

Rigid Bronchoscopy as a Diagnostic and Therapeutic Modality

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Abstract :

Tracheobronchial foreign body is more common in children when compared to adults. Diagnosis requires high index of suspicion based on history, clinical examination and chest radiography. Rigid bronchoscopy is the gold standard for removal of tracheobronchial foreign body. This retrospective study is aimed at reporting the incidence, most sensitive clinical and X ray findings for diagnosis, and the importance of bronchoscopy not only as a therapeutic tool but also as a diagnostic method for other conditions of larynx and tracheobronchial tree.

Key words : Foreign body, aspiration, bronchoscopy, respiratory distress

Introduction :

Tracheobronchial foreign body aspiration is a common cause of respiratory emergency, mainly in pediatric age group¹⁻⁴. When parents do not recall a history of acute choking/coughing or witnessed aspiration episode, diagnosis may be missed or delayed. Symptoms and signs depend on nature of foreign body, its size, location and time since lodgement in the tracheobronchial tree³⁻⁵. Early diagnosis and treatment are needed to prevent serious complications like acute respiratory distress, chronic and recurrent pneumonia, airway obstruction, atelectasis and pulmonary abscess⁶. Rigid bronchoscopy remains the gold standard for diagnosis as well as removal of foreign body from the tracheobronchial tree under direct vision⁷⁻⁹.

Materials And Methods :

All patients who were subjected to bronchoscopy from department of Otolaryngology in our hospital between November 1st 2011 and October 31st 2014 were studied retrospectively. Case records were reviewed with respect to the clinical presentation, duration of symptoms, clinical signs, imaging findings, complications, diagnosis and treatment of tracheobronchial foreign body. All patients were admitted in intensive care unit. Vitals including oxygen saturation were monitored. Oxygen by mask was given for those with respiratory distress. All patients were kept nil per oral for 6 hours before procedure. High risk informed written consent was taken from patient attenders. Nebulisation with

bronchodilators and hydrocortisone injection according to weight was given for all patients just before procedure. Bronchoscopy was done with rigid bronchoscopes under general anaesthesia using jet ventilation. Patients were kept under observation in intensive care unit for one day post foreign body extraction and discharged on 3rd post operative day after taking a repeat chest X-ray in foreign body positive cases.

Results :

A total of 59 patients underwent bronchoscopy during the study period, out of which 36 patients (61%) were males and 23 (39%) were females. 46 patients (78%) were less than 3 years of age. Youngest patient was 6 months old and eldest was of 28 years, though maximum numbers of patients were between 1-2 years of age. Foreign body was identified in tracheobronchial tree in 46 patients (78%), out of which 3(5%) were in the trachea, 27(45.8%) in right main bronchus, 15(25.4%) in left main bronchus and 1 in both bronchus. 13 cases were negative for foreign body.

Out of the foreign body positive cases, 16 cases presented to hospital on day 1(35.6%), 7 cases in the 1st week, 11 cases between 1 week and 1 month, 9 cases after 1 month. History of foreign body aspiration was present for 15 cases. No such history was given by parents for 31 cases. Cough was the most common symptom in 41 patients followed by difficulty in breathing in 31 patients and fever in 17 patients. 4 patients had noisy breathing at the time of presentation. Out of the 3 cases with tracheal foreign body, 2 patients presented on same day with severe respiratory distress, 1 patient presented on day 4 with cough and difficulty in breathing.

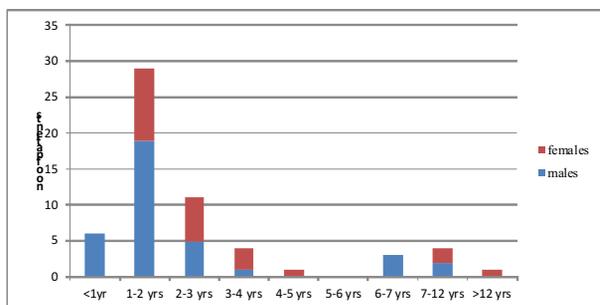
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Graph 1: Distribution of study participants based on age and sex.



Graph 2: Showing difference between tracheal and bronchial foreign body based on onset of symptoms

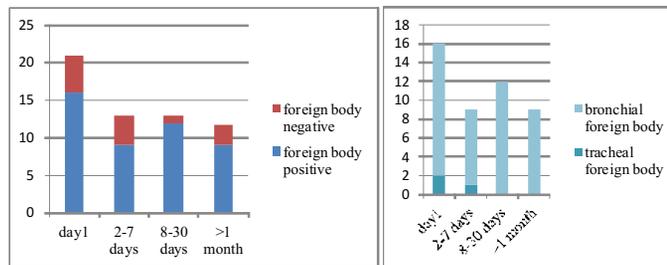


Table 1: showing the distribution of study participants based on symptoms

Symptoms	Foreign body positive cases			Foreign body negative cases	total
	tracheal	bronchial	total		
cough	2	28	30	11	41
breathlessness	3	20	23	8	31
fever	0	12	12	5	17

Table 2: showing distribution of study participants based on added sounds.

Other signs	Foreign body positive cases			Foreign body negative cases	Total
	tracheal	bronchial	total		
Stridor	0	2	2	2	4
Bilateral rhonchi					
Unilateral rhonchi ipsilateral	3	3	6	4	10
contralateral	0	4	5	1	6
crepitations	0	1	2	0	2

On examination, most common sign was decreased unilateral air entry in the chest found in 45 patients, out of which 40 patients (93.02%) were found to have ipsilateral bronchial foreign body. 3 cases of bronchial foreign body showed bilateral normal and equal air entry. Out of 3 cases of tracheal foreign body, 2 cases showed

bilateral reduced air entry and 1 had unilateral air entry decreased. Stridor was present for 2 cases of bronchial foreign body. No stridor was present for any tracheal foreign body cases. For 2 foreign body negative cases also stridor was present.

Table 3: showing distribution of patients with chest Auscultatory findings

Signs	Foreign body positive cases			Foreign body negative cases	Total
	tracheal	bronchial	total		
Bilateral normal & equal air entry	0	3	3	9	12
Unilateral/ipsilateral decreased air entry	1	40	41	4	45
Bilateral decreased air entry	2	0	2	0	2

Ipsilateral hyperinflation of the lung was the most common chest X ray finding in cases of bronchial foreign body (39.53%), followed by ipsilateral collapse (16.28%). Normal chest X ray was found in 7 cases of bronchial foreign body. Cases of tracheal foreign body were diagnosed clinically and taken up for bronchoscopy

directly without X ray due to severe respiratory distress. Out of 13 cases where bronchoscopy did not reveal any foreign body, 9 cases had a normal chest X ray, only 1 case had unilateral hyperinflation. This shows that unilateral hyperinflated lung is a sensitive parameter in diagnosing foreign body tracheobronchial tree.

Table 4 : showing distribution of patients with X ray findings

X ray finding		Foreign body positive cases			Foreign body negative cases	Total
		tracheal	bronchial	total		
normal		0	7	7	9	16
Unilateral hyperinflation	ipsilateral	0	17	20	1	21
	contralateral		3			
Unilateral/ipsilateral collapse		0	7	7	0	7
Unilateral / ipsilateral haziness		0	2	2	2	4
Increased bronchovascular markings		0	1	1	0	1
Unilateral hyperlucency		0	0	0	0	0
Bilateral hyperlucency		0	0	0	1	1
X ray not done/unavailable		3	6	6	-	9

Site of foreign body

Out of the 46 positive foreign body cases, majority were found in the right bronchus (58.69%) followed by left bronchus (32.6%). Tracheal foreign body was found in 6.5% of cases.

Table 5 : showing foreign body site.

Foreign body positive	46
Tracheal	3
Bronchi	43
-right	27
-left	15
-both	1

In most of the cases, vegetable foreign body was recovered. Only 2 patients had aspirated non vegetable matter. Nuts were found to be the most common foreign body (36.96%), ground nut being most common. 2nd most common was areca nut (26.09%). Out of the non vegetable foreign bodies, 1 was bead and the other was

tablet. Out of the foreign body negative cases, there were no relevant findings for 6 cases. There was slough suggestive of infection and inflammation of tracheobronchial tree (tracheobronchitis) in 5 cases, bronchial polyp in 1 case, and bilateral vocal cord palsy in 1 case.

Table 6 : Showing nature of foreign body

Type of foreign body	No.
Vegetable matter	44
garlic	1
nuts	17
seeds	8
arecanut	12
Coconut chunk	1
others	5
Non vegetable matter	2

Table 7: Showing participants with foreign body negative cases

Findings on bronchoscopy	No.
No relevant findings	6
Evidence of inflammation/ infection	5
Bronchial polyp	1
Bilateral vocal cord palsy	1

There were no complications from the procedures and in those with foreign body in tracheobronchial tree, symptoms resolved following foreign body removal.

Discussion :

According to our study, incidence of foreign body aspiration was higher in children compared to adults. The highest risk age group was found to be the first 3 years of life constituting 78.26% out of all aspirated cases. This was similar to other studies carried out showing high incidence among the above mentioned age group^{5,10-13}. Male to female ratio was 1.55. This was similar to various studies showing male propensity¹¹⁻¹⁴. A positive history of witnessed foreign body aspiration/ a sudden onset of cough and breathlessness while taking food are important clues to diagnosis. Cough was found to be the most common symptom as in other similar studies followed by breathlessness¹⁵⁻¹⁷. In our study, 9 patients (19.57%) presented after 1 month history of cough. So a case of chronic cough/recurrent cough in the high risk age group for aspiration not responding to medication should always be evaluated by diagnostic bronchoscopy. In our study, ipsilateral decreased air entry was found to be the most common sign (93.02%) in bronchial foreign body which was higher to that mentioned in other studies by McGuirt *et al*¹⁷ & Tomaske *et al*¹⁸. Stridor was found to be a less specific clinical sign, according to our study since it was present for 15.38% of foreign body negative cases as opposed to 4.65% of foreign body positive cases. Out of the 3 tracheal foreign body cases, 2 cases presented on same day with severe respiratory distress, bilateral decreased air entry and wide spread rhonchi. 3rd case presented on 4th day with unilateral decreased air entry and rhonchi with less severe distress.

Chest X rays are frequently used in assessment of patients with respiratory complaints. Diagnosis would be more obvious in patients with radio opaque foreign body. In those with radioluscent foreign body, diagnosis is based on effects caused by foreign body impaction and degree of obstruction caused by the same. Partial obstruction in bronchus causes 'valvular obstruction' allowing air into the lungs during inspiration but traps air in the lungs due to expiratory obstruction. This gives rise to emphysema. Complete bronchial obstruction causes collapse of lung. Ipsilateral hyperinflation was the most common positive finding in X ray in those with bronchial foreign body (39.53%), followed by ipsilateral collapse (16.27%). But normal chest radiograph was found in 7 patients with bronchial foreign body (16.28%) which can be attributed to early presentation to hospital. 67.44 % patients with bronchial foreign body had some or the other finding suggestive of localized pathology compared to 23.08 % of those without any foreign body. This shows that chest radiography is a sensitive but less specific investigation to diagnose foreign body

tracheobronchial tree and this opinion is similar with other studies^{9,17-21}.

Right main bronchus was found to be the most common site of foreign body impaction according to our study which is similar to the observation by Mc Guirt *et al*¹⁷, Falase *et al*⁶ and Gang *et al*²². The higher incidence in right main bronchus is because it is more wide and more in line with the trachea. Among the types of foreign bodies, organic materials had higher incidence when compared to inorganic materials in our study and Similar findings were reported in other studies^{15,16}. Food products, especially nuts were found to be the most commonly aspirated foreign body. This may be due to poor chewing ability and immaturity of deglutition mechanism in children and the unawareness among parents regarding the danger of feeding nuts to children.

Among foreign body negative cases, 6 cases had oedematous inflamed mucosa with thick mucopurulent discharge found in the tracheobronchial tree (1 patient had in trachea, 4 in both bronchi, and 1 in left bronchus). Secretions were suctioned out and sent for culture and sensitivity. Antibiotics were started according to the reports and patients responded well to sensitive antibiotics. Among 2 cases with stridor, 1 showed subglottic oedema with bilateral vocal cord palsy and the other revealed supraglottic oedema.

Complications of foreign body include asphyxiation, post-obstructive pneumonia, haemoptysis, foreign body granuloma, bronchiectasis, atelectasis and rupture of emphysematous bullae resulting in pneumothorax^{16,17,23,24}.

Rigid bronchoscopy has been the gold standard for removal of tracheobronchial foreign body for many years. Rigid bronchoscope has the advantage of a large working channel, which allows the use of a wide variety of instruments. Good airway is the other main advantage of rigid bronchoscopy, ensuring a rapid and safe foreign body extraction. But disadvantage is that rigid bronchoscopy requires general anaesthesia which may be risky for some patients. Main complications associated with bronchoscopy are hypoxemia, haemorrhage and pneumothorax^{9,24,25}. Efforts to retrieve foreign body should be well co-ordinated and require close co-operation between the surgical and anaesthetic teams²⁶. No complication was observed in any of our patients.

Conclusion :

Tracheobronchial foreign body should be in the differential diagnosis of patients especially children presenting with cough or breathlessness which is of sudden onset or recurrent or persisting inspite of treatment. Thorough clinical examination and chest

radiography are helpful in diagnosis in most cases. In all suspected cases a bronchoscopy should be performed which serves to be useful not only in a therapeutic way but also as a diagnostic tool for other conditions of tracheobronchial tree and helps in specific treatment according to the same. Rigid bronchoscopy is considered as the gold standard for removal of tracheobronchial foreign body.

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