Acute Respiratory Distress Syndrome following Autotransfusion with the Biosurge™ Autotransfuser

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SUMMARY: A case of acute respiratory distress syndrome in a 79-year-old man is presented in which the use of a BioSurge™ synchronous autotransfuser may be implicated. This has not been reported before.

Introduction
Intraoperative autotransfusion is not a new concept and is becoming more widespread with the risks of transfusion associated diseases and the demands put upon blood banks. Cell savers have been widely and safely used in many types of surgery (1, 2). They have been demonstrated to reduce the need for blood transfusion in elective aortic aneurysm surgery (3).

The BioSurge™ synchronous autotransfuser is a system designed to collect and reinfuse salvaged blood simultaneously.

Case History
A 79 year old man was admitted for elective repair of an abdominal aortic aneurysm. He was previously fit and well and had never been in hospital before. The only abnormal physical findings on examination were a labile blood pressure that settled to 180/100 mmHg and a pulsatile abdominal mass. He received 20 mg of oral temazepam as premedication, followed 1 hour later by induction of anaesthesia with propofol 80 mg, alfentanil 2 mg and atracurium 40 mg. Anaesthesia was maintained using a total intravenous technique with propofol and alfentanil. The patient's lungs were ventilated with 33% oxygen in air. After induction of anaesthesia a lumbar epidural was inserted and a mixture of fentanyl 100 mcg in 20 ml of 0.25% bupivacaine was administered as 5 ml boluses during the procedure.

The total anaesthetic time was two hours. The operation for repair of the abdominal aortic aneurysm was uneventful, the total cross clamp time being 45 minutes and the estimated blood loss 1500 ml. During the procedure the patient received a total of 2500 ml of crystalloid, 1500 ml of colloid and 1 unit of packed red cells from the blood bank. This maintained a central venous pressure of between 10 and 13 mmHg and a urine output in excess of 1 ml/Kg/min. The patient also received 1300 ml of his own salvaged blood from the BioSurge™ synchronous autotransfuser. Although this was the first time that we had used this form of cell saver, a representative of the company was present throughout to ensure its correct usage.

Postoperatively the patient did well and was extubated. Twenty four hours following surgery he began to have difficulty maintaining oxygen saturation, became confused and progressively tachypnoeic. The chest radiographs at this point showed some atelectasis at the right lung base. Forty eight hours postoperatively his arterial partial pressure of oxygen (PaO2) had decreased to 7 kPa with an inspired oxygen fraction (FiO2) of 0.4. The chest radiograph now showed widespread diffuse alveolar shadowing. His condition continued to deteriorate so he was sedated, paralysed, reintubated and ventilated. A pulmonary artery catheter was inserted and the pulmonary artery occlusion pressure (PAOP) measured as 13 mmHg. His airway pressures were between 26 and 29 cmH2O. A diagnosis of acute respiratory distress syndrome (ARDS) was made. This was later complicated by collapse of the lower lobe of the right lung. He had no evidence of disseminated intravascular coagulation but required low doses of dopamine and dobutamine to support his cardiac output. There were no signs of renal failure and he continued to absorb enteral feed throughout. The patient made slow progress complicated by bronchopneumonia. Seven days following reintubation he underwent elective tracheostomy but remained ventilator dependent for a further 4 weeks. He was eventually returned to the ward on the 39th postoperative day requiring a FiO2 of 0.4 via a tracheostomy mask. The patient went on to make a full recovery and was discharged from hospital.

Discussion
The acute respiratory distress syndrome (ARDS) is thought to be due to increased pulmonary capillary permeability. ARDS is diagnosed in patients with the...
appropriate clinical setting, who have bilateral diffuse infiltrates on the chest radiograph, abnormalities in pulmonary gas exchange as defined by $\text{PaO}_2: \text{FiO}_2$ ratio < 20 kPa and a PAOP less than 16 mmHg. ARDS may be caused by direct injury to the lungs by aspiration, infection or inhalational injury, or due to indirect injuries such as multiple transfusions, disseminated intravascular coagulation, prolonged hypotension, sepsis or fat embolism. ARDS is not a common complication following aortic aneurysm repair (4). The syndrome however is a complication of multiple blood transfusion and carries a mortality rate of 50 - 60% (5). In this case the patient received one unit of packed red cells intraoperatively and a further two units postoperatively. None of the conditions commonly shown to predispose to ARDS (6) occurred in our patient.

Autotransfusion using cell saver devices dates back to 1818. The equipment in use has been reviewed (7). The two basic methods of autologous blood salvage and replacement involve either washing cells before retransfusion or not washing them. Both methods have been shown to be safe and effective in the conservation of blood during aortic aneurysm repair (3, 8, 9). The BioSurge™ synchronous autotransfuser collects blood from the operation site which is then filtered and defoamed through double foam filters. 30 mls of citrate phosphate dextrose solution is mixed with each 500 mls of salvaged blood. This is then returned to the patient through a 40 micron filter. The reinfused blood is not washed. The manufacturers claim that washing the blood eliminates platelets and clotting factors.

There are some constituents of salvaged blood such as tissue debris, activated platelets and white cells, activated complement and clotting factors that may be detrimental to the patient. Disseminated intravascular coagulation, ARDS and multiple organ failure are all possible consequences of reinfusing these substances and washing the salvaged blood may prevent them (3) (10). On the other hand, disseminated intravascular coagulopathy and ARDS have been seen in occasional patients following the administration of washed autologous red cells (11). Mechanical deposition on the centrifuge bowl wall during the cell saving process causes activation of platelets and the release of leukoattractant substances (11). On reinfusion these factors are thought to cause increases in vascular permeability and may result in ARDS. Whatever the exact mechanism, and the relative contribution of not washing the reinfused red blood cells, we postulate that in the absence of any other causes, the Biosurge™ synchronous autotransfuser may have been responsible for the development of ARDS in this patient.

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REFERENCES