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Severe Pulmonary Edema Following Extraction of a Tracheal Foreign Body: A Case Report

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ABSTRACT

We report the case of a 42-year-old man with a history of tracheal stenosis secondary to prolonged orotracheal intubation. He was then tracheotomized for acute respiratory distress. He subsequently underwent tracheoplasty and multiple tracheal balloon dilations, with a very satisfactory functional result. However, due to his critical lung condition, decannulation was deferred. The patient presented to our emergency department in acute respiratory distress, following a direct blow to his neck. A quick physical assessment revealed a loosely hanging tracheostomy-tube-plate around his neck. He was immediately transferred to the operation room and the cannula was extracted through cervical and bronchoscopic approach. A fenestrated cuffed #6 tracheostomy tube was inserted, and the patient was stabilized. Fifteen minutes later, we started observing a rapid drop in O2 saturation from 98% to 60%. A chest X-ray revealed a severe pulmonary edema. Despite appropriate treatment, the oxygen saturation was barely reaching 60% and he presented a cardio-respiratory arrest. Post obstructive pulmonary edema (POPE) is a potentially life-threatening acute respiratory failure. Two types of POPE are described: type I caused by increased inspiratory effort from acute airway obstruction and type II, caused by sudden relief of a chronic partial airway obstruction.

To our knowledge, only two cases of type II POPE secondary to the removal of a bronchial foreign body in the last 2 decades were reported. The diagnosis is based on the patient's medical history, clinical characteristics, and radiological results. Treatment strategy will include endotracheal intubation and positive pressure ventilation with supplemental oxygen.

INTRODUCTION

We report a case of severe pulmonary edema following the extraction of a broken tracheostomy cannula caused by cervical traumatism in a patient with COVID 19 induced interstitial lung disease. Respiratory arrest leading

to death has occurred despite appropriate treatment. As a result, practitioners should be aware of the symptoms and severity of this disorder to initiate prompt and aggressive treatment. More research is needed to determine the occurrence of POPE after foreign body removal and to investigate the probable relationship between the prevalence of underlying pulmonary illness and the POPE mortality rate.

CASE PRESENTATION

Patient Information

We report the case of a 42-year-old man with a history of severe iatrogenic tracheal stenosis secondary to a 5-week orotracheal intubation for a COVID-19-induced acute respiratory failure in a peripheral hospital. His past medical history was significant for a poorly controlled type 2 diabetes mellitus, high blood pressure and severe coronary artery disease having required multiple angioplasties two years ago. He was admitted to our emergency department in acute respiratory distress and underwent an emergent awake tracheostomy. He subsequently underwent a double-stage tracheoplasty with grafting of a rib cartilage and 6-week-stenting, followed by multiple tracheal balloon dilations, with a very satisfactory functional result and an early plugging of his tracheostomy tube around December 2021. However, due to his critical lung condition (extensive COVID-19-sequellar interstitial lung disease), decannulation was deferred, and his tracheostomy tube was being regularly checked and replaced.

The patient presented to our emergency department approximately 6 months after his last tracheal procedure in acute respiratory distress, following a direct blow to his neck.

Clinical Findings and Timeline

He had a heavy stridulous breathing with marked intercostal retractions, sinus tachycardia, and an oxygen saturation of 90% despite a high-concentration O2 mask. A quick physical assessment revealed a loosely hanging tracheostomy-tube-plate around his neck, and a near collapsed tracheostomy.

Diagnostic Assessment and Therapeutic Intervention

Given the high suspicion of intratracheal trapped cannula, he was immediately transferred to the operation room and the cannula was extracted through a combined cervical and bronchoscopic approach, in a setting of near respiratory collapse (Figures 1 and 2). An armed endotracheal tube was immediately inserted, secondarily replaced by a new fenestrated cuffed #6 tracheostomy tube when the patient was stabilized and started waking up from his sedation. Fifteen minutes later, we started observing a rapid drop in O2 saturation from 98% to 60%, with an abundant pink frothy mucus coming out of the cannula. Quick bronchoscopic assessment revealed the cuffed canula in place with no signs of bleeding or blockage all the way down to the main bronchi. A chest X-ray revealed a severe pulmonary edema (Figure 3).

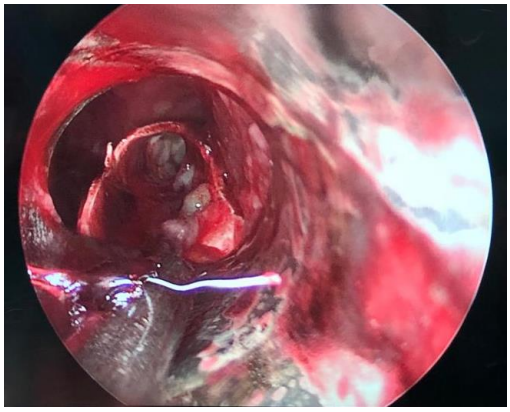

Figure 1: Bronchoscopy showing broken tracheostomy cannula impacted into trachea

Figure 2: Broken tracheostomy cannula extracted from trachea

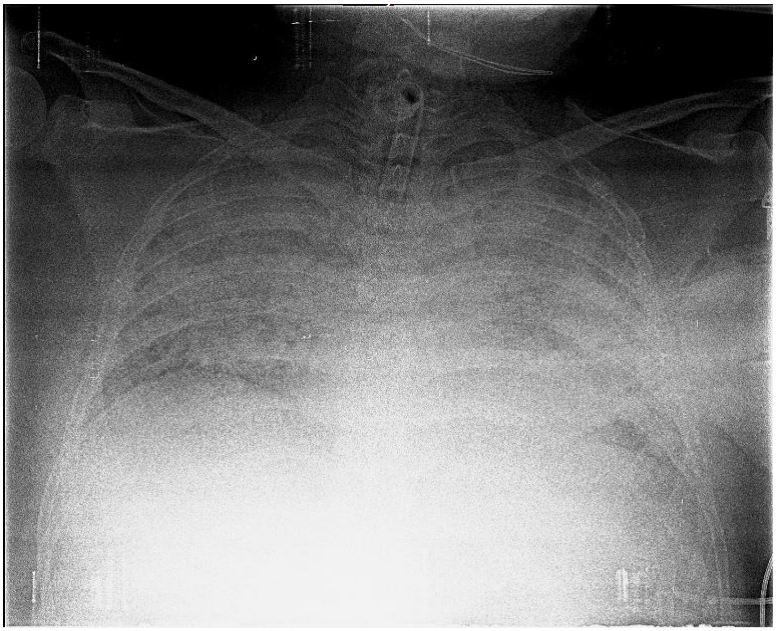

Figure 3: Chest x-ray showing severe pulmonary edema

Follow-up and Outcomes

Despite positive-pressure ventilation, repeat suctioning, steroids and diuretics administration, the oxygen saturation was barely reaching 60%. After 30 minutes of relentless attempts at stabilizing the patient, he presented a cardio-respiratory arrest and could not be saved despite 45 minutes of intense resuscitation.

DISCUSSION

Post obstructive pulmonary edema (POPE) also referred to as negative-pressure pulmonary edema is a potentially life-threatening acute respiratory failure. It is caused by sudden relief of an upper airway obstruction usually from upper airway foreign body, tumor, infection, or laryngospasm.[1] Thus, a negative intrathoracic pressure with a high pulmonary venous pressure will be generated which will lead to an increase in hydrostatic pressure and edema formation. The first case report of POPE was by Oswalt ut al. in 1977.[2]

Two types of POPE are described in the literature: type I is caused by increased inspiratory effort from acute airway obstruction (foreign body, strangulation, laryngospasm, endotracheal tube obstruction, epiglottitis, laryngeal tumor, etc), and type II, is caused by sudden relief of a chronic partial airway obstruction (laryngeal mass resection, foreign body removal, tonsillectomy, etc).[2]

The incidence of type I and type II POPE due to upper airway obstruction has been found to be 9.6-12% and 44 percent, respectively.[3] To our knowledge, only two cases of type II POPE in the last 2 decades were reported, secondary to the removal of a bronchial foreign body. The first case was in a 5-year-old boy after extraction of an inhaled peanut for 24h[4] and the second was in a 21-month-old boy after extraction of an inhaled peanut for one month.[5] The two cases had recovered uneventfully. In adults, post-extubation laryngospasm is the most common cause of airway blockage resulting to POPE (1). In 1986, Thomas A. Tami et al. reported three occurrences of POPE following blockage relief. One patient's blockage was caused by cancer, while two others had inflammatory lesions.[6] Three case series comprising 193 patients with upper airway obstruction discovered that 10% developed later pulmonary oedema.[7]

POPE has no diagnostic criteria, and the diagnosis is based on the patient's medical history, clinical characteristics, and radiological results.[7] It is characterized by the quick onset of respiratory distress, rales, tachypnea, frothy pink sputum, tachycardia, and oxygen desaturation following the release of an upper airway obstruction. Chest radiographs will show bilateral opacities consistent with pulmonary edema. Rarely, the presentation will be delayed after 24h.[1] In our case, the patient had typical clinical and radiological manifestations consistent with type II POPE rapidly after extraction of broken tracheostomy cannula from the trachea.

Differential diagnoses include aspiration pneumonitis, cardiogenic pulmonary edema, iatrogenic volume overload and anaphylaxis. To differentiate between POPE and aspiration pneumonitis, chest x ray is essential. The development of radiological alterations is rapid in the setting of POPE, as we discovered in our case, whereas radiological changes are delayed in aspiration pneumonitis.[1] In our case, there was no gallop and murmur on physical examination nor cardiomegaly on chest x ray which is against cardiogenic pulmonary edema. An electrocardiogram and echocardiogram may be performed to rule out cardiogenic etiology.[3]

Iatrogenic volume overload can be excluded because our patient did not receive an excessive intravenous fluid or transfusion. There is no history of allergic reactions in the patient. Furthermore, there was no wheezing on physical examination, no bronchospasm on endoscopic evaluation, and no hypotension throughout the oxygen desaturation episode. As a result, anaphylaxis can also be ruled out.[7]

Treatment strategy will include endotracheal intubation and positive pressure ventilation with supplemental oxygen. Steroids and diuretics are also thought to accelerate recovery, but their role is still controversial.[8] Clinical and radiological manifestations generally improve within 24h if early treatment is initiated. However, mortality rate rises from 11% to 40% if treatment is delayed.[9] P. P. McConkey has reported six cases of pulmonary oedema following an episode of post extubation laryngospasm in previously healthy males. With positive pressure ventilation, all of these episodes were self-limiting, and only one patient required reintubation .[7] In our case, positive pressure ventilation by tracheostomy, diuretics, and steroids were quickly started, but there was no evident response.

Two variables may have led to our patient's poor response to adequate treatment. The first is severe interstitial lung disease, although there is no apparent association between lung disease and POPE severity in the literature. The second is underlying heart illness, as documented by Goldenberg et al. in a case series of six patients. The authors discovered that elevated pulmonary venous pressures could reveal underlying ventricular dysfunction and predispose to severe POPE.[10]

CONCLUSION

POPE is a severe condition that can result in death. The removal of an inhaled fractured tracheostomy cannula can cause type II POPE. As a result, practitioners should be aware of the symptoms and severity of this disorder to initiate prompt and aggressive treatment. More research is needed to determine the occurrence of POPE after foreign body removal and to investigate the probable relationship between the prevalence of underlying pulmonary illness and the POPE mortality rate.

Patient Perspective

Not applicable

Ethics Statement and Informed Consent

We retrieved the data with the approval of the hospital medical committee and informed parental consent was obtained.

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