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## An Otolaryngologist's Perspective of Managing Byzantine Tracheo-Bronchial Foreign Bodies Using Rigid Bronchoscopy

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### Abstract

**Introduction:** Foreign bodies account to about 0.2% to 0.33% of the indications for all the bronchoscopies performed in the west. Foreign bodies in the laryngotracheal tree have several dire complications ranging from aspiration, causing stridor, pulmonary atelectasis, lobe collapse, to development of infection in the form of pneumonia, recurrent cough. Sometimes sharp FBs lodged for a long duration may develop granulation tissue and adhesions all around them and making it difficult to remove them. The risks of haemorrhage, dislodgement elsewhere or fragmentation, can also occur during the course of removal of the foreign body. In spite of newer modalities, it is still seen that in cases of trachea-bronchial foreign bodies, owing to their wide spectrum of presentations and difficulty in manipulation, conventional rigid bronchoscopy is a reliable and safe method in their retrieval.

**Aims and Objectives** The study was done to analyse in detail the ordeals faced while diagnosing as well as while performing rigid bronchoscopy for retrieval of challenging tracheo-bronchial foreign bodies

**Materials And Methodology:** An observational study was done on all challenging tracheo-bronchial foreign bodies presenting to us at our tertiary care centre during a course of 2 years, in patients, encompassing all age groups and this data was analysed.

**Conclusion:** we conclude by reiterating the need for always ruling out tracheo-bronchial foreign bodies as a foreseeable cause among cases of respiratory distress. Rigid bronchoscopy is the treatment of choice, especially in the paediatric patients, due to the advantages such as ease of instrumentation, adequate ventilation and visualization during the surgery. Retained or missed foreign bodies can cause grave consequences and their diagnosis along with immediate removal is crucial.

**Keywords:** Tracheobronchial Foreign Bodies; Rigid Bronchoscopy; Challenges in Foreign Bodies; Otorhinolaryngology; Missed Tracheobronchial Foreign Bodies.

### Introduction

Foreign bodies account to about 0.2% to 0.33% of the indications for all the bronchoscopies performed in the west. The presence of a foreign body in the respiratory tract constitutes a direct cause of approximately 3,000 deaths a year, while in the group of children up to 3 years of age, it accounts for 7% of sudden deaths, this higher rate of morbidity and mortality is accounted to the missed or delayed presentations.<sup>1</sup> Foreign bodies in the laryngotracheal tree have several dire complications ranging from aspiration, causing stridor, pulmonary atelectasis, lobe collapse, to development of infection in the form of pneumonia, recurrent cough.

Certain organic and vegetative foreign bodies aren't radio-opaque and pose the risk of being missed, not only at diagnosis but also due to lack of knowledge of their location their retrieval becomes a herculean task, or can also lead to missed foreign bodies Sometimes sharp FBs lodged for a long duration may develop granulation tissue and adhesions all around them and making it difficult to both identify and remove them. Rigid bronchoscopy has been a time-tested method for their removal.<sup>2</sup>

The risks of haemorrhage, dislodgement elsewhere or fragmentation, can also occur during

the course of removal of the foreign body<sup>3</sup>. During extraction of the foreign body different instruments such as alligator forceps and baskets are needed and they can be passed through a rigid bronchoscope with ease making rigid bronchoscopy a safe and ideal method for removal of laryngotracheal foreign bodies as well as helping in providing good visualization<sup>4</sup>. In paediatric age group the rigid bronchoscopy is the gold standard for diagnosis as well as for management.<sup>5&6</sup>

There are now several advances in bronchoscopy in the form of electromagnetic navigation bronchoscopy, that use CT scans to reconstruct the tracheobronchial tree and give a three-dimensional view, providing a virtual map as the scope is passed, to assist the surgeon in excision of growths, biopsies or even retrieval of foreign bodies with limited tissue damage and more visibility.<sup>7</sup> The use of therapeutic bronchoscopy was begun to manage central airway obstruction and to that end other than a wide variety of instruments, forceps and baskets even radio frequency ablaters, microdebriders have been introduced to remove growths and foreign bodies causing this. There are different types of intra-bronchial valves that allow passage of air and secretions past the occluded site, giving time to operate and ensuring distal ventilation such as the Pulmonx<sup>®</sup> valve, Spiration<sup>®</sup> valve and newer Miyazawa<sup>®</sup> valve.<sup>8</sup>

Here we present a series of byzantine cases of tracheobronchial foreign bodies presenting in patients ranging across all age groups and the challenges encountered in their management.

### **Aim and Objective**

The study was done to analyse in detail the ordeals faced while diagnosing as well as while performing rigid bronchoscopy for retrieval of challenging tracheo-bronchial foreign bodies

### **Materials and Methodology**

An observational study was conducted at our tertiary care centre, included 14 challenging cases of tracheobronchial foreign bodies, among a total of 42 cases that presented to us in the period between April 2020 up to March 2022. The "byzantine" aspects with regard to their presentation, diagnosis and management were noted and compared, following which this data was analysed and interpreted as follows.

### **Results**

During the study period, we had a total of 42 cases of tracheobronchial foreign bodies among which we came across 14 challenging cases. Further among these 53% were paediatric cases, 33.33% were adults, 12.34 % were adults with psychiatric illness in the form of delirium or mental retardation. Five of them were certain unusual inorganic materials like one stone, one case of a tooth, 3 others were plastic and metallic objects and the remaining nine cases were organic foreign bodies such as case of a chikoo seed, cases of betel nuts, bones and one missed foreign body which was a tooth. We found organic foreign bodies such as nuts and bones common in adults, meanwhile inorganic foreign bodies such as parts of toys or plastic objects common in children or those with psychiatric conditions. Missed foreign bodies was found in toddlers as well as in neglected patients with psychiatric or neurological ailments. We found that 64% foreign bodies were lodged in right bronchus.

The commonest presenting complaint was respiratory distress, sudden in onset and gradually progressive, along with history of feeling of choking immediately after consumption of food or ingestion of a foreign body. Chest x-ray and x-ray neck were our preliminary investigations and, following which HRCT thorax was done to confirm the diagnosis further.

Three cases were during the covid pandemic making it a challenge to distinguish them from an acute presentation of covid 19 and its related complications. Such as a case of a 3yr old male patient, during the COVID -19 pandemic, wherein the PPE increased the difficulty of instrument handling and fogging of face shields led to poor visualisation. The main Challenge was to identify the foreign body, which was a betel nut amidst the granulation tissue. Due to its triangular shape the nut couldn't be held and again several attempts were made before it could be retrieved. since it was a paediatric patient the narrow bronchus itself was a major hurdle to first pass the scope. We also have had cases of respiratory distress without any typical history of aspiration of foreign bodies, where in upon investigations we found the foreign bodies on the radiography of chest such as the case of a 15 years old male patient as shown in figure 2.

Another case was that of a 29yr old primigravida in her 3<sup>rd</sup> trimester, with history of accidental ingestion of a portion of a plastic whistle while blowing, with complaints of continuous cough. A chest x-ray couldn't be done due to high risk in pregnancy thus on emergency basis she was taken up for surgery, without any knowledge of the possible location of the foreign which posed a challenge. Flexible bronchoscopy was initially attempted but was futile and the case was referred to otolaryngology. We performed rigid bronchoscopy and the whistle was visualised at the level of left bronchus close to the bifurcation into secondary bronchioles and it was then removed as shown in the figure 1. We also had a case of a young girl with cough and dyspnoea and she had to undergo tracheostomy for removal of the lodged foreign body which was a chikoo seed owing to its site of lodgement, but no history suggestive ingestion of this was given that made both diagnosis and management challenging.

Yet another young girl came with severe cough with dyspnoea for 4 days, but they CT thorax was suggestive of a well-defined hyperdense structure in the left main bronchus, causing complete occlusion with collapse of the entire left lung, it also showed mediastinal and tracheal shift to the left side, all these features were suggestive of a revealed an obstructive lesion, a foreign body/ mucous plug. Emergency rigid bronchoscopy done foreign body - a mutton bone adhered to granulation tissue at the tracheal bifurcation. It was impacted so multiple attempts with different instruments were done, while simultaneously ensuring adequate intermittent ventilation, following which it was removed in pieces. (Figure 3)

We also encountered 4 cases where in history was vague as the patients were either neglected adults or those with psychiatric ailments. Also, symptoms were not that acute making such a diagnosis of the foreign body further dicey.

Some cases were accidental findings, such as a case of a mentally challenged man with respiratory distress, after chest x-ray which was inconclusive, he was taken for emergency bronchoscopy. Here we retrieved a stone of

approximately 2x1.5cm at the level of the bifurcation of trachea, following which upon advancing the bronchoscope further, surprisingly another plastic foreign body like was found at the level of left main bronchus and was also removed. (Figure 4)

Another case of missed foreign body was also in a patient who was tracheostomized for prolonged intubation for neurological ailments, upon decannulation he suddenly desaturated and further chest x-ray and HRCT thorax for evaluation showed a canine tooth in the right bronchus at the level of the tracheal bifurcation, and emergency bronchoscopy was performed to retrieve the same. (Figure 5)

### Discussion

The historical significance of foreign body in the tracheobronchial tree goes back a long time, Haugen<sup>5</sup> in 1963 was one of the first to have reported a case series of deaths for the 1<sup>st</sup> time due to foreign bodies, while eating and choking in restaurants.<sup>9,10</sup> The term "Café coronary: which describes a spontaneously occurring obstruction of upper respiratory tract due to swallowing large pieces of meat as people talk or laugh while eating, has been said that successful bronchoscopic removal was done to manage such cases since 1897 by the pioneer Gustav Killian.<sup>10,20</sup>

Studies have been done by Goyal et al to analyse the factors responsible for missed foreign bodies or the delay in their evaluation, and they have found that the causes of the same are such as lack of proper history, unnoticed aspiration by children or elderly, absence of typical symptoms of respiratory distress, physicians not getting primary evaluation chest X-ray.<sup>11</sup>

Several organic foreign bodies such as vegetables being radio-opaque initially get missed in an x-ray also do not produce immediate obstruction or lung collapse but upon serial x-rays or after few days there will be severe distress and x-ray changes these leads to these tracheo-bronchial foreign bodies staying lodged for a longer time.<sup>12</sup> Faud Brick et al in their study have described organic foreign bodies having a high content of protein and sugar will upon aspiration into the trachea-bronchial tree tend to absorb water from it, thereby will increase in size and cause more obstruction with time. Oil, salt, vegetable proteins in cooked foods also lead to inflammatory reaction within the bronchus thus causing more oedema and formation of granulation tissue at the site of the FB.<sup>16</sup> This is the manner in which impaction, or granulation tissue formation occurs posing a challenge at the time of their retrieval, similar to what we found in cases of seeds, nuts and chicken bones in our study.

Montserrat Blanco Ramos et al in their series have observed that FBs in left main bronchus were less common than in right, we too have found the same in our study.<sup>1</sup> This lodgement of foreign bodies is more common in the right main bronchus as compared to the left owing to the angulation of the right bronchus being more in line with the trachea, as compared to the left bronchus which is a rare finding.<sup>14</sup>

Another reason for a foreign body to be missed is the

presentation to this accord Ramos et al in their study have also observed that foreign bodies which are non-asphyxiating cause certain common symptoms such as 66.1% had cough which was the most common complaint, followed by choking, dyspnoea, fever was also seen and some patients presented with complaints of hemoptysis.<sup>15</sup> We found respiratory distress and cough to be the commonest presentation at our centre.

Yang et al<sup>21</sup> have said that the complications due to aspiration of foreign bodies among the paediatric age group are such as cough, cyanotic spells, wheeze, pneumomediastinum, pneumothorax or even pleural effusion, all of which mainly occur due to long standing FB which are missed at initial evaluation<sup>16</sup>.

In adults there are several risk factors which make one more prone to foreign body aspiration, they include, mentally challenged individuals, those who are on sedatives, in cases if post trauma where in patient is in a of unconsciousness, alcoholics and in case of improper tracheostomy cannula handling.<sup>17,18</sup>

Asif et al in their study found that of the total foreign bodies aspirated by children maximum are by those under the age of 5 years.<sup>19</sup>

One of the factors which play an important role in management of foreign bodies is the corresponding size with respect to the diameter of the respiratory tract, studies done by T. Hampton et al have shown that in adults on an average the mean diameter of the left main bronchus is around 12.6 +/- 1.9 mm and in males LMB was 13.0 +/- 2.6mm, and for females it was around 11.8mm this makes it accordingly easy or difficult to dislodge an impacted foreign bodies as well as to manoeuvre instruments for their removal, in our case the diameter of the foreign body was as large as the bronchus thereby it was very difficult to dislodge, likewise we had to struggle to dislodge and retrieve the 3cm long and 2cm broad chicken bone in the paediatric patient in our study.<sup>19</sup> Prompt diagnosis and treatment in the form of retrieval of the foreign body by bronchoscopy is thus essential.<sup>20,22</sup>

### Figures and Images



Fig. 1.

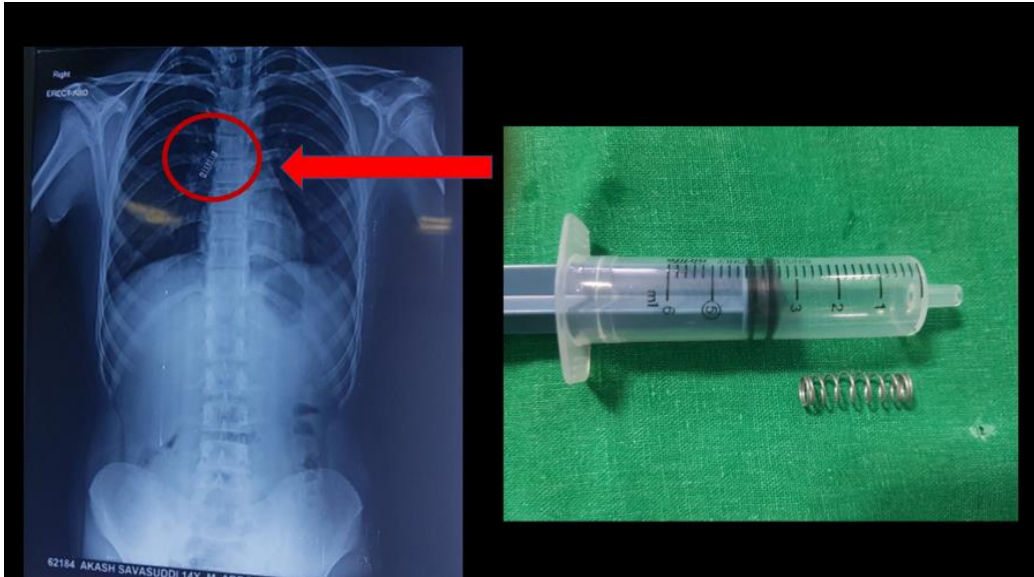


Fig. 2.

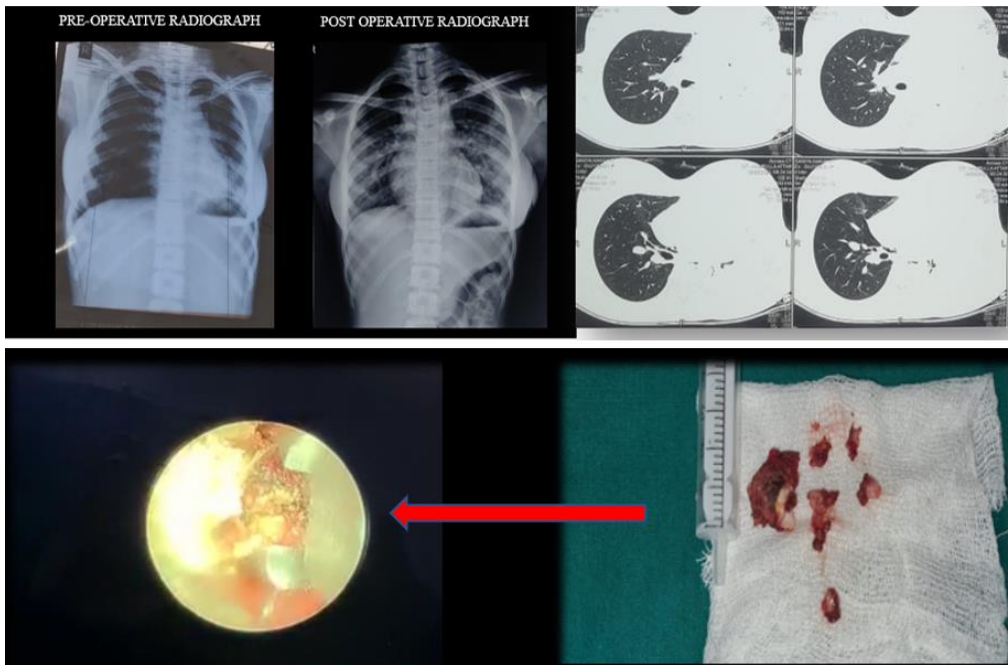


Fig. 3.

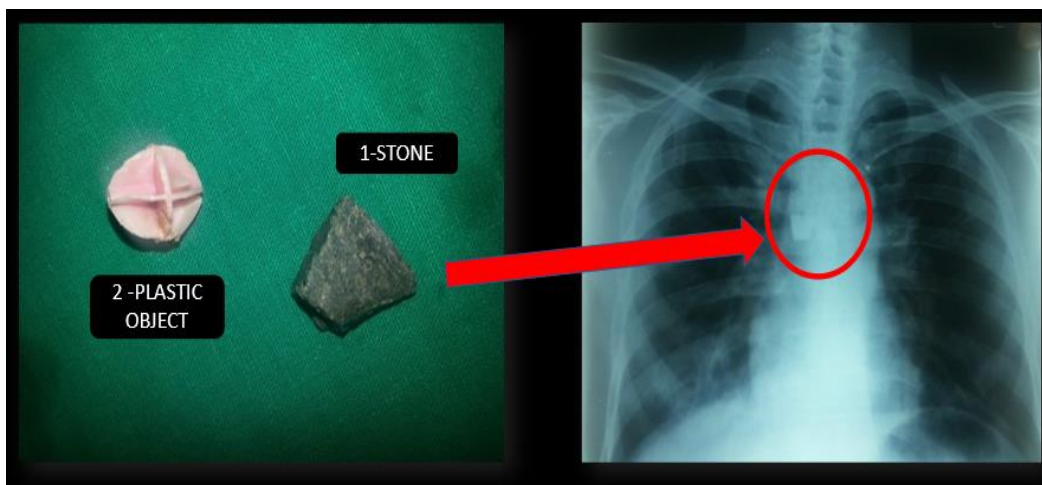


Fig. 4.



Fig. 5.

### Conclusion

We conclude by reiterating the need for a detailed history taking and examination in all cases of respiratory distress especially among children and elderly and to keep in mind foreign bodies as a differential. Different foreign bodies pose different forms of challenges thus the surgeon must take thorough history radiological investigation tailor made to each case. Rigid bronchoscopy is a gold standard treatment of choice due to the advantage in ease of using instruments, adequate ventilation and visualization during the surgery, newer modalities are now being introduced for manoeuvring and locating the foreign bodies with lesser struggle. As retained foreign bodies can cause grave consequences, their diagnosis along with immediate removal is imperative.

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### Author contributions

PSH was the lead operating surgeon accompanied by CV and VVM and PB. CV and PB contributed to the conception and formulation of the study and data collection and interpretation. All authors have read and approved the final manuscript.

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### Declaration

#### Conflict of interests

The authors declare that they have no conflict of interests. Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### Consent for Participation

The adult patients, and in case of the paediatric patients their guardians had full mental capacity and informed consent to publish this case report was obtained. Informed Consent Informed consent was obtained from the participant

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