

Transfusion requirements of patients undergoing routine cardiac surgery

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Background: *Several factors contribute to the need for blood transfusion after cardiac surgery. These include perioperative blood loss, haemodilution on cardiopulmonary bypass, and pre-operative anaemia. Blood and blood products are at a premium and it is advantageous to decrease the burden on transfusion services by requesting fewer blood units to cover routine surgery. It has been customary in the past to cross-match 6 units of whole blood but this figure has been reduced over the years to 4 units and more recently to 2 units.*

Methods: *A retrospective study of the transfusion requirements of our patients over a one-year period (2005–2006) was performed. Transfusions were classified as urgent (i.e. those required in the immediate post-operative period to replace losses and maintain haemodynamic stability) or non-urgent (i.e. those required after the first 24 hours in order to correct a residual anaemia).*

Results: *143/286 patients (50%) patients were transfused. A total of 298 units, average 2.1 units per patient, were transfused. 58 patients received 1 unit of blood, 56 patients received 2 units of blood, 10 patients received 3 units of blood, 7 patients received 4 units of blood, and 12 patients received over 4 units of blood. Sixteen transfusion episodes were urgent, but no undue delay was experienced in administering treatment.*

Conclusion: *The practice of reserving 2 units of packed cells for cardiac surgery has proved safe and adequate. Further studies should be performed in our unit to determine the rate of unnecessary transfusions.*

Introduction

Cardiac surgery is a major user of blood. In addition to its life-saving effect in hemorrhagic shock, transfusion of allogenic packed red blood cells can be beneficial in situations where a critically low haematocrit is contributing to a state of oxygen-supply dependency. These benefits are countered by the risks of transfusion-

associated lung injury, transfusion-associated immunomodulation, and cellular hypoxia after transfusion. The critical haematocrit is patient and organ specific, and varies intraoperatively according to the duration and temperature of bypass, as well as for a variable postoperative period.¹

Methods

Data was collected prospectively and validated against intensive unit and ward charts at the time of the patient’s discharge. The urgency of blood cross matching and transfusion was based upon a clinical decision to replace post-operative blood loss in order to maintain haemodynamic stability until the cause of the haemorrhage could be dealt with. Data pertaining to urgency of cross matching was validated with the transfusion department records. This data was entered into the cardiac database and analysed retrospectively.

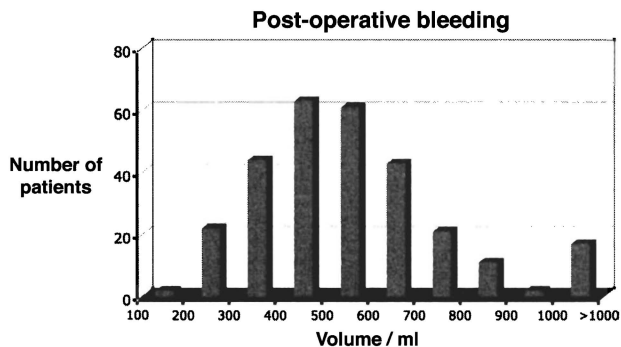
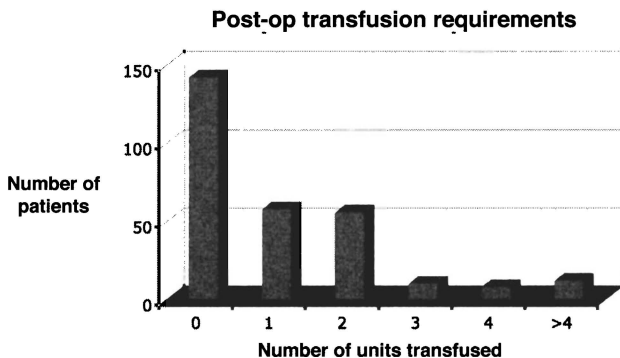


Figure 1. Graph showing post-operative bleeding in cardiac surgical patients.

Figure 2. Graph showing post-operative transfusion requirements as number of units of red cell concentrate transfused in cardiac surgical patients (1 unit = 260ml).



¹G.J. Murphy and G.D. Angelini, ‘Indications for Blood Transfusion in Cardiac Surgery’, *Annals of Thoracic Surgery*, 2006; Volume 82: 2323–34.

Results

A. Post-operative haemorrhage

Post-operative chest drain haemorrhage, shown in Figure 1, measured from the time of chest drain collection in theatre until the point of chest drain removal, averaged 582ml. The median bleeding was in the range 400–499ml. Seventeen patients experienced a post-operative haemorrhage of over 1 litre.

B. Transfusion

During the study period 2005–2006 half of our patients received a blood transfusion, namely 143 out of 286 patients. A total of 298 units were transfused, average 2.1 units per transfused patient (1 unit per patient for the total surgical population). Figure 2 shows that 58 patients received 1 unit of blood, 56 patients received 2 units of blood, 10 patients received 3 units of blood, 7 patients received 4 units of blood, and 12 patients received over 4 units of blood (mean 4.8 units). Eighty per cent of patients requiring transfusion received no more than 2 units of blood. 16 transfusion episodes were urgent, but no undue delay was experienced in administering treatment.

Discussion

The use of guidelines and blood conservation techniques such as perioperative cell salvage,² perioperative normovolaemic haemodilution,³ or the use of anti-fibrinolytic drugs⁴ may result in a reduction in blood use. The increasing acuity and complexity of the condition of patients undergoing surgery, as well as the availability of safer allogeneic blood, have resulted in an increasing number of transfusions to patients undergoing cardiac operations. Overall, the majority of patients having open heart surgery receive allogeneic blood.⁵ Despite Health Department guidance, there is a wide range in transfusion practices among cardiac surgery units in the UK. Blood transfusion appears to be excessive in some units. Our local usage of transfusion in 50% of patients is in line with other cardiac units in the UK. An important number of transfusions may be unnecessary. Identifying unnecessary transfusions performed may be a useful index of transfusion practice. Identification of how units achieve

² Department of Health: 'Better Blood Transfusion', Health Service Circular, London, 1998/224.

³ N. McGill, D. O'Shaughnessy, R. Pickering, M. Herbertson, and R. Gill, 'Mechanical methods of reducing blood transfusion in cardiac surgery: randomised controlled trial', *British Medical Journal*, 2002; 324: 1299.

⁴ John Wiley & Sons, Inc., 'Antifibrinolytic Drugs Reduce Blood Loss During Cardiac Surgery', *Science Daily*, 13 December 2007.

⁵ R.L. Thurer, 'Blood transfusion in cardiac surgery', *Canadian Journal of Anaesthesia*, 2001 Apr; 48 (4 Supplement):S6–12.

low transfusion rates and model guidelines by the Association of Cardiothoracic Anaesthetists may be helpful to units in which transfusion is excessive.⁶

Improved donor selection and screening by increasingly sophisticated tests have dramatically reduced the risks of transfusion-transmitted disease. However, blood is expensive and carries risks.

The theoretical risk of variant Creutzfeldt-Jakob disease and the consequent introduction of leucodepletion by UK blood services have significantly increased the cost of blood to the National Health Service. This is with a probable increase in demand because of waiting lists and no concurrent increase in donations.

Other and more important risks have been attributed to blood transfusion. Researchers have linked women's increased likelihood of complications or death after cardiac surgery to an increased likelihood of receiving red blood cells or platelets during the procedure. In the cohort study of 380 patients who underwent primary coronary artery bypass graft surgery, primary valve replacement, or both during 1997 and 1998, 149 (99.3%) of 150 women in the study received donor blood during their hospitalization, compared with 77% of the men. Women also tended to receive greater quantities of blood than male patients, receiving 9.2 units of unfiltered blood compared with 6.3 units. Women were also more likely to die while in the hospital: 6.7% of women died compared with 1.3% of men, which yielded a risk ratio of 5.1. Of the 13 patients who died in the hospital, all had received blood transfusions. The authors explain that transfusion increased the risk of infection which, in turn increased the risk of pulmonary dysfunction and death.

Conclusion

The usage of blood in our unit compares well with other units in the UK. Eighty per cent of our patients who required transfusion received one or two units of blood. Sixteen transfusions were deemed clinically urgent. In these cases the transfusion service provided additional units of blood in a timely fashion, with no significant risk to the patient. Our experience demonstrates that the practice of cross-matching 2 units of blood for routine cardiac surgery is safe.

Issues such as the cost of blood, limited availability and the potentially harmful effects of transfusion dictate continued research and the development of methods to appropriately minimize transfusion to patients having cardiac surgery.

⁶S.F. Moise, M.J. Higgins, and A.D. Colquhoun, 'A survey of blood transfusion practice in UK cardiac surgery units', *Critical Care*, 2001; 5 (Supplement A).

⁷M. Rogers, 'Increased risk of infection and mortality in women after cardiac surgery related to allogeneic blood transfusion', *Journal of Women's Health*, 2007; 16: 1413–21.