

# Successful breast reconstruction using acellular dermal matrix can be recommended in healthy non-smoking patients

Gudjon Leifur Gunnarsson<sup>1</sup>, Mikkel Børsen-Koch<sup>2</sup>, Susanne Arffmann<sup>2</sup>, Ivar Guldvog<sup>1</sup>, Peter Wamberg<sup>2</sup>, Christina Kjær<sup>2</sup>, Tormod Westvik<sup>1</sup> & Jørn Bo Thomsen<sup>2</sup>

## ABSTRACT

**INTRODUCTION:** We present Scandinavia's first series of immediate alloplastic breast reconstructions with an acellular dermal matrix.

**MATERIAL AND METHODS:** Data were collected retrospectively in 76 cases of immediate breast reconstruction using an acellular dermal matrix (ADM) and an implant.

**RESULTS:** A total of 59 women were reconstructed between June 2011 and January 2013. Cases included 42 unilateral and 17 bilateral reconstructions. A large number of patients had adjuvant therapy, hormone therapy (34), radiation therapy (27) or chemotherapy (38). The median age was 51 years (30-70 years) and the median follow-up period was 326 days (68-624 days). The co-morbidity factors included hypertension (11), diabetes (2) and 19 patients were smokers. Unsuccessful reconstructions counted ten cases (13%), eight of these due to necrosis and/or wound dehiscence (10%) and two due to infection (3%). The failure rate in non-smokers was 2/52 (4%) compared with 8/24 (33%) in smokers,  $p = 0.001$ . In hypertensive patients, the failure rate was 6/12 (50%) compared with 4/64 in normotensive patients (6%),  $p = 0.001$ . 70% of the failed reconstructions occurred in patients older than 65 years of age.

**CONCLUSION:** Immediate alloplastic breast reconstruction using an ADM can be recommended to healthy non-smoking patients.

**FUNDING:** not relevant..

**TRIAL REGISTRATION:** not relevant.

Breast cancer survival seems to be increasing despite a more conservative surgical approach in oncologic breast surgery [1]. Preservation of aesthetically important units is of paramount importance, and skin- or even nipple-sparing mastectomies are becoming the standard of care depending on the tumour extent. Post-ablative reconstruction of the breast has thus become a parallel primary goal of modern breast cancer therapy, where oncologic and reconstructive objectives go hand in hand. Immediate breast reconstruction offers an aesthetic and psychological advantage to the patients [2].

The use of autologous tissue has been the reconstructive gold standard, among others due to the disap-

pointing longevity of implant-based reconstructions as well a high rate of complications and revisions [3]. However, implant-based immediate breast reconstruction seems to have gained popularity during the past decade. An important factor is the introduction of acellular dermal matrix (ADM) as well as fat grafting [4]. The ADM was first introduced in the 1990s for burn wound management [5] and later in 2003 reported to be beneficial in aesthetic breast surgery as well [6]. Breuing & Warren described a hammock extension to the subpectoral pocket with ADM in 2005 [7]. Subsequently, the technique has been widely adapted and modified by surgeons worldwide with evermore reports of its use and debates on its value or benefits [8]. We present Scandinavia's first series of immediate alloplastic breast reconstruction with ADM.

## MATERIAL AND METHODS

We collected data on 76 immediate breast reconstructions in 59 women with a median age of 51 years (range 30-70 years) using implant-based reconstructions in combination with an ADM. The procedures were performed at the Telemark Hospital in Norway and at Vejle Hospital in Denmark between June 2011 and January 2013. Patient data were recorded in a standard fashion and collected retrospectively. The median follow-up period was 326 days (range 68-624 days). Data on body mass index (BMI), smoking habits and relevant co-morbidity in the form of hypertension and diabetes were collected along with information of adjuvant chemo-, radiation and hormone therapy following the mastectomy. The indication for breast reconstruction was prophylactic and oncologic.

The reconstructions were carried out in immediate conjunction with a skin or nipple sparing mastectomy using an implant in combination with a sheet of Strattice, a porcine-derived ADM, to form an internal bra. The operative technique for immediate breast reconstruction was standardised as follows: the mastectomy was performed by the breast surgeon aided by a tumescent hydrodissection followed by subcutaneous dissection using a pair of scissors. A pocket was then dis-

## ORIGINAL ARTICLE

- 1) Telemark Hospital Skien, Norway
- 2) Lillebælt Hospital, Vejle Hospital/Odense University Hospital

Dan Med J  
2013;60(12):A4751

**TABLE 1**

Indication for surgery, types of mastectomies, implants used and adjuvant therapy. The values are n.

Indication	Patients			Implant E/B/R/A	Total
	total	SSM	NSM		
<i>DCIS or cancer</i>	49				
Unilateral		41	1	4/15/3/20	42
Bilateral		7	0	0/3/2/2	7
<i>Prophylactic</i>	10				
Unilateral		0	0	0/0/0/0	0
Bilateral		2	8	2/1/3/4	10
<b>Total</b>	<b>59</b>	<b>50</b>	<b>9</b>	<b>6/19/8/26</b>	<b>59</b>

DCIS = ductal carcinoma in situ; E/B/R/A = expander/Becker/round silicone/anatomic silicone; NSM = nipple-sparing mastectomy; SSM = skin-sparing mastectomy.

**TABLE 2**

Intended reconstructions, achieved or failed. The values are n (%).

	Overall	Smokers	Hypertensive
Reconstruction achieved	66 (87)	16 (67)	6 (50)
Reconstruction failed	10 (13)	8 (33)	6 (50)
<b>Total</b>	<b>76 (100)</b>	<b>24 (100)</b>	<b>12 (100)</b>

sected between the pectoralis major muscle and the chest wall using a monopolar cautery from lateral to medial and upwards releasing the inferomedial insertion. Following thorough rinsing of the ADM in three sets of sterile, isotonic saline baths for at least five minutes, the sheet was applied to the cavity. The inferomedial corner of the ADM was rounded off with scissors for a better fit before it was sutured along the new inframammary fold, the cut edge of the pectoralis major and along the anterior axillary line upwards laterally using a running 2-0 mono- or polyfilament resorbable suture. The implant was placed in the pocket under the ADM and the pectoralis major muscle. Implant selection was based on the breast footprint and mastectomy specimen weight. An expander or Becker type implant was used if the patient had a compromised or thin skin flap. In those cases, the expander was filled to a safe extent without causing tension on or compromising the overlying skin. Two drains were then placed, one within the implant pocket and one between the mastectomy skin and neocapsule. The vitality of the mastectomy skin flaps was evaluated for signs of perfusion, skin edge bleeding and capillary response and debrided accordingly prior to skin closure. The drains were left in place until the draining volume was less than 10-20 ml per day. All patients received a prophylactic dose of intravenously administered antibiotics for the first 24 hours, followed by oral antibiotics four times a day until drain removal. Mobility was en-

couraged. Application of a compressive bra and a breast band was used if indicated to guard elevation of the implant.

The patient follow-up parameters registered were: 1) skin- or fat necrosis, 2) wound dehiscence, 3) infection, 4) seroma and 5) success/failure of reconstruction.

## RESULTS

We performed immediate breast reconstruction in a total of 59 patients. The indication was oncologic in 49 cases and prophylactic in ten cases. A skin-sparing mastectomy was chosen in 50 patients and a nipple-sparing mastectomy (NSM) in nine patients (**Table 1**). The average BMI was 24 kg/m<sup>2</sup> (range 18-36 kg/m<sup>2</sup>). Active smoking was the most common co-morbidity registered in 19 patients, 11 had hypertension and two were diabetics.

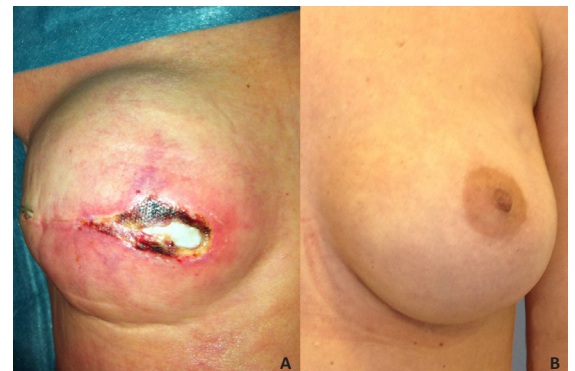
The total number of reconstructed breasts was 76; 38 left-sided and 38 right-sided. The median implant size was 370 cc, (range 200-620 cc). We used six expanders, 19 Becker, eight round silicone and 26 anatomic silicone implants (Table 1). A total of 65 pieces of ADM sized 8 × 16 cm and 11 pieces of 8 × 20 cm. The median number of days with a drain was 12, (range 4-19 days). The total number of unsuccessful reconstructions was 10/76 (13%) (**Table 2**).

The main reasons for complications were skin necrosis (**Figure 1**) or fat necrosis followed by wound dehiscence and infection. These three factors have a significant impact on the outcome of reconstruction (**Table 3**).

Smoking, hypertension and age seem to have an impact on the outcome of intended breast reconstruction. Only two intended reconstructions failed in non-smokers (4%) compared with eight failures in patients who smoked (33%) (Table 2). This is statistically signifi-

**FIGURE 1**

Post-operative results: A. Skin flap necrosis in a smoker revealing the acellular dermal matrix underneath. B. Nipple-sparing breast reconstruction in a non-smoker.



cant,  $p = 0.001$  ( $\chi^2$ -test). Interestingly, out of the two non-smokers in whom an intended reconstruction failed, one was hypertensive and the other was a former smoker. In hypertensive patients, six out of 12 intended reconstructions failed (50%) (Table 2), compared with only 4/64 intended reconstructions in normotensive patients (6%),  $p = 0.001$ . The impact of hypertension may be confounded by the fact that five out of the six failed reconstructions were also smokers. The median age in the group of patients with a successful outcome was  $50 \pm 10$  years compared with  $63 \pm 9$  years in those who failed (Table 2). The median age overall was 51 years. However, the age distribution was skewed; 7/10 patients in whom the reconstruction failed were older than 66 years of age. None of the other factors measured, including diabetes and adjuvant therapy, showed any significant impact on the reconstructive outcome.

## DISCUSSION

In our series of 59 women, we achieved 66 successful reconstructions out of the 76 intended using an ADM and an implant (87%), Table 2. The success rate in non-smokers was 52/54 (96%), which is comparable to the results presented in other papers [9]. We chose to use ADM for breast reconstructions in all patients disregarding any proposed exclusion criteria or previously suggested risk factors to investigate if ADM had any impact on the risk of failure [10]. The Norwegian and Danish patient groups differed in the higher amount of smokers amongst the Danish population and greater number of bilateral cases and NSMs performed on the Norwegian population. Otherwise the groups were homogenous.

When the mastectomy flap was thin or felt compromised, we used an expander or a Becker type prosthesis with over 80% filling volume of saline in order to be able to compensate for skin flap tension if necessary or if the patient wished to have a bigger breast size post-operatively.

Hypertensive patients had a significantly higher risk of failure than normotensive patients. However, all but one of the failed breast reconstructions in the hypertensive group were smokers, Table 2. Age was another important factor, and the risk of failure appears to be higher in patients aged 65 years or older.

This is in accordance with published data on the impact of age on the risk of reconstructive failure [11]. The higher risk of failure among elderly patients in this series may represent the added years of tobacco smoking and thus the accumulated effect of smoking rather than age being a significant factor itself.

Seroma formation has not been a problem in our series, Table 3, in contrast to other published papers where seroma occurrence has been on average 6.5%, ranging from 0 to 15.4% [12, 13]. Our strict drain re-

**TABLE 3**

Intended reconstructions, achieved or failed in patients with complications. The values are n (%).

	Overall	SFN		WD		I		S	
		+	-	+	-	+	-	+	-
Reconstruction achieved	66 (87)	3	63	7	59	1	65	2	64
Reconstruction failed	10 (13)	5	5	4	6	4	6	0	10
Total	76 (100)	8	68	11	65	5	71	2	74

I = infection; S = seroma; SFN = skin- or fat necrosis; WD = wound dehiscence.

moval criterion in which drains were left until drainage was below 10-20 ml per day is a possible explanation for having only one case of prolonged seroma formation. Most published papers describe the use of Alloderm and not Strattice. However, Strattice has been shown to cause less seroma formation than Alloderm in comparative studies [13]. We had two cases of implant removal due to infection without skin flap necrosis, which is less than expected compared with previously published results [14]; however, a recent paper on surgical site infection risk factors is in concordance with our findings [15].

Chemo- or radiation therapy did not contribute to increase complication or failure rates in this series as found by others [16]. It must be stated that suboptimal aesthetic results or the need for corrective procedures were not considered complications and have not been addressed in this study.

There is a considerable amount of confusing and confounding evidence in the literature in terms of the use of ADM, and most of the studies are based on the human-derived Alloderm.

Based on our experience using ADM for immediate breast reconstruction, we find that non-smokers and normotensive patients can be reconstructed in one stage using an ADM and a permanent implant with a 96% success rate. Caution is advised if an immediate breast reconstruction is considered in active smokers even if they cease smoking, as well as in hypertensive patients. The combined use of an ADM and an implant seems to be a promising technique for immediate breast reconstruction. However, careful patient selection is warranted. Smoking, hypertension and age are important factors which add significantly to the risk of reconstructive failure. Despite a relatively small sample size, the significant results cannot be overlooked. Immediate alloplastic breast reconstruction using an ADM can be recommended to healthy non-smoking patients.

**CORRESPONDENCE:** Jørn Bo Thomsen, Plastikkirurgisk Afdeling Z, Vejle Sygehus, Kabbeltoft 25, 7100 Vejle, Denmark. E-mail: jbth@dadlnet.dk.

**ACCEPTED:** 15 October 2013

**CONFLICTS OF INTEREST:** none. Disclosure forms provided by the authors are available with the full text of this article at [www.danmedj.dk](http://www.danmedj.dk).

## LITERATURE

1. Miles RC, Gullerud RE, Lohse CM et al. Local recurrence after breast-conserving surgery: multivariable analysis of risk factors and the impact of young age. *Ann Surg Oncol* 2012;19:1153-9.
2. Isern AE, Tengrup I, Loman N et al. Aesthetic outcome, patient satisfaction, and health-related quality of life in women at high risk undergoing prophylactic mastectomy and immediate breast reconstruction. *J Plast Reconstr Aesthet Surg* 2008;61:1177-87.
3. Zurrida S, Bassi F, Arnone P et al. The changing face of mastectomy (from mutilation to aid to breast reconstruction). *Int J Surg Oncol* 2011;2011:980158.
4. Petersen A, Eftekhari AL, Damsgaard TE. Immediate breast reconstruction: a retrospective study with emphasis on complications and risk factors. *J Plast Surg Hand Surg.* 2012;46:344-8.
5. Cotlar AM, Dubose JJ, Rose DM. History of surgery for breast cancer: radical to the sublime. *Curr Surg* 2003;60:329-37.
6. Wainwright DJ. Use of an acellular allograft dermal matrix (AlloDerm) in the management of full-thickness burns. *Burns* 1995;21:243-8.
7. Breuing KH, Warren SM. Immediate bilateral breast reconstruction with implants and inferolateral AlloDerm slings. *Ann Plast Surg* 2005;55:232-9.
8. Baxter RA. Intracapsular allogenic dermal grafts for breast implant-related problems. *Plast Reconstr Surg* 2003;112:1692-6, discussion 1697-8.
9. Sbitany H, Langstein HN. Acellular dermal matrix in primary breast reconstruction. *Aesthet Surg J* 2011;31(7 Suppl):30S-37S.
10. de Blacam C, Ogunleye AA, Momoh AO et al. High body mass index and smoking predict morbidity in breast cancer surgery: a multivariate analysis of 26,988 patients from the national surgical quality improvement program database. *Ann Surg* 2012;255:551-5.
11. Padubidri AN, Yetman R, Browne E et al. Complications of postmastectomy breast reconstruction in smokers, ex-smokers, and nonsmokers. *Plast Reconstr Surg* 2001;107:350-1.
12. Xue DQ, Qian C, Yang L et al. Risk factors for surgical site infections after breast surgery: a systematic review and meta-analysis. *Eur J Surg Oncol* 2012 ;38:375-81.
13. Colwell AS, Damjanovic B, Zahedi B et al. Retrospective review of 331 consecutive immediate single-stage implant reconstructions with acellular dermal matrix: indications, complications, trends, and costs. *Plast Reconstr Surg* 2011;128:1170-8.
14. Glasberg SB, Light D. AlloDerm and Strattice in breast reconstruction: a comparison and techniques for optimizing outcomes. *Plast Reconstr Surg* 2012;129:1223-33.
15. Decker MR, Greenblatt DY, Havlena J et al. Impact of neoadjuvant chemotherapy on wound complications after breast surgery. *Surgery* 2012;152:382-8.
16. Sbitany H, Serletti JM. Acellular dermis-assisted prosthetic breast reconstruction: a systematic and critical review of efficacy and associated morbidity. *Plast Reconstr Surg* 2011;128:1162-9.