Strategies for enhancing Patient Blood Management in Cardiovascular Surgery

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Various practical strategies for reducing blood loss and enhancing patients' outcomes have been used in cardiac surgery employing cardiopulmonary bypass (CPB). This lecture outlines the advantages of the major strategies from the perspective of patient blood management (PBM).

Preoperative anemia should be evaluated to determine its etiology, such as iron deficiency, and promptly managed before proceeding with the surgery. The sufficient correction of etiology can avoid or reduce the risk of allogeneic blood transfusion by increasing the red blood cell (RBC) mass

Acute normovolemic hemodilution (ANH) reduces RBC and non-RBC transfusion rates in a volume-dependent manner in patients undergoing cardiac surgery. The withdrawn and collected blood in ANH can reduce the exposure of the blood to the undesirable effects of systemic heparinization and the inflammatory events that are inevitable in cardiac surgery with CPB. The withdrawn blood is rich in RBCs, platelets, and other plasma components, and its reinfusion at the end of surgery would improve coagulation performance and reduce the risk of bleeding and the need for transfusion (1).

Applying CPB induces various impacts on all blood components. CPB-induced hemodilution dilutes all blood components. Retrograde and antegrade autologous priming is beneficial in attenuating the degree and impact of CPB-induced hemodilution (2). Shortening the circuit and reducing the priming volume are also advantageous in attenuating the degree of hemodilution. A restrictive transfusion threshold has to be preferred, since RBC transfusions during CPB are an independent risk factor for AKI and mortality. Managing perfusion and oxygen-carrying capacity needs to be directed to achieve optimal oxygen delivery (DO_2, > 280 mL/min/m^2) during CPB (3). In addition to blood gas analysis at regular intervals, continuous (inline) monitoring of SvO2 and hematocrit levels should be applied to longer CPB applications (3).

Retransfusion of the remaining residual blood volume of the CPB circuit, intraoperative cell salvage (CS), and ultrafiltration (UF) are recommended as an option for intraoperative blood conservation (3). Intraoperative CS reduces overall blood loss during cardiac surgery, but applying more cycles of the cell salvage and washing process can induce a greater loss of plasma components. UF during CPB improved clot firmness and coagulation performance: the improvement was limited in patients with CPB-induced dilutional coagulopathy (3, 4). Normovolemic modified UF provided greater platelet aggregation and less bleeding in adult complex cardiac surgery (5).

Using lyophilized factor concentrates enhances perioperative management of coagulopathic bleeding in cardiac surgery. It also reduces the incidence and degree of transfusion-induced risks and adverse events: prothrombin-complex concentrate (PCC) and fibrinogen concentrates (FC) may be superior to FFP and cryoprecipitate transfusion in avoiding the dilution of other blood components and reducing the risk of RBC and platelet transfusions in cardiac surgery (6, 7). Goal-directed management employing point-of-care viscoelastic tests, such as rotational thromboelastometry and thromboelastography, contributes to enhanced goal-directed coagulation management in cardiac surgery (8).

References

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