CASE REPORT

Nebulized N-Acetylcysteine for Management of Plastic Bronchitis

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Background: Plastic bronchitis is characterized by formation of extensive obstructive endobronchial casts and high recurrence rates. **Case characteristics**: Two children (1-year-old girl, 7-year-old boy) who had recurrent episodes of respiratory distress with acute worsening. Bronchoscopy revealed membrane-like casts. Both children were managed with nebulized N-acetylcysteine in addition to management for asthma. **Outcome**: Symptom-free without recurrence for more than 9 months of follow-up. **Message**: Nebulized N-acetylcysteine may be helpful in prevention of recurrence of plastic bronchitis due to asthma.

Keywords: *Bronchial asthma, Bronchial casts, Foreign body, Refractory.*

Plastic bronchitis, a condition characterized by formation of casts in tracheobronchial tree, can lead to airway obstruction and asphyxiation. It may affect all age groups [1] and is mostly seen in post-cardiac surgery patients, especially Fontan procedure [1-5]. The hallmark of the disease is expectoration of large branching casts [5,6]. Clinical presentation is with acute onset respiratory distress [3], productive cough [2-10], dyspnea, cyanosis, and wheezing. Plastic bronchitis has been reported in association with asthma [1], allergic bronchopulmonary aspergillosis, cystic fibrosis, pulmonary tuberculosis, etc. The treatment is not well defined, and the recurrence rates are high. We share our experience with two children who had plastic bronchitis with asthma phenotype, and responded well to nebulized N-acetylcysteine.

CASE 1

A one-year-old girl presented with fever and cough for 6 days followed by breathlessness for 2 days. Child had history suggestive of recurrent episodes of acute respiratory infections since the age of 4 months which were treated with oral antibiotics and nebulized medications. On examination, child had tachypnea, lower chest indrawing and reduced breath sounds in left hemithorax. Oxygen saturation (SpO_2) in room air was 84%, and Chest *X*-ray showed loss of lung volume on left side (***Fig.* 1*a***). The child was administered oxygen by a head box, and considering a possibility of foreign body aspiration, the infant underwent rigid bronchoscopy. Procedure revealed dirty-white membrane-like deposit fully occluding the left main bronchus. This structure when removed had an appearance like the replica of bronchial tree (***Fig.* 2**). No foreign body could be found. The post-operative chest *X*-ray showed some aeration of the left lung. The child was weaned-off from ventilator after 48 hours. Chest *X*-ray three weeks later showed complete expansion of left lung (***Fig.* 1*b***). Histopathology of cast revealed fibrin mucin with numerous eosinophilic and neutrophilic infiltrates.

Sweat chloride test, bronchoalveolar lavage culture of polymerase chain reaction for influenza virus, and lymphoscintigraphy (for lymphatic malformations) were non-contributory. Post-procedure child was managed with inhaled bronchodilators, N-acetylcysteine (1.5 mL, 20% solution) twice-a-day, chest physiotherapy and systemic steroids for 5 days. Child showed marked improvement with improvement in breath sounds and SpO_2 to 96% in room air. Child was discharged on

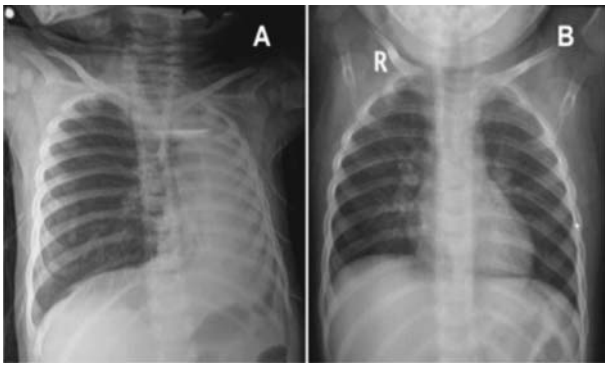

FIG. 1 *Chest X-ray of patient 1 at admission (a); and at follow-up after three weeks (b).*

FIG. 2 *Cast removed from left bronchial tree of patient 1.*

inhaled salbutamol (as and when required), nebulized N-acetylcysteine (1.5 mL, 20% solution, twice a day) and inhaled Budesonide 100 µg twice a day by metered dose inhaler with spacer and face mask.

Child was followed-up every three months, and the above mentioned treatment continued. At follow-up of 12 months, child was asymptomatic.

CASE 2

A 7-year-old boy presented with history of cough and breathlessness for one week. He had recurrent cough, cold and breathlessness every month since the age of 5 years. Each episode was managed with inhaled bronchodilators, antibiotics and occasional systemic steroids. For current episode of breathlessness, child received inhaled bronchodilators, systemic steroids and supportive care. Due to non-response and worsening hypoxia child underwent bronchoscopy twice and membranous structures were removed. Child improved but continued to have wheezing and mild respiratory distress. He presented to our hospital at this stage; he was managed with supplemental oxygen inhalation and nebulized bronchodilators. His *X*-ray and high-resolution computed tomography of chest showed loss of left lung volume. His blood counts, echocardiogram and immunoglobulin profile was normal. Flexible bronchoscopy revealed membrane-like structures in left bronchial tree; bronchoalveolar lavage (BAL) cultures were sterile.

We continued his treatment with inhaled bronchodilator, inhaled budesonide (400 µg) with long-acting beta-agonists and started nebulized N-acetylcysteine (2.5 mL 20% solution) twice a day. There was significant improvement in cough, wheezing and breathlessness. On inhaled budesonide 200 µg and nebulized N-acetylcysteine twice a day, he was completely asymptomatic at 9-month follow-up.

DISCUSSION

Bronchial casts may be of two types: Type I (inflammatory casts) characterized by acute presentation [2], associated bronchial disease and fibrin/mucin [1] along with numerous eosinophilic and neutrophilic infiltrates on histopathology; and Type II (Acellular casts) associated with chronic and recurrent course, mostly seen in cyanotic congenital heart diseases [2,3], and show mucin with few mononuclear cells on histopathology [1].

Pathophysiology of plastic bronchitis in cardiac patients include abnormality in lymphatic drainage, endobronchial lymph leakage [1,5-6], elevated venous pressure, disruption of integrity of bronchial mucosa, and leakage of proteinaceous material in the airway [5,6]. In non-cardiac patients, the pathophysiology is constant inflammation/irritation in the bronchial mucosa by allergens or infective agents leading to induction of mucin hypersecretion by inflammatory cytokines (goblet cell hyperplasia); finally thick mucinous material casts and airway obstruction develop.

Plastic bronchitis had been treated with various modalities along with optimal treatment of primary disease. In acute condition, removal of casts with rigid bronchoscopy may be life-saving [3]. Inhalational therapy using different agents – rhDNase in asthma, rhDNase and acetylcysteine in cystic fibrosis, urokinase in cardiac disease – has been useful in the prevention of recurrence [5,6,10]. Systemic therapy with corticosteroids and macrolides has been used in cases where etiology is asthma/cystic fibrosis [6]. In post-cardiac surgery cases, correction of hemodynamics and correction of lymphatics leakage detected by dynamic contrast magnetic resonance lymphangiography has been used successfully to treat the condition [9]. As the condition is recurrent in nature, inhalational therapy with N-acetylcysteine may be one modality of treatment to prevent the disease recurrence.

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