Surgery is used in burn injury management to advance rates of healing, limit infection risks, improve result scattering, and reduce mortality. However, undergoing surgery itself is associated with physiological stress, through the activation of neuropeptides and cytokine-mediated inflammatory responses secondary to tissue damage during surgery. Post-operative fatigue, hyperthermia and immunosuppression can then occur, contributing to a prolonged healing process and increased complication rates.

Furthermore, when these effects of surgery are superimposed on the inherently physiologically-compromised burn patient, they can translate into an increased incidence of adverse outcomes such as infection, prolonged hospital stay, additional requirements for blood products and graft loss.

Given that any surgical episode imposes substantial physiological stress, our hypothesis is that extended surgery duration is associated with poorer outcomes and increased complications. Literature from other surgical patient populations supports this. Thus, this study examined the association between acute burn surgical duration and short-term adverse outcomes.

**METHODS**

This was a retrospective observational cohort study performed to examine patients who underwent acute burn surgery (≥15% TBSA) at Royal Perth Hospital (RPH) between the years 2004-2011 inclusive. The data was collected prospectively during the time period.

**Inclusion and exclusion criteria**

Patients aged 15 years and above who underwent a single episode of acute burn surgery to reconstitute a skin deficit were included. Patients who required debridement only, or an escharotomy and only one other episode of surgery were considered to have one definitive skin closure procedure and were therefore included.

Patients who underwent more than one surgical episode or did not survive treatment were excluded to improve sample homogeneity. However, summary data from the multi-surgery sample was included for comparison of patient characteristics.

**Adverse outcome measures**

Infectious complications, increased length of stay (LOS) in hospital, blood product usage and graft loss were investigated. Infection was confirmed with a positive quantitative wound swab. Blood product usage and graft loss occurrence were recorded categorically (yes/no).

**Surgery duration (in minutes)**

The independent variable of interest was ‘knife to skin’ time. This was derived from the time between commencement of donor site harvesting to completion of skin grafting/Recell application. Patient preparation and recovery times were not included to reduce variation related to these components of surgery.

**Analysis**

Univariate analysis was performed to determine the correlation of surgery duration and LOS with patient demographics, burn injury, operative factors and adverse outcomes. Variables with p-values <0.05 were included in multivariate analyses.

**Multivariate analyses**

Multivariate analyses involved two regression models. The first determined the correlation between surgery duration and significant co-variables from the univariate analyses. The second determined the correlation between LOS and significant co-variables. P-values to choose to indicate the significance of associated variables was <0.05.

**RESULTS**

Without controlling for confounding factors, there was a predominantly positive relationship between increased surgery duration (30 min intervals) and individual adverse outcomes (Table 2).

Univariate analysis revealed significant co-variables for surgery time and LOS to be gender, TBSA, surgery type, culture positive wound swab, blood product usage and graft loss. There was insufficient power to conduct multivariate analyses for blood product usage and graft loss due to small sample sizes (low event rates).

Association of surgery duration with significant co-variables from univariate analysis*

A 10% TBSA increase independently predicted a 60.9% increase in surgery duration.

Use of Recell alone predicted an 18.3% decrease in surgery duration as compared to use of SSG alone for the same TBSA prepared by the first treatment.

Association of LOS with surgery duration and significant co-variables from univariate analysis*

A 30 min increase in surgery duration independently predicted a 13.1% increase in LOS.

A 10% TBSA increase predicted a 34.8% increase in LOS.

Use of Recell alone predicted a 21.7% decrease in LOS as compared to use of SSG alone.

A culture positive wound swab predicted a 26.2% increase in LOS.

Multiple surgical episodes

The summary data showed that this population had a substantially higher median TBSA than the single surgery group, and hence included a larger proportion of patients with major burns. All adverse outcome measures were higher, especially blood product usage and graft loss which are considered low event rate measures.

*Calculated predictors are independent of all other co-variables. Zero truncated binomial regression with backward elimination of non-significant variables was used for both models. This model was chosen to account for the non-normality and over-dispersion that the data exhibited.

**DISCUSSION**

The results of our study show that higher TBSA burns predicted increased surgery duration, while use of Recell alone predicted decreased surgery duration when compared to use of SSG alone. This suggests that tissue salvage strategies with reduced surgical intervention improve clinical outcomes.

Increased surgery duration. TBSA and presence of a culture positive wound swab independently contributed to an increase in LOS. Use of Recell alone compared to SSG alone predicted a decrease in LOS.

Our results on the relationship of surgery duration and LOS are in agreement with similar studies on other surgical populations, where longer surgery duration predicted increased LOS.

The results suggest that development of strategies to reduce acute burn surgery duration is justified. This is further substantiated by the inpatient care costs involved, where theatre costs were $1785/hour in the 2011/12 period at RPH. Additionally, an inpatient bed-day in the burns ward cost $1015 in the same period at RPH.

**CONCLUSION**

Extended acute burn surgery duration was associated with increased risk of adverse outcomes, specifically a longer length of stay in hospital.

Burn injury and surgery factors (TBSA and surgical technique) were also associated with surgery duration.

Patients with higher TBSA burns and/or required skin grafting had a higher likelihood of having longer surgery.

The clinical implications involve the development of strategies to reduce surgery duration without endangering the patient to ameliorate the increased risk of adverse outcomes, especially in those with a higher likelihood of having longer surgery.