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ORIGINAL ARTICLE

Acceptable adverse outcomes after delayed breast reconstruction using abdominal advancement flap – a 15-year experience

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Summary

Purpose: *To evaluate the adverse outcomes after delayed breast reconstruction (DBR) by abdominal advancement flap (AAF) and permanent prosthesis in patients treated with mastectomy due to unilateral breast carcinoma, as well as to determine which factors are predictive for their occurrence.*

Methods: *The study included 155 patients operated at the Institute for Oncology and Radiology of Serbia from 1996 to 2010. All patients had total mastectomy and axillary lymph node dissection, followed by specific oncological treatment. Patients were selected for DBR after complete diagnostic evaluation. Adverse events were evaluated in regard to patient, disease and prostheses-related factors.*

Results: *During follow-up, DBR adverse events were observed in 23.23% of the patients – the majority (91.67%) had only one. The most frequent was capsule contracture (47.22%), followed by asymmetry (22.22%), infection (16.67%) and prosthesis rupture (16.67%). There were isolated cases of prosthesis prolapse and local disease recurrence. Infections were treated conservatively in all but one patient. Other events were managed by additional operation. Statistical analysis showed that complications occurred significantly more often in patients ≥51 years (vs 18-40, vs 41-50), disease stage IIb (vs Ia), T2 (vs T1) tumors and adjuvant radiotherapy (vs without). Prostheses-related factors were not significant for DBR complications, neither body mass index (BMI), nor smoking habits.*

Conclusions: *DBR using AAF and permanent prosthesis is a safe technique with acceptable complication rate. It provides one-time surgery with satisfactory aesthetic results and good postoperative recovery. Most frequent complication is capsule contracture. Patients' age and irradiation of the chest wall after mastectomy are predictive factors for complications.*

Key words: *abdominal advancement flap, breast cancer, complications, delayed breast reconstruction, factors*

Introduction

DBR after mastectomy is mainly performed using expander prostheses that are later replaced by permanent ones, or using pedicle or free musculocutaneous flaps [1]. Insufficient amount of skin in this area represents the main problem. Expander technique is rarely available in our country due to financial implications of this method. Flap procedures are performed in several instances which increase treatment costs and prolong the patient's recovery due to many expected complications [2].

Besides these two techniques, it is possible to use AAF technique to increase the skin envelope for permanent prosthesis. This surgical technique was first described by Lewis in 1979 [3]. Later, in 1980s it was modified by Ryan [4].

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Furthermore, some authors combined AAF with expander prostheses [5], latissimus flap [6], as well as non-absorbable mesh [7,8]. This technique reduces the number of operational stages, as well as donor-site complications, whilst providing more optimal aesthetical results [9,10].

AAF technique for DBR in our tertiary cancer care center is performed for 20 years now.

The aim of this study was to evaluate adverse outcomes after DBR by AAF and permanent prosthesis in patients treated with mastectomy due to unilateral breast carcinoma, as well as to determine which factors are predictive for their occurrence.

Methods

Patients

This study included 155 primary breast carcinoma patients who were subjected to DBR with AAF technique and permanent prosthesis implantation after mastectomy due to unilateral breast carcinoma. All patients were operated from 1996 to 2010 at the Institute for Oncology and Radiology of Serbia. They were previously informed about the planned treatment, and signed written informed consent.

Oncological treatment

All patients were diagnosed and treated following current recommendations and protocols of the Institution for the breast carcinoma diagnostics and treatment. Patients initially had operable unilateral breast carcinoma with no distant metastases. Primary breast carcinoma treatment consisted of total mastectomy with axillary lymph nodes clearance, followed by adjuvant treatment (chemotherapy, radiotherapy, hormonotherapy) according to each case. Complete diagnostic evaluation prior to delayed reconstruction was performed in order to exclude local recurrence, distant disease progression and appearance of contralateral breast carcinoma. It consisted of physical examination by experienced surgical oncologists, ultrasonography or mammography of the other breast, abdominal ultrasound, chest X-ray, CA 15-3 tumor marker estimation, complete laboratory analyses and bone scintigraphy, if indicated. Only patients with stable disease and no verified distant metastases at the time of breast reconstruction were included in this study.

Delayed breast reconstruction

Prior to reconstruction, surgical technique, type, size and shape of prostheses were discussed with all patients, as well as potential complications and possible unsatisfactory treatment outcomes. Also, all patients were offered one-time cosmetic surgery of the other, cancer-free breast, and written consent was obtained for that procedure, as well. Permanent prostheses that were used for breast reconstruction were placed under the major pectoral muscle in all patients. Due to financial limitations, round shape prostheses were mostly used, while anatomic, contour prostheses were implanted only in some cases. Dominantly, silicone gel prostheses were used and only some patients had saline prostheses implanted. The size of the prostheses was determined by patient's constitution, the other breast volume and the quality of the skin and muscle for the flap. Other breast cosmetic surgery was performed by mastopexy, reduction or augmentation technique, and prostheses were also placed under the major pectoral muscle. Six months after the breast reconstruction and after success of the procedure was confirmed, all patients had nipple-areola complex reconstruction with local anaesthesia. Areola was reconstructed using free skin graft from the other breast areola or from the upper-medial thigh skin, close to perineum. Nipple was reconstructed by the Little skate flap technique [11].

Postoperative check-ups were frequent during the first months, followed by six-monthly visits in the first 5 years after cancer treatment, with complete diagnostic evaluation of potential disease relapse. All patients are still on follow-up by oncological and reconstructive surgeons.

Parameters

Data that were collected from medical records included: patients' characteristics (age, BMI, smoking habits), time of first operation, pathological type of breast carcinoma, tumor size, disease stage, adjuvant therapy applied after surgery (radiotherapy, chemotherapy, hormonotherapy), time of delayed reconstruction after mastectomy, prosthesis type (silicone gel; saline), size (in cc) and shape (round:high or moderate profile; anatomic–contour). All complications that occurred after DBR (both early and late) and local relapses were registered and statistically tested with patients' characteristics, primary breast carcinoma characteristics and treatment and DBR characteristics, in order to analyze their correlations. Patients were distributed into 3 age categories for statistical analysis: 18-40 years, 41-50 years and ≥51 years.

Statistics

For normal distribution data testing, the Kolmogorov–Smirnov and Shapiro-Wilk tests were used. Descriptive methods (frequencies, percentages, mean, median, standard deviation [SD], and range) were used to summarize the data. The statistical significance level was set at $p<0.05$. For multiple testing at the same set of data, the Bonferroni correction test was used. Pearson x^2, Fisher's exact, Kruskal-Wallis and Wilcoxon rank sum tests were used for testing differences between independent groups. The statistical analysis was

done with the program R (version 3.1.1 (2014-07-10) -- "Sock it to Me"; Copyright (C) 2014 The R Foundation for Statistical Computing; Platform: x86_64-w64-mingw32/x64 (64-bit); downloaded: 22.10.2014).

Results

Out of 155 patients with DBR using AAF and permanent prosthesis, 66% had one-time breast cosmetic surgery of the other breast by mastopexy, reduction or augmentation technique. The majority of patients were satisfied with the functional and aesthetic results of the procedure, as well as with the short postoperative stay. Preoperative, postoperative and the results after nipple-areola complex reconstruction are shown in Figure 1 a, b and c.

Adverse outcomes rate

The majority of the patients had no postoperative complications (Figure 2), while in 23.23% (36/155) of them adverse outcomes were observed. Mostly, patients had only one complication (91.67%, 33/36). One patient, among them, had local recurrence of the primary disease.

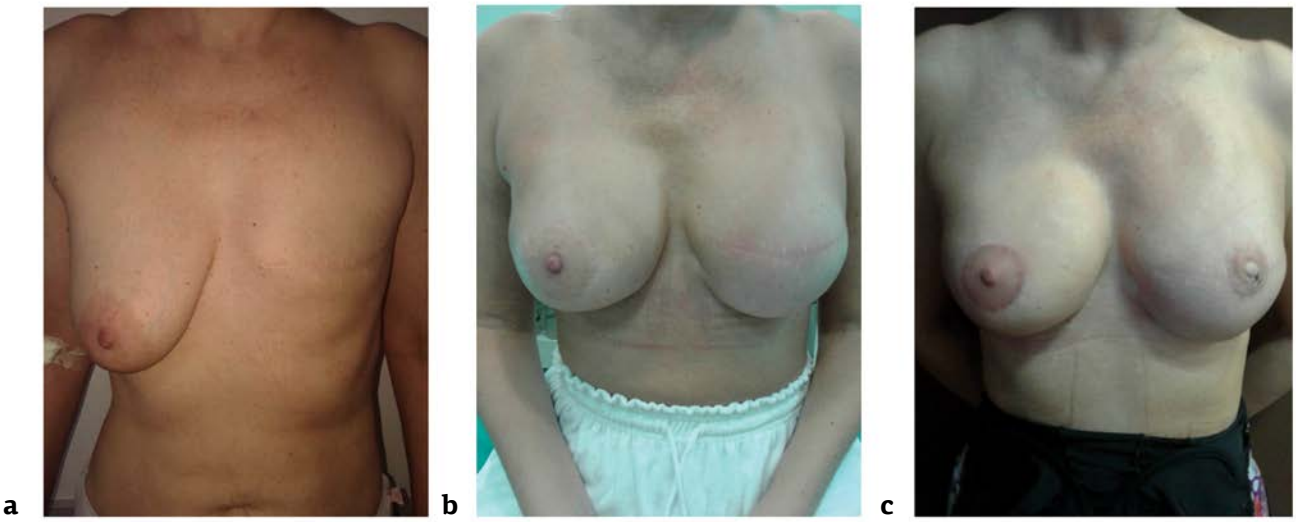

Figure 1. A patient with left breast cancer (in AP position): **a:** after total left mastectomy, axillary dissection and adjuvant treatment; **b:** 5 months after delayed breast reconstruction using abdominal advancement flap and permanent, round shape, silicone gel prosthesis on the left, with the other (right) breast mastopexy and prosthesis implantation; **c:** after reconstruction of the left nipple-areola complex using skin flap from right breast and skate flap technique for nipple reconstruction.

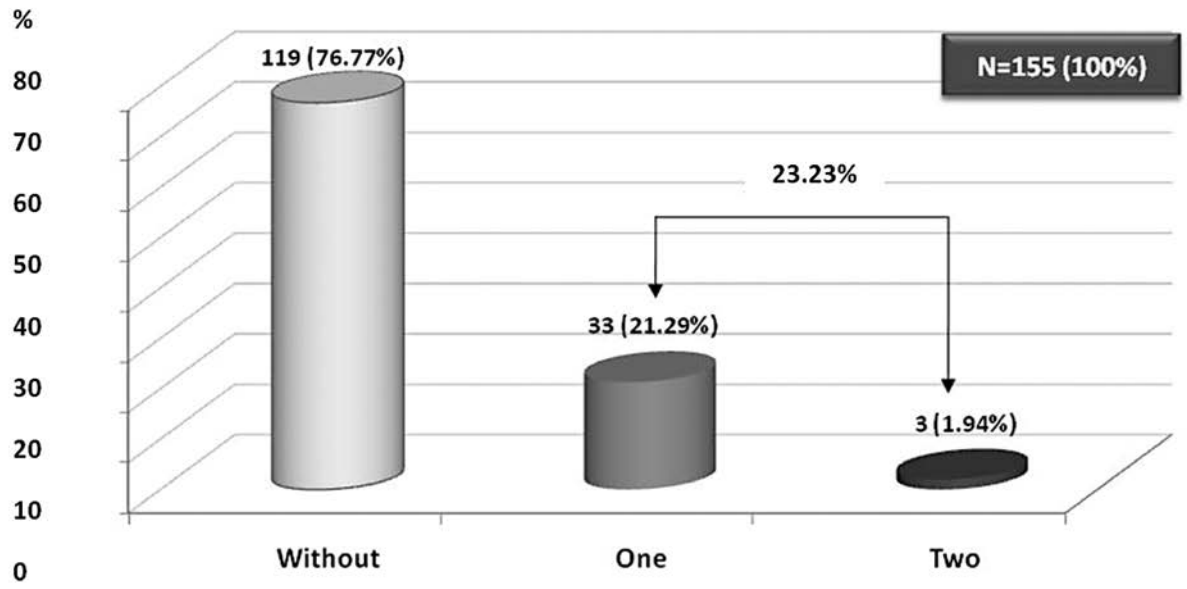

Figure 2. Adverse outcomes after delayed breast reconstructions (N=155).

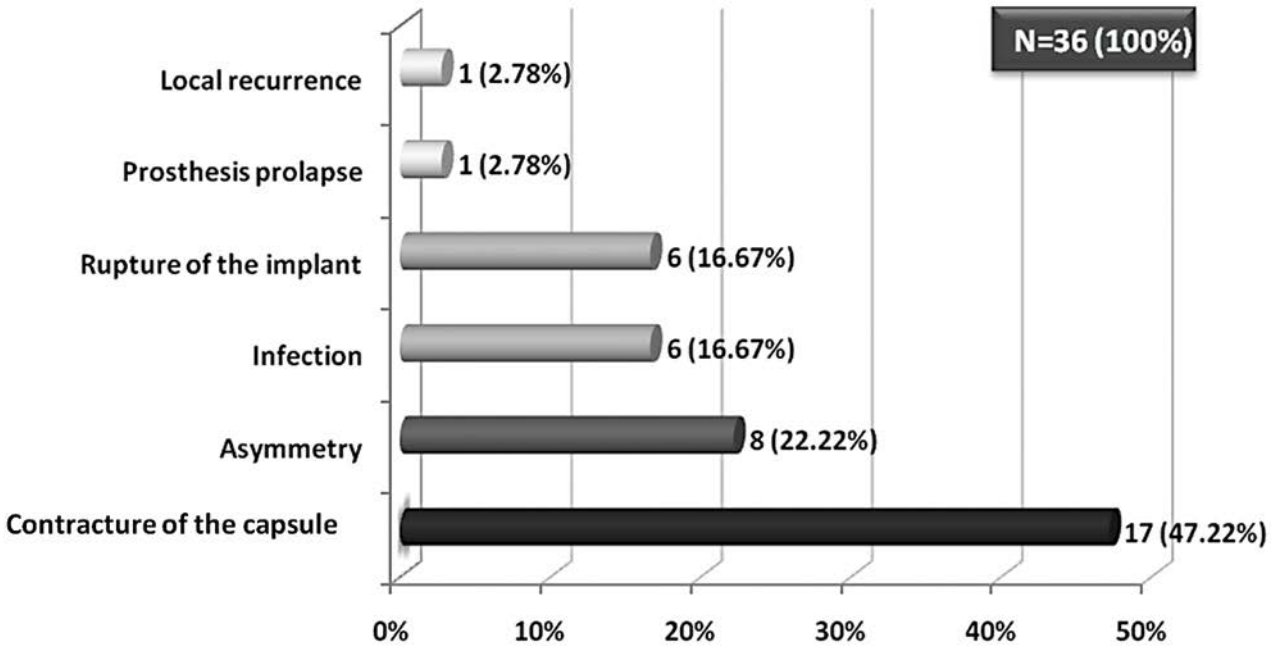

Figure 3. Distribution of adverse outcomes after delayed breast reconstructions (N=36).

Among complications, the most frequent was capsule contracture (Figure 3), followed by asymmetry of breasts, infection and prosthesis rupture or prolapse.

Infections were treated conservatively in all but one patient who had diabetes mellitus and was not motivated, neither adequate candidate, for a new reconstructive procedure after the prosthesis removal.

Other adverse outcomes were managed by additional operation. In capsule contracture, capsulectomy was done, in case of prosthesis rupture the implant was evacuated and a new one was placed, and asymmetry requested some short corrective procedures. In one patient with prosthesis prolapse due to adjuvant radiotherapy and sequelae on skin, the prosthesis was removed along with skin, and latissimus flap was used for reconstruction. The local recurrence was excised by a surgical oncologist under general anaesthesia with postoperative therapy according to indications.

Patient-related factors

Patients were aged from 18 to 64 years, with a mean of 47.18 years (Table 1). Over 80% of them were older than 40, with predominance of the second age category (41-50 years). There were more adverse outcomes observed in older patients comparing the age categories 18-40 vs 41-50 vs ≥51 years (19.44 vs 27.78 vs 52.78%, respectively). Statistical analysis showed significant difference between age categories in regard to the presence of adverse outcomes (Pearson x^2 test; x^2=7.86; p=0.0196). After multiple testing, it was shown that patients over 50 years of age had significantly more often complications after DBR in comparison to younger age categories (Pearson x^2 test;x^2= 7.90; p=0.0049; Bonferroni correction for α value: 0.0167).

Patient BMI ranged from 19.1 to 35.9, with a mean of 24.01 (Table 1). The majority of them had normal weight (18.6 ≤BMI ≤24.9). Isolated cases of obese patients (BMI≥30) were treated as well, yet without postoperative complications. Statistical analysis did not show significant difference between BMI categories in regard to the presence of adverse outcomes. Similarly, there was no statistically significant correlation between smoking habits and presence of complications.

Disease-related factors

All pathological characteristics of primary breast carcinomas are shown in Table 2. Patients had mostly Ia disease stage (78%), with tumors less than 2cm in size, and no lymph node metastases (N0). Postoperative complications were noted in 50% of the T2 and N1 groups (separately). Statistically significant difference in appearance of postoperative complications was noticed in different disease stages of the primary breast carcinomas, as well as in T and N as separate parameters (Table 2). Multiple testing showed higher occurrence of adverse outcomes in IIb compared to Ia disease stage (Fisher exact test; $p=9.7*10^{-4}$; Bonferroni correction for α value: 0.005), as well as in

Table 1. Patient characteristics and adverse outcomes after delayed breast reconstruction

Characteristics	*N (%)*	*Adverse outcomes after delayed breast reconstruction*		
		Without *N (%)*	*With* *N (%)*	*Test*
Age (years)				
Mean (SD)	47.18 (7.57)	46.79 (7.23)	48.47 (8.6)	Wilcoxon rank sum;
Median (range)	47 (18-64)	47 (18-63)	51 (29-64)	W=1802; p=0.15
Age categories (years)				
18-40	29 (18.71)	22 (18.49)	7 (19.44)	
41-50	72 (46.45)	62 (52.1)	10 (27.78)	Pearson x^2
≥51	54 (34.84)	35 (29.41)	19 (52.78)	x^2=7.86; p=0.0196
BMI				
Mean (SD)	24.01 (2.76)	24.16 (2.79)	23.51 (2.62)	Wilcoxon rank sum;
Median (range)	23.7 (19.1-35.9)	23.9 (19.4-35.9)	22.65 (19.1-29.4)	W=2470; p=0.16
BMI categories				
18.6≤BMI≤24.9	101 (65.16)	74 (62.18)	27 (75)	
25≤BMI≤29.9	51 (32.9)	42 (35.29)	9 (25)	Fisher exact
BMI≥30	3 (1.94)	3 (2.52)	-	p=0.33
BMI categories				
BMI≤24.9	101 (65.16)	74 (62.18)	27 (75)	Pearson x^2
BMI≥25	54 (34.84)	45 (37.82)	9 (25)	x^2=2.00; p=0.16
Smoking				
No	72 (46.45)	56 (47.06)	16 (44.44)	Pearson x^2
Yes	83 (53.55)	63 (52.94)	20 (55.56)	x^2=0.076; p=0.78
Total	155 (100)	119 (76.77)	36 (23.23)	-

BMI: body mass index, SD: standard deviation

T2 vs T1 tumors (Pearson x^2 test; x^2=12, p=5.3*10^{-4} Bonferroni correction for α value:0.0083). Furthermore, statistical analysis showed significantly higher percentage of complications in patients with adjuvant radiotherapy (after primary breast carcinoma surgery), compared to those without (Pearson x^2 test; x^2= 10.91; p= 9.6*10^{-4}).

Prostheses-related factors

Details regarding prostheses subtype, size and shape are given in Table 3. Round shape prostheses (high and moderate profile) were used in the majority of the patients (94.84%, 147/155), while anatomic, contour prostheses were implanted only in some cases. Dominantly, silicone gel prostheses were used (96.13%, 149/155), only some patients had saline prostheses implanted. The volume of implanted prostheses ranged from 140 to 800 cc. Statistical analysis did not show significant difference between prostheses subtype, size and shape in relation to presence or absence of DBR complications.

Discussion

Delayed breast reconstruction is performed several months after completion of adjuvant treatment [10]. There are many possibilities for breast reconstruction after mastectomy. However, the aim remains the same: natural, ptotic look of the reconstructed breast, and maximum symmetry with cancer-free breast regarding the shape, size and position, in terms of inframammary fold and anterior axillary line placement. Corrective procedures on the cancer-free breast are very convenient for accomplishing a highly satisfactory outcome.

AAF technique with permanent prosthesis implantation is not so commonly used method for breast reconstruction nowadays [9,10,12]. However, it has many advantages, the most important of which are good cosmetic effect and no donor-site related complications. Well-defined and fixed neo-inframammary fold provides more ptotic breast look, along with more adequate skin color and texture that cannot be achieved using, for example, latissimus flap. Another important issue concerning this technique is that it reduces the number of operational stages, which is quite relative for the treatment of patients in developing countries, since it reduces the treatment costs. It is possible to perform one-stage cosmetic surgery of the other breast as well within the same general anaesthesia time.

Breast reconstruction by tissue expansion,

Table 2. Characteristics of primary breast carcinomas, their treatment and adverse outcomes after delayed breast reconstruction

Characteristics	*N (%)*	*Adverse outcomes after delayed breast reconstruction*		
		Without *N (%)*	*With* *N (%)*	*Test*
BC pathology				
DCIS	4 (2.58)	4 (3.36)	-	
IDC	78 (50.32)	60 (50.42)	18 (50)	Fisher exact;
ILC	54 (34.84)	38 (31.93)	16 (44.44)	p=0.29
Other+	19 (12.26)	17 (14.29)	2 (5.56)	
T in TNM staging				
T0	3 (1.94)	3 (2.52)	-	
T1	128 (82.58)	104 (87.39)	24 (66.67)	Fisher exact;
T2	23 (14.84)	11 (9.24)	12 (33.33)	p=0.0037
T3	1 (0.65)	1 (0.84)	-	
N in TNM staging				
N0	137 (88.39)	110 (92.44)	27 (75)	Pearson x^2
N1	18 (11.61)	9 (7.56)	9 (25)	x^2=8.19; p=0.0042
Clinical stage				
0	3 (1.94)	3 (2.52)	-	
Ia	121 (78.06)	98 (82.35)	23 (63.89)	
Ib	7 (4.52)	6 (5.04)	1 (2.78)	Fisher exact;
IIa	12 (7.74)	8 (6.72)	4 (11.11)	p=0.0055
IIb	12 (7.74)	4 (3.36)	8 (22.22)	
BC therapy				
Breast surgery				
Mastectomy	155 (98.06)	119 (76.77)	36 (23.23)	
Adjuvant* radiotherapy				
No	139 (89.68)	112 (94.12)	27 (75)	Pearson x^2
Yes	16 (10.32)	7 (5.88)	9 (25)	x^2=10.91; p=9.6*10^{-4}
Adjuvant* chemotherapy				
No	64 (41.29)	48 (40.34)	16 (44.44)	Pearson x^2
Yes	91 (58.71)	71 (59.66)	20 (55.56)	x^2=0.19; p=0.66
Adjuvant* hormonotherapy				
No	47 (30.32)	35 (29.41)	12 (33.33)	Pearson x^2
Yes	108 (69.68)	84 (70.59)	24 (66.67)	x^2=0.20; p=0.65
Total	155 (100)	119 (76.77)	36 (23.23)	-

BC**:** primary breast carcinoma; DCIS**:** ductal carcinoma *in situ*; IDC**:** invasive ductal carcinoma; ILC**:** invasive lobular carcinoma; +mucinous and tubular carcinomas; *after primary breast carcinoma surgery

Table 3. Characteristics of delayed breast reconstruction and adverse outcomes after delayed breast reconstruction

Delayed breast reconstruction	*N (%)*	*Adverse outcomes after delayed breast reconstruction*		
		Without *N (%)*	*With* *N (%)*	*Test*
Prostheses subtype				
Silicone gel	149 (96.13)	114 (95.80)	35 (97.22)	Fisher exact;
Saline	6 (3.87)	5 (4.20)	1 (2.78)	p=0.56
Prostheses size (cc)				
Mean (SD)	345.4 (116.32)	353.5 (119.71)	318.3 (101.23)	Wilcoxon rank sum;
Median (range)	340 (140-800)	350 (140-800)	300 (150-550)	W=2491.5 ; p=0.14
Prostheses shape				
High profile*	84 (54.19)	63 (52.94)	21 (58.33)	
Moderate profile*	63 (40.65)	51 (42.86)	12 (33.33)	Fisher exact;
Contour profile	8 (5.16)	5 (4.20)	3 (8.33)	p=0.41
Total	155 (100)	119 (76.77)	36 (23.23)	-

*round prostheses, SD: standard deviation

on the other hand, is a quite demanding procedure. Other than weekly expander injections, the patients may require additional procedures for complications, as well as corrective procedures to achieve better aesthetic result, which may take many months to be seen [13-15]. In addition, the percentage of various complications is not negligible [16,17].

Autologous tissue reconstruction using various flaps is performed in several procedures as well, which increase the treatment costs and prolong the recovery of patients [2]. There are many expected complications of flap procedures, such as bad scaring and hernias of donor-site, muscle weakness or differences in breast size and shape which decrease the cosmetic effect of the operation [18-20]. Blood supply of the flap can be severely compromised in smokers, women with vascular diseases, uncontrolled diabetes or connective tissue diseases [2].

A group of surgeons from the European Institute of Oncology in Milan [8], inspired by AAF, developed a suspension technique for immediate breast reconstruction with permanent prosthesis to reduce the number of operational stages and donor-site complications, achieving at the same time better aesthetic results. They introduced a non-absorbable mesh for fixation of the neo-inframammary fold. However, this technique is limited by the breast size (not applicable in voluminous breasts), and use of special mesh increases the costs of operation. The financial aspect of this method makes it unavailable in our country.

Human acellular dermal matrix (AlloDerm) has also been used to provide implant coverage, especially for larger breast size, however, it is a quite expensive material [21].

Mainly due to lack of health care funds regarding prosthesis procurement, but also due to patients' motivation for fewer operations with good aesthetical outcome, we have included the AAF technique as a one-stage procedure in our daily practice two decades ago.

There are insufficient data regarding the predictive factors for occurrence of complications after DBR by AAF due to rare use of this technique. Urban et al. [10] reported a complication rate of 28% in their 207 breast reconstructions with AAF, which is slightly higher than in our series with 23%. They listed capsule contracture as the most common complication (55%) and more frequent adverse effect in irradiated patients, which is in agreement with our results. The majority of our 17 patients with capsule contracture had adjuvant radiotherapy after mastectomy. Also, one prosthesis prolapse occurred in an irradiated patient. Complications were more frequent in stage IIb disease due to prior adjuvant radiotherapy. Similar results were obtained in other studies regarding expander/implant techniques [22,23].

Limited and conflicting data in the available literature imply the importance of patient's age for the occurrence of complications after breast reconstruction. While August et al. [24] showed lower incidence of complications in older vs younger women (32 vs 50%), Padubidri et al. [25], Woederman et al. [26] and Fischer et al. [27] demonstrated the opposite. In our data, women over 50 years of age had significantly more often complications after DBR in comparison to younger age categories.

Several authors found a positive correlation between BMI and complication rates after breast reconstruction [19,27-30], which contrasts our findings. Similarly, we found no statistically significant correlation between smoking habits and complications, although some authors report differently [18,27,29,31].

As for the prostheses-related factors, Woederman et al. [26] found that larger breast volume was more often associated with complications. In contrast, the complication rate of our patients was not influenced by the prosthesis size or shape.

Our study showed that DBR using AAF and permanent prosthesis is a safe technique with acceptable adverse outcomes rate. It provides one-time surgery with satisfactory aesthetic results and good postoperative recovery. The most frequent DBR complication is capsule contracture. Patients' age and irradiation of the chest wall after mastectomy are the next most influential factors for complications.

Conflict of interests

The authors declare no confict of interests.

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