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Intra-Operative Blood Conservation Strategies for the Reduction of Allogenic Blood Transfusion in Cardiac Surgery

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Introduction

The use of cardiopulmonary bypass (CPB) in open heart surgery contributed to haemodilution, blood trauma as well as Systemic Inflammatory Response Syndrome (SIRS) which often resulted in massive blood transfusion. More blood components are required in cardiac surgery than in most other medical disciplines. Over the past six years, the red blood cell (RBC) transfusion rate for cardiac patients remained high (47-51% for emergency case / 23-32% for elective case). Apart from high cost, allogenic blood transfusion is known to have undesirable risks such as infection, transfusion reactions and transfusion related lung injury, contributing to morbidity and mortality. Aggressive blood conservation strategies should be adopted to minimize the chance for blood transfusion.

Objectives

A retrospective analysis of the utilization of RBC for the patients undergoing cardiac surgery with CPB at the Prince of Wales Hospital was performed over a 6-year period, comparing the data between Period A (January 2012 – December 2014, corresponding to 1023 patients) and Period B (January 2015 – December 2017, corresponding to 1047 patients).

Methodology

During Period A, conventional blood conservation methods were applied on all cardiac patients undergoing CPB; while during Period B, aggressive blood conservation strategies were adopted, as listed below: (1) Since January 2015, a new model of oxygenator was used for all cases with Body Surface Area (BSA) under 1.9 m². With an incorporated arterial filter and shorter tubing, the priming volume of the cardiopulmonary bypass circuit was decreased by 27%. (2) Other techniques such as Acute Normovolemic Hemodilution (ANH), (3) autologous blood priming and (4) ultrafiltration were applied for patients with too high or too low haemoglobin levels respectively. (5) Blood salvage for the concentration of RBC after bypass weaned off can remove excess fluid in shed blood from the operative field.

Result

Despite the implementation of aggressive blood conservation strategies, blood transfusion rate remained high in cardiac surgical patients. In Period B, the blood transfusion rates for emergency and elective cases were 51% and 32% respectively. 2.2 units of RBC were consumed for the patients receiving blood transfusion on average. These numbers were comparable to those in Period A. The main contributing factor to the overall high blood demand is the increase in complexity of procedures performed in recent years. The number of aortic surgeries with long bypass time was increased twofold(28 cases in 2012 vs 61 cases in 2017). Further studies are required to investigate and validate the effectiveness of blood conservation strategies applied on aortic surgery which is more technically demanding. The optimal transfusion trigger is still a controversial topic to be discussed.