

# Adverse Outcomes Following Free Tissue Transfer: A 3-year Experience From a Major Referral Centre

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## Research Article

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# Abstract

## Background

Free tissue transfer encompasses a variety of techniques by which tissue is moved to another region of the body, with anastomosis of the divided artery and vein. Currently, success rates are reported at 91-99% [1], however, little is known regarding predictors for adverse outcomes. We aim at identifying predictors for negative outcomes following free flap surgery; and predict that elderly patients and patients with head and neck free flaps will have inferior outcomes due to comorbidity.

## Methods

This is a retrospective case series. All free flap surgeries between 02/2018 to 02/2021 were identified using the electronic operation record system at Flinders Medical Centre. Chi squared hypothesis testing assessed patient factors and implications on outcome.

## Results

67 patients of varying demographics were included in this study. The odds of wound infection was much higher in patients aged older than 65 (OR: 4.1 (95%CI 1.24-13.6, z-score: 2.31, p=0.017)). The odds of unplanned reoperation was also higher in this population (OR: 13.7 (95%CI 1.42-132.9, p=0.0053)). Free flap location was significant in determining whether patients would require a subsequent blood transfusion (p=0.0071). Head and neck patients did not experience a higher rate of adverse events.

## Conclusion

Patients aged 65 and older are more likely to require treatment for infection and more often require reoperation because of flap related issues. Patients with limb free flaps are more likely to require transfusions. Head and neck patients did not have higher complication rates.

# Introduction

The first recorded successful free flap reconstruction was reported in 1972 [2]. Since this time, numerous techniques have evolved in relation to the transfer of free tissue from one region of the body to another. Microvascular surgery is utilised to anastomose donor blood vessels to regional blood supply at the recipient site. Free tissue transfer is the final rung in the reconstructive ladder and should only be utilised when other all reconstructive techniques are deemed inferior for the clinical problem at hand. For this reason, thought must be given to potential perioperative complications that can adversely affect patient outcomes.

Since 1972, surgical techniques pertaining to free tissue transfer have continued to improve. Currently, success rates are reported between 91 to 99%. [1] Regardless, this patient population is at great risk for postoperative complications. Formeister reported that 45.6% of patients undergoing free tissue transfer

experienced an adverse event during admission. [3] Tam found that 18.8% of patients required an unplanned return to theatre. [4] For free fibular bone flaps, it has been reported that 48 major recipient site complications occurred in 41 reconstructions. [5] Because free flap patients are at significant risk of adverse outcomes, it is important to identify predictors for complications and to identify groups most at risk.

Previous publications have found patient risk factors for complications, however, to date, there is no clear consensus regarding free tissue transfers. Low skeletal muscle mass [6], increased alcohol consumption [4], age [3, 7, 8], higher ASA [8], flap type, and site of reconstruction [3] have all been shown to increase the incidence of medical and surgical complications. Obesity has not demonstrated an increased number of adverse events. In fact, higher body weight has been protective in some cases [9]. Many authors have been unable to find an association between advanced age and harmful outcomes [10–14]. Further research is needed to delineate associations between free flap reconstructive surgery and any subsequent complications.

The objective of this study is to identify predictors for negative outcomes following free flap surgery. We aim to compare free flaps by body region, age, and gender. We predict that elderly patients and patients with head and neck free flaps will have inferior outcomes because these populations are more likely affected by co-morbidity.

## Methods

This is a single centre retrospective case series. All cases of free tissue transfer occurring between 28th February 2018 and 17th February 2021 were collated using the theatre electronic medical records system at a large tertiary centre in Adelaide, South Australia. 67 cases were identified. Case files and discharge summaries were then retrospectively analysed to identify complications that occurred as a result of the operation. Chi squared hypothesis testing was used to identify factors that contribute to negative outcomes for patients. Patients outcomes were delineated by body region (head and neck, breast, limbs), age, and gender.

### Ethics approval

was sought from the Southern Adelaide Clinical Human Research Ethics Committee and the need for informed consent was waived due to the retrospective nature of the study. Research was performed in accordance with relevant guidelines and regulations. Patient data was stored and managed in accordance with the Australian Code for the responsible Conduct of research. Informed consent is not required for this type of study. The authors have no conflict of interest to disclose. The authors did not receive support from any organisation for the submitted work. The authors received no financial support for the research, authorship, and/or publication of this article.

## Results

# Patient Demographics

Table 1 provides an overview of the patient demographic data included in this study. A total of 67 patients underwent free tissue transfer. Patients ranged from 18 to 86 years of age, with an average of 57. Almost half of the patients were aged between 46 to 64 years. There were 37 males and 30 females, with a ratio of 1.23 to 1. 46.3% of patients in this cohort experienced at least one complication. This was more likely to occur in the elderly with 61.1% of patients over the age of 65 being affected. Only 40.8% of patients younger than 65 experienced a complication. This trend also holds true for major complications. The elderly were more than twice as likely to experience a major problem (defined as a Clavien-Dindo Classification grade of IIIa or higher). [15] 44.4% of cases required substantial unplanned post-operative intervention, compared to 20.4% of the younger cohort. Breast reconstruction patients were less likely to experience any complication with 36.8% of cases affected, compared to 48.4% of head and neck patients and 52.9% of limb patients. No differences were found in terms of incidence of major complications between body regions.

Table 1  
Patient demographic

	No. of participants (n = 67)
Age	49
<65 years	18
≥65 years	Mean age: 57 Age range: 18 to 86
Gender	37
Male	30
Female	M:F Ratio: 1.23:1
Flap Location	31
Head and neck	19
Breast	17
Limb	
Flap Type	21
Radial/ Ulnar	19
TRAM	7
Latissimus dorsi	7
Anterolateral thigh	7
Gracilis	2
Temporo-parietal	1
Fibular	1
Lateral arm	1
Other	1
Rectus Abdominis muscle only	

	No. of participants (n = 67)
Total complications number	31/67 (46.3%)
≥65	11/18 (61.1%)
<65	20/49 (40.8%)
Head and neck	15/31 (48.4%)
Breast	7/19 (36.8%)
Limb	9/17 (52.9%)
Major complications number	18/67 (26.9%)
≥65	8/18 (44.4%)
<65	10/49 (20.4%)
Head and neck	8/31 (25.8%)
Breast	5/19 (26.3%)
Limb	5/17 (29.4%)

## Complications by age

Table 2 categorises adverse events data by age. The accompanying figure 1 provides a visual analysis of the same. A total of 49 patients were younger than 65 and 18 patients were older than 65. It was found that older patients were more likely to require an unplanned return to theatre and were much more likely to develop a post-operative infection of the reconstructed site. The odds ratio for a patient over the age of 65 to require a return to theatre was 4.1. This was statistically significant with a p-value of 0.017. The odds ratio for developing a free flap infection was 13.71. This was statistically significant with a p-value of 0.0053. No significant difference was found in terms of death, unplanned ICU, anaemia requiring transfusion, and rates of total flap failure.

Table 2  
Complications by age

Complication	< 65 years % (n=49)	≥ 65 years % (n=18)	Odds Ratio (95% CI)	Chi <sup>2</sup> p- value
Death	2.04 (n=1)	0	N/A	0.54
Total flap failure	4.08 (n=2)	11.11 (n=2)	2.94 (0.38 – 22.60)	0.28
Unplanned return to theatre	16.33 (n=8)	44.44 (n=8)	4.1 (1.24 – 13.60)	0.017**
Unplanned intensive care admission	0	5.56 (n=1)	N/A	0.096
Reconstructed site infection	2.04 (n=1)	22.22 (n=4)	13.71 (1.42 – 132.85)	0.0053***
Anaemia requiring transfusion	12.25 (n=6)	16.67 (n=3)	1.23 (0.32 – 6.46)	0.64
Other/ medical	22.45 (n=11)	16.67 (n=3)	0.69 (0.17 – 2.83)	0.61

**\*\*\* significant at the 99% level**

**\*\* significant at the 95% level**

## Complications by body region

Table 3 groups complications data by the site of surgery. This information is also presented visually in figure 2. A total of 31 patients underwent head and neck free flaps, 19 patients underwent breast free flaps, and 17 patients underwent limb free flaps. It was found that free flap location was significant in determining whether patients would require a subsequent blood transfusion, with a p-value of 0.0071. There was no statistically significant difference in terms of complication rates between body regions for death, unplanned ICU admission, unplanned return to theatre, flap failure, and reconstructed site infection.

Table 3  
Complications by body region

Complication	Head and Neck % (n=31)	Breast % (n=19)	Limb % (n=17)	Adjusted Chi <sup>2</sup> (p-value)
Average age	64	52	50	
Death	0	0	5.88 (n=1)	2.99 (0.22)
Total flap failure	6.45 (n=2)	10.53 (n=2)	0	1.85 (0.40)
Unplanned return to theatre	25.81 (n=8)	21.05 (n=4)	23.52 (n=4)	0.15 (0.93)
Unplanned intensive care admission	0	0	5.88 (n=1)	2.99 (0.22)
Reconstructed site infection	9.68 (n=3)	5.26 (n=1)	5.88 (n=1)	0.42 (0.81)
Anaemia requiring transfusion	3.21 (n=1)	10.53 (n=2)	35.29 (n=6)	9.90 (0.0071***)
Other/ medical	16.13 (n=5)	10.53 (n=2)	0	3.05 (0.22)

**\*\*\* significant at the 99% level**

## Complications by gender

There were no statistically significant differences found between males and females in terms of post-operative free flap complication rates.

## Discussion

This study demonstrates that free flaps are a generally safe and successful procedure. The overall mortality was 1.5% and overall flap success was 92.5%. These numbers are similar to other studies [1, 16]. There was no difference in incidence of total flap failure or death in patients older than 65 years. It can therefore be concluded that age does not predispose to failure of the procedure. In keeping with our findings, Ferrari et al concludes that as long as patients are carefully selected pre-operatively in terms of comorbidities, age should not be a disqualifying factor for reconstruction with free flaps. [16]

The total percentage of cases affected by a complication according to the Clavien-Dindo classification was 46.3%. This is in line with other publications. [3] The likelihood of a major complication was 26.9%. The elderly were more likely to experience any complication and much more likely to experience a grade IIIa complication or higher, compared to younger patients. Breast patients were less likely to experience any complication, compared to other body regions. No difference was found in terms of major complications between body regions. It can therefore be concluded that age is a suitable predictor of

worse post-operative outcomes, while breast reconstruction patients are more likely to have a favourable recovery period.

Overall, it was found that the elderly were much more likely to require reoperation and develop post-operative reconstructed site infection. 45% of free flaps over the age of 65 required an unplanned return to theatre. The most common reasons for this were wound breakdown, flap congestion, and haematoma formation. 22% of elderly patients also developed infection of the reconstructed site and required treatment with antibiotics. Only 2% of younger patients also experienced this complication. Currently, the literature suggests that elderly patients are 3-4 times more likely to develop chronic wounds because of difficulty with wound healing. This is thought to be secondary to prolongation of the inflammatory phase of healing, macrophage dysfunction, and malnutrition. [17] Regardless, these findings highlight the need for careful monitoring of elderly patients post operatively, in terms of flap health, but also in terms of overall physiology. There should be a low threshold to initiate antibiotic prophylaxis when free flap infection is suspected in patients aged 65 or older.

Head and neck free flaps are most commonly performed following resection of cancers in this body region. In general, these patients are well known to be more medically co-morbid than other patient populations. In this patient population, the average age for patients with head and neck free flaps was 64. This was 12 years older, on average, than breast patients and 14 years older than limb patients. Since elderly patients are more likely to be co-morbid, this patient population would have therefore been considered a higher pre-operative risk. Our findings suggest that despite this, the rate of all complications is not significantly increased. Head and neck free flaps are not more likely to result in complications. Other authors report similar results, although it is interesting to note that Las et al found significantly reduced rates of post-operative infection and total flap failure in patients undergoing breast reconstruction. [18]

In this study, patients undergoing limb operations were found to be significantly more likely to require a blood transfusion peri-operatively. The most common indication for reconstruction involving limbs was trauma. Many of these free flaps were performed following orthopaedic intervention or to reconstruct significant soft tissue loss following trauma. Blood loss is therefore more likely related to the mechanism of injury and orthopaedic interventions, rather than directly to the free flap itself. Regardless, these findings suggest that patients undergoing limb free flap reconstruction, especially in the setting of trauma, will require more careful monitoring of haemoglobin levels than other patient populations.

As predicted, there was no difference in complication incidence between male and female patients.

The main limitation of this study is that this is a single centre retrospective analysis. Generalisability is therefore limited. The sample size is also small.

## Conclusion

This study found that elderly patients were more likely to experience any complication and much more likely to experience a major complication. In particular, patients aged 65 and older were more likely to require an unplanned return to theatre (OR 4.1) and were much more likely to develop a post-operative reconstructed site infection (OR 13.7). This highlights the need for careful post-operative monitoring of elderly patients. Patients undergoing limb operations were more likely to require a blood transfusion, although this is likely related to trauma as the most common indication for surgery. No difference was found in terms of complication rates between head and neck patients and other patient groups.

## Declarations

### DISCLOSURES

Ethics approval was sought from the Southern Adelaide Clinical Human Research Ethics Committee and the need for informed consent was waived due to the retrospective nature of the study. Informed consent is not required for this type of study. The authors have no conflict of interest to disclose. The authors did not receive support from any organisation for the submitted work. The authors received no financial support for the research, authorship, and/or publication of this article.

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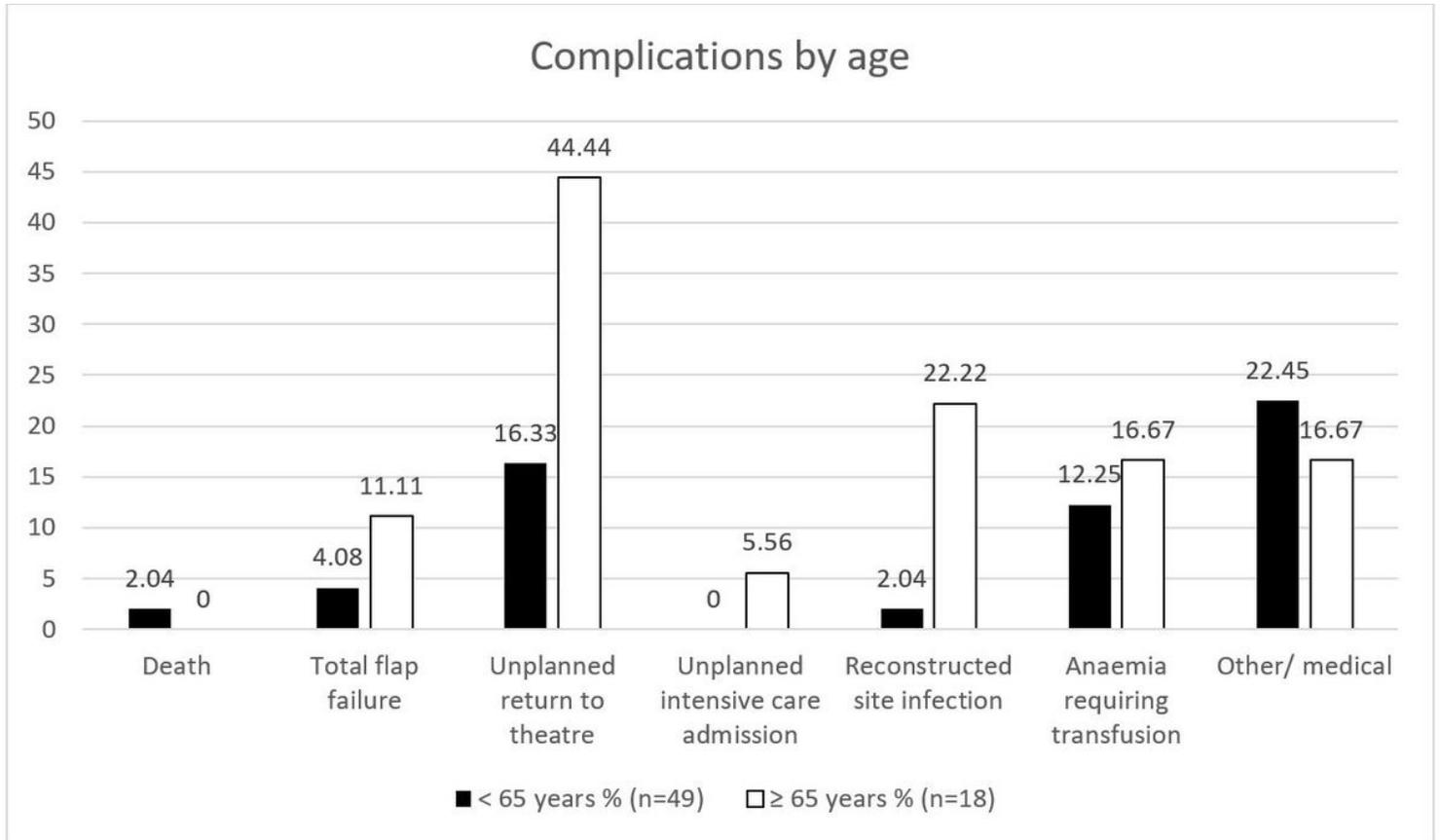
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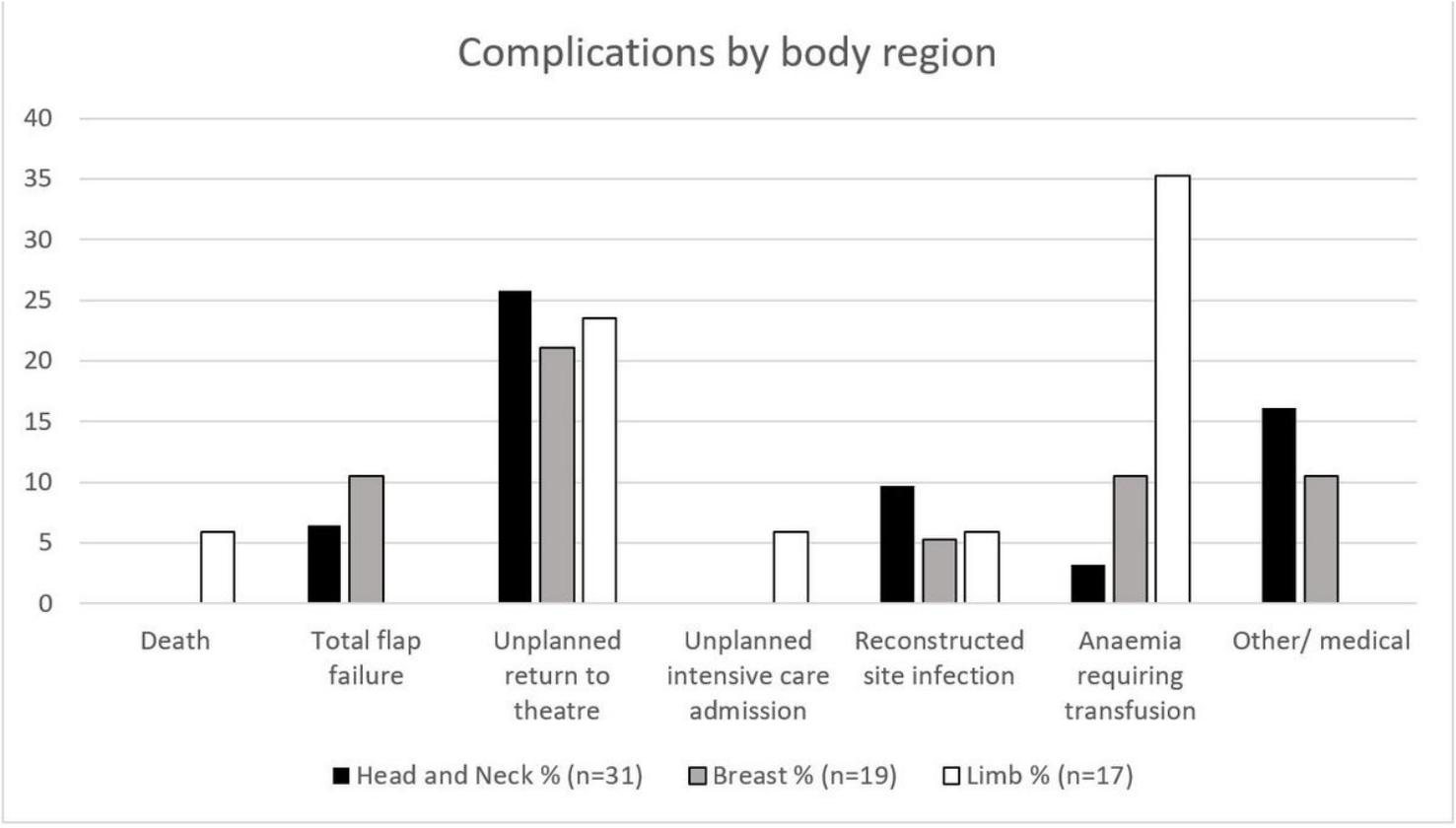
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## Figures



**Figure 1**

*Complications by age*



**Figure 2**

*Complications by body region*