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Case Report

Emergency Use of Extracorporeal Membrane Oxygenation for Pediatric Acute Airway Obstruction Caused by an Anterior Mediastinal Mass

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Abstract

Airway management, especially among children, is one of the most stressful conditions for physicians. Early recognition of acute airway obstruction along with prompt and proactive treatment can reduce the chances of potential complications and improve the clinical outcomes, thereby improving not only survival rates but also quality of life. This statement is especially true if other pathologies are involved [1]. This paper presents the case of a 13-year-old boy who developed an acute airway obstruction presenting as a respiratory failure with decompensated acidosis and nearly respiratory arrest. Initial management went from tracheal intubation to the successful input of a pediatric Venovenous Extracorporeal Membrane Oxygenation (ECMO) due to an impossibility to ventilate the patient.

Keywords: Emergency; Extracorporeal membrane oxygenation; Pediatric; Airway; Obstruction; Cancer; Mediastinal

Introduction

Acute airway obstruction is a frequent life-threatening condition in the pediatric population. It is the primary cause of cardio-respiratory arrest [2]. The differential diagnosis is wide and sometimes difficult to establish. In some critical condition, the use of ECMO is useful to undergo other examinations and treatment [2-6]. Sometimes the obstruction is the consequence of a tumor expansion [7], especially in pediatric patients who develop anterior mediastinal tumors. These may cause severe cardiorespiratory compromise and sudden collapse, in particular when anesthesia or analgesia is required [8,9]. It is not such a rare presenting sign as about 50 to 75% of patients with T-cell Lymphoblastic lymphoma have mediastinal lesions [10,11].

Case Presentation

We present the case of a 13-year-old boy who was admitted to our emergency department due to respiratory distress. He had a history of increasing dyspnea and orthopnea in the recent week. The day before his admission, dysphagia and asthenia developed and he went to a rural hospital without pediatric intensive care unit (PICU). The first Emergency Room (ER) examination showed a decompensated respiratory acidosis (pH 7.32; PCO2 58) and a status asthmaticus was initially suspected. His condition worsened despite the different treatments (bronchodilation aerosol and corticoids). So, he was transferred to our hospital at the end of the

day. During the medicalized transfer, the patient's state continued to deteriorate, presenting a respiratory arrest at his admission in the PICU. An oro-tracheal intubation was performed without difficulty. However, the ventilation became extremely difficult, with elevated airway pressure necessitating hand ventilation with bag valve on the endotracheal tube during the diagnosis workup. A tracheo-bronchoscopy showed a tracheal extrinsic compression difficult to overpass (Figure 1). Thus, an emergency CT scan was executed, which demonstrated an anterior mediastinal mass (AMM) measured of 9.7 x 14 cm, responsible of a sub-occlusive compression of the trachea and below the tip of the endotracheal tube (Figure 2). Despite this event occurred in late evening with limited staff, cooperation with our adult ECMO team allowed us to successfully manage the insertion of a pediatric veino-venous ECMO. After stabilization, he could undergo a surgical biopsy of the mass. The anatomopathological results demonstrated a non-Hodgkin lymphoma (NHL), ultimately found to be a T-cell lymphoblastic lymphoma. This management allowed to start intra-veinous and intra-thecal chemotherapy of methotrexate and other specific hematologic treatment within the 24 hours after his arrival at our hospital. On day 6 of ECMO support and chemotherapy treatment, the patient was weaned off ECMO and decannulated. His tumor size appeared radiographically reduced (Figure 3). He was extubated on day 7 after fibroscopic control. He developed a lung infection and was successfully treated by intra-venous antibiotics and iterative lung fibroscopy. The patient left our PICU 14 days after his admission.

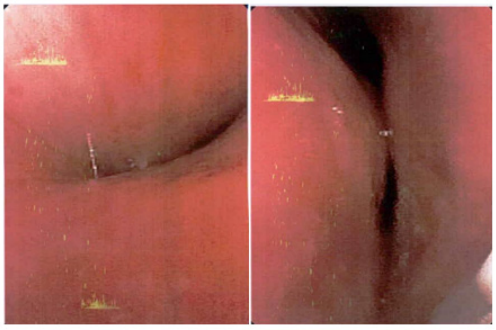

Figure 1: Endobronchial view of the carina and the bilateral mainstem bronchi with extrinsic compression from a large mediastinal mass.

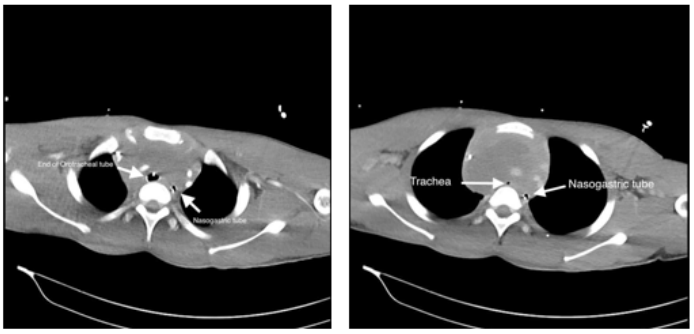

Figure 2: Axial computed tomography of chest. (A) shows the tube in the trachea. (B) shows extrinsic airway compression of the trachea below the tube (nasogastric tube).

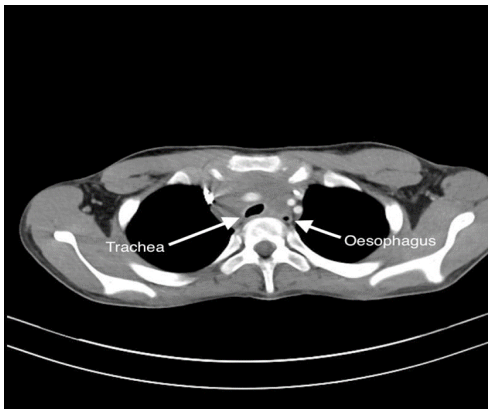

Figure 3: Axial computed tomography of the chest after 1 week of chemotherapy showing that the tumor did rapidly shrank and that the extrinsic compression of the mainstem bronchi disappeared.

Discussion

Tumors arising from the mediastinum are rare in children and teenagers, and such tumors are frequently malignant [12,13]. Nevertheless, with advancements in the fields of oncology, cancer survival rates have improved dramatically in recent years and more than 80% of children with cancer can now be expected to survive for 5 years or more [14]. Lymphoblastic lymphoma (LBL) is the second most common type of NHL in childhood and teens, accounting for 25-35% of all cases. The majority,

70–80%, is of T-lymphoblastic origin while only 20-25% arise from B lymphoblasts [11]. The pediatric population of T-LBL patients most commonly present with an AMM arising from the thymus that can cause airway compression or superior vena cava syndrome. Symptoms include shortness of breath, cough, stridor, dyspnea, and acute respiratory distress [11,12]. For patients with airway compression and superior vena cava syndrome, the clinical management at initial diagnosis is challenging. Furthermore, pediatric patients in comparison to adult patients are at increased risk for respiratory complications, especially intraoperatively, which is the primary cause of mortality in all mediastinal masses [9,15,16]. Sometimes the use of an ECMO support is an effective way to manage those patients. The overall survival rate for pediatric patients on ECMO in other indication is 40% to 60% [17,18], with the higher survival rates reported from high-volume ECMO centers [19]. Previously, malignancy was considered a relative contraindication for ECMO support due to poor outcomes [20,21]. Furthermore, neutropenia, low platelet count, and coagulopathy in hematologic malignancies increase the risks of infection and bleeding. However, with advanced technology and improved prognosis for hematologic malignancies, ECMO support has increasingly been proposed to children with malignancy, especially as a bridge to chemotherapy [4,6,22-31]. As these emergencies can happen on night staff, this case emphasizes the importance of established emergency protocols. Communication and teamwork facilitated the decision to perform an unusual but life-saving therapy. An adult ECMO center should anticipate the need to perform this unusual but life-saving therapy in children too. Frequent contacts with a Pediatric ECMO center are essential to establish protocol, store pediatric cannulas and adapted filters and prepare the team in case of pediatric events.

Conclusion

We report a case of a T-cell lymphoblastic lymphoma in a 13 year-old patient presenting as acute respiratory distress with decompensated respiratory acidosis inducing a respiratory arrest. He was successfully managed by the insertion of a VV-ECMO. ECMO support can be an effective way to manage acute respiratory distress in pediatric population and more recently it could also be used in malignant hematopoietic diseases. It can be a life-saving therapy, as the stabilization of the acute respiratory distress allows work-up and acts as a bridge to chemotherapy.

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