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Revision Surgery to Improve Cosmesis with Immediate Implant-Based Breast Reconstruction ☆

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ABSTRACT

Background: Following mastectomy for breast cancer, patients may be presented with a range of reconstructive options. The most popular being immediate implant-based reconstruction (IBR).

Objective: To determine the rate of revision surgery to improve cosmesis following IBR.

Design: Retrospective cohort study.

Setting/Patients: All patients who underwent IBR at a single UK-based specialist breast reconstructive centre between June 2012 and June 2013.

Measurements: The authors collected data, including demographics, original surgery, revision surgeries and factors likely to influence the cosmetic result.

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Results: A total of 88 procedures were included in the study and follow up was performed for a mean duration of 1125 days. In all, 39 breasts required further revision to improve cosmesis to undergo a total of 53 additional procedures. Lipomodelling was the most frequently performed revision (n = 18), whilst implant exchange (n = 16), implant removal (n = 11) and other minor revisions (n = 8) made up the remainder. An early (<3 months) complication, adjuvant radiotherapy and capsular contracture significantly increased the chance of revision surgery (p = 0.018, p = 0.04 and p = 0.009, respectively). Revision surgery added an additional monetary cost of 27.1%-74.1%, which depends on the original procedure performed.

Limitations: The risk of further revision surgery is likely to be higher in those who are followed up for longer periods.

Conclusions: Following immediate IBR, revision surgery represents a substantial burden to the patient including healthcare costs.

Introduction

Many women who undergo mastectomy for breast cancer opt for breast reconstruction due to a desire to avoid wearing an external prosthesis and to regain a sense of femininity and wholeness.[1] Women may be presented with a range of reconstructive options. Currently, the most popular form of reconstruction in the United Kingdom is immediate implant-based breast reconstruction (IBR), which is performed at the time of mastectomy.[2] Reported benefits of immediate reconstruction as opposed to delayed, are improved psychosocial well-being, superior cosmetic results and reduced cost.[3] However, the development of microsurgical techniques has seen increasing number of women opt for autologous flap reconstruction, with reports indicating a superior result both in terms of patient satisfaction and cosmetic outcome.[4]

The requirement for revision surgery following breast reconstruction can be an indicator of a patient's level of aesthetic satisfaction. This study seeks to clarify the rate of unplanned revision surgery to improve cosmesis following immediate IBR. Patients have emphasised the importance of receiving clear information regarding reconstructive options to facilitate decision-making,[5] and it is hoped that the results of this study will provide information to allow better communication of the risk of requiring revision surgery following immediate IBR to prospective surgical candidates.

Materials, Methods and Patients

Retrospective review of medical records identified all patients who underwent mastectomy and immediate IBR at The Royal Victoria Infirmary, Newcastle Upon Tyne NHS Foundation Trust between June 2012 and June 2013. All patients who underwent mastectomy with immediate IBR during this period were included. Review of medical records was conducted to determine the number, timing and nature of all revisional procedures that were performed before February 2016. All patients were followed up until this date or until they left the unit or had the breast implant removed. All procedures counted as revision surgery in this study were unplanned and performed to improve the aesthetic appearance of the reconstructed breast. Procedures to correct postoperative complications, including salvage procedures were not included. Nipple reconstruction, procedures performed on the contralateral breast and planned conversion from expanders to definitive implants were not included.

Table 1
Summary of Patient Demographics.

Characteristic	
Mean age	49.6 (15-73)
Mean body mass index (kg/m^2)	25.4 (18-44)
Smoking status	
Non-smoker	45
Current Smoker	12
Ex-Smoker	14
Diabetes	0

Additional information was gathered for all patients, including their demographics, incidence of complications within the first 3 months post-operatively, the presence of capsular contracture, dates of pre and post-operative radiotherapy, mastectomy incision, whether reconstructions were one or two stages, treatment to the axilla and use of acellular dermal matrices. Chi-squared test was used to determine the statistical significance of several factors and the rate of revision surgery.

Implants were supplied by Allergen. Where used, acellular dermal matrices were provided by Strattice or Veritas. The type of mastectomy incision varied depending on patient characteristics but consisted of either skin-sparing, skin and nipple-sparing or skin-reducing procedures. When given, the standard radiotherapy dose was 40 Gray in 15 fractions over 3 weeks.

Results

Between June 2012 and June 2013, a series of 86 consecutive patients underwent mastectomy with immediate IBR. Overall, 106 procedures (66 unilateral and 40 bilateral) were performed by 7 different surgeons. Of the 106 procedures, 88 were included in this study, whilst 18 were excluded. Reasons for exclusion were early implant loss (<3 months, n = 8), requirement for completion mastectomy (n = 3), completion axillary node clearance (n = 6) and pre-planned expander placement prior to conversion to a DIEP reconstruction (n = 1). Of the 18 operations that were excluded, 15 of the original reconstructions were unilateral whilst 3 were bilateral.

The demographics of those entered in the study are shown in Table 1. The mean patient age was 49.6 years (15-73 years), average BMI was 25.4 (18-44), 45 were non-smokers, 12 were smokers, 14 were ex-smokers and no patients had diabetes.

Details of the initial surgeries performed are outlined in Table 2. A total of 88 reconstructions were performed on 71 patients. This consisted of 51 unilateral reconstructions and 37 (in 20 patients) bilateral reconstructions. In all, 82 procedures were one stage direct-to-implant reconstructions whilst 6 were two-stage expander/implant reconstructions. Fifty-four procedures were performed to treat cancer, whilst 34 had risk reducing or symmetrising intent. Mastectomies were skin-sparing nipple-sacrificing (n = 33), skin and nipple-sparing (n = 26) or skin-reducing (n = 29). Thirty-six reconstructions used acellular dermal matrices, of which 25 were Strattice™ and 11 were Veritas™.

All patients were followed up until February 2016 or explant. One patient was followed up for 439 days post-operatively due to ceasing association with the unit. Mean duration of follow up was 1125 days, ranging from 114 to 1412 days. Of the 88 breasts operated on, 39 required further revision to improve the aesthetic appearance of the reconstructed breast. Of those who underwent further surgery, the majority required a single procedure (30/39, Table 3). The mean number of additional procedures performed was 1.36. The mean time until first revision was 494 days (114-1140 days).

The details of the different revisional procedures performed are outlined in Table 4. Of the 53 revisional procedures performed, the majority consisted lipofilling (n = 18) and implant exchange (n = 16). Eleven implants were removed, six of which were immediately reconstructed using free flaps whilst the remaining five had opted for no further reconstructive surgery during the follow-up period. The remainder of revisions consisted of minor skin and excess soft tissue excisions.

Twenty patients experienced complications within 3 months postoperatively from initial implant placement. A total of 26 complications occurred in 21 breasts, seven of which required expedient

Table 2
Surgical Characteristics of Patients

Characteristic	Number of reconstructions
Total number of reconstructions	88
Unilateral/bilateral	
Unilateral	51
Bilateral	37
Procedure type	
One stage	82
Two stages	6
Surgical intent	
Cancer	54
Prophylactic/symmetry	34
Mastectomy incision	
Skin-sparing	33
Skin and nipple-sparing	26
Skin-reducing	29
Use of acellular dermal matrix	
Yes	36
No	52
Previous Radiotherapy	5
Adjuvant Radiotherapy	11
Contracture	22

Table 3
Number of Revisional Surgeries Performed.

Number of Revisional Procedures	Proportion (%) which underwent (n = 88)
0	56 (49)
1	34 (30)
2	6.8 (6)
3	2.3 (2)
4	0 (0)
5	1.1 (1)

Table 4
Revisional Surgeries Performed.

Revisional Procedure	Number performed	Proportion of revisional surgeries (%)	Proportion of total surgeries (%)
Lipomodelling	18	34	20
Implant exchange	16	30	18
Implant removal	11	21	13
Conversion to free flap	6/11 (54%)		
No further reconstruction	5/11 (46%)		
Other revisional surgery	8	15	9

surgical correction, which included one implant salvage. Complications experienced included seroma formation that required drainage (n = 13), wound infection (n = 5), wound dehiscence (n = 2), skin necrosis (n = 2), prolonged drainage (n = 2), haematoma formation (n = 1), and expander rotation (n = 1). The rate of capsular contracture throughout the follow-up period was 25% (22/88,Table 2).

Table 5 indicates the impact of different factors on the likelihood of revisional surgery. An early complication (<3 months), the use of adjuvant radiotherapy and the presence of capsular contracture were found to cause a statistically significant increase in the rate of revisional surgery (p = 0.018, 0.043 and 0.009, respectively). Of the eleven breasts that underwent radiotherapy, eight required revisional surgery with an average time between the last dose of radiotherapy and first revisional surgery being 588 days (123-945). We found no significant effect on the rate of revisional surgery from the use of acellular dermal matrices or two-stage reconstructions (p = 0.37 and 0.15, respectively).

Table 5
Analysis of relationship between different factors and revisional surgery.

Factor	Proportion requiring revisional surgery with	Proportion requiring revisional surgery – without	Chi Squared Statistic	P value (signif. <0.05)
Complication (<3 months)	66% (14/21)	37% (25/67)	5.5825	0.018
ADM placement	50% (18/36)	40% (21/52)	0.797	0.372
Fixed volume implant vs expander	46% (38/82)	16% (1/6)	1.9951	0.158
Radiotherapy	73% (8/11)	40% (31/77)	4.1115	0.043
Capsular contracture	68% (15/22)	36% (24/66)	6.7692	0.009

Table 6
Cost of Revisional Procedures.

Revisional procedure	Cost of revisional procedure	Multiplier (Frequency)	Average additional cost per IBR reconstruction
Lipomodelling	£1979	0.20 (18/88)	£395.80
Implant exchange	£824	0.18 (16/88)	£148.32
Implant removal and revision	£2006	0.06 (5/88)	£120.36
Implant removal and conversion to DIEP abdominal free flap	£7449	0.07 (6/88)	£521.43
Breast implant revision (including repositioning and scar revision)	£2006	0.09 (8/88)	£180.54
		Total average additional cost	£1366.45

Table 7
Proportion of additional cost added by revisional surgery.

Initial reconstruction	Cost of initial reconstruction (per breast)	Additional cost of revisional surgery as a % of initial reconstruction
Implant-based IBR with mastectomy (unilateral)	£5026	27.1
Implant-based IBR with mastectomy (bilateral)	£2840.5	48.1
Implant-based IBR + latissimus dorsi (unilateral)	£4971	27.5
Implant-based IBR + latissimus dorsi (bilateral)	£2930.5	46.6
Two-stage IBR with mastectomy (unilateral)	£2781	49.1
Two-stage IBR with mastectomy (bilateral)	£1843	74.1

The tariffs charged by the hospital for revisional procedures as of July 2017 are listed in Table 6. Using the frequency with which they have been performed during this study, the average additional cost that each revision adds to the initial reconstruction has been calculated (Table 7). The average additional cost of revisional surgery ranged between 27.1% and 74.1% depending on the cost of the original procedure performed.

Discussion

Following mastectomy, for many patients, the initial reconstruction represents only the first step in the recovery of their identity. To achieve completion without the need for further work is a major determinant in aesthetic satisfaction.[6] Therefore, when the suitability of reconstructive options for each individual is evaluated, it is also crucial to take account of all revision procedures that may be expected and communicate this to the patient.

The scope of this study permitted only short-term follow up, but a revision rate of 44% at this stage was substantially higher than expected. This result emphasises the already well-established link

between the use of breast implants and high rates of revision surgery. The cosmetic outcome of breast implants has been suggested to degrade in a linear fashion over time;[7] therefore, even greater rates of revision are to be expected in the long-term.

To our knowledge, only one other paper that examines the rates of revision surgery in immediate implant-based reconstruction (IBR) has been published. In 2001, the senior author reported a revision surgery rate of 30.2% over a longer follow-up period of 5 years.[7] This was lower than the figure reported here, which is expected to rise accordingly. However, the large difference in the rate of revision is primarily due to a difference in criteria chosen, as the study from Institut Curie considered only implant exchange whilst our study took into account other revision procedures. The overall implant exchange rate in our study was 18%, which is lower than that reported by Clough et al.[7] We anticipate that over a longer follow-up period, this figure would rise to a similar level.

A satisfactory cosmetic result depends both on the objective appearance and the patient's expectation of how it should appear. However, the decision to undertake further revision surgery is multifaceted, which combines the patient's current level of satisfaction with the surgeon's expert judgement through a joint decision-making process. This process balances the potential benefit in appearance against costs, including the risks associated with the surgical procedure, recovery time and the possibility that further revision surgery could actually result in a less satisfactory outcome. The retrospective nature of this study meant that neither objective nor subjective measures of cosmetic outcome were available. Instead, the lack of requirement for further correctional surgery was used as a surrogate marker for cosmetic adequacy. However, factors such as an individual's expectations and their own set of circumstances may confound attempts to interpret cosmetic satisfaction from revision surgery rates.

In those who required revision surgery, generally one procedure was sufficient to provide adequate cosmesis, with only 9 of the 39 breasts (23%), which underwent revision that requires two procedures or more. However, subsequent procedures were almost twice as likely in those who underwent lipomodelling (5/12, 42%), which is perhaps unsurprising, given that lipomodelling is often performed as several serial procedures. In this series, a mean 1.60 procedures, including the original operation were performed on each breast. In contrast, the mean number of procedures for autologous breast reconstruction was previously reported as 2.04 over a 10-month follow-up period.[8] However, the difference in criteria between these two studies would negate any attempts to draw meaningful comparisons.

As expected, we found the occurrence of capsular contracture and early complications to be predictors of a poorer cosmetic outcome. Notably, however, acellular dermal matrices did not reduce the requirement for revision. Indeed, reconstructions with ADMs had a slightly higher rate of revision in our series. As these devices are purported to enhance cosmetic outcome and decrease capsular contracture,[9] this is an interesting finding that is currently the subject of a larger multicentre study. A relationship was observed between the use of radiotherapy and increased revision rate. Although this relationship was less strong in our series than has been suggested previously,[10] this may reflect the limited follow-up period in our study.

The additional monetary burden of revision surgery should not be underestimated. We estimate that revision surgery added between 27.1% and 74.1% to the cost of the original reconstruction in this series. For simplicity, average cost of revision for all initial procedures was calculated as opposed to the cost of revision for each procedure individually. On top of this lie other less tangible costs such as additional clinic appointments. Interestingly, one in five implant reconstructions were removed outright during the follow-up period. Half of these women opted for conversion to total autologous reconstructions. The remainder had no further reconstructive procedure during the course of follow-up. The unplanned conversion of an IBR to a free flap represents a large burden both in terms of impact on the patient as well as monetary cost, and where a cosmetically satisfactory result from IBR is deemed to be challenging at the planning stage, consideration should be given to an immediate autologous tissue reconstruction instead.

This study further questions the ability of implant-based IBR to provide a stable cosmetic result in the short-term. Further studies should look to demonstrate the reproducibility of these results in another cohort and investigate the stability this reconstruction provides over a longer period. Another important question yet to be answered definitively, is whether autologous tissue flaps can achieve long-term stability. Current reports suggest that autologous tissue flaps provide good stability over

time with comparatively low rates of revision.[11] However, more research is required to clarify this rate and directly compare it with implant-based IBR.

In conclusion, our series shows a high rate of surgical revision to improve cosmesis in the initial years following immediate implant-based breast reconstruction. It is important that patients are aware of this possibility of requiring revisional surgery, to facilitate their reconstructive decision-making process. It is anticipated that with longer follow-up, the proportion of patients who require revision surgery would increase further still, and studies to confirm this are warranted. The authors of this paper believe that it is important to take into account not only the initial reconstructive procedure but all revision procedures that may reasonably be anticipated when the advantages and disadvantages, as well as cost-effectiveness, of the different breast reconstruction techniques are assessed.

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Ethical Approval

No ethics board approval required. Registered as an audit project.

Conflicts of Interest

The authors declare no conflict of interest.

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