

Subcutaneous emphysema: Unique presentation of a foreign body in the airway

Mahendra Kumar, Arun Goyal¹, Neelima Gupta¹, Rajesh Singh Rautela

Departments of Anaesthesiology and Critical Care and ¹ENT, University College of Medical Sciences and GTB Hospital, Dilshad Garden, Delhi, India

Abstract

Foreign body airway (FBA) is a common problem among the children. Variable presentation makes it difficult to diagnose a case of FBA, particularly, when no definite history of aspiration is available. Subcutaneous emphysema (SCE) and pneumomediastinum are rare presentations. We report a case of FBA who presented with SCE without any history of aspiration. A 3-year-old female child was admitted with respiratory distress, fever and SCE over the right side of chest, neck and face. Initially, she was diagnosed as a case of pneumonitis with barotrauma. X-ray of the chest revealed SCE with pneumomediastinum without pneumothorax. Diagnostic bronchoscopy with rigid ventilating bronchoscope was done under general anesthesia. A plastic foreign body with sharp projections embedded in the mucosa was detected and retrieved from right main bronchus. Postoperatively SCE regressed gradually.

Key words: Foreign body airway, pneumomediastinum, respiratory distress, subcutaneous emphysema

Introduction

Foreign body airway (FBA) must be suspected when a child is presented with sudden onset of respiratory distress,^[1] particularly, when presentation is unique even without a history of aspiration. Subcutaneous emphysema (SCE) and pneumomediastinum are rare presentation of FBA; only few cases have been reported.^[2-4]

Case Report

A 3-year-old female child was brought to the hospital with complaints of cough, difficulty in breathing, fever and swelling over the right side of chest, neck and face for last 2 days. She had no history of any similar episode in the past. Physical examination revealed that child was conscious but tachypneic and febrile. SCE was present all over the right side of face,

neck and chest. Auscultation revealed diminished air entry with fine crepitations on the right side of the chest without any rhonchi. Her X-ray of the chest depicted SCE and pneumomediastinum with infiltrates in the middle zone of the right lung without any evidence of collapse of the lung and the presence of fluid or air in the pleural cavity. There was no evidence suggestive of foreign body (FB) [Figure 1].

She was initially diagnosed as a case of pneumonitis with barotrauma and put on antibiotic therapy. As there was no clinical improvement and cause of SCE without pneumothorax was also not clear, therefore, diagnostic bronchoscopy under general anesthesia was planned.

Standard monitors were applied for monitoring heart rate, noninvasive blood pressure and pulse oximetry. Injection glycopyrrolate-0.05 mg was given intravenously. Anesthesia was induced with an inhalational technique using oxygen, nitrous oxide (50:50) and halothane 1-2% delivered through Ayre's T piece face mask with spontaneous ventilation. Anesthesia was maintained with oxygen, nitrous oxide and halothane. Succinylcholine 20 mg was administered intravenously (IV) and direct laryngoscopy was attempted but it revealed no abnormality. It was followed by tracheobronchoscopy with Richard Wolf rigid ventilating bronchoscope size 5 mm OD. Left side bronchoscopy revealed normal study, but on the right side a granulation tissue was detected. On careful examination and removal of granulation tissue, a FB was detected just near the origin of apical branch of right main bronchus, embedded

Address for correspondence: Dr. Mahendra Kumar,
47 D, Pocket-A, MIG, GTB Enclave, Shahdara,
Delhi - 110 093, India.
E-mail: mahendramohit@yahoo.com

Access this article online	
Quick Response Code:	Website: www.joacp.org
	DOI: 10.4103/0970-9185.161682

in the mucosa. It was retrieved safely but with great difficulty. It was a plastic piece in tortoise shape with multiple sharp pointed projections measuring 5 mm × 9 mm [Figure 2]. During the procedure, the child was ventilated gently through bronchoscope with oxygen, nitrous oxide (1:1) and halothane 1-2%. Besides the initial dose, only two intermittent doses of succinylcholine (5 mg IV each) were required. She maintained her all vitals and oxygenation throughout the procedure.

She was given steroids (dexamethasone-2 mg and hydrocortisone-50 mg) intravenously. Her trachea was intubated with a tracheal tube (4 mm ID) to provide chest physiotherapy and endotracheal suction was done to remove secretions. Lignocaine 1% 1 mL was instilled intratracheal through endotracheal tube to reduce the irritation of the tracheobronchial tree and hence, to control cough reflex. The trachea was extubated when the child was awake. During postoperative care, she was given humidified oxygen by face mask (FiO₂: 0.35) for 6 h. She maintained her SpO₂ above 96% in postoperative period. SCE reduced gradually within next 48 h without any subsequent intervention. On 3rd day, X-ray of the chest revealed no abnormality [Figure 3], and the child was discharged to the care of her parents.

Discussion

Definitive history of FB aspiration, a sudden appearance of respiratory symptoms and radiological investigations play an important role in making diagnosis of FB in the airway. In some cases, parents of small kids may not be aware of the incident of aspiration; hence even if there is no history of FB aspiration but sudden onset of respiratory symptoms, the treating physician must suspect FB airway.^[1,5] Recurrent episodes of wheezing, coughing, choking and sudden onset of asthma indicate a possibility of FB aspiration.^[2]

After FB aspiration, following symptomatic phase, there may be a symptom free period which may vary from days to months depending on the size, nature and site of FB.^[3,6] Patient of FBA may present as a case of asthma, bronchiectasis, pneumonitis or hemoptysis without any underlying cause and are often misdiagnosed.^[2,7]

Besides the history and signs, various investigations are useful to confirm the diagnosis. Chest X-ray findings may not confirm the diagnosis as radio-opaque foreign bodies are rare, but associated findings such as hyperinflation, mediastinal shift and pneumonitis, secondary to FB may contribute to the diagnosis.^[7] Magnetic resonance imaging and computed tomography scan have been suggested as more useful investigations for the definitive diagnosis and location



Figure 1: X-ray chest showing subcutaneous emphysema, pneumomediastinum, and infiltrates in right lung middle zone



Figure 2: Foreign body retrieved from right main bronchus



Figure 3: X-ray chest after retrieval of foreign body showing no abnormality

of foreign bodies.^[3] Bronchoscopy should be considered for diagnostic as well as therapeutic purposes.

Pneumomediastinum and SCE without pneumothorax are uncommon presentation with FB in the airway. Only few such cases of FBA have been reported in literature.^[2-4,6] Ramadan *et al.* reported a 2-year-old male child with FB in the airway, who presented with SCE. His chest X-ray revealed isolated pneumomediastinum without pneumothorax.^[4]

There are two mechanisms of development of SCE following FB aspiration. First is related with the FB in airway which behaves as a “one-way valve” allowing air to enter but not exit out of the affected part of the lung causing trapping of air, gradually increasing the distal

volume and pressure. This forms a sufficient pressure gradient across the alveoli causing rupture of the alveolar membrane through which air travels along the blood vessels to the mediastinum.^[8,9]

Second mechanism is due to mechanical disruption of the mucosal membrane of bronchus or airway through which air enters in the tissue under pressure. During the cough or respiratory distress, high pressure gradient is generated to push the air through disrupted mucosal membrane which travels along perivascular and peribronchial interstitial tissue to the mediastinum resulting in pneumomediastinum.^[10]

Air in the mediastinum moves to the subcutaneous tissue under pressure gradient through a peculiar arrangement of fascial planes in the neck, chest and abdomen which result in the development of SCE.^[9] Coughing, valsalva maneuver, high airway pressure, positive end expiratory pressure (PEEP) etc. are the risk factors for SCE.^[11]

In the present case, the second theory is applicable. The plastic FB with sharp projections pierced the mucosa and went into submucosal tissue making a false passage for the entry of the air into the tissue to develop SCE.

Anesthetic management of such patient is a challenge. Muscle relaxation is required for bronchoscopy but intermittent positive pressure ventilation IPPV is not advocated by some authors during bronchoscopy as positive airway pressure may worsen the condition by facilitating the more air entry through ruptured part of the mucosa into the tissue,^[4,11] although in the literature, to the best of our knowledge, no case has been published showing worsening of the condition following IPPV in a patient of FBA. Theoretically, it may worsen the condition in the patient where FB behaves as a “one-way valve” allowing the air to go in but not to come out of the lung causing hyperinflated lung. IPPV, in the presence of pneumothorax, is not advocated before putting the intercostal tube. In other patients, where cause of SCE is just disruption of mucosa, the authors feel that the gentle IPPV may be used with low-airway pressure, which may be achieved by using low but adequate tidal volume and slight leakage of gases. High-airway pressure and PEEP are the risk factors of SCE.^[11] Without IPPV, oxygenation may be achieved by apneic diffusion of oxygen through rigid ventilating

bronchoscope,^[4] but CO₂ elimination is not possible with this method. Intercostal drain tube is avoided in routine patients of SCE without pneumothorax.^[8] Removal of FB is sufficient treatment of SCE.

We conclude that the cases of FBA which present with respiratory distress and SCE without history of aspiration may be misdiagnosed. Bronchoscopy, a diagnostic as well as therapeutic procedure for FBA, is a challenge for anesthesiologists. IPPV may be used safely during bronchoscopy without putting intercostals drain tube in the absence of pneumothorax in a patient of FBA with SCE.

References

1. Black RE, Johnson DG, Matlak ME. Bronchoscopic removal of aspirated foreign bodies in children. *J Pediatr Surg* 1994;29:682-4.
2. Narasimhan KL, Chowdhary SK, Suri S, Mahajan JK, Samujh R, Rao KL. Foreign body airway obstruction in children: Lessons learnt from a prospective audit. *J Indian Assoc Pediatr Surg* 2002;7:184-9.
3. Mehta AK, Sarin D. Subcutaneous emphysema: An unusual presentation of foreign body bronchus. *Med J Armed Forces India* 2007;63:71-2.
4. Ramadan HH, Bu-Saba N, Baraka A, Mroueh S. Management of an unusual presentation of foreign body aspiration. *J Laryngol Otol* 1992;106:751-2.
5. Banerjee A, Rao KS, Khanna SK, Narayanan PS, Gupta BK, Sekar JC, et al. Laryngo-tracheo-bronchial foreign bodies in children. *J Laryngol Otol* 1988;102:1029-32.
6. Mu LC, Sun DQ, He P. Radiological diagnosis of aspirated foreign bodies in children: Review of 343 cases. *J Laryngol Otol* 1990;104:778-82.
7. Shubha AM, Das K. Tracheobronchial foreign bodies in infants. *Int J Pediatr Otorhinolaryngol* 2009;73:1385-9.
8. Maunder RJ, Pierson DJ, Hudson LD. Subcutaneous and mediastinal emphysema. Pathophysiology, diagnosis, and management. *Arch Intern Med* 1984;144:1447-53.
9. Saoji R, Ramchandra C, D'Cruz AJ. Subcutaneous emphysema: An unusual presentation of foreign body in the airway. *J Pediatr Surg* 1995;30:860-2.
10. Waldhausen JA, Pierce WS. *Johnson's Surgery of the Chest*. Chicago: Year Book Medical Publishers Inc.; 1985. p. 6-7.
11. Wong DT, McGuire GP. Subcutaneous emphysema following trans-cricothyroid membrane injection of local anesthetic. *Can J Anaesth* 2000;47:165-8.

How to cite this article: Kumar M, Goyal A, Gupta N, Rautela RS. Subcutaneous emphysema: Unique presentation of a foreign body in the airway. *J Anaesthesiol Clin Pharmacol* 2015;31:404-6.
Source of Support: Nil, **Conflicts of Interest:** None declared.