

# Role of Microlaryngobronchoscopy in Pediatric Airway Obstruction

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## ABSTRACT

**Introduction:** Respiratory distress due to airway obstruction is a common emergency seen in children. The aim of this study was to study the clinical profile of airway obstruction in pediatric age group and to identify the site and cause of obstruction using microlaryngobronchoscopy.

**Material and methods:** A prospective hospital based study was carried out on 60 patients under 18 years of age presenting with signs and symptoms of airway obstruction. Microlaryngobronchoscopy under general anesthesia was carried out in all the cases.

**Results:** Maximum number of patients were between 1-3 years of age (46.67%). Foreign body bronchus was found to be the most common cause of airway obstruction (41.67%) followed by laryngomalacia (28.33%) and bilateral abductor palsy 8.33%.

**Conclusion:** In our study, foreign body bronchus was the most common cause of airway obstruction in pediatric age group. Microlaryngobronchoscopy is the current gold standard for diagnosis in airway obstruction. In our study it proved to be not only a diagnostic tool but also a therapeutic modality.

**Keywords:** Airway, Emergency, Microlaryngobronchoscopy, Pediatric, Respiratory Distress

## INTRODUCTION

Respiratory distress due to airway obstruction is a common emergency in pediatric age group. It can occur due to congenital or acquired causes.<sup>1</sup> Congenital causes are more commonly seen in children less than one year of age. These include laryngomalacia, congenital laryngeal webs, cysts, vocal cord palsy. Acquired causes include laryngeal and tracheal stenosis, foreign bodies in airways, vocal cord palsy. Lower respiratory reserve and collapsible laryngeal cartilages make children more susceptible to airway obstruction. The airway is narrower, so even a small decrease in diameter leads to a four fold increase in resistance (Poiseuille's law).<sup>1</sup> Stridor is the most common symptom in such cases. Depending on the site of obstruction, stridor may be inspiratory (pharynx or supraglottic), biphasic (glottis and infraglottic) or expiratory (trachea and lower airways).<sup>2</sup> Various airway pathologies can present with stridor, but the prognosis and management can be markedly different depending on the cause.

A thorough history regarding onset and progression of symptoms should be taken. Clinical examination includes looking for stridor and chest retractions to assess the degree of respiratory distress. Voice quality may indicate the anatomical region of the pathology. Radiological investigations including soft tissue airway films of neck and chest in both lateral and anterior/ posterior projections help in looking for enlarged adenoids, size and shape of

epiglottis, retropharyngeal area, anatomy of subglottis, radio opaque foreign bodies and any underlying lung pathology.<sup>3</sup> Endoscopic examination of airway should be carried out to identify the site and cause of obstruction.<sup>4</sup> Flexible nasopharyngolaryngoscopy does not require general anesthesia and allows the examination of anatomy of airway and laryngeal dynamics as well. The disadvantages of this technique include lack of co operation by the child and its inability to diagnose synchronous airway lesions.<sup>1</sup> Microlaryngobronchoscopy under general anesthesia on the other hand is a much more controlled technique and allows a detailed examination of the airway.<sup>3</sup> Under spontaneous ventilation, laryngeal dynamics can be visualised and it also helps in diagnosing synchronous airway lesions. The main aim of this study was to study the clinical profile of airway obstruction in pediatric age group in our tertiary care set up and to identify the cause and site of airway obstruction with the help of microlaryngobronchoscopy under general anesthesia. This was further helpful in planning the definitive management of these patients.

## MATERIAL AND METHODS

An approval was taken from the ethical committee of the institute for this study. Informed consent for inclusion in this study was taken from the parents of all children. A cross sectional hospital based study was carried out on 60 children of the age group 18 years and below presenting to our institution over a time period of one and a half years with signs and symptoms of airway obstruction. Children with airway obstruction due to involvement of nose and nasopharynx for example bilateral choanal atresia, adenoid hypertrophy etc and children with extrapulmonary cause of airway compromise for example pneumothorax, pleural effusion were excluded

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from the study. A detailed clinical history regarding the onset and progression of symptoms was taken by the parents. A thorough examination was done to look for the presence of stridor and to evaluate the degree of respiratory distress. Radiological investigations including X-Ray soft tissue neck and chest were carried out in both anterior/posterior and lateral projections. Microlaryngobronchoscopy under general anesthesia was carried out in all the cases. An informed consent was taken from the parents for carrying out this procedure. The child was kept nil per oral for six hours prior to the procedure. After induction, the child was ventilated down to the level of anesthesia that allowed rigid endoscope to be passed maintaining spontaneous ventilation thereby allowing the examination of vocal cord mobility and the collapse of laryngeal structures, if any. A 0° telescope was then introduced and the vocal cords, subglottis and trachea were visualised upto the level of the carina. Distal airways were visualised using ventilating bronchoscope. CT-Scan (neck) was carried out in cases of subglottic stenosis. The findings of microlaryngobronchoscopy were recorded using AIDA (Advanced Interface Database Application) for future reference.

### STATISTICAL ANALYSIS

The data was analysed in the form of mean, median, percentages and statistical averages. For determining the level of significance, Mantel Haenszel Chi square test was applied. These statistical tests were analysed with IBM SPSS version 19.0.

### RESULTS

60 children presenting with signs and symptoms of airway obstruction underwent microlaryngobronchoscopy under general anesthesia. Out of these 37 patients (61.67%) were males and 23 patients were females constituting 38.33% of the total. Maximum number of children were between 1-3 years of age (46.67%) followed by less than one year of age (35%) and 3-5 years of age including 8.33% of the total. The mean age group of patients was 1.90. These children presented with varying degrees of respiratory distress. The distress was classified on the basis of clinical grading as described in Table 1<sup>5</sup>

26 patients (43.33%) presented with Grade I respiratory distress and 20 patients presented with grade 2 respiratory distress. Grade 3 distress was seen in 13 patients (21.67%). Microlaryngobronchoscopy (MLB) under general anesthesia was carried out in all the cases. The main indication for carrying out MLB was stridor seen in 55 patients (91.67%). Four tracheostomised patients underwent MLB because of difficult decannulation and suspected upper airway obstruction. One patient underwent MLB due to weak cry. (Table -2)

The most common cause of airway obstruction in our study was found to be foreign body lodged in bronchus seen in 25 patients constituting 41.67% of the total, peanut being the most common foreign body aspirated seen in 18 patients followed by whistle seen in 2 patients and cashewnut, nutbolt,

Grade I	-Noisy breathing with mild to moderate dyspnoea and chest retractions -No anxiety or restlessness -Normal intake of food and drink -Interest in playing
Grade II	-Noisy breathing with severe dyspnoea and chest retractions -Anxiety and restlessness -Refusal of food and drink -No interest in playing
Grade III	-Exhausted child with severe dyspnoea and inter-costal muscle retractions -Slowing down of RR and HR -Ash-grey color and perspiration - Spells of somnolence

**Table-1:** In clinical practice, respiratory distress can be graded as above<sup>5</sup>

Indication	Number of patients	Percentage
Stridor	55	91.67%
Difficult Decannulation	4	6.66%
Weak Cry	1	1.67%

**Table-2:** Indications for microlaryngobronchoscopy

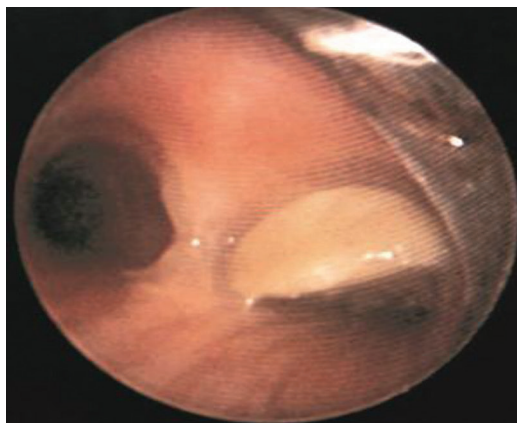
Findings	Number of patients	Percentage
Foreign Body Bronchus	25	41.67%
Laryngomalacia	17	28.33%
Bilateral abductor palsy	5	8.33%
Multiple Laryngeal Papillomatosis	3	5.00%
Subglottic stenosis	2	3.33%
Contact Granuloma	2	3.33%
Suprastomal mucosal tag	2	3.33%
Vallecular Cyst	1	1.67%
Anterior Laryngeal Web	1	1.67%
Posterior Glottic Web	1	1.67%
Acute Laryngotracheobronchitis	1	1.67%

**Table-3:** Microlaryngobronchoscopy findings

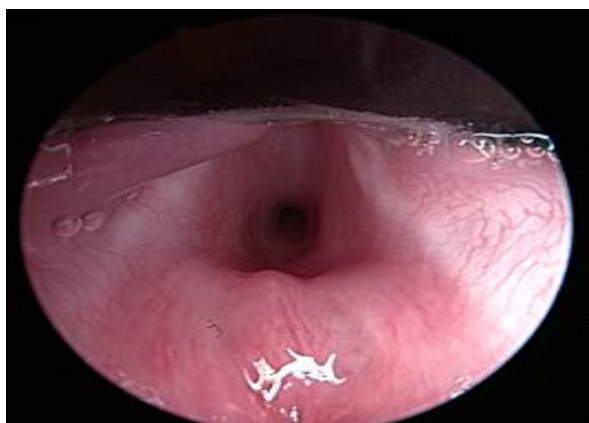
Co-Morbidities	Number of Patients	Percentage
Pneumonia	6	10.00%
Bronchopneumonia	3	5.00%
Meningoencephalitis	2	3.33%
Bronchiolitis	1	1.67%
Patent ductus arteriosus	1	1.67%
Recurrent Bronchopneumonia	1	1.67%
None	46	76.67%

**Table-4:** Presence of Co-morbidities

hook, lipstick cover and popcorn seen in 1 case each. This was followed by laryngomalacia seen in 17 patients. The MLB findings have been summarised in Table 3. Still images of some of the findings have also been shown (Figure 1, Figure 2). Congenital causes of airway obstruction were seen in 22 patients constituting 33% of the total while acquired causes



**Figure-1:** Foreign body (peanut) lodged in the right main bronchus



**Figure-2:** Subglottic Stenosis

were seen in 38 patients. Out of the 60 patients included in the study, 7 patients had a prior history of intubation. All these patients were tracheostomised in view of prolonged intubation. Later on out of these 7 tracheostomised patients, 3 underwent decannulation while the other 4 patients had a difficult decannulation and hence underwent MLB to look for the underlying cause. Two patients were found to have suprastomal mucosal collapse and 1 patient had a postintubation granuloma in the interarytenoid area.

Twenty patients in our study were low birth weight (birth weight less than 2.5 kgs) while the other 40 patients had birth weight appropriate for gestational age (birth weight between 2.5 to 4 kgs). It was observed that out of 17 patients diagnosed with laryngomalacia, 10 patients had low birth weight. This association was found to be statistically significant with a *P*-value of 0.008 (<0.05).

A number of co morbidities were also found in these patients. These co morbidities have been summarised in the Table 4.

## DISCUSSION

Out of the 60 patients included in our study, 37 were males and 23 patients were females. This finding is consistent with other studies which have consistently shown male children having airway obstruction outnumbering females with similar problems.<sup>6-8</sup> It has been postulated in certain studies that there may be some anatomical, immunological and cellular vulnerabilities which may predispose a male child to have airway obstruction as compared to females.<sup>7</sup>

Maximum number of children were between 1-3 years of age contributing to 46.67% of the total followed by less than one year of age constituting 35% of the total patients. The main indication of carrying out MLB was stridor seen in 55 patients (91.67%) followed by difficult decannulation seen in 4 patients and post extubation weak cry in 1 patient. The most common cause of airway obstruction was foreign body bronchus seen in 25 patients. The maximum number of children with foreign body aspiration were below 3 years of age. This finding is consistent with the other studies and standard texts also mention that the peak incidence of foreign body aspiration is between 1-3 years of age.<sup>9,10</sup> Peanut was the most common foreign body seen in 18 patients followed by whistle seen in 2 patients. The foreign body was most commonly seen to be lodged in the right main bronchus (22 cases) which is wider, shorter and more vertical as compared to left main stem bronchus.<sup>9,10</sup> All foreign bodies were successfully removed using telescopic guidance. Laryngomalacia was the second most common MLB finding followed by bilateral abductor palsy. Acquired causes of airway obstruction were found to be more common as compared to congenital causes.

Laryngomalacia was found to have a statistically significant association with low birth weight with a *p* value of 0.008. A similar correlation has also been found in a previous study by Lis et al between laryngomalacia and weight deficit.<sup>11</sup>

With the recent advancement in technology, there has been an increase in the number of children surviving in the neonatal intensive care unit, thereby increasing the incidence of airway injuries because of increase in number of attempts of intubation, increased cuff pressure, inadequate diameter of tube, prolonged intubation and excessive tube movement.<sup>1</sup> In our study, problems related to prolonged intubation and airway injuries were also found which included suprastomal mucosal tag seen in 2 patients and granuloma in the interarytenoid area seen in 1 patient. Using microlaryngobronchoscopy, the granuloma and mucosal tags were removed and the children were successfully decannulated later.

A number of associated co-morbidities were also seen in our study. These included pulmonary, neurological and cardiac co-morbidities, pneumonia being the most common co-morbidity seen in 6 cases.

Microlaryngobronchoscopy under general anesthesia is the current gold standard for the diagnosis in cases of suspected airway obstruction in children.<sup>3</sup> In our experience, it was found to be a safe and effective procedure in expert hands. It could be carried out safely even in infants and neonates. No major complications were observed during this procedure in our study. Under spontaneous ventilation, assessment of laryngeal dynamics was possible in most of the cases. Simultaneous therapeutic intervention was also possible in most of the cases as the patient was under anesthesia. Management of rest of the cases was planned according to the MLB findings. Video recordings and still images were kept in all the cases for maintaining record and for future reference. Visual images helped in proper understanding

as a part of undergraduate and post graduate teaching as well. Parents of the patients were also motivated regarding definitive management after they were shown the video recording.

## CONCLUSION

Airway obstruction in children is an emergency condition. A prompt medical attention and stabilisation of the airway is important in all such cases. An endoscopic examination should be carried out to identify the site and cause of obstruction and to prevent further deterioration in the condition of the patient. Any patient presenting with signs and symptoms of airway obstruction should therefore be stabilised first and then referred to a centre where the facilities for airway endoscopy and further management are readily available. Microlaryngobronchoscopy under general anesthesia is the current gold standard for the diagnosis of the cause of airway obstruction.<sup>3</sup> It has an advantage over flexible fiberoptic bronchoscopy in being a much more controlled technique and also it can easily diagnose secondary airway lesions. In our study it did not only prove to be a diagnostic tool, but also proved to be of therapeutic importance in most of the cases. On reviewing the literature, in many of the previous studies, laryngomalacia was reported as the commonest cause of airway obstruction.<sup>2,6,10,12,13,14,15</sup> More recently there has been an increased incidence of airway obstruction secondary to airway injuries occurring during intubation. The main aim of our study was to find the recent trend of clinical profile of airway obstruction in our tertiary care centre with the help of microlaryngobronchoscopy under general anesthesia. Foreign body bronchus was found to be the most common cause followed by laryngomalacia. Based on the site and cause of obstruction as determined by MLB, further definitive management was planned in all the cases.

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