Anaesthetic management in a case of vertebral haemangioma with Bidirectional Glenn Shunt

Sir,

A 14-year-old, 45-kg female was diagnosed to have a thoracic vertebral haemangioma (VH) and was posted for resection and spinal instrumentation. She had a double outlet right ventricle, ventricular septal defect (VSD) with pulmonary stenosis for which a Bidirectional Glenn shunt (BGS) and VSD repair was done at 4 years of age. Her pulse rate, blood pressure and room air oxygen saturation were 60/min, 132/78 mmHg and 92%–95%, respectively. Her electrocardiogram showed a normal sinus rhythm with a P and T-wave inversion in leads V1-3 and V3-6, respectively. Echocardiogram revealed patent BGS with normal ejection fraction and left ventricular function. Her blood parameters and coagulation profile were normal. Baseline arterial blood gas (ABG) analysis showed pH 7.43, pCO_2 28 mmHg, pO_2 165 mmHg, HCO_3 24.7 mmol/L, lactic acid 1.1 mmol/L and haemoglobin (Hb) 19.4 g/dL. The on-going warfarin was discontinued and enoxaparin was started 5 days prior to surgery which was withheld 12 h before surgery. Infective endocarditis prophylaxis was given.

Pre-operatively, adequate hydration was maintained with normal saline. An anaesthesia technique of etomidate, fentanyl, rocuronium, sevoflurane and oxygen: air (1:1) was used. Post-induction ABG analysis revealed pH 7.39, pCO_2 33 mmHg, pO_2 85 mmHg, HCO_3 22.7 mmol/L, lactic acid 0.9 mmol/L and Hb 18.9 g/dL. Femoral vein and arterial cannulation were done, and surgery was done in the prone position (Haemodynamic changes are summarised in Table 1). During 6 h of surgery, she had 400 mL blood loss and received 2300 mL normal saline with stable intraoperative haemodynamics. She had a stable post-operative course and was discharged on the fourth postoperative day.

Early diagnosis and prompt treatment can prevent an irreversible neurologic deficit in cases of symptomatic VH. BGS shunt is a type of cavopulmonary shunt where systemic venous blood from the great veins passively enters the pulmonary artery. The transpulmonary gradient is the primary force promoting pulmonary blood flow and cardiac output (CO). While dealing with a patient with BGS, a thorough preoperative clinical assessment for co-existing problems, evaluation of functional capacity and recent echocardiogram is required.[1,2] The main determinants of the Glenn circulation are pulmonary vascular resistance (PVR), cardiac rhythm, left ventricular function and systemic venous pressure.[1] Hypoxia, hypercarbia, acidosis, inadequate analgesia, positive end-expiratory pressure and sympathetic stimulation should be avoided as they result in an increase in PVR, reducing pulmonary blood flow causing systemic hypotension and arterial desaturation.[2] These patients have a blunted heart rate response due to difficulty in increasing ventricular preload and impaired ventricular function such that any cardiac dysrhythmias necessitate prompt management to avoid haemodynamic instability.[1] Myocardial depressant drugs should be avoided.[2] It is desirable to avoid anaemia, polycythaemia and hypovolemia.[3]

Table 1: Changes in haemodynamic variables during positioning

Variables	Before Prone Positioning	After Prone Positioning
Airway pressure (cmH_2O)	13	18
Heart rate (beats/min)	71	82
Mean blood pressure (mmHg)	85	76
Central venous pressure (mmHg)	5	7
Cardiac Index ($L/min/m^2$)	3.2	2.7

It is imperative to maintain spinal cord perfusion (avoiding haemodynamic perturbations and prolonged spinal traction, and proper positioning) and haemodynamic stability during spine surgery in the prone position in a patient with cardiac abnormality.[4] Most marked cardiovascular changes noticed during prone surgery in such patients are a decrease in mean arterial pressure, CO, cardiac index, and stroke volume (attributed to increase in intra-thoracic pressure) accompanied by an increase in systemic vascular resistance, PVR and sympathetic activity. Before prone positioning, the haemodynamic response to anterior-posterior chest compression should be assessed and rechecked upon turning prone, before spinal exposure, and prior to instrumentation. Omitting nitrous oxide can avoid an increase in PVR and paradoxical emboli.[5] A high tidal volume ventilation with prolonged expiratory phase (as pulmonary blood flow occurs predominantly during exhalation) and avoidance of hypercarbia/higher mean airway pressure are necessary. Pressure-regulated volume control is useful to reduce peak inspiratory pressure, which may be useful in such patients.[6] Early weaning from ventilator and extubation should be considered to avoid prolonged ventilation-induced increased intrathoracic pressure leading to impaired venous return and shunt flow. Early management of specific events such as dysrhythmias, haemodynamic instability, bleeding, dehydration, pain and thromboembolic events in the post-operative period is desirable.[1,2] A comprehensive understanding of the physiology of Glenn shunt to plan the anaesthetic/cardiovascular drugs, ventilation strategies with strict intra-operative monitoring will be useful in this scenario.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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