Utility of Acellular Dermis–Assisted Breast Reconstruction in the Setting of Radiation: A Comparative Analysis

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Background: The role of acellular dermis in immediate prosthetic breast reconstruction remains unclear, particularly within a radiated field. The authors evaluated and compare outcomes following reconstruction with and without acellular dermis, and analyzed patients exposed to radiation therapy.
Methods: Retrospective review of 417 consecutive patients (592 breasts) treated from January of 2006 to October of 2008 at one institution was performed. Relevant patient characteristics and follow-up were recorded. Complications were categorized by type and end outcome, including nonoperative, operative, or explantation. Both groups had comparable follow-up (acellular dermis, 23.2 ± 8.9 months; no acellular dermis, 24.4 ± 12.7 months; $p = 0.23$). Appropriate statistical analyses, including multiple regression, were performed.
Results: Acellular dermis patients (n = 199 breasts) had larger body mass indexes (p = 0.0001) and more nipple-sparing mastectomies (p = 0.04) than non–acellular dermis patients (n = 393 breasts). Breasts with acellular dermis had larger intraoperative fill volumes ($p < 0.0001$) and decreased postoperative expansions ($p = 0.02$), but no decrease in time to implant exchange. There were no significant differences in complication profiles between acellular dermis and non–acellular dermis breasts, after adjusting for other relevant patient variables on regression analysis. After stratifying patients by exposure to radiation, acellular dermis breasts had a decreased risk of all complications related to radiation as compared with non–acellular dermis breasts.
Conclusions: This study suggests that acellular dermis does not adversely affect complication rates following prosthetic breast reconstruction. It may be advantageous, however, in select patients, particularly those undergoing postoperative radiation therapy. Therefore, the choice to use acellular dermis does not compromise outcomes but should be individualized to each patient. (*Plast. Reconstr. Surg.* 130: 750, 2012.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Risk, II.

Traditional implant reconstruction involves the subpectoral placement of an implant following skin-sparing mastectomy, which generally provides muscle coverage for the superior two-thirds of the implant but may be insufficient for the implant's inferolateral border.[1–6] Techniques such as serratus muscle elevation,[2,7,8] pectoralis minor flaps,[9] or recruitment of rectus and external oblique fascia[10] have all been used to alleviate this issue, but not without the risk of increased postoperative pain or compromised muscle function.7 First utilized in 2006 by Salzberg et al.,[11] acellular dermis can also be used to bridge the gap created by releasing the inferior border of the pectoralis major, but without

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Received for publication April 27, 2012; accepted April 30, 2012.
Presented at the American College of Surgeons Clinical Congress, Surgical Forum, in San Francisco, California, October 26, 2011.

DOI: 10.1097/PRS.0b013e318262f009

Disclosure: *Dr. Kim receives research funding from Mentor (Santa Barabara, Calif.) and the Musculoskeletal Transplant Foundation (Edison, N.J.). Dr. Fine receives research funding from Allergan (Irvine, Calif.). The remaining authors have no financial interests to disclose.*

additional muscle dissection.[1,12] The result is an additional layer of tissue coverage to help minimize implant exposure, while improving cosmesis through greater control over breast shaping and the inframammary fold.[6,7,11,13–18] Acellular dermisassisted reconstruction also allows for greater intraoperative fill volumes, reducing the number of postoperative expansions,[3,19] while decreasing costs by potentially eliminating the need for a second-stage exchange operation.[2,7,20] There is also sporadic evidence that acellular dermis may minimize capsular contracture secondary to radiation.[14,21–24]

Although several early studies posited a comparable complication profile between complete submuscular and acellular dermisassisted breast reconstruction,[3,6,25–27] there is more recent literature that suggests that acellular dermis may confer a heightened risk.[7,12,16] In particular, an increased rate of postoperative infections has been reported with the use of acellular dermis products, such as AlloDerm (LifeCell Corp., Branchburg, N.J.).[16] Some attribute these findings to the fact that AlloDerm, although tested to confirm a lack of microbial contamination, is a nonsterile, foreign body.[28] Others have indicated a significant effect on their rates of postoperative seroma, reconstructive failure, and overall complications.[7,12,16] In particular, a recent meta-analysis suggests that there is a slightly increased risk of postoperative complications using acellular dermis as compared with traditional submuscular reconstruction.[18] Specifically, overall pooled complication rates were higher, and in direct comparative analyses, there was an increased risk of total complications, infection, seroma, and reconstructive failure.

The conflicting evidence surrounding acellular dermis–assisted breast reconstruction stands in contrast to patients' growing interest in, and knowledge of, innovative reconstructive techniques. Furthermore, with an increasing number of acellular dermis products available to the reconstructive surgeon, understanding if and when to use acellular dermis remains critical, but unclear. Although several authors have reported their experience with acellular dermis, the majority of the data presented are limited by small sample sizes and anecdotal evidence.[28] In particular, there remains a paucity of evidence addressing the role of acellular dermis within a radiated field.[2] A number of groups have also compared completely submuscular and acellular dermisassisted implant reconstruction,[3,6,7,12,16,24–26] but few have studied a large, consecutive patient populations with long-term follow-up. The goal of this study, a comparative analysis between completely submuscular and acellular dermisassisted breast reconstruction, was to further define the role of acellular dermis in breast reconstruction. In particular, using one of the largest consecutive series of immediate prosthetic reconstructions with and without acellular dermis to date, we aimed to identify and discuss the potential benefits and/or risks associated with acellular dermis use, particularly in the setting of radiation therapy.

PATIENTS AND METHODS

This study was performed under the approval of the Northwestern University Institutional Review Board. Retrospective review of medical records at Northwestern Memorial Hospital (Chicago, Ill.) revealed 417 consecutive patients (592 breasts) who underwent mastectomy with immediate tissue expander reconstruction from January of 2006 to October of 2008. The patients of seven mastectomy surgeons and six reconstructive surgeons were included in the study. A search for patients who underwent breast reconstruction with a tissue expander was used to identify potential patients. Inclusion and exclusion criteria were reviewed, followed by stratification by use of acellular dermis during reconstruction. For each patient, individual inpatient (including operative and pathology notes) and outpatient electronic records, and outpatient paper charts, were thoroughly reviewed. Relevant demographic information, preoperative characteristics, operative factors, including the use of acellular dermis by the reconstructive surgeon, outcomes, and complications were recorded.

Two types of acellular dermis were used in patients included in this study: AlloDerm and Flex HD (Musculoskeletal Transplant Foundation, Edison, N.J.). Mean follow-up for acellular dermis and non–acellular dermis patients was 23.2 ± 8.9 months (range, 3 to 45 months) and 24.4 ± 12.7 months (range, 4 to 49 months), respectively (p = 0.23). In particular, the follow-up for radiated acellular dermis and nonacellular dermis patients was 22.8 ± 7.7 months (range, 4 to 45 months) and 25.8 ± 11.1 months (range, 4 to 49 months), respectively (p = 0.23). Patients designated as having an axillary dissection included patients who underwent a planned modified radical mastectomy and those with an unplanned axillary dissection following a simple mastectomy with a concurrent, positive sentinel lymph node biopsy. Patients with a recorded history of smoking within 3 months of their operation were deemed smokers.

Inclusion criteria were those patients who underwent mastectomy with immediate tissue expander reconstruction with or without acellular dermis during the study period. Only patients who underwent a second-stage, permanent implant exchange (or were eligible for one before complication or planned conversion to flap) were included. All patients followed a protocol of first-stage prosthetic reconstruction, followed by outpatient expansion, postoperative radiotherapy if necessary, and finally second-stage, permanent implant exchange. Radiotherapy was always performed before permanent implant placement. Exclusion criteria included patients who underwent a combination of autologous tissue flap and tissue expander reconstruction (e.g., latissimus dorsi flap reconstruction).

During reconstruction, the pectoralis muscle is first disinserted, followed by securing of the chosen acellular dermis to the resulting lower pole defect. In particular, the inferior aspect of the acellular dermis is sutured to the inframammary fold, and the lateral aspect is sutured to the serratus muscle fascia directly. A tissue expander is then placed in the submuscular and subgraft space. Once the muscle and graft interface is secured and complete expander coverage has been obtained, two 7-mm clot-stop drains (Axiom, Torrance, Calif.) are placed in the inferior space between the mastectomy flap and the graft and in the axillary and superior subcutaneous planes. The expander is judiciously inflated according to the degree of skin excess. Postoperatively, the drains remain in place until the output is less than 30 ml over 24 hours, a period typically lasting 7 to 10 days after surgery. Routine perioperative antibiotic prophylaxis is given. Serial expansions of the tissue expander are initiated in patients after their incision is healed. Intervals and volumes of serial tissue expansions are determined on a per patient basis. After completion of adjuvant therapy and tissue expansion, second-stage reconstruction with tissue expander to implant exchange is performed, with procedures for contralateral symmetry done simultaneously when appropriate.

The primary outcome of interest was complication rates per breast following first-stage reconstruction and radiation therapy (if needed). Complications were reported as an overall rate per breast, as well as subdivided into several categories, including hematoma (only those requiring reoperation), extrusion (evidence of expander exposure but without explantation), infection (requiring at a minimum intravenous antibiotics and/or hospital readmission), seroma, pain, or tightness (if explicitly documented by the surgeon following at least one subjective patient complaint), and major mastectomy flap necrosis (requiring surgical excision with or without closure at bedside or in the operating room). Total complications were also categorized by end outcome, including nonoperative, operative except explantation, and explantation with or without conversion to autologous flap.

Statistical analysis was performed using the *t* test and Fisher's exact test to determine significant differences in clinical characteristics, operative factors, and complication rates between breasts with and without the use of acellular dermis. Multiple regression analysis was performed with each complication subtype as the dependent variable. Several independent variables were evaluated in the analyses, including age, body mass index, smoking status, radiation therapy before or following mastectomy and reconstruction, use of tumescent mastectomy technique, use of acellular dermis, individual mastectomy and reconstructive surgeon, type of mastectomy, and expander intraoperative fill volumes. Odds ratio calculations were performed to compare the risk of complications attributable to postmastectomy radiation therapy in patients reconstructed with and without acellular dermis. Statistical significance was set at p less than 0.05. All analyses were performed using Prism, version 4.0b (GraphPad Software, La Jolla, Calif.).

RESULTS

A total of 592 breasts (417 patients) underwent mastectomy with immediate tissue expander reconstruction, of which 199 breast reconstructions (33.6 percent) were performed using acellular dermis. On comparison of the acellular dermis and non–acellular dermis study groups (Table 1), acellular dermis patients were significantly older ($p = 0.02$) and more overweight ($p = 0.0001$) than non–acellular dermis patients. In addition, the acellular dermis group also underwent a higher percentage of nipple-sparing mastectomies (10.1 versus 5.3 percent, $p = 0.04$). When comparing tissue expander/implant characteristics, nonacellular dermis patients tended to have smaller volume tissue expanders placed ($p = 0.0003$), along with significantly smaller intraoperative fill volumes ($p < 0.0001$) and overall fill percentages ($p < 0.0001$), as compared with acellular dermis patients. After their primary stage of the reconstruction, patients in the acellular dermis group were expanded to similar final volumes but required significantly

Table 1. Clinical and Operative Characteristics of Breasts with and without Acellular Dermis*

Characteristic	ADM (*n* = 199 breasts; 137 patients)	No ADM (*n* = 393 breasts; 280 patients)	*p*
Age, yr	49.5 ± 11.0	47.4 ± 10.1	0.02
BMI, kg/m²	26.5 ± 5.6	24.7 ± 5.3	0.0001
Smoking	12 (6.0)	38 (9.7)	0.16
Pre-reconstruction XRT	9 (4.5)	25 (6.4)	0.46
Type of mastectomy			
MRM	42 (21.1)	66 (16.8)	0.22
NSM	20 (10.1)	21 (5.3)	0.04
Axillary dissection	59 (29.7)	93 (23.7)	0.14
Tumescent technique	76 (38.2)	150 (38.2)	1.00
PMRT	49 (24.6)	74 (18.8)	0.11
TE volume, ml	407.5123.4	370.5 ± 114.7	0.0003
Intraoperative TE			
Fill volume, ml	235.8 ± 118.9	171.5 ± 127.2	<0.0001
Fill %	58.9 ± 25.6	45.5 ± 28.1	<0.0001
TE following expansion			
Fill volume, ml	467.0 ± 151.5	445.1 ± 155.5	0.10
Fill %	115.2 ± 25.7	118.5 ± 32.6	0.12
No. of expansions	4.8 ± 2.4	5.3 ± 2.4	0.02
Time to implant exchange, minutes	7.5 ± 4.7	6.9 ± 4.5	0.13
Final implant volume, ml	444.2 ± 132.7	437.3 ± 132.2	0.55

ADM, acellular dermis; BMI, body mass index; XRT, radiation therapy; MRM, modified radical mastectomy; NSM, nipple-sparing mastectomy; PMRT, postmastectomy radiation therapy; TE, tissue expander.
*Data are reported as mean ± SD or number, with percentage of breasts in parentheses.

Table 2. Complications in Breasts with and without Acellular Dermis*

Complication	ADM (*n* = 199 breasts; 137 patients)	No ADM (*n* = 393 breasts; 280 patients)	*p*
Total complications†	37 (18.1)	56 (14.3)	0.19
Hematoma	6 (3.0)	6 (1.5)	0.23
Extrusion	2 (1.0)	9 (2.3)	0.35
Infection	14 (7.0)	17 (4.3)	0.17
Seroma	8 (4.0)	8 (2.0)	0.18
Pain/tightness	5 (2.5)	10 (2.5)	0.60
Major flap necrosis	17 (8.5)	26 (6.6)	0.41
Nonoperative	22 (11.1)	33 (8.4)	0.30
Operative	26 (13.1)	37 (9.4)	0.20
ECF	17 (8.5)	29 (7.4)	0.63

ADM, acellular dermis; ECF, explantation or conversion to flap.
*Data are reported as number of breasts, with percentage of breasts in parentheses.
†Breasts with more than one complication were counted once.

less outpatient expansions when compared with non–acellular dermis patients ($p = 0.02$). Time to implant exchange for non–postmastectomy radiation therapy patients was 6.03.8 months, whereas for postmastectomy radiation therapy patients it was 11.8 ± 4.7 months.

Complication rates, measured both by type and end outcome, were not different between acellular dermis and non–acellular dermis patients (Table 2). In particular, there were no significant differences in total complications ($p = 0.19$), extrusion ($p = 0.35$), infection ($p = 0.17$), seroma ($p = 0.18$), or pain or tightness ($p = 0.60$). Furthermore, acellular dermis patients did not have a higher rate of operative complications ($p = 0.20$) or explantations ($p = 0.63$) as compared with the non–acellular dermis group. When looking at complication rates between the two types of acellular dermis used in this study, there were no differences in any complication categories (data not shown). Multiple regression analysis, adjusted for several clinical variables, revealed similar trends between the two study groups (Table 3). In particular, patients reconstructed with acellular dermis did not have a significantly increased risk of complications as compared with non–acellular dermis patients. Regression analysis also revealed that the individual mastectomy and reconstructive surgeon did not have an independent effect on any complication categories. However, other preoperative variables, such as age (>50 years), body mass index (>30 kg/m²), and smoking, were also

Table 3. Multiple Regression Analysis: Acellular Dermis

Complication	OR	95% CI	*p*
Total complications	1.37	0.87–2.17	0.17
Hematoma	2.35	0.78–7.09	0.12
Extrusion	0.43	0.09–2.02	0.45
Infection	1.67	0.81–3.47	0.16
Seroma	2.02	0.75–5.45	0.16
Pain/tightness	0.98	0.33–2.93	0.98
Major flap necrosis	1.32	0.70–2.49	0.41
Nonoperative	1.36	0.77–2.39	0.33
Operative	1.64	0.95–2.83	0.08
ECF	1.17	0.63–2.19	0.62

OR, odds ratio; CI, confidence interval; ECF, explantation or conversion to flap.

Table 4. Multiple Regression Analysis: Clinical Characteristics

Complication	OR	95% CI	*p*
Age > 50 yr			
Total complications	2.29	1.46–3.59	0.0002
Hematoma	1.08	0.34–3.44	0.64
Extrusion	1.83	0.55–6.07	0.19
Infection	4.70	2.06–10.7	<0.0001
Seroma	1.53	0.56–4.12	0.40
Pain/tightness	1.18	0.43–3.21	0.75
Major flap necrosis	2.01	1.07–3.75	0.03
Nonoperative	1.29	0.74–2.25	0.41
Operative	1.77	1.05–2.98	0.04
ECF	3.83	2.00–7.35	<0.0001
BMI > 30kg/m^2			
Total complications	1.97	1.16–3.33	0.01
Hematoma	1.00	0.21–4.62	0.54
Extrusion	4.32	1.29–14.4	0.01
Infection	1.49	0.62–3.55	0.37
Seroma	1.69	0.53–5.35	0.37
Pain/tightness	2.33	0.79–6.86	0.11
Major flap necrosis	2.06	1.02–4.16	0.04
Nonoperative	0.97	0.46–2.06	0.95
Operative	2.01	1.10–3.69	0.07
ECF	2.98	1.55–5.70	0.0006
Smoking			
Total complications	2.84	1.50–5.40	0.0009
Hematoma	1.09	0.14–8.66	0.68
Extrusion	1.09	0.14–8.66	0.68
Infection	2.82	1.10–7.24	0.03
Seroma	1.57	0.35–7.12	0.56
Pain/tightness	1.57	0.35–7.12	0.56
Major flap necrosis	1.47	0.55–3.93	0.45
Nonoperative	0.84	0.29–2.42	0.76
Operative	2.31	1.09–4.88	0.03
ECF	2.53	1.11–5.76	0.02

OR, odds ratio; CI, confidence interval; ECF, explantation or conversion to flap.

independent risk factors for certain complication categories, particularly total and operative complications and explantation (Table 4).

To assess the effects of acellular dermis within a radiated field, non–acellular dermis and acellular dermis patient groups were further subdivided into those that did and did not receive postmastectomy radiation therapy, followed by the measurement of complication rates (Table 5). When comparing radiated and nonradiated patients who did not receive acellular dermis, postmastectomy radiation therapy led to a significant increase in total complications ($p = 0.003$), including extrusion ($p = 0.01$) and pain or tightness ($p < 0.0005$). There was also a concordant increase in operative complication rates ($p = 0.004$) and the number of explantations ($p = 0.04$) following postmastectomy radiation therapy. In contrast, for patients reconstructed with acellular dermis, postmastectomy radiation therapy did not increase the rate of any complication subtypes, including total complications ($p = 0.14$), extrusion ($p = 1.00$), pain or tightness ($p = 0.10$), operative complications ($p = 0.23$), or explantation ($p = 0.14$) (Table 5).

Calculations of odds ratio were performed to further assess the relationships seen in Table 5 between postmastectomy radiation therapy and acellular dermis–assisted reconstruction. Non–acellular dermis patients who received postmastectomy radiation therapy were almost three times as likely to have a complication as nonradiation patients (odds ratio, 2.63; $p = 0.002$). This included an increased risk of postoperative extrusion (odds ratio, 5.71; $p = 0.004$), pain or tightness (odds ratio, 11.0; $p < 0.0001$), operative complications (odds ratio, 3.00; $p = 0.003$), and explantation (odds ratio, 2.47; $p = 0.03$; Table 6). Meanwhile, patients receiving acellular dermis did not show a significant increase in their risk of complications following radiation exposure.

DISCUSSION

Despite an increasing amount of literature, the role of acellular dermis during immediate, implant-based breast reconstruction remains controversial and unclear.[3,6,7,12,16,18,25–27] The use of acellular dermis provides adequate coverage to the inferolateral border of an implant, avoiding painful muscle elevation while potentially improving aesthetic outcomes,[1,6,7,11–17] decreasing overall patient costs,[2,7,20] and minimizing the risk of contracture due to radiation.[14,21–24] Some, however, remain cautious, given that recent studies have shown increased rates of infection, seroma, and total complications with acellular dermis use.[7,12,16,18] Given its growing presence within reconstructive surgery, understanding the effects of acellular dermis on outcomes remains critical. Our retrospective study, one of the largest series of its kind to date, helps to clarify a single-institution experience with acellular dermis in direct comparison with submuscular reconstruction.

With a growing body of literature surrounding acellular dermis and breast reconstruction,

Table 5. Complications in Breasts with and without Acellular Dermis, Stratified by Postmastectomy Radiation Therapy Exposure

Complication	No Radiation (n = 319 Breasts)	Radiation (n = 74 Breasts)	
No ADM (n = 393 breasts, 280 patients)			
Total complications†	37 (11.6)	19 (25.7)	0.003
Hematoma	5 (1.6)	1 (1.4)	1.00
Extrusion	4 (1.3)	5 (6.8)	0.01
Infection	11 (3.5)	6 (8.1)	0.11
Seroma	6 (1.9)	2 (2.7)	0.65
Pain/tightness	3 (0.9)	7 (9.5)	0.0005
Major flap necrosis	20 (6.3)	6 (8.1)	0.60
Nonoperative	24 (7.5)	9 (12.2)	0.24
Operative	23 (7.2)	14 (18.9)	0.004
ECF	19 (6.0)	10 (13.5)	0.04
ADM (n = 199 breasts, 137 patients)	(n = 150 breasts)	(n = 49 breasts)	
Total complications†	24 (16.0)	13 (26.5)	0.14
Hematoma	3 (2.0)	3 (6.1)	0.16
Extrusion	2 (1.3)	0 (0.0)	1.00
Infection	10 (6.7)	4 (8.2)	0.75
Seroma	6 (4.0)	2 (4.1)	1.00
Pain/tightness	2 (1.3)	3 (6.1)	0.10
Major flap necrosis	11 (7.3)	6 (12.2)	0.38
Nonoperative	15 (10.0)	7 (14.2)	0.43
Operative	17 (11.3)	9 (18.4)	0.23
ECF	10 (6.7)	7 (14.3)	0.14

ADM, acellular dermis; ECF, explantation or conversion to flap.
*Data are reported as number, with percentage of breasts in parentheses.
†Breasts with more than one complication were counted once.

Table 6. Likelihood of Complications Due to Postmastectomy Radiation Therapy, with and without Acellular Dermis

	No ADM (n = 393 Breasts; 280 Patients)			ADM (n = 199 Breasts; 137 Patients)		
Complication	OR	95% CI	p	OR	95% CI	p
Total complications*	2.63	1.41–4.91	0.002	1.90	0.88–4.09	0.10
Hematoma	0.86	0.10–7.48	0.89	3.20	0.62–16.4	0.14
Extrusion	5.71	1.49–21.8	0.004	0.00	—	0.42
Infection	2.47	0.88–6.91	0.08	1.24	0.37–4.16	0.72
Seroma	1.45	0.29–7.33	0.65	1.02	0.20–5.23	0.67
Pain/tightness	11.0	2.77–43.7	<0.0001	1.53	0.24–9.60	0.06
Major flap necrosis	1.32	0.51–3.41	0.58	1.76	0.62–5.05	0.24
Nonoperative	1.70	0.76–3.83	0.24	1.50	0.57–3.92	0.14
Operative	3.00	1.46–6.17	0.003	1.76	0.73–4.25	0.21
ECF	2.47	1.10–5.56	0.03	2.33	0.84–6.51	0.10

ADM, acellular dermis; OR, odds ratio; CI, confidence interval; ECF, explantation or conversion to flap.
*Breasts with more than one complication were counted once.

navigating the conflicting recommendations from different studies can be difficult. Antony et al.[12] reported a retrospective review of 96 patients who underwent immediate, two-stage breast reconstruction with acellular dermis, finding increased seroma and reconstructive failure rates when compared with a large cohort of traditional reconstruction patients. Meanwhile, Chun et al.[7] and Liu et al.[16] performed two separate comparative studies (415 and 470 reconstructions, respectively) from the same institution, demonstrating increased rates of infection, seroma, and complications related high intraoperative fill volumes. In both studies, careful patient selection before acellular dermis use was advocated. In contrast, Sbitany et al.[3] concluded that acellular dermis has a comparable safety profile to complete submuscular coverage but with the benefit of fewer expansions, albeit in a smaller patient population. Preminger et al.[27] also demonstrated no differences in complication rates through a matched cohort study. Many of these studies, however, suffer from short (or unreported) follow-up and smaller sample sizes. Other reports have demonstrated positive outcomes with a discussion of potential benefits from acellular dermis reconstruction[4,5,14,17] but are based on either small, single-surgeon series or lack comparative submuscular coverage data,

limiting the applicability of their conclusions.[29] Furthermore, no series have rigorously evaluated the role of acellular dermis in patients receiving postmastectomy radiation therapy. We believe this study supplements the current literature available to reconstructive surgeons, while validating the different patient circumstances that warrant consideration of acellular dermis–assisted breast reconstruction.

This study demonstrated comparable overall complication profiles between acellular dermis and the traditional submuscular approach. Stratified analysis did not show a statistically significant difference in complication rates (Table 2). Through subset analysis, we demonstrated that the use of acellular dermis may decrease the risk of postradiation complications. Without acellular dermis, postmastectomy radiation therapy significantly affected the majority of complication subtypes that we measured. In acellular dermis patients, however, postmastectomy radiation therapy did not appear to significantly increase the risk of complications, such as extrusion, explantation, and additional surgery. With the potential for wound breakdown following postmastectomy radiation therapy, acellular dermis acts as an additional physical barrier to implant exposure and buttresses points of weakness in the surgically developed muscular pocket. Acellular dermis also appears to potentially affect the amount of subjective pain or tightness reported by patients. If we use pain or tightness as a corollary for capsular contracture, our results indicate that the lack of radiation-induced capsular contracture reported with acellular dermis in animal and small case studies may potentially translate clinically.[20–22] Physiologically, acellular dermis is thought to incorporate into its surrounding native tissue before radiation exposure. Complete incorporation, however, is often not possible as the acellular dermis lacks many of the live, connective tissue, and structural components of native tissue, such as fibroblasts. As a result, following postmastectomy radiation therapy exposure, acellular dermis may not be as subject to the capsular fibroproliferative disorder that is thought to occur with radiation-induced capsular contracture,[29] resulting in a decreased overall level of capsule tightness. Therefore, the potential protective influence of acellular dermis warrants preoperative consideration for patients who will require adjuvant radiation therapy.

There may be other unique circumstances that are also suited for acellular dermis–assisted breast reconstruction, as evidenced by our study group distribution. In particular, our surgeons tended to use acellular dermis for reconstructions that followed a nipple-sparing mastectomy. With a nipple-sparing approach, the amount of mastectomy skin flap spared is maximized, thus requiring the underlying implant pocket to enlarge proportionally to avoid the appearance of excess skin. By bridging the gap between the pectoralis and inframammary fold, acellular dermis allows the pocket depth and volume to increase, accommodating the additional skin flap that is preserved following a nipple-sparing procedure. Similarly, the significant difference in body mass index between the study groups may also be related to maximizing the use of the available skin flap. This assumes that an increased body mass index in the acellular dermis group correlates with larger breast volume and subsequently larger skin flaps following a skin-sparing or nipple-sparing mastectomy. The pocket expansion achieved with acellular dermis also results in the significant differences in tissue expander volume and intraoperative fill seen in our study, along with others.[3] Acellular dermis facilitates greater intraoperative fill, reducing the number of postoperative expansions required before implant exchange. Interestingly, as reported by others,[3,26] this did not decrease the time between first and second stage surgery.

We recognize that our review has limitations. The acellular dermis and non–acellular dermis groups demonstrated statistically significant differences in age and body mass index, two prominent risk factors for reconstructive complications.[12,30,31] The clinical significance of 2-year age and two-point body mass index difference, however, would be expected to be minimal. Furthermore, although there were some differences between our cohorts, utilizing regression analysis to evaluate the independent impact of acellular dermis on complication rates helped to minimize their effects. Furthermore, our study evaluates reconstructions that have occurred over a similar range of time and with similar follow-up, minimizing the bias seen with changing trends in mastectomy and reconstructive technique. Similar to other studies, we did not directly address the potential learning curve bias associated with comparing acellular dermis reconstruction, a relatively new technique, with traditional submuscular reconstruction. The comparable complication profiles between both techniques, however, suggest that increased familiarity with acellular dermis over time may compensate for any early, learning-curve related

complications. Our retrospective design must also be acknowledged, limiting our ability to have accurate information on certain comorbidities (e.g., diabetes, hypertension) and complications (e.g., capsular contracture graded by Baker classification). Also, without a controlled, prospective design, variations in individual patient follow-up times and how different surgeons evaluated certain complications could not be avoided. A large, multi-institutional, randomized controlled trial would be more appropriate to validate our findings. Nevertheless, we believe our study benefits from a substantial sample size and comparable mean follow-ups for each cohort in comparison with previous studies of acellular dermis. Furthermore, our inclusion of multiple surgeons who perform acellular dermis and non–acellular dermis breast reconstructions minimizes the bias that is associated with a single surgeon's experience.

CONCLUSIONS

Traditional implant-based breast reconstruction, with the goal of complete submuscular coverage, remains a popular and effective option following mastectomy. Nevertheless, acellular dermis breast reconstruction represents a modification in technique that may benefit certain patients without otherwise compromising reconstructive outcomes. Therefore, the choice to use acellular dermis can be individualized to each situation and should be included in any preoperative discussions of reconstructive goals with the patient. As the demand for improvements in aesthetic and reconstructive outcomes continues to grow, surgeons should recognize and utilize acellular dermis–assisted breast reconstruction as an additional tool in their surgical armamentarium.

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