

# Management of Post-Intubation Croup in a Down Syndrome Infant with Dexamethasone and Low Dose Nebulized Epinephrine- A Case Report

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## Abstract

I describe my experience with the management of postintubation croup in a 10-month-old infant with Down syndrome (DS). While it has been recognized that children with DS tend to develop obstruction of the upper airway postoperatively, debate remains concerning the appropriate management in this situation. Although there is no evidence either supporting or refuting the use of nebulized epinephrine in infants, postintubation croup was successfully treated by inhaled nebulized epinephrine in addition to intravenous dexamethasone in an infant with DS.

**Keywords:** Postintubation croup; Down syndrome; Epinephrine

## Introduction

Postintubation croup is a serious complication among pediatric population, frequently necessitating reintubation. It is a potential threat to any child anesthetized with endotracheal intubation [1]. It is characterized by hoarseness, stridor and severe upper airway obstruction. Although the annual incidence was reported to range from 1.5 to 6 per 100 children younger than six years of age [2], in a more recent study, it was 1.83% [3]. Several factors have been associated with the development of postintubation stridor, including female, young age particularly those less than 6 month old, asthma, excessive tube mobility due to insufficient fixation, fighting against the tube, reintubation, duration of intubation, and absence of an air leak around the endotracheal tube [4-6]. It has been reported that aerosolized racemic epinephrine is beneficial in the management of croup due to any cause including postintubation croup [7]. I report my experience with the management of postextubation croup using intravenous dexamethasone and low dose nebulized epinephrine in a 10-month-old infant with Down syndrome (DS) operated for bilateral undescended testis.

## Case Summary

A 10 months old male infant of 11 kg weight with Down syndrome was scheduled for bilateral undescended testis surgery. During preoperative examination, the infant was found to have a flat nasal bridge a narrowed nasopharynx and a large protruding tongue. The infant was also evaluated for natural airway obstruction, cervical spine instability and subglottic narrowing. However, these issues and other congenital abnormalities including cardiac defects and gastrointestinal anomalies were excluded. The infant was postponed 3 times for 3 weeks because of upper respiratory tract infection presented as cough and running nose. However, in this time which was two weeks after the last episode, there was neither fever nor running nose or any other symptoms of upper respiratory tract infection. The blood count and X-ray chest were within normal limits.

The patient was not premedicated and standard monitors were connected. Anesthesia was induced using inhalational sevoflurane, i.v. fentanyl 2 microgram per kg. Laryngoscopy and intubation were easy and non-traumatic using 4 mm size PVC endotracheal tube. On auscultation, bilateral air entry was equal, although, an audible air leak was found around the endotracheal tube. To minimize this leak, the tube was changed with 4.5 mm size. Anesthesia was maintained

with 50 % oxygen with air, sevoflurane 2-3%. The course of anesthesia was uneventful and the immediate recovery was fair.

Twenty minutes after extubation, the infant developed barking cough and respiratory difficulty. On physical examination, he had audible stridor, intercostal retractions, cyanosis, lethargy and the Westley Croup Score was 16. The oxygen saturation (SpO<sub>2</sub>) of the infant decreased to 50% and he developed bradycardia and was given atropine 0.15 mg/kg. The patient was immediately returned back to operation room where 100% O<sub>2</sub> with face mask with some gentle pressure was given to increase the SpO<sub>2</sub>, but SpO<sub>2</sub> did not increase more than 80%. Dexamethasone 0.6 mg/kg was immediately injected intravenously and, concurrently, nebulized 0.5 mL of epinephrine of 1:4000 ratio (0.25 mg/mL) diluted with 3 mL saline was given. The patient did not improve considerably after 10 minutes, Westley Croup Score [8] was 13. Another identical dose of nebulized epinephrine was repeated. The infant improved significantly. At 15 min after the second dose of epinephrine, his Westley Croup Score was 9. At 30 min, the Westley Croup Score was 4. Finally, at 6 h, the Westley Croup score was 0. No additional doses of epinephrine were not given and the infant was not admitted to the pediatric intensive care unit "PICU". The patient's vital signs were not markedly changed, except mild tachycardia. Neither arrhythmia nor tremor was observed. Follow up of the infant revealed uneventful postoperative course.

## Discussion

It is important to select the patient for surgery in case of upper respiratory tract infection (UTI) especially in children. Although the infant in the present case report had mild dry cough, other criteria for diagnosis of UTI like rhinorrhea, scratchy throat, sneezing,

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congestion, malaise, fever or voice changes were not fulfilled [9]. Two or more criteria are required to diagnose UTI. In children with Down syndrome, they have usually more oral secretions, and it is difficult to differentiate an infective cough from an irritation cough due to oral secretion or allergy. The post intubation croup is influenced by many factors like age of the patient, number of attempts for intubation, a tight fitting tube, staining on the tube or changing the position of the head while intubated, prolonged intubation, position other than supine and head and neck operations [4-6]. Cohen et al reported a 3.77 % incidence of croup in patients with URI while those without URI had an incidence of 0.67% [10]. Clinical signs generally appear within 30 min of extubation and respond well to the treatment with nebulized epinephrine [7,11] and dexamethasone [12]. Children who have Down syndrome may be at high risk because of increased incidence of subglottic narrowing and more salivation [13].

In the present case, URI might play an insignificant role in causing the croup since the infant exceeded the recommended two weeks span and was clinically accepted on preoperative examination. However, subclinical upper respiratory infection, more irritating secretions and abnormally small tracheal diameter to his age might have precipitated postextubation croup in our patient. After intubation, there was leak around the tube. After changing the tube to 4.5, which was slightly tight fitting causing irritation and lateral pressure to tracheal wall, causing further narrowing of tracheal lumen. The therapy of this condition consists of humidified oxygen, steroids, and racemic epinephrine [14,15]. If the obstruction is very serious, reintubation or even tracheotomy and ventilation is required [14,15].

In children with moderate-to-severe croup, treatment with nebulized epinephrine was found to significantly decrease the number of children requiring intubation or tracheotomy [8,16]. In a previous study, it was reported that the nebulization of 2.25% racemic epinephrine was associated with a significant decrease in the croup severity score [8]. Thereafter, a further study showed that nebulized L-epinephrine at a ratio of 1:1000 (1 mg/mL) was as effective as racemic epinephrine in resolving the croup [7]. Epinephrine reduces respiratory distress within 10 min of administration and lasts from 90-120 minutes [11]. It causes vasoconstriction in the boggy subglottic area, thereby increasing the diameter of the airway [7]. In the current case, while epinephrine was given at a lower dose than the recommended one, the infant responded considerably. At the same time, the infant did not require reintubation or tracheotomy. Epinephrine treatment is usually associated with mild side effects including tachycardia, pallor, and increase in blood pressure [7]. However, in a case report of a previously healthy child with severe croup developed ventricular tachycardia and myocardial infarction after treatment with repeated nebulization of epinephrine [17]. Therefore, it might be wise to administer the lowest effective dose of epinephrine to treat patients with croup so as to prevent the rarely recorded severe complications that may arise with higher doses, especially when given in repeated doses and patients with cardiovascular diseases. In a previous letter about case series of emergency croup management in children, they found that nebulized 1:4000 epinephrine might be as effective as nebulized 1:1000 epinephrine in the treatment of severe croup [18]. According to the present case report, this view is supported. However, multicenter randomized studies on children with moderate to severe croup may be performed to evaluate the efficacy of lower doses of epinephrine in the treatment of croup.

Corticosteroid therapy is now routinely recommended by most

clinicians. Evidence of corticosteroids efficacy for the treatment of croup in children is now clear [19]. Children with severe croup and impending respiratory failure who are treated with corticosteroids have a significant reduction in the rate of intubation or duration of ventilation [20,21]. In moderate-to-severe croup patients who are treated with corticosteroids, an average 12-h reduction in the length of stay in the hospital, and a 10% reduction in the absolute proportion treated with nebulized epinephrine [22]. Trials of corticosteroids in croup have involved a variety of drugs, dosages, and routes of administration [14,15,19,23-26]. In the present case, dexamethasone 0.6 mg/kg was given intravenously as advised in the literature [12,14,15] and it was effective when combined with low dose nebulized epinephrine. In agreement of this combination, early treatment with nebulized L-epinephrine and intramuscular dexamethasone or nebulized budesonide in patients with moderate to severe croup, croup scores improved rapidly and hospitalization rates were low [27].

The highest incidence of croup in relation to age occurred in the 1 to 4 year age group, then incidence decrease with age [5]. This is might be attributed to the narrower laryngeal lumen and more sensitive tissues of younger children. It is now a standard practice to choose an endotracheal tube that allows a leak when tested with 20-25 cm H<sub>2</sub>O pressure [28,29]. Edema may rebound after treatment with racemic epinephrine so patient must be checked after one hour and overnight admission must be considered in outpatients [7,14,15].

In conclusion, low dose nebulized epinephrine and single dose intravenous dexamethasone improved postintubation croup in a 10 month old infant with DS. Further studies are required evaluate the efficacy of this combination to manage this postoperative ventilatory complication in Down syndrome.

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