Undiagnosed Tracheal Mass Requiring ECMO on a Newborn Immediately After Repair of Double Outlet Right Ventricle and Type B Interrupted Aortic Arch: The Ball Valve Effect

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Introduction

Extracorporeal membrane oxygenation (ECMO) has been used in patients to treat or repair airway related complications when normal ventilation methods have failed. (Huang, S) ECMO has been used as a bridge to some tracheal pathology requiring surgery. (Kunisaki, S) This case presents the complications of an undiagnosed tracheal mass discovered after the newborn was successfully weaned of cardiopulmonary bypass. The patient had a Double Outlet Right Ventricle (DORV) with Type B Interrupted Aortic Arch (IAA) and underwent a modified Norwood (DKS with Sano shunt). DORV is when both great vessels receive output from the right ventricle. It compromises about 1-1.5% of all CHD, although variants are based on location of VSD, other lesions, and great artery. (Bent, S) Type B (IAA) is an interruption between left carotid and left subclavian. Type A is interruption between L SCA and Ductus Arterious, and Type C is interruption in the proximal aortic arch between innominate and left carotid.

Case

The patient was a 5-day-old 3.85 kg male born at 39 weeks with DORV, IAA Type B, Large subaortic VSD, bicuspid Aortic Valve, grade 1 IVH, multiple dysmorphism and prolonged PTT. The patient was transferred from the NICU to the OR with PGE infusion and already intubated with a 3.00 cuffed ETT. The ETT was changed to a 3.5 cuff taped at 9.5 cm per request of the surgeon. It was a Grade 1 view; no complications with ventilation encountered. The patient underwent a modified Norwood (DKS with a Sano shunt), and reimplantation of the L SCA to the L CCA. During bypass blood was noted to come from the ETT. Suction of the ETT tube was done throughout the case, and small tissue noted by the anesthesiologist. CPB total time was 250 minutes and cross clamp 109 minutes with a complete circulatory arrest for 8 minutes. After achieving hemostasis, adequate saturations and ventilation, the surgeon requested ETT change for pulmonary toilet in PICU. It was felt ETT would be filled with dried blood and changing it in the OR would be more controlled. A new 3.5 cuffed was replaced with grade 1 view of the cords. Initial CO2 was present but then disappeared. Breath sounds were heard on the left. ETT suction, replacement of the ETT with 4.0 uncuffed and all placed at 9.5 cm with the same result. The patient started to decompensate and was placed on emergent VA ECMO. The anesthesiologist performed a flexible fiberoptic bronchoscopy which revealed a tracheal mass tissue at the end of the ETT extending to the right bronchi. ENT removed redundant tracheal tissue, and patient was weaned from ECMO week later.

Discussion

ECMO has been known to be beneficial in treatment of known tracheal/airway pathology and complications. This was an unknown mass that was discovered after major critical and complex surgery. The ball-valve effect is partial obstruction of the airway that traps the air in the alveoli causing hyperinflation during inspiration (Clark) In this case, the tissue in the trachea, which may bleed due to the anticoagulation of CPB and become enlarged due to edema, occlude the EET during expiration, causing hyperinflation of the lung. This could lead to pneumonia, pneumomediastinum, or pneumopericardium. The physiological results: hypoxemia, decreased cardiac output, decreased venous return, increased pulmonary vascular resistance and arrhythmias could have disastrous effects. Retrospectively, a review of the NICU x-ray report stated after intubation there was R upper lobe atelectasis. Ventilator adjustments were made, which repeat x-ray revealed R upper lobe inflation. It is extremely important to have complete preoperative evaluation and to discuss all aspects of concern. However, how important is the anesthesiologist's say when it was felt by the cardiac team that exposing this neonate's RV to systemic pressure could not be delayed?

References


* Case done at Rush University Medical Center