Massive pneumomediastinum after tracheostomy: A case report

Chin-Pang WONG 黃展鵬 * and Daniel Kwok-Keung NG 吳國強
Department of Paediatrics, Kwong Wah Hospital, Hong Kong

Abstract

We reported a 2-year-old child with severe croup requiring emergency tracheostomy complicated by a massive pneumomediastinum and tension pneumothorax. The resolution of pneumomediastinum was hastened by a novel suction device via the tracheostomy site.

Keywords: Pneumomediastinum, Suction, Surgical emphysema, Tracheostomy

Case report

A 26-month-old boy with good past health, complained of fever, barking cough and shortness of breath for 2 days, was admitted via the emergency room. Physical examination showed an agitated and distressed child, unable to speak with no drooling of saliva, breathing at a rate of 56/min with SpO_2 93% in room air. His breath sounds were reduced on both lungs and there were marked subcostal recessions bilaterally. His voice was hoarse but there was no stridor. Westley croup score was 9. He was tachycardic with heart rate of 160 per minute while his blood pressure and perfusion were normal. Chest X-ray on admission showed increased bronchial markings on both lungs. The upper tracheal shadow was not distinct. Nasopharyngeal aspirate later showed Influenza A antigen positive. A presumptive diagnosis of severe croup was made and he was treated with intramuscular injection of dexamethasone at 0.6 mg/kg, nebulised adrenaline and budesonide. As his respiratory distress persisted, acute epiglottitis was suspected. He was sent to the operation theatre for emergency intubation under general anesthesia. Anesthesiologist and surgeon were consulted and emergency bronchoscopic examination +/- tracheostomy in the operation theatre was decided. He was also covered with IV antibiotic. Flexible endoscopic examination of the airway revealed signs of laryngitis with partial ventricular obliteration, moderate vocal cord oedema and diffuse laryngeal oedema. There was also a suspected necrotic inflammation over the subglottic area. A 4.0 mm non-cuffed ET tube was inserted which revealed no airleak. To avoid subglottic stenosis, emergency tracheostomy was therefore decided and performed by the surgeon, a non-cuffed 4 mm tracheostomy tube was inserted. He was then transferred to the paediatric intensive care unit , kept sedated and ventilated via the tracheostomy tube, with controlled ventilation at 14/5 cmH_2O, rate of 30/min and I-time of 0.6 second.

At about 14 hours after the operation, he presented with sudden onset of desaturation with right tension pneumothorax (Figure 1) and dislodged tracheostomy tube. Tracheostomy tube could not be re-inserted at bedside and oral intubation was then performed. Right pneumothorax was aspirated and he could then be stabilised. Right chest chain was later inserted and the right lung re-inflated (Figure 2). Re-insertion of the tracheostomy tube was performed in the operation theater, unfortunately, it was dislodged again shortly afterwards. Oral intubation was then decided and patient was kept sedated and ventilated. The tracheostomy site was covered with gauze and Tegaderm. Ventilator settings could be weaned down gradually and he was extubated one day later to Heated Humidified High Flow (HHHF) at 8 L/min and FiO_2 40%. The right pneumothorax was completely resolved and the chest drain was then removed on the same day. The HHHF was weaned down gradually although he still coughed quite frequently. However, 4 days after extubation, he presented with sudden onset of respiratory distress again, chest X-ray (Figure 3) showed left pneumothorax, worsened pneumomediastinum and surgical emphysema. Left chest drain was inserted and the pneumothorax resolved afterwards. Six days after extubation, he developed fever and neutrophilia, echocardiogram showed mild pericardial effusion. Contrast CT thorax was performed (Figure 4), that

*Author to whom correspondence should be addressed.

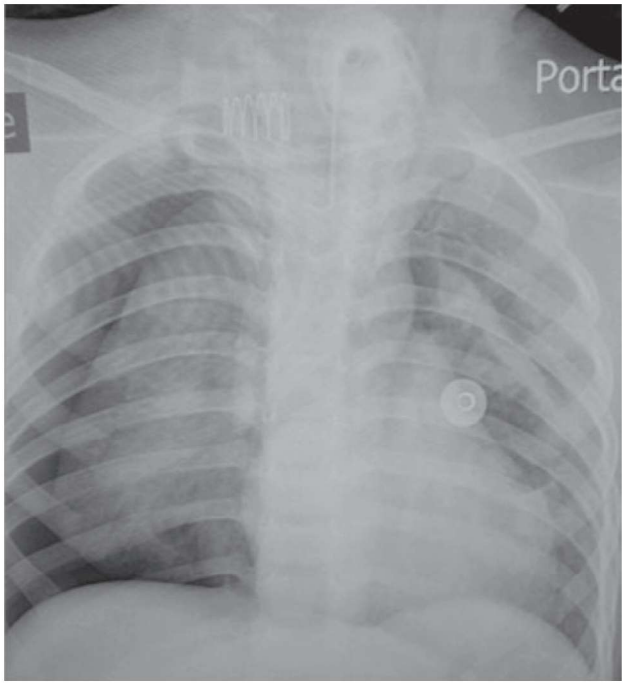

Figure 1. Chest X-ray showing right pneumothorax.

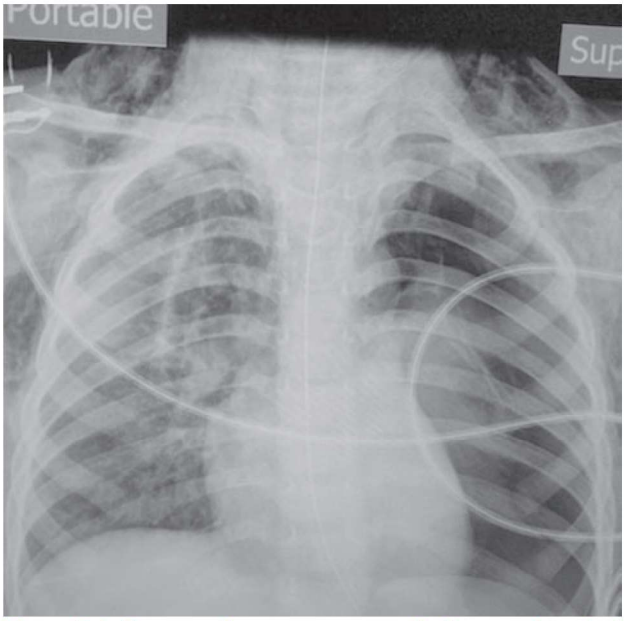

Figure 3. Left pneumothorax, pneumomediastinum and surgical emphysema.

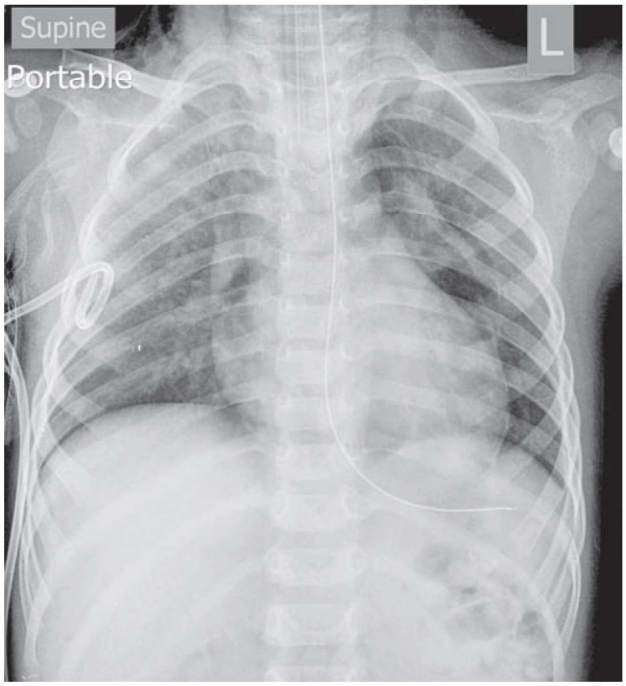

Figure 2. Right chest drain inserted. Endotracheal tube in-situ. Pneumomediastinum.

Figure 4. CT thorax showed massive pneumomediastinum and surgical emphysema, no mediastinal collections and atelectatic left upper lobe.

showed massive pneumomediastinum and surgical emphysema, no mediastinal collections and atelectatic left upper lobe. Cardiothoracic surgeons suggested conservative management. Otolaryngologist advised to leave the tracheostomy wound open instead of covering with occlusive dressing.

With the conservative approach, the resolution of pneumomediastinum and surgical emphysema as documented by serial chest X-rays was very slow (Figure 5). A novel suction device, fashioned from a tracheostomy mask to cover the tracheostomy site, sealed with Tegaderm, connected to an under water seal with 10 cmH_2O pressure and suction, was set up to hasten the resolution of the pneumomediastinum (Figure 6). The patient responded very well and the pneumomediastinum and surgical emphysema largely resolved 3 days afterwards (Figure 5). The tracheostomy wound was closed by sterile strip and the patient was discharged afterwards. Chest X-ray at discharge showed complete recovery (Figure 7).

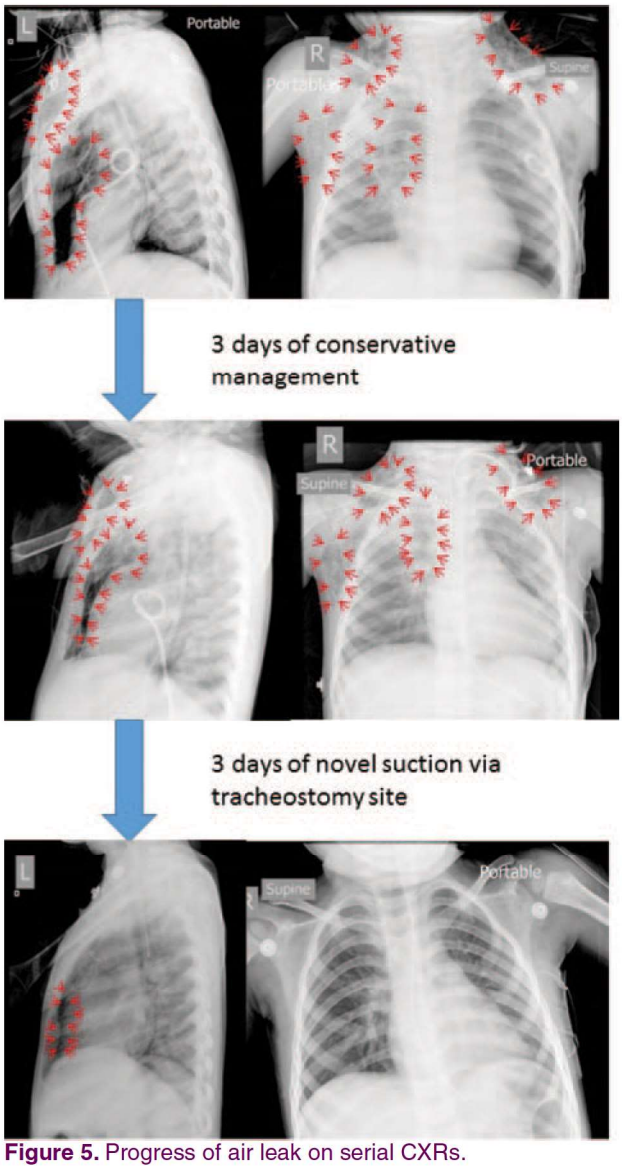

Figure 5. Progress of air leak on serial CXRs.

Figure 6. Novel suction device with a tracheostomy mask covering the open tracheostomy site, sealed with Tegaderm, connected via under 10 cmH_2O seal with suction.

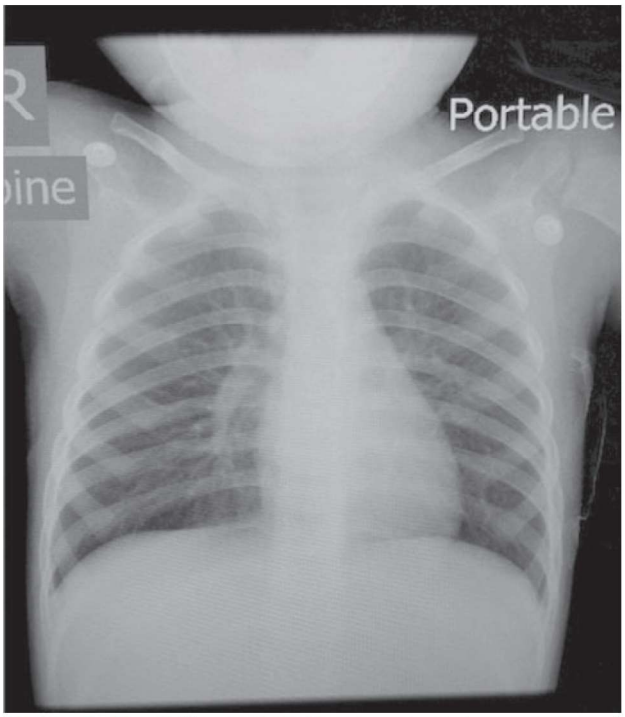

Figure 7. Chest X-ray at discharge, complete resolution of pneumomediastinum and surgical emphysema.

Discussion

Pneumomediastinum is uncommon in children. According to Chalumeau et al.,[1] its incidence ranged from 1 in 800 to 1 in 42000 patients presenting to hospital emergency units. The difference in reported incidence rates was probably related to differences in the diagnostic methods used and also to the severity of symptoms in the population studied. On the other hand, spontaneous pneumomediastinum is more common among newborns. Hauri-Hohl et al.[2] reported an incidence of 0.1% in an NICU in Switzerland between January 2000 to September 2006.

Pneumomediastinum in children could be classified into spontaneous and traumatic. Spontaneous pneumomediastinum are cases that do not occur during or after chest trauma, endotracheobronchial or endoesophageal procedures, mechanical ventilation, cardiac catheterisation, or thoracic surgery.[1] The pathogenesis of spontaneous pneumomediastinum is usually secondary to rupture (by excess pressure and then distension) of a pulmonary alveolus bordering bronchioles or pulmonary vessels. The leaked air then dissects to the hilum along the peribronchovascular sheaths and spreads into the mediastinum. It would cause surgical emphysema when the air dissects the planes of the mediastinal fascia and spreads further to subcutaneous tissues of the thorax, upper limbs or cervical region. A trigger can usually be identified before the onset of the symptoms of spontaneous pneumomediastinum. In a recent study of spontaneous pneumomediastinum in children in Taiwan,[3] the authors reported the major triggers as infection (43.2%), asthma (21.0%), esophageal rupture (5.4%), foreign body aspiration (2.7%), and diabetic ketoacidosis (2.7%) while 35.1% were idiopathic in all 37 cases.

Pneumomediastinum is a known but rare complication of tracheostomy. In a large retrospective review of 1130 tracheostomies in adults,[4] the authors reported a mortality rate of 0.7% and major complication rate of 4.3%, in which there were only 3 cases (0.08%) with pneumomediastinum or surgical emphysema that was similar to our reported case. A cadaveric anatomic study[5] suggested the possible mechanisms between surgical emphysema and tracheostomy to be the imperfect positioning of a fenestrated tube causing extraluminal fenestration and posterior tracheal wall laceration. Although these two factors were not present in our case, we believed the cause of the massive pneumomediastinum and surgical emphysema to be forceful cough against a covered tracheostomy site.

In this case, we found that suctioning over the tracheostomy site did hasten the resolution of pneumomediastinum compared to the conservative approach. This method may need further evaluation in a well-designed study before it becomes generalised.

Conclusion

We reported a child suffering from a rare complication of pneumomiastinum and surgical emphysema following removal of tracheostomy tube. This patient illustrates the importance of leaving tracheostomy open in those with cough to avoid pneumomediastinum. Suction over the tracheostomy site could be a potential method to hasten the recovery of pneumomediastinum associated with surgical emphysema with an open stoma.

References

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