Unrelenting Anaemia in an Extensive Burn Injury

D. De Silva, A. Wijewardena, E. Ting, I. Kerridge & J. Vandervord

Introduction

Burn injuries exert enormous physiological stress on the body. Anaemia has been documented as a complication following severe burn injury.[1] The cause of anaemia in this setting is multifactorial and differs with the stage of injury and recovery, so requires a tailored approach to management. Anaemia occurring 1-2 weeks following burn injury results largely from acute blood loss from thermal injury and surgical wound management, red blood cell sequestration and haemolysis. The physiological contributors to chronic anaemia following severe burns are less well characterised but include nutritional deficiencies, reduced bone marrow erythropoiesis, erythropoietin resistance and reduced iron availability.

Figure 1. Haemoglobin level

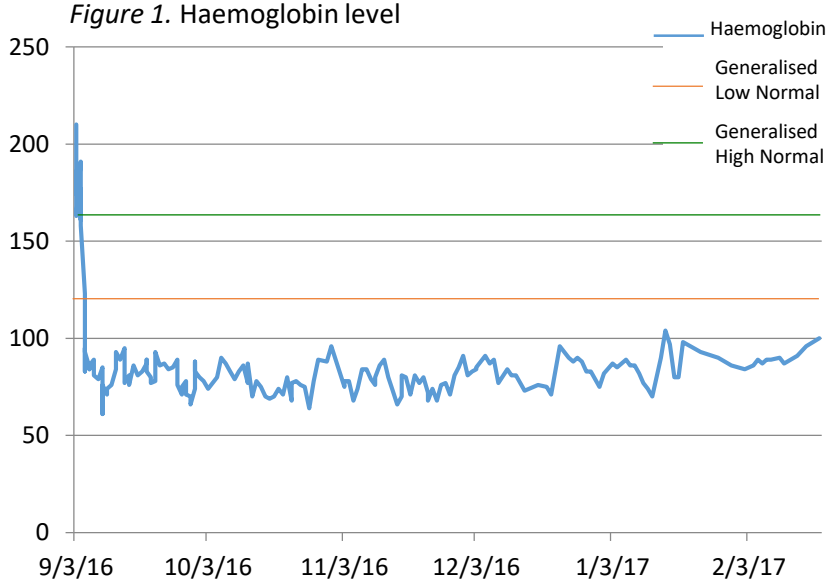
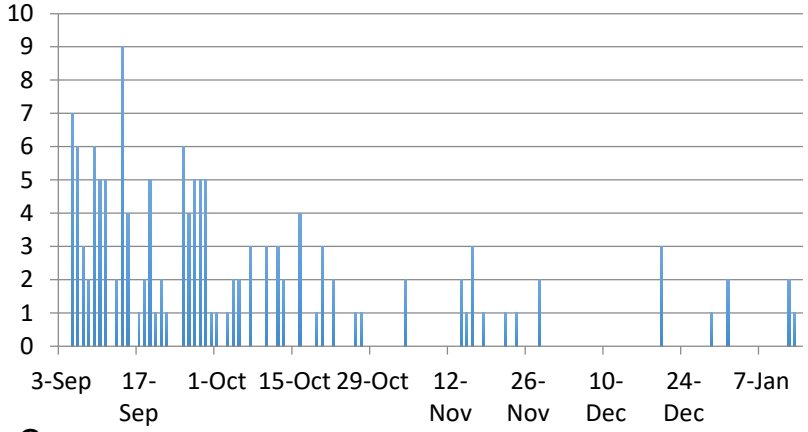


Figure 2. Number of transfused red blood cell units



Case

A 26-year-old male presented to Royal North Shore Hospital via air retrieval, having suffered extensive burns from a chemical explosion. He had full thickness burns to 83% of his total body surface area (TBSA), sparing parts of the face/scalp (7%), abdomen (5%) and genital/groin regions (5%). He was intubated on arrival due to peri-oral burns and increasing analgaesia requirement, and transferred to the operating theatre (OT) for urgent escharotomies and application of dressings. Grafting was initiated day 6, with a number of regrafts required during the 170-day admission. From a haematologic point of view, initial haemoconcentration was followed by a drastic drop in haemoglobin (Figure 1), and an unrelenting normocytic anaemia.

Discussion

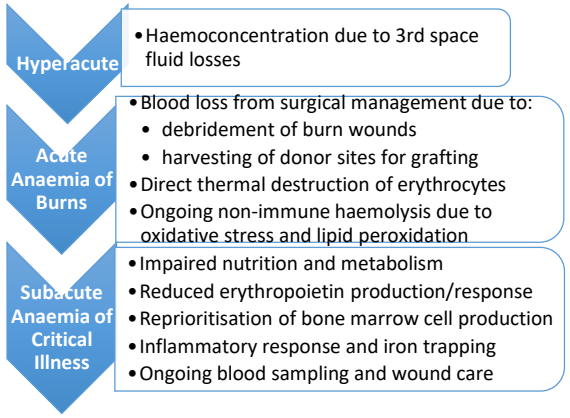
The anaemia in this case of severe burns was ongoing despite aggressive replacement of substrates and red blood cells (138 units in total – Figure 2). Blood counts showed selective erythrocyte depletion, and bone marrow biopsy revealed non-specific gelatinous change.

Haemoglobin correlated with the haematocrit throughout.

The findings of the case are consistent with the literature. In Figure 3, a model is proposed based on a review of the burns anaemia literature.

Anaemia in burns should be considered as two distinct entities:

Figure 3. Progression of anaemia in burns



1. Acute anaemia of burns

This is due to direct thermal injury of erythrocytes, ongoing haemolysis secondary to oxidative stress, and blood loss from surgical management. The most measurable of these is operative loss from debridement (excision of avascular eschar to healthy bleeding tissue) and harvesting of skin grafts.[2]

2. Anaemia of critical illness

This may be due to a combination of decreased erythropoietin, a shift of bone marrow cell production away from erythropoiesis, systemic inflammation with subsequent iron trapping, impaired nutrition and metabolism, and repeated blood sampling in the hospital setting.

Conclusion

It is important to consider the pathophysiological contributors to anaemia at each stage of burns in order to manage it effectively. Surgical techniques such as tourniquets and adrenaline tumescence have been suggested to minimise acute blood loss anaemia, while transfusion restriction has been suggested in critical illness. These strategies may jeopardise graft take, and further research in the burns population is required.

References

1. Curinga G, Jain A, Feldman M, Prosciak M, Phillips B & Milner S. 2011, 'Red blood cell transfusion following burn', *Burns*, 37(5): 742-752.
2. Posluszny JA & Gamelli RL. 2010, 'Anemia of Thermal Injury: Combined Acute Blood Loss Anemia and Anemia of Critical Illness', *J Burn Care Res*, 31(2): 229–242.