SHOT COMMUNICATION

Necrotizing pneumonia following cardiac surgery in a neonate

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Introduction

Necrotizing pneumonia (NP), also called massive pulmonary gangrene, is a known form of complicated pneumonia that typically affects immunocompetent individuals with no risk factors. This condition has been rarely reported in neonates. Therefore, we present our neonatal case of NP following the surgical repair of congenital heart defects.

Case summary

A full-term baby boy born to a healthy mother presented to a community hospital at 9 days of age with heart failure secondary to coarctation of the aorta (CoA) and patent ductus arteriosus (PDA), which was managed with prostaglandins and...
required invasive ventilation. During his hospital stay, there were no complications and no requirement for antibiotics. He was transferred to our institute for surgical repair at 17 days of age. Upon arrival, he was hypotensive secondary to his cardiac defects, and this condition was managed conservatively until surgery. Surgical correction of the CoA and ligation of the PDA were performed at 19 days of age. After the surgery, the patient remained ventilated, and peritoneal dialysis was initiated because of relative acute renal failure that developed preoperatively secondary to his heart condition. He remained ventilated for two days and was then extubated to nasal continuous positive airway pressure (NCPAP). His serial chest X-rays from admission until 24 days of age showed an increase in haziness on the right side that did not require intervention because of the stability of his condition. At 24 days of age, his respiratory status deteriorated, with significant desaturation and acute hypercapnic respiratory failure that required intubation and ventilation. Subsequently, his clinical condition deteriorated, with evidence of septic shock, disseminated intravascular coagulopathy (DIC) and leucopenia (white blood cell (WBC) count, 1900/mm$^3$). He was started on broad-spectrum antibiotics. An endotracheal tube (ETT) culture grew *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus* (MRSA); therefore, the antibiotics were changed to vancomycin and meropenem for a total of 10 days. He remained stable for an additional six days and was extubated successfully to NCPAP, with significant improvement in right lung aeration. Subsequently, he developed *P. aeruginosa* bacteremia and respiratory distress that required reintubation. He was initially treated with ceftazidime, amikacin and cloxacillin and was later treated with meropenem. Repeated ETT cultures at 41 days of age grew *Stenotrophomonas maltophilia* in addition to *P. aeruginosa*. Meropenem was administered at that time. His clinical condition improved, and he was extubated at 44 days of age. Computed tomography (CT) of his chest was performed at 44 days of age and showed multifocal patchy airspace disease in the right upper and lower lobes and soft

**Figure 1** (A) A frontal chest X-ray at the age of 43 days shows hazy opacity in the left upper lobe consistent with pneumonia. (B) A chest CT (without contrast) image at 44 days of age shows multiple parenchymal cystic lesions in the left upper lobe consistent with the diagnosis of multifocal necrotizing pneumonia. (C) A chest CT (with contrast) image, axial view, taken post-therapy at 60 days of age shows complete resolution of the necrotizing pneumonia. (D) A follow-up frontal chest X-ray (at the age of 3 months) after the treatment course showing complete resolution of the left upper lobe multifocal necrotizing pneumonia.
tissue density in the anterior segment of the left upper lobe with air lucency suggestive of NP (Fig. 1A and B). He remained stable until 46 days of age, when he again developed respiratory distress and required reintubation and supportive mechanical ventilation. His ETT culture grew *P. aeruginosa* and *Enterobacter cloaca*, and thus, the patient was treated with tazocine and vancomycin for ten days. He was then extubated and maintained on NCPAP for two days. He maintained saturation with supportive oxygen at 2 l/min via a nasal cannula. Repeated CT of the chest at 60 days of age showed significant improvement with near complete resolution of the multifocal air space disease (Fig. 1C). The patient was moved to the cardiac step-down ward for observation until 65 days of age and was then transferred in a stable condition to his primary hospital after a total of 51 days of admission. A follow-up chest X-ray at 3 months of age showed marked improvement in the lung fields (Fig. 1D).

**Discussion**

Ventilator-associated pneumonia (VAP) is considered the second most common hospital-acquired infection among pediatric intensive care unit patients, and many risk factors contribute to the development of this disease [1]. Cardiac surgery is considered an important risk factor for VAP [2] and is an important contributing factor to morbidity and mortality associated with VAP, which are highly associated with the complexity of the cardiac disease [2].

VAP following cardiac surgery has been studied extensively in the adult population, but there have been few studies of VAP among pediatric patients following cardiac surgery specifically [2]. The rate of VAP post-cardiac surgery in the pediatric population varies between 8.8% and 21.5%, and the majority of these cases have been reported in infants [3].

Necrotizing pneumonia typically occurs as a complication of community-acquired pneumonia [6,7]. Furthermore, neonates are not part of the age group that typically develops NP. To our knowledge, only three neonates with NP have been reported: a preterm infant who was 2 weeks old [4] and a pair of twins [5]. However, none of those infections occurred following cardiac surgery. NP typically affects immunocompetent individuals with no risk factors, and the usual presentation is fever with constitutional symptoms [6]. NP is primarily caused by *Streptococcus pneumonia*, community-acquired MRSA and other organisms [7]. Additionally, NP is typically caused by a single organism, but it can be caused by multiple organisms in the adult population [7–9]. Although the WBC count is not known to be predictive of the occurrence or severity of NP based on the reported cases, leucopenia in patients with NP caused by MRSA has been reported by some authors to be related to bacterial toxins that directly lyse neutrophils. Some authors have reported that neutropenia is a severity factor that can affect prognosis [10,11]. Regarding the management of NP, there are no evidence-based data to guide the choice of antibiotics, and the choice of antibiotics is dependent on the clinical situation in individual cases. Surgical intervention may be required [9–12]. The typical duration of hospitalization is up to 2–3 months [10]. Although the outcome of community-acquired NP in the adult population is generally poor and although this disease is associated with high morbidity and mortality rates, the situation is different in the pediatric population, in which NP is generally associated with a favorable outcome; however, there are no supporting data regarding the outcome of hospital-acquired NP [6,11].

To our knowledge, our case is the first to be reported in the literature. Our patient was a neonate who developed VAP following cardiac surgery, which was complicated by NP caused by multiple organisms. The patient received multiple antibiotic courses and required prolonged hospitalization, which ended with a favorable outcome.

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