The reconstructive journey: Description of the breast reconstruction pathway in a high-volume UK-based microsurgical centre

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Summary   *Introduction:* Autologous breast reconstruction, on its own, is a complex microsurgical procedure. However, this operation is usually just one of a series of steps along a patient's reconstructive journey. This includes not only a primary major surgical event but also the consequent recovery, potential complications and secondary surgeries required to optimise the final outcome. Unfortunately, there is limited information of what patients can expect from this reconstructive journey in the literature. The aim of this study was to characterise the journey of a consecutive cohort of patients through their whole reconstructive pathway in a high-volume UK-based breast reconstruction service.

Methods: A retrospective case analysis was undertaken including all the patients who had an autologous breast reconstruction at the Queen Victoria Hospital in East Grinstead between January 2012 and December 2014. Their case notes were reviewed from their initial referral to their final discharge. Number of operations, complication rates and time required to complete their journey were recorded, as well as differences between different flap options, immediate versus delayed and unilateral versus bilateral breast reconstructions.

Results: A total of 409 autologous breast reconstruction cases were performed in the 3-year study period. The vast majority of breast reconstructions used a deep inferior epigastric perforator flap (81.5%), with muscle-sparing transverse abdominal flaps (14.6%) and transverse upper gracilis flaps (3.9%) being the other options utilised. Free flap success was observed in 99.5% cases. Almost all patients opted for subsequent surgery (94%) of any kind. Only 75% opted for the reconstruction of their nipples. On average, 3.20 procedures were required per patient on this cohort, and these procedures were performed in 1.5 surgical episodes on average.

Bilateral reconstructions reached the discharge point sooner than unilateral reconstructions and required a smaller number of operations. The average time to complete the reconstructive journey was 20.8 months.

Discussion: Patient-centred decision-making is fundamental to select the correct intervention for each patient and empower her in her healing journey. Standard measuring of patient satisfaction is still an unaccomplished goal in our unit.

Introduction

In the United Kingdom, breast reconstruction is currently a standard of care for women who require a mastectomy for the treatment of breast cancer. It has been widely reported in the literature that these procedures have a significant impact on quality of life and psychological well-being of these patients.[1] Among the different reconstructive options, autologous free tissue transfer has been shown to be a reliable and satisfactory alternative. It could potentially involve less costs and a shorter reconstructive journey than implant-based reconstruction.[2]

Multiple case series involving the use of microsurgical breast reconstruction can be found in literature. These reports have mainly focused on flap success rate and the overall cosmetic result following reconstruction with free tissue transfer.[3-7] In a similar manner, donor site selection has also been investigated, with most authors agreeing that abdominal-based flaps such as the deep inferior epigastric perforator flap (DIEP) and the muscle-sparing transverse rectus abdominis flap (MSTRAM) are the best alternative for suitable patients. Yet, no such consensus has been agreed in terms of which would be the second-best option, with the transverse upper gracilis (TUG) and gluteal perforator flaps being candidates for this role.

Previous studies have been able to characterise the intricacies of unilateral versus bilateral autologous breast reconstruction and the timing of it, comparing immediate versus delayed reconstructions, along with the associated complication and patient satisfaction rates.[8-12] However, to the best of our knowledge, there are no reports in the literature describing the complete reconstructive journey that a patient must follow after their primary autologous reconstructions. This information would not only provide an insight for clinicians involved in running these services but also serve as a useful resource for patients in counselling before they embark on their reconstructive journey. Patients considering autologous breast reconstruction might be interested in knowing the possible acute and delayed complications, average number of further procedures required for achieving an optimal result, mean number of further consultations and average length of the journey from their first surgery until definitive discharge from the reconstructive service.

The aim of this study is to address this existing gap in evidence by conducting a retrospective analysis of a large cohort of patients in a high-volume UK-based microsurgical centre. The aims of this study were to measure the time required to complete the reconstructive journey by this cohort, compare different types of reconstruction and compare bilateral versus unilateral reconstructions and immediate versus delayed microsurgical reconstructions.

Methods

A retrospective case review was conducted, including consecutive breast reconstruction cases performed in our unit, between January 2012 and December 2014. We included adult female patients with a previous diagnosis of breast cancer who underwent microsurgical reconstruction in our hospital. Patients who underwent implant-based reconstructions were not included in this study. Our study is compliant with the STROBE guidelines for cohort studies.[13]

A comprehensive list of eligible cases was constructed by our hospital coding team. A standardised data collection sheet was used to scrutinise the medical records of the patients included in this list along with our online free flap database.

Delayed breast reconstruction was defined as the surgical procedure to restore a breast that had undergone a mastectomy previous to the day of the reconstruction. Immediate breast reconstruction, on the other hand, was defined as cases in which mastectomy and reconstruction were performed during the same surgical event. Likewise, bilateral breast reconstructions were considered cases in which both breasts were reconstructed at the same time, which is in contrast with unilateral reconstructions.

Information regarding flap selection, immediate versus delayed and unilateral versus bilateral reconstruction was gathered in an anonymised, encrypted and password-protected Microsoft Excel spreadsheet (Microsoft, USA). Emerging complications, further procedures needed after the primary free tissue transfer with their associated hospital stay, mean number of outpatient consultations and overall average length of their reconstructive journey were also recorded. According to our hospital audit committee advice, no further demographic information was made available for the purpose of this study.

Patients had to undergo their primary reconstruction between 1 January 2012 and 31 December 2014, with follow-ups until 1 August 2018 included. This arbitrary time frame was pre-established to provide enough time (3.5 years) for every patient included in this study to complete their whole reconstructive journey.

Descriptive and analytical statistics were performed on this database using SPSS software (IBM). Continuous variables are presented as mean ($+/-$ standard deviation), and categorical variables are presented as percentage. Chi-square and independent samples Student's *t*-tests were

Table 1 Number of patients and flaps performed during the study period.

Number of patients	2012	2013	2014	Total included
DIEP	96	104	133	333
TUG	4	5	7	16
MSTRAM	18	15	27	60
Total	118	124	167	409

used to compare significant differences between different patient subgroups.

Results

Between 1 January 2012 and 31 December 2014, 409 autologous breast reconstructions were performed at Queen Victoria Hospital in East Grinstead. Of the total, 333 cases involved a deep inferior epigastric (DIEP) flap (81%), 60 cases involved a MSTRAM flap (15%) and 16 cases involved a TUG flap (3.9%). The annual increase in free flap breast reconstructions performed in our unit was noted, with 118 flaps being performed in 2012, 124 flaps in 2013 and 167 flaps in 2014, showing a 19% annual increase in terms of caseload (Table 1).

Primary reconstruction episode

With regard to primary autologous reconstructions, the recorded overall flap failure rate was 0.48%, with only 2 patients losing their free tissue transfer in the study period. The mean hospital stay for the initial reconstruction was 5.5 days (SD $\pm$ 0.170755). The length of inpatient stay for each of the different techniques used along with acute and delayed complication rates for these primary reconstructions is given in Table 2.

Subsequent surgical episodes

After their initial operation, 79% of the included patients underwent further procedures. The mean period between their first and second operations was 9.05 months (SD $\pm$ 6.02). Ninety per cent of the patients who had an MSTRAM flap and 88% of the patients who had a DIEP flap had a secondary symmetrising intervention, while only 62.5% of the patients who had a TUG flap had this intervention. In total, patients who had MSTRAM and DIEP flaps had on average 3.1 (SD $\pm$ 1.97) and 3.3 (SD $\pm$ 2.40) subsequent surgical episodes after their primary reconstruction, respectively, as compared to those with TUG flaps who has on average 2.6 (SD $\pm$ 2.03) subsequent surgical episodes.

Routinely, these final adjustments were done as day-case surgeries. On average, for the studied cohort of patients, the average number of required attendances to the hospital, either for surgery or for outpatient consultations, was ten, and the mean length of the whole reconstructive journey from their initial reconstruction until the definitive discharge date was 20.83 months (SD $\pm$ 1) (Figure 1).

Unilateral versus bilateral breast reconstructions

There was no significant difference in terms of hospital stay, number of subsequent surgeries and required outpatient consultations when comparing bilateral with unilateral reconstructions. However, on average, patients who received bilateral breast reconstruction were discharged from our service sooner than those in the unilateral group: 17.5 months versus 21.5 months (*p*-value: 0.0237) (Table 3).

Immediate versus delayed breast reconstructions

Immediate breast reconstructions required a higher number of symmetrising procedures than delayed reconstructions, with a mean of 3.83 in the former group and 3.12 in the latter (*p*-value: 0.0088). The immediate reconstruction group also required more plastic surgery outpatient consultations (9.52 versus 8.48 (*p*-value: 0.0473)). Breast oncology consultations were not included in this study, as they usually take place in peripheral units. A more detailed comparison is presented in Table 4.

Table 2 Acute complication rates following autologous breast reconstruction.

|		DIEP	MSTRAM	TUG
Mean length of inpatient stay	Unilateral	6.46	6.56	6.09
	Bilateral	6.82	6	7
	Immediate	6.85	6.89	
	Delayed	6.38	6.3	
	Total	6.5	6.7	6.38
Acute complications	Flap loss	2/3330.6%	0	0
	Haematoma	25/3337.5%	2/603.3%	3/1618.75%
	Infection	33/3339.9%	8/6013.3%	3/1618.75%
	Delayed healing	48/33314%	8/6013.3%	1/166.25%
	Seroma	43/33312.9%	7/6011.67%	1/166.25%
Delayed complications	Fat necrosis	51/33315%	9/6015%	1/166.25%
	'Dog ear' deformity	77/33323%	15/6025%	2/1612.5%
	Hypertrophic scarring	16/3334.8%	2/603.3%	0
	Abdominal hernia	7/3332.1%	1/601.67%	0
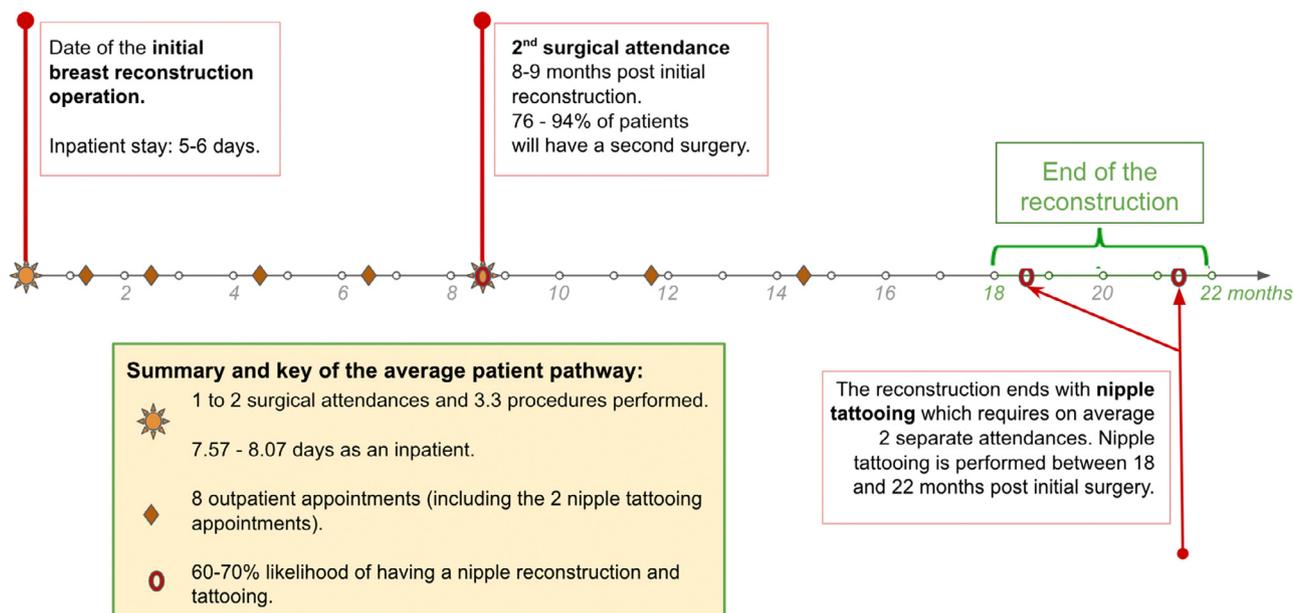
Figure 1 Timeline showing the reconstructive journey of the studied cohort of patients.

Table 3 Comparison between unilateral and bilateral autologous breast reconstructions.

	Total unilateral	Total bilateral	*p*-value
Percentage who had subsequent surgery after their free flap	282/31988%	39/5176%	$p = 0.5244$
Number of operations needed in total	1075/3293.267	169/473.5957	$p = 0.3676$
Time between the reconstruction date and first subsequent operation (in months)	2492/2858.74	336/398.615	$p = 0.9011$
Inpatient days for the initial breast reconstruction surgery	1878/2975.32	358/525.88	$p = 0.2307$
Total inpatient stay for the whole reconstruction process	3066/3388.07	473/537.92	$p = 0.8294$
Total number of clinical appointments	2594/3088.42	344/44 7.82	$p = 0.2795$
Length of the reconstruction pathway (in months)	6949/32421.45	824/4717.53	**$p = 0.0237$**

Table 4 Comparison between immediate and delayed autologous breast reconstructions.

	Total immediate	Total delayed	*p*-value
Percentage who had subsequent surgery after their free flap	75/9479.8%	110/11794%	$p = 0.4209$
Number of operations needed in total	387/1013.83	857/2753.12	**$p = 0.0088$**
Time between the reconstruction date and first subsequent operation (in months)	708/797 8.96	2120/245 8.65	$p = 0.6842$
Inpatient days for the initial breast reconstruction surgery	604/935.49	1632/2565.375	$p = 0.6011$
Total inpatient stay for the whole reconstruction process	938/1087.685	2425/2837.57	$p = 0.7958$
Total number of clinical appointments	876/929.52	1586/1878.48	**$p = 0.0473$**
Length of the reconstruction pathway (in months)	2075/9521.84	4133/19621.09	$p = 0.5949$

Nipple-areola complex reconstruction

In our cohort, 65.7% of patients had nipple-areola complex tattooing along their reconstructive journey. On average, this procedure occurred 17.11 months after their initial reconstruction. Bilateral patients had a shorter time to nipple reconstruction: 8.71 months elapsed between the initial reconstruction until the nipple reconstruction as compared to 12.97 months for unilateral cases (*p*-value: 0.0222). For patients in the bilateral reconstruction group, tattooing of the areola occurred on average 12.43 months after their primary reconstruction. This is much shorter than the 17.96 months that on average elapsed for the unilateral group (*p*-value: 0.0072).

Patient satisfaction

For the studied groups of patients who had their primary reconstruction between 2012 and 2014, patient satisfaction was not consistently documented in their notes. Out of the total, 58.7% of patient notes had no descriptors whatsoever documenting patient views in relation to the overall result.

Discussion

To date, this is one of the largest microsurgical breast reconstruction case series reported, comprising the whole

reconstructive journey of more than 400 patients. Many of the findings of this retrospective review correlate with those reported in previous reports in the literature, one of them being that free tissue transfer for breast reconstruction is successful in 99.5% of our cases, a higher standard than free flaps in other territories such as head and neck and the extremities.

Our trend in terms of flap selection also correlates well with the international experience. The abdominal skin and soft tissues have demonstrated to be a superior donor site for suitable patients. In the presence of redundant abdominal skin and fat, transferring this tissue not only provides adequate volume and shape restoration but also is associated with a cosmetically pleasing abdominal enhancement. TUG flaps have been a more recent incorporation to our reconstructive armamentarium, and during the study period, it was still a novel approach in our unit. This flap is a suitable option for slimmer patients who do not have enough abdominal skin and subcutaneous fat. Even though one of the problems is that TUG flaps provide a more limited volume for reconstruction, this is not usually a problem if candidates for this technique have smaller breasts. This again reinforces the fact that patient selection is crucial for these complex procedures. It is difficult to comment how the incorporation of TUG flaps in our armamentarium might have affected our flap failure rate because of the small group size.

This study has provided an insight for the length of the whole reconstructive journey that women that have had a mastectomy have to go through; from their initial reconstructive surgery until the point when they are ready to be discharged from our service. Our project has also revealed how patients who have delayed reconstructions finish their journey sooner than the immediate group, and likewise, bilateral reconstructions show the same pattern as that of unilateral reconstructions.

Even though this study is not powered to reveal the underlying causes, we could speculate that patients who have lived with a mastectomy scar for a period could have lower expectations regarding the outcome of their reconstructive journey. For patients who had an immediate reconstruction, the transition is different. This may be because they have a normal looking and feeling breast before their surgery and they wake up with a reconstructed breast that feels and looks different without going through the phase of having a mastectomy scar in between.

Similarly, we could speculate that patients who had bilateral reconstructions are discharged sooner from our centre because the reconstructed breasts are meant to be close to symmetry from their surgical episode. Unilateral reconstructions often require a symmetrising procedure for the contralateral non-reconstructed breast, which does not apply for bilateral cases.

One of the main challenges ahead in our unit is to improve the way we routinely document patient outcomes, including self-perceived satisfaction. Despite the fact that there are several patient-reported outcome instruments available for patients undergoing breast reconstruction, there have been barriers for their adoption in our local environment. We are currently working on improving this issue by validating a short clinician- and patient-centred questionnaire that could fill this gap in our practice.

We believe that having a better insight into how patient satisfaction and motivation fluctuates along their journey could help us answer some of the questions that arise from this study, such as why an important number of patients, approximately a quarter of our cohort, decline the chance of having their nipple-areola complex reconstructed. After all, considering that breast reconstruction services are meant to improve quality of life of patients who had to go through breast cancer treatment, substandard documentation of satisfaction should be considered worrisome.

This study presents several limitations. First, it is a retrospective case series. Further, we recognise that not having access to patient demographic information and concurrent treatment such as chemotherapy or radiotherapy makes the assessment of potential occult confounding factors difficult. Similarly, the only outcomes that were assessed in this study were the ones documented in the patients' records. In other words, if there were poor documentation of these outcomes in the first place, then our study is liable to reproduce those flaws. A more consistent documentation system or a prospectively conducted cohort study would enable to provide more reliable information regarding the patients' reconstructive journey. We hope to conduct this study in the near future, but first, we need to address the standardisation approach of how we measure patient satisfaction.

Despite the limitations, this article reports one of the largest case series of autologous breast reconstructions available in literature, while providing answers to one of the unknown issues related to this field: what happens after the primary free tissue transfer? We hope that the readers of this article find our findings useful for counselling patients who consider autologous breast reconstruction. We believe that a truly patient-centred service needs to empower its patients by presenting the whole picture, including a variety of reconstructive alternatives along with the repercussions that these decisions can have while they are going through this journey. Empowering patients while maintaining high standards of care should be the ultimate goal of any breast microsurgical reconstructive centre.

Disclosures

Declaration of Competing Interest

The authors do not have any conflicts of interest to disclose.

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