FORE-SIGHT ELITE Cerebral Oximetry Readings Used to Confirm Decision to Administer Donor Red Blood Cells During CABG and Valve Procedure

Michael Hartley, M.B, Ch.B, FRCA; Cardiothoracic Anesthetist, Blackpool Teaching Hospitals NHS Foundation Trust, Blackpool, United Kingdom

An 85 year-old female presented with a history of shortness of breath on exertion. Transthoracic echocardiography (TTE) revealed severe aortic stenosis with left ventricular hypertrophy and preserved left and right ventricular function. Coronary angiography demonstrated coronary artery disease with significant lesions in the left anterior descending and circumflex arteries. Carotid dopplers showed mild bilateral internal carotid disease with normal antegrade flow in the vertebral arteries. The pre-operative haemoglobin concentration was 114 g/l.

Cerebral oxygen saturation monitoring using the FORE-SIGHT ELITE cerebral oximeter was commenced prior to the induction of anaesthesia. Standard monitoring was supplemented by direct measurement of arterial and central venous pressures. The induction and maintenance of anaesthesia were unremarkable. The pre-operative TTE findings were confirmed by transoesophageal echocardiography.

Haemodilution was minimized by the avoidance of fluid administration before cardio-pulmonary bypass (CPB), the use of a 'mini-bypass' circuit to limit the initial crystalloid pump volume and the practice of retrograde autologous priming of the circuit to replace the crystalloid prime with the patient's blood. Despite these measures, the haemoglobin concentration fell from a pre-CPB level of 104 g/l (haematocrit 31%) to a level of 70 g/l (haematocrit 21%) and then to 51 g/l (haematocrit 15%) following the administration of cardioplegia.

Concurrently, cerebral oxygen saturations fell to levels below 60%. It was confirmed that arterial P_aO_2, arterial P_aCO_2, mean arterial pressure, and bypass pump flow were appropriate, and a decision was made to transfuse blood cells to achieve an enhanced haemoglobin concentration. Two units of blood were required to achieve a haemoglobin concentration of 73 g/l (haematocrit 22%). Cerebral oxygen saturations rose progressively during the transfusion to levels between 60 and 65%.

An aortic valve replacement, a LIMA graft to the left anterior descending artery, and a saphenous vein graft to the circumflex artery were performed. The patient separated from CPB with ease, supported by atrial pacing to achieve an adequate heart rate, and maintained stable haemodynamics thereafter. Transesophageal echocardiogram confirmed successful aortic valve replacement with no aortic regurgitation and that the left ventricular function was good. The patient received an autologous transfusion and left the operating theatre with a haemoglobin concentration of 95 g/l and cerebral oxygen saturations of 70 -75%.

Cerebral oximetry was continued in the immediate post-operative period on the intensive care unit until the patient awoke with intact neurology after 6 hours following tracheal extubation. The cerebral oxygen saturations were maintained above 70% over this period. The patient was transfused two further units of blood on the second post-operative day to maintain a haemoglobin concentration above 80 g/l. She made an entirely uneventful recovery.

Conclusion

Measurement of cerebral oxygen saturations using the FORE-SIGHT ELITE cerebral oximeter can be used to guide the requirement for the use of donor red blood cells caused by the haemodilution associated with CPB. On this occasion, the fall in cerebral oxygen saturations supported the decision to add donor red blood cells during CPB. On other occasions, the maintenance of normal cerebral oxygen saturations in the presence of a low haemoglobin concentration/haematocrit may support a decision to avoid red blood cell transfusion.