follow-up, an analysis of 48 patients was performed (Table 8). It was found that the breast reduction surgery was particularly effective in increasing patient self-esteem, correcting specific macromastia or symptomatology, and improving the patient's overall health by increasing their quality of life (both physical and psychosocial).

TABLE 4
DIFFERENCES IN SURGICAL DATA COLLECTION BETWEEN COMPLICATIONS GROUP: MANN-WHITNEY U TEST

	Any complications	N	Min	Max	Percentiles			p
					25th	50th (Median)	75th	
Age (years)	No	26	32	73	43.00	48.50	53.25	0.271
	Yes	33	24	74	36.50	45.00	53.00	
Sterna notch to nipple distance (cm)	No	26	24	36	26.75	27.00	28.25	0.462
	Yes	33	21	41	26.50	28.00	29.00	
Nipple elevation (cm)	No	26	5	9	5.00	6.00	7.00	0.943
	Yes	33	5	13	5.00	6.00	7.00	
Total parenchyma removed (grams)	No	26	420	2060	985.00	1140.00	1371.25	0.009
	Yes	33	329	2050	755.00	1029.00	1090.00	
Duration of surgery (min)	No	26	69	140	100.00	109.00	115.75	0.587
	Yes	33	56	160	99.00	109.00	132.50	

TABLE 5
SURGICAL DATA COLLECTION REGARDING WHOLE SAMPLE (N=59)

	Minimum	Maximum	Percentiles		
			25th	50th (Median)	75th
Age (years)	24.00	74.00	41.00	47.00	53.00
Sterna notch to nipple distance (cm)	21.00	41.00	27.00	28.00	29.00
Nipple elevation (cm)	5.00	13.00	5.00	6.00	7.00
Total parenchyma removed(grams)	329.00	2060.00	870.00	1050.00	1210.00
Duration of surgery (min)	56.00	160.00	100.00	109.00	120.00

Discussion

Currently, breast reduction surgery is safe, effective and beneficial to the patient. In Croatia, reduction mammoplasty is often excluded from the general health care plan. The distinction between »reconstructive« *versus* »cosmetic« breast surgery is very well defined by the American Society of Plastic Surgeons Board of Directors³². Unfortunately, the Croatian Health Society has yet to standardize such a distinction. There is an imperative need for an evidence-based selection criteria's. Literature that has examined and contrasted BMI levels has concluded that most patients with macromastia received beneficial physical and psychological results from bilateral breast reduction regardless of BMI level³³. Many authors have demonstrated that weight loss alone does not relieve the symptoms of macromastia³⁴. Recent studies addressing this issue have shown a positive correlation between obesity and the benefit from bilateral breast reduction. It was concluded that obese patients had the largest benefit from bilateral breast reduction, which improved their overall lung function, physical condition, quality of life, sexual outcome, overall care process, and psychosocial status^{3,5}. It is also well documented that some women develop negative psychosocial behavioral patterns after breast reduction. Lastly, the female breast has powerful symbolic significance and is a vital part of

femininity, sexuality and nurturing, while reduction mammoplasty is an operation that cuts, scars, changes and desensitizes this a part of a women's body³. Therefore great patient care and screening is necessary for every patient considering undergoing this procedure. A prospective study from Canada by O'Blenseset al.⁵ was conducted in an aim to determine whether the beneficial effects of reduction mammoplasty are maintained over a long period of time and to determine whether reduction mammoplasty facilitates weight loss in an overweight patient. In this long-term prospective study of 57 patients undergoing reduction mammaplasty, they have showed significant improvements in all three of their standardized outcome measures 6 and 21.5 months post-surgery. Stable improvements in self-reported self-esteem, specific macromastia symptomatology, and health-related quality of life were shown after this procedure. Particularly effective was the improvement of the physical quality of life and the overall well-being of the patient. It was found that after 2 years, overweight patients were found to have significant weight loss and a change in BMI, with an increased ability to participate in sports and recreation. Our long-term outcome study provided evidence that reduction mammoplasty is an effective method for the reduction or alleviation of both physical and psychological symptoms associated with macromastia. It is imperative that the overall personal and social benefits provided by

TABLE 6
LOGISTIC REGRESSION MODEL FOR HAVING ANY COMPLICATION

Predictors	p	OR	95 CI for OR	
			Lower	Upper
Smoking	0.008	61.92	2.94	1302.59
Age (years)	0.599	0.98	0.90	1.07
BMI (groups)	0.482	1.48	0.50	4.39
ASA score	0.371	0.46	0.08	2.55
Sterna notch to nipple distance (cm)	0.670	0.95	0.75	1.20
Nipple elevation (cm)	0.517	1.16	0.73	1.84
Total parenchyma removed (grams)	0.007	0.98	0.97	0.99
Duration of surgery (min)	0.019	1.05	1.01	1.10

this surgery, not only for the patient, but for their family and friend’s be acknowledged. It is thus crucial that the medical community, patient population and the national Health Care Insurance clinically and financially support this procedure.

During the past two decades multiple studies have analyzed and compared various techniques of breast reduction¹⁶. Most of them concluded that the inferiorly based dermal flap procedure was the most beneficial in regards to NAC position and was most beneficial at maintaining nipple sensation. When vertical bi-pedicle flaps were used, their postoperative nipple to IMF distance tended to stretch with time, resulting in nipples that were too high on the breast mound. Each procedure must be adapted to the personal need and desires of the patient. The in-

verted-T scar technique may still be the best choice for patients with large breasts or in patients who have undergone massive weight loss with a considerable amount of excess skin. The vertical approaches use the new shape of the breast parenchyma to contour the remaining skin. Increased closure tension is unnecessary as it can lead to wound healing difficulties. It is crucial in both the inverted-T and vertical approaches to properly mark the new nipple position. A nipple that is too high is difficult or impossible to correct and can be very detrimental to the patient. The nipple should be positioned near or at the level of the IMF, and with the vertical approach this position should be somewhat lower to accommodate the increased projection. The IMF can rise with some of the vertical techniques but tends to drop beneath the horizontal scar with the inverted-T scar me-

TABLE 7
COMPARISON OF OUR FOUR TECHNIQUES FOR BREAST REDUCTION*

Variables	Inverted T-scar	Vertical RM	Inferior pedicle	Free nipple graft
Marking pattern	Similar to Wisa pattern without extension	Wisa pattern without extension	Wisa pattern	Wisa pattern
Pedicle design	Vertical bi-pedicle	Medial dermoglandular	Inferior dermoglandular	Superior dermal
Glandular resection	Separate from skin design	Skin pattern plus lat. and med. curve-put	Follows skin pattern	Follows skin pattern
Insertion of pedicle	Variable: easy to difficult	Easy	Easy	Easy
Breast shaping	Suture of medial and lateral pillars	Suture of medial and lateral pillars	No glandular sutures	Suture of medial and lateral pillars
Skin undermining	Extensive	None	None	None
Liposuction	Breast volume and contouring	Breast volume and contouring	Contouring only	Breast volume and contouring
Operative time	2–3 hours	2–3 hours	3–4 hours	2–3 hours
Scaring	Racquet shaped	Racquet shaped	Anchor shape	Anchor shape
Recovery	2–4 weeks	2–4 weeks	3–6 weeks	2–4 weeks
Shape	Occasional »bottoming out«	Occasional »bottoming out«	Frequent »bottoming out«	Occasional »bottoming out«
Scar length (excluding areola)	25–35 cm	12–15 cm	25–35 cm	15–20 cm

* Based on the article: HIDALGO DA, ELLIOT F, PALUMBO S, CASA L, HAMMOND D. Current trends in breast reduction, *Plast ReconstrSurg*, 104 (1999) 806.

TABLE 8
SATISFACTION SURVIVE CHART: DATA FROM 48 PATIENTS,
AFTER 6-MONTHS FOLLOW-UP

Satisfaction with overall outcome of the new breast	Number
Are you satisfied with the new breast size?	
Yes	22
Quite	16
No	10
Are you satisfied with appearance of the postoperative scars?	
Yes	42
No	6
How is your overall cosmetic outcome score (from 1 to 10 points score)?	
Bad (1–6 points)	4
Good (7–8 points)	8
Excellent (9–10 points)	36
Satisfied with overall outcome	
Would you recommend it to anybody who is interest in?	
Yes	48
No	0
Psychosocial outcome	
Have psychosocial symptoms which you have been suffering from disappeared?	
Yes	32
Only a little	6
No	10
Sexual outcome	
Have you sexual life improved?	
Yes	41
No	7
Physical outcome	
Have physical symptoms which you have been suffering from disappeared?	
Yes	37
Only a little	5
No	6
Satisfaction with overall care process	
Do you consider that you have received complete preoperative information data about the surgical procedure?	
Yes	44
No	4
Are you satisfied with overall care provided?	
Yes	46
No	2

thod. With the wide range of techniques and the availability of pre/post-operative liposuction, the choice of which procedure to undertake can be difficult, especially since the patient population can range from teenagers to postmenopausal women.

In this study, 17 (28.8%) patients have been found to be without any form of complication, 29 (49.2%) patients

have minor complications while 13 (22.1%) have major complications, postoperatively. Various literatures has documented that the most common complications which appeared after breast reduction surgery usually included seroma, hematoma, infection, fat necroses, dog-ear, hypertrophic scars, diminished nipple sensation, stitch abscesses, and delayed healing⁵. These findings are similar with our analysis of non-specific minor and major complications after breast reduction surgery. Non-parametric Sperman's rho test which was made between the total parenchyma resection volume and the number of observed complications showed that a higher number of complications positively correlated with an increased resection weight. Patients with macromastia often report subjective poor or limited sensation on the nipple areola complex³⁵. Therefore, two hypotheses were proposed. Firstly, the decreased sensation could result from neuropraxia of the sensory nerve fibers secondary to traction caused by the heavy breast tissue while secondly tissue expansion of the nipple-areola by the voluminous breast parenchyma causes a decrease in the number of nerve fibers *per* surface area and hence decreased sensory perception. There seems to be general agreement that before surgery, the large breast is less sensitive than the small breast in response to pressure testing in the NAC³⁶. This change in NAC sensation after breast reduction is variable depending on the pattern of operative technique used and the preoperative distribution of the patient's sensory nerves. In a study conducted by Gonzaleet al.³⁷, a positive correlation between preoperative breast volume and the corresponding amount of tissue removed at surgery had a direct implication on the loss of nipple areola sensibility. In our study, it was observed that patients with the higher parenchyma volume removed have a decreased sensation in NAC. After a period of time, post-surgical breast pain was also a frequent complaint, reported by 50% of patients. Breast pain has been documented to interfere with sexual activity, reported by 48% of patients, exercise (36%), social activity (13%), and employment (6%). Postsurgical breast neurogenic pain must be differentiated and regarded separately from infectious, neoplastic, or wound-related origin, as these late surgical complications can be avoided as stated by evidence-based studies for antibiotics, oncologic techniques, and appropriate tissue modeling³⁵.

The results of our study generally reinforce the observation that reduction mammoplasty significantly provides increased improvements in health status, long-term quality of life, and postsurgical breast pain. Patients with breast hypertrophy often experience a various number of physical symptoms (including intertrigo, painful bra strap grooves, upper and lower back pain, shoulder pain, neck pain, arm pain, numbness or pain in the hands, breast pain, and headaches), as well as psychosocial difficulty⁴. Reduction mammoplasty also reduces neck, back, and shoulder discomfort in all patients and it was found that pain was totally eliminated in 25% of sampled patients³⁷. Symptom's improvement after breast reduction surgery was independent of patient height-

-to-weight ratios. This casts doubt on weight loss as an effective therapy for macromastia³⁸. A large number of patients usually reported complete postoperative resolution of the three main symptom groups: arm pain, headaches, and general pain.

Our results indicate that patients responded with a high level of satisfaction following reduction mammoplasty. Overall satisfaction with the new breast size (79%), appearance of the postoperative scars (87%), overall cosmetic outcome score (91%), overall outcome (100%), psychosocial outcome (46%), sexual outcome (85%), physical outcome (88%), satisfaction with preoperative information data (92%), and finally satisfaction with overall care process (96%) was observed. As expected, the physical symptoms disappeared or were minimized in 88% of patients.

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Conclusions

Each method of breast reduction surgery has its advantages and disadvantages. The surgeon should evaluate each patient's desires on the basis of her physical presentation. Every patient is unique and therefore there is not a single technique which satisfies every patient. Therefore, each surgeon should be confident with the several surgical techniques available. Breast reduction surgery increases the overall personal and social health; not only for the patient, but for their family and friends as well. It is imperative that every surgeon be aware of this, in order to provide the highest level of care and quality to their patients. The Croatian Health Society should standardize national criteria for breast reduction mammoplasty which are based on the evidence-based criteria's^{32,33}.

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SUVREMENI TREND OVI KOD REDUKCIJE DOJKE

SAŽETAK

Rezultati naše studije pokazuju kasne učinke kod redukcije tkiva dojki. Mnoge žene koje imaju neobično male grudi ili one s velikom grudima imaju promijenjen osobni imidž, i obično trpe zbog osjećaja manje vrijednosti, kao i zbog drugih psiholoških stresova. Operacija redukcije dojke je dizajnirana za smanjenje i oblikovanje dojke. Dugoročno praćenje post operacijskih rezultata liječenja je potrebno zbog toga što veličina, oblik i simetrija dojki može znakovito utjecati na mentalno i psihičko zdravlje žene koja ima velike dojke. Općenito govoreći, danas su operacije za redukciju dojki sigurne i djelotvorne, te imaju veliku učinkovitost. Redukcija dojki u Hrvatskoj još nije na listi zahvata koji idu na teret HZZO (Zakon o obaveznom zdravstvenom osiguranju), već se svaki slučaj razmatra pojedinačno i pojedinačno se daje odobrenje za zahvat na teret HZZO. Inače je razlika između rekonstrukcijske i estetske korekcije dojki najbolje definirana od strane Američkog udruženja za plastičnu kirurgiju. Stoga u Hrvatskoj u najskorije vrijeme treba napraviti standardizaciju tih zahvata prema kriterijima medicine dokaza. U članku smo retrospektivno analizirali 59 žena koje su bile podvrgnute redukciji dojki zbog sindroma makromastije, koje smo operirali između 1995. i 2011. godine. Na temelju analize konačnog ishoda liječenja i zadovoljstva pacijenta željeli smo utvrditi operacijsku tehniku koja je najprihvatljivija za određeni tip makromastije. Rezultati studije su pokazali da redukcija dojki znakovito pridonosi poboljšanju sveukupnog zdravstvenog statusa, kvaliteti življenja i smanjenju bolova. Ukupno je liječeno 59 žena, kod kojih smo primijenili 4 različite operacijske tehnike: Invertnu-T tehniku ili Wisa shemu za redukciju dojke, vertikalnu redukciju, pojednostavljenu vertikalnu tehniku, tehniku s bazom reznja prema dolje i slobodni presadak bradavice. Uobičajeno postoperacijsko praćenje je trajalo 6 mjesecu i uključilo je 48 pacijentica. Statistička obrada podataka je utvrdila direktnu povezanost broja komplikacija s pušenjem. Većina komplikacija je bila povezana s cijeljenjem rane, a što se tiče drugih varijabli utvrdili smo da je veći broj komplikacija vezan za starosnu dob, indeks tjelesne mase, preoperacijsku anesteziološku procjenu rizika operacije, težinu odstranjenog tkiva dojke, visinu na koju je podignuta bradavica, trajanje operacije i tip peteljke na kojoj se premješta tkivo dojke. Veći broj komplikacija je bio u direktnoj vezi s težinom reseciranog tkiva dojke ($\rho = -0,321$). Krajnje zadovoljstvo pacijentice s veličinom dojke je iznosilo 79%, a izgledom postoperacijskog ožiljka 87%. Ukupni kozmetički skor je bio 91%, ukupni ishod operacije 100%, psihosocijalni ishod 46%, seksualno zadovoljstvo 85%, psihičko zadovoljstvo 88%, zadovoljstvo s prijeoperacijskim informacijama o redukciji dojki 92%, i konačno zadovoljstvo s cijelom procedurom je bilo 96%. Svaka operacijska metoda ima svoje prednosti i mane. Kirurg mora posebno analizirati svaki pojedinačni slučaj i za svaki slučaj mora odabrati operaciju koja je najprikladnija. I konačno, operacije redukcije dojki može znakovito unaprijediti osobni i socijalni status žene, kao i njezine porodice.