An Analysis of Children with Tracheomalacia Treated With Ipratropium Bromide (Atrovent)

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INTRODUCTION
Tracheomalacia is weakness of the tracheal cartilage causing collapse of the anterior tracheal wall. Tracheomalacia is the most common congenital tracheal anomaly.1 The incidence of tracheomalacia is estimated to be 1 in 1500-2000 children.2,3

Tracheomalacia symptoms include cough, wheeze, recurrent lower airway infections, exercise intolerance, and respiratory insufficiency.4 The majority of children outgrow tracheomalacia by 2 years of age, but a significant proportion go undiagnosed for years and fail to outgrow their symptoms entirely.5

Anecdotal experience in our clinic of children with tracheomalacia taking ipratropium bromide (Atrovent, Boehringer Ingelheim Pharmaceuticals, Germany) revealed improvement in symptoms. The purpose of this report is to describe the symptoms and operative findings in children diagnosed with tracheomalacia and treated with ipratropium.

METHODS AND MATERIALS
This review received institutional review board approval. The study cohort included all children under the age of 18 who were diagnosed with tracheomalacia via rigid and flexible bronchoscopy and treated with ipratropium bromide between 2005 and 2009.

Bronchoscopy Evaluation
Rigid laryngoscopy/tracheoscopy was carried out using a 4mm rigid endoscope while flexible bronchoscopy was done through an LMA. Appropriate photos and videos were taken and stored during each individual endoscopy.

Tracheomalacia was defined as mild, moderate, and severe. Mild malacia was defined as less than 50 percent anterior tracheal wall collapse while moderate malacia was greater than 50 percent collapse. Severe malacia was defined as the anterior wall collapsing onto the posterior membranous segment of the trachea. The severity was determined by the attending pulmonologist and otolaryngologist at the time of the procedure.

Ipratropium bromide (Atrovent) is an anti-cholinergic most commonly used to treat asthma in children. Children in our clinic are administered ipratropium either via nebulization or inhaler depending upon their age. Children under the age of 2 are given 125-250mcg nebulization treatment three times a day while children over the age of 2 are given 250-500mcg three times per day. Children under the age of 12 who can use a metered dose inhaler with spacer take 1 puff (17mcg per actuation) three times a day; those over 12 take 2 puffs three times a day. Each child underwent at least a 6 month trial of therapy prior to assessing effectiveness.

RESULTS
A retrospective chart review identified 52 children who had been diagnosed with tracheomalacia and treated with ipratropium. There were 22 girls and 30 boys. The average age was 4.2 years (range 6 months to 13 years.) The most common presenting symptom was cough (28), followed by recurrent croup (19), and stridor (4). Of those children with pre-existing diagnoses the most common were extra-esophageal reflux disease (16), asthma refractory to standard treatment (14), and recurrent croup (3).

Mild tracheomalacia was diagnosed in 34 (65.3%) children while moderate tracheomalacia was seen in 18 (34.7%). 28 out of 52 children had BAL fluid examined. In 17 children at least one pathogen was cultured. The most common pathogen was Moraxella catarrhalis (41%) followed by Streptococcus pneumoniae (18%). In 24 children lumen macophage index (LLMI) was determined in the BAL fluid. Mean LLMI was 26.5 (range 0-120).

Overall 32 (61.5%) children had improvement in their symptoms following treatment with ipratropium bromide. There was no association with improvement in regards to BAL culture or LLMI.

CONCLUSIONS
Our preliminary review of children with mild to moderate tracheomalacia shows modest results in symptom resolution in children with mild to moderate tracheomalacia. Further controlled studies will be necessary to determine the true effectiveness of ipratropium. Children with continuing refractory asthma and airway symptoms attributed to extra-esophageal reflux that are not improving with a medical regimen should be evaluated in a multi-disciplinary manner for tracheomalacia.

REFERENCES