

# An evaluation of wound care product costs, from failed lower limb surgical sites compared with patients who heal immediately postoperatively

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## ABSTRACT

**Background:** Following general surgery, the cost of postoperative care is known to increase, for both patients and the health care facility, when a surgical site fails to heal. However, in the Australian setting little is known about wound product cost differences between healed versus failed dermatological surgical sites.

**Aim:** The aim of the study was to explore the wound product costs associated with healed versus failed lower limb dermatological surgical sites.

**Method:** A sub-analysis from a prospective observational study was conducted. The sample included 73 participants recruited between July 2010 and March 2012. Patients were those with lower limb split skin graft or primary closure who subsequently presented to the dermatology dressing clinic for lower limb for post-surgical management.

**Results:** Of 73 participants, 39 (53.4%) experienced surgical site failure. Time to healing in the healed group was two weeks and three days (SD±0.49) versus an average of 8½ (range 3–17) weeks in the failed group. The wound product cost difference between the two groups by three weeks postoperatively was \$22.53 in the healed group versus \$48.38 in the non-healed group (p<0.01).

**Conclusion:** Costs for primary wound care products and compression therapy were significantly higher among patients who had a failed dermatological surgical site compared with those that healed immediately postoperatively.

*Keywords:* Cost, wound care, surgical site.

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## INTRODUCTION

Skin cancer removal using surgical techniques such as a split-skin graft (SSG) or primary closure, are vital to reduce the morbidity and mortality associated with such cutaneous diseases<sup>1</sup>. An SSG is defined as the transplantation of one's own harvested skin or 'donor site', over the excised area<sup>2</sup>. This differs from the more simple surgical technique of primary closure, in which the lesion is removed and the surgical edges are approximated together and closed with sutures<sup>3</sup>. Primary closure is the preferred choice of surgical closure; however, increasing lesion size, poor laxity of skin and lack of tension lines may require that an SSG method is used<sup>2-3</sup>.

Success of the surgery relies on many factors and surgical site failure will increase the costs of postoperative care<sup>4-6</sup>. Surgical site failure can be defined as any surgical site resulting in prolonged unexpected care, due to primary closure dehiscence, graft failure, and/or surgical site infection<sup>7-11</sup>. Surgical site failure becomes a burden as it puts pressure on hospital resources and increases patient stressors, such as loss of income from time off work, pain and disability<sup>12-13</sup>.

The dermatologically failed surgical site leads to prolonged care due to the development of a chronic wound<sup>7-11</sup>. In Australia the cost of chronic wounds is estimated at \$2.85 billion each year<sup>6</sup>. Currently, there is no literature available which evaluates the difference in cost between a healed acute wound and a failed acute wound in ambulatory postoperative patients. This study endeavours to provide some insight into this product cost difference, immediately postoperatively, which is often a financial cost paid out by the health care organisation.

## MATERIALS AND METHODS

### Study design

A sub-analysis of data collected in a prospective observational study.

### Study setting

The study setting was a major Australian east coast metropolitan hospital, dermatology outpatient department. The hospital is a tertiary referral teaching hospital, which covers the majority of the state, including parts of neighbouring states and the Pacific Rim. The dermatology outpatient department has a dressing clinic attached with specialist nursing services to review patients postoperatively.



### Patient population and sample

The study population were patients who had a lower limb SSG or primary closure in the day-case surgical suite at the hospital; and who subsequently presented to the dermatology dressing clinic for lower limb (below knee and excluding the knee) SSG management and primary closure management. Exclusion criteria included patients who had previously been recruited for the same type of lower limb surgery and those who received curette and cauterisation, where the wound is left open to heal by secondary intention. Patients were followed until it was determined that complete surgical site healing or failure had occurred. This was able to be determined by the third postoperative visit to the dermatology dressing clinic.

### Measures

A purpose-designed instrument was developed for this study. The primary outcome measure was a *failed* SSG and primary closure dehiscence. A failed SSG or primary closure dehiscence was defined as one that had a greater than 20% failure at any assessment point (within the allocated first three visits), which then required ongoing wound management. The baseline measurement of 20% was chosen based on seminal research by Henderson and colleagues<sup>10</sup>.

Additional data was collected during the main study, which included time to healing, wound care products related to the surgical site (primary closure or SSG) and discharge details related to ongoing care. Wound and product cost data was not collected for the donor site. Wound care product costs were extracted from a major national public (patient and health care) distributor of these products within Australia, current from the date of 11 May 2014. Verification of cost data is accessible online to both patients and health care professionals.

### Procedures

All postoperative patients are allocated 30-minute appointment times. All registered nurses (RNs) assisting in recruiting patients, documenting and assessing the success of the surgery were highly skilled wound/surgical care nursing clinicians, with advanced knowledge in postoperative management of surgical wounds and management of chronic wounds. Wound care products were selected by skilled staff based on factors associated with the primary closure or SSG or related surgical site failure and wound bed preparation attributes. Surgical site failure and wound bed preparation included the management of infection, the presence of slough, necrotic or granulation tissue, high levels of exudate, and lower limb vascular support (compression therapy).

## ETHICAL CONSIDERATIONS AND CONSENT

The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in approval by the hospital and university's Human Research Ethics Committees. Patients were recruited after written consent was obtained.

### Statistics

De-identified data was entered into the SPSS software, version 18 (Chicago: SPSS Inc., 2009). All data was cleaned and cross-checked for accuracy.

## Descriptive statistics

Wound product items and participant discharge details are reported as counts and percentages. Continuous data, time to healing, and financial costs are reported as means and standard deviation (SDs) if normally distributed; median and range if not normally distributed<sup>14</sup>.

## Bivariate statistics

To compare the difference in cost of wound care products between healed and failed surgical sites, relationships between groups were calculated using t-test for normally distributed data or Wilcoxon-Mann-Whitney test if data was not normally distributed<sup>14</sup>.

## RESULTS

During the study period from 2 July 2010 to 12 March 2012, a total of 73 patients were recruited from the dermatology dressing clinic for lower limb postoperative SSG and primary closure review. From this sample, there was a total failure rate of 53.4% (n=39). The majority of failed surgical sites were in the SSG cohort (66%, n=33).

Of patients that healed (n=34), the mean time to healing was two weeks and three days (SD±0.49). The mean time to healing in the failed group was significantly higher. For patients who were referred to chronic wound care specialists within the health care facility (n=19), the average time to healing was 8.5 weeks (range 3–17). However, half of the failed surgical sites (n=20) were discharged to the care of other health care professionals in the community (general practitioner or community nurse) and healing times for these patients is unknown.

## Wound care demographics

Of the 73 participants in the study, eight patients presented for review without postoperative dressing or compression therapy in situ. All these patients were in the healed lower limb surgical site group, and all had primary closure of the surgical site. One patient presented at the clinic with a failed surgical site; however, due to poor documentation, we were unable to determine what wound care products were used to assist healing of the dehisced primary closure site, before being discharged to community nurses for ongoing care.

From the 73 participants, there were five groups of wound care products used: moist gauze, haemostatic, silicone, antimicrobial and compression. A total of 11 individual products were used (Table 1).

Table 2 Frequency and costs of products between healed and failed surgical sites

Group of product	Frequency (n), Healed/Failed	Total product cost for healed surgeries	Total product cost for failed surgeries
Moist gauze	n=54, 17/37	\$39.74	\$86.09
Haemostatic	n=3, 0/3	\$0	\$31.8
Silicone	n=32, 12/20	\$93	\$155
Antimicrobial	n=25, 3/22	\$144.54	\$650.54
Compression therapy	n=67, 26/41	\$145.70	\$307.19
Total costs for products, healed versus failed surgical sites		\$422.99	\$1230.62

The most common products used were evenly distributed between the healed and failed groups and commenced at time of surgery; these included cost-effective, moist gauze dressings (Bactigras™ and Xeroform™). The most common form of compression therapy was single- or double-layer Tubigrip™ (n=41). From the 39 participants with surgical site failure, the majority required antimicrobials (n=23) during the first three visits postoperatively.

## Wound care costs

The average cost of wound care, immediately postoperatively, in the healed group was \$22.53 among the 34 participants compared with \$48.38 from 39 failed surgical sites whose data was available. This difference was statistically significant (t=-4.409, p<0.00). Table 2 highlights the frequency of products used between groups and the costs of products associated with healed and failed surgical sites.

Table 1 Product numbers and product cost

Group of products	Individual products	n	Cost (each)
Moist gauze	Bactigras 10x10cm	45	\$2.04
	Xeroform 10x10cm	9	\$4.57
	Haemostatic	3	\$10.60
Silicone	Algisite M 10x10cm	32	\$7.75
	Mepilex 10x10cm	19	\$24.50
Antimicrobials	Mepilex Ag 10x10cm	3	\$54.40
	Acticoat Absorbent 10x12.5cm	1	\$95.54
	Acticoat7 10x12.5cm	2	\$35.42
	Iodosorb tube 10g	61m	\$4.29/m
Compression therapy	Tubigrip	2	\$18.70
	Short stretch/Comprilan	4	\$38.45
	High stretch/Profore lite		

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## DISCUSSION

This is the first study to compare the product costs associated with the early management of lower limb surgery. We found that the cost of surgical site failure immediately postoperatively was over twice as

high in the failed surgical site group when compared to the healed group. This is important information for institutions that usually provide care for these patients immediately postoperatively. It is important to note that this study did not include the number of expert nursing hours required to treat these patients, or the cost of ongoing care for patients who were referred internally for chronic wound management, or costs of extra tests required to care for failed surgical sites until healing has occurred. The inclusion of this cost data would have further increased the financial cost of the failed surgical site.

Interestingly, there was one patient in the healed group who had an initial postoperative wound care regimen which cost the organisation \$140. Had this patient not been included, the average cost of dressings in the healed group would have been even lower. However, in reviewing this participant's data, it was noted that they had a previous history of surgical site infection and surgical site failure leading to a chronic wound. Operating theatre nursing staff identified this participant as high risk, covering the surgical site with a silver dressing and high-stretch compression bandages. During this participant's three visits postoperatively, there was no evidence of SSG failure or surgical site infection. Surgical site success in this instance was potentially due to rigorous, individualised care delivered to the patient at the time of the procedure. Health literature<sup>15-19</sup> identifies and supports the need for appropriate, individualised medical and nursing pre-operative assessment as an essential component to improving surgical site success. In doing so, the financial cost of surgical site failure could be reduced.

## LIMITATIONS

A limitation of the initial study was the low recruitment rate. However, 73 participants were recruited, of which 39 had failed surgeries, and outcomes for this sub-analysis allowed for statistically significant differences between costs of care to be determined.

In regard to cost of care, only the list of primary dressings and compression layers were included. Failure to include the total hours of specialist nursing care, investigations such as swab analysis costs or Ankle-Brachial Index (ABPI) has led to an underestimation of costs, especially as the cost of wound care products is often the lowest cost of surgical site failure. Although the actual amount of time involved in wound management was not collected, all postoperative patients are allocated 30-minute appointment times. Depending on the level at which the health professional is paid, the staff costs for dressing a wound are estimated to be between \$20 and \$30 per patient<sup>20</sup>.

We were also unable to include the cost to other facilities where the patient with the failed surgical site was referred, nor the financial or emotional cost to the patient. Furthermore, a third of participants with failed surgical sites (n=15) were referred onto sub-specialties after the first postoperative appointment, due to early detection of surgical site failure, therefore lowering the total cost of wound products associated with surgical site failure, which was collected for the majority of patients over the three visits. Also, some patients (n=3) used their own compression therapy during the postoperative phase, further reducing the total cost of wound products in this population.

## CONCLUSION

In the general surgical literature the cost of a failed surgical site is well reported. This sub-analysis focused on the cost of wound care products used immediately postoperatively in the Australian outpatient setting. Although this study was limited in regard to the total cost of care, it supports current literature that the failed surgical site incurs significantly higher financial burden on the health care system.

## CONFLICT OF INTEREST

There has been no financial interest by companies of products mentioned in this manuscript.

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