A 3 month-old male with single ventricle heart disease s/p Norwood stage I palliation with modified Blalock-Taussig (mBT) shunt was anesthetized for cavo-pulmonary connection (bidirectional Glenn shunt). The operative course was uneventful and preparations for transport to the ICU were being made, when a sudden drop in SpO2 and rise in CVP occurred, and the patient’s head and face became profoundly plethoric. EtCO2 was also markedly decreased. CPR was initiated and the chest was urgently reopened. Upon inspection of the chest, air was visible through the SVC, causing an airlock in the cavo-pulmonary connection. The patient was placed emergently on cardiopulmonary bypass (CPB) and the air evacuated. Subsequently, the patient was weaned from bypass, cooled for 24 hours, and recovered with no sequelae of the arrest.

The trans-pulmonary pressure (TPP) gradient is a measure of pulmonary blood flow following cavo-pulmonary shunt. It is the pressure difference between the central venous pressure (CVP measured in the upper compartment) and the end-diastolic pressure (usually left atrial pressure). Management of the patient following cavo-pulmonary anastomosis is focused on minimizing the trans-pulmonary gradient (TPP) to promote passive pulmonary blood flow. The TPP is a valuable tool when evaluating patients following cavo-pulmonary shunt. Oxygen saturations are typically in the range of 75-85%, and saturations below 70% are abnormal and should be aggressively investigated and treated. An elevated TPP gradient may be the result of decreased pulmonary blood flow through the cavo-pulmonary circuit, often from obstruction at the cavo-pulmonary connections, distortion of the PAs, or thrombus. In the absence of mechanical obstruction, an elevated TPP may signify elevated PVR. A decreased TPP gradient may result when LAP approaches SVC pressure, i.e. when EDP is elevated. This may be a manifestation of AVV dysfunction or ventricular dysfunction. Obstruction of the SVC-PA junction and reduced pulmonary blood flow was suspected by the profound hypoxia, elevation in cvp and change in patients head and face color. Diagnosis was confirmed with visualization of the air embolism creating an airlock in the SVC, resulting in complete obstruction to pulmonary blood flow.

Gas emboli are relatively uncommon occurrences during pediatric cardiac surgery. They have been reported to occur during placement of invasive monitors, sternotomy, insertion of arterial or venous cannula for CPB, during cardiotomy on CPB, or from extra-corporeal circuit disconnections. Vascular embolism occurring in a patient with cavo-pulmonary connection leading to cardiopulmonary arrest after surgical closure has not previously been reported. This case offers an unusual presentation of gas embolism and an unusual cause of hypoxemia following cavo-pulmonary connection.

References: