Review Article

Tracheobronchial Foreign Bodies Aspiration

Abstract :

A foreign body aspiration occurs when a foreign object becomes lodged in the airway, causing breathing difficulties or choking. Objects can enter the respiratory and digestive tracts through the mouth and nose, but when an object enters the respiratory tract, it causes aspiration. The foreign bodies can then lodge in the trachea or further down the respiratory tract, such as in a bronchus. Regardless of the type of item, any aspiration can be a life-threatening situation that demands immediate evaluation and response to reduce the risk of negative outcomes. Despite significant improvements in clinical outcomes as a result of enhanced care, there were still 2,700 fatalities. The literature on tracheobronchial foreign bodies aspiration was retrieved using the Cochrane Database of systematic reviews, Pubmed, and Google scholar. Keywords and phrases used during the search included " tracheobronchial," " bronchial," and "aspiration." This review aims to reflect on the pattern of tracheobronchial tree foreign-body aspiration and the rate of success for rigid bronchoscopy in children admitted to a single center and the correlation between the type of foreign bodies and the age of the patients , presentation of the patient, and comorbidities.

KEYWORDS: Bronchial, tracheobronchial , airways , toddlers , foreign particles , aspiration .

INTRODUCTION :

Foreign body aspiration (FB aspiration) is a widespread source of morbidity and mortality in toddlers (1). Inhaled foreign bodies can become trapped in the larynx, trachea, or bronchi. The size, shape, and kind of foreign material would all have an impact on where the lodgment occurred. A significantly bigger foreign body that cannot pass through the glottis will get lodge in the superior part of glottis region (supraglottic), a tiny foreign body, on the other hand, will slide through the larynx and then into the trachea or bronchi. Edgy FB things, such as pins, needles, fish bones, and so on, can become entangled in the larynx or tracheobronchial tree at any point. The blockage induced by the FB may cause breathing and oxygenation complications, resulting in substantial morbidity. The most prevalent causes of death are hypoxic-ischemic brain damage and, less commonly, pulmonary hemorrhage (1).

Young juveniles under age of 3 years are more susceptible to aspirate foreign bodies (2). Foreign bodies aspiration (FBAs) is also likely to occur in adults (3). The most common form of FBs aspiration that causes injuries belongs to lilliputian food items . Male children are affected more commonly than female children in the ratio of 2:1 . In case of older infants (3 to 7 months) and toddlers, the foreign bodies are aspirated into the air passage. In the previous centuries, the mortality rate was very high in such a way that almost 1/4th of the case led to the death of survivors. With the advance of modern technologies, the bronchoscopy treatment lead to decline the current mortality rate (2).

The common symptoms are - chocking and cough . On physical examination the, findings are - fevers, high pitch sound heard during inspiration, decreased breath sound. In radiographic imaging the inspirated object appears radiopaque and sometimes the objects can also be

identified by appreciating the shape (3). The lengthier a foreign body is lodged in the airway, the more harm it causes. Chance of foreign bodies reign to migrate to other organs increases more. Tracheobronchial foreign bodies can cause severe problems such as inflammation of airways, hemoptysis, bronchiectasis, pulmonary atelectasis, and so many others even mortality due to hypoxia (4). Despite having a foreign body in the bronchial tree, only a tiny percentage of youngsters (according to the researchers) were satisfactorily asymptomatic. Even fewer than half of the patients with FB aspiration had normal physical tests, (according to sources). Thus, the absence of clinical symptoms in a young kid with a positive history of FB aspiration did not necessarily rule out the existence of an FB in the airway(1). According to the researchers ' case report, in comparison to bronchial foreign bodies, laryngeal foreign bodies are an uncommon occurrence in the pediatric age cohort. The size, shape, location, character of the foreign body, and degree of blockage all influence how a laryngeal foreign body manifests, resulting in a variety of symptoms. The persistence of the foreign body in situ increases the risk of bronchoscopy and laryngotracheal foreign body sequelae (5).

PREDISPOSING FACTORS FOR FBAs

Children are particularly affected; more than half of those affected are under the age of four. Accidents are caused when they suddenly and unexpectedly inspire while playing or fighting with something in their mouth. Peanut is the most commonly encountered vegetable foreign body in children. Engulfing undesirable food items and minute objects like coin, nuts, stones, toys, seeds, popcorn, etc. According to other researchers, foreign body ambition was most common in boys, consistent with earlier research. The fact that boys are impacted by the majority of desires may be explained by their more impulsive personality and daring activities(1).

Physical active behaviour while eating like running , talking , laughing , jumping , playing , crying sneezing , etc. also increases the risk of FBA(2). Foreign body aspiration can occur at the pharyngeal stage of deglutition associated with the consumption of liquid substance or solid food into the airways(6). Other risk factors for aspiration typically involve maxillofacial injuries, unconsciousness, intoxications, dementia, including use of sedative pharmaceuticals, and dental forms of treatment(7). Socioeconomic status has a limited role in causing FBA as they have different lifestyles but are more associated with high and low-middle income countries(6).

CHARACTER OF FOREIGN BODIES

1. Nonirritating type - Metallic foreign bodies, glass or plastic are largely nonirritating and can go unnoticed for lengthy periods of time.
2. Irritating type - materials such as peanuts, beans, seeds, and so on cause a diffuse violent reaction that leads to tracheobronchial mucosal congestion and oedema, a disease known as "vegetal bronchitis." They also expand with time, producing obstruction to airways and, subsequently, pulmonary suppuration. Due to practice of chewing these nuts repeatedly, areca nuts are a common foreign body in Rajasthan (India), while peanuts are popular in the United States, watermelon seeds are popular in Egypt and pumpkin seeds in Greece.

PATHOPHYSIOLOGY

FBA is most frequent in pediatrics of all ages (infants to 12years of age). A bipedal age distribution (pediatrics and geriatrics) exists, with a second highest at the age of 10 years. (8). The younger group is more vulnerable because of their weak dentition and underdeveloped

swallowing coordination. The most common causes of FBA in adults are alcohol overdose, inadequate teeth and gums, an aesthetic or hypnotic pharmaceutical drug consumption, mental retardation, neurological illnesses associated with impaired swallowing or mental state, trauma leading to loss of subjective experience, convulsion, and general anesthesia. Accidental aspiration of any item (most commonly food or toy components) into the mouth when laughing, weeping, or sneezing occurs less frequently in all age groups.

Aspirated foreign bodies obstruct the right bronchial system more frequently in adolescents. Rather than the distal bronchi, the main stem bronchi are also where two-thirds of aspirated items eventually wind up. Organic elements cause mucosal inflammation to be more severe, and granulation tissue can form in a couple of moments. Furthermore, particles including beans, seeds, and maize can absorb water, causing partial blockage to become total obstruction as a result of swelling. Patients who inhale tiny inorganic materials, on the other hand, typically remain asymptomatic for a longer time until the next comprehensive obstruction of a distal airway occurs (8). Foreign bodies initiate inflammatory reactions into our body. Metallic objects brings minimal inflammatory reactions while the lipophilic objects produces excessive chemical inflammatory response again that foreign body. Food rich in starch content can adsorb water, resulting in semi-obstruction to complete obstruction (6).

CLINICAL FEATURES

Foreign-body aspiration symptoms and manifestations spontaneously erupt and differ depending on foreign body types, its positioning in the respiratory tract, its size, and how prolonged it remains in the tracheobronchial system(9). Unless they significantly obstruct a terminal airway, patients who aspirate minute inorganic bodies are usually asymptomatic in the long run. And it can make you cough a lot or make you feel like you're about to collapse. Continuing to follow aspiration, there seem to be three separate clinical episodes that very often occur. Acute and severe convulsions or agitation, cramping when eating, gagging, discoloration, cyanosis, and potentially airway obstructions characterized the first (initial) episode foreign-body ingestion. The foreign body is settled and acute simulative symptoms decrease in the second phase (asymptomatic phase). This stage produces misinterpretation and delays in the patient's primary complaints to a physician by family, resulting in a physician's lack of attention or diagnosis, and consequently, a lack of appropriate therapy. The third phase (complication phase) involves blemishes, hives, and itchy skin(9).

Inhaled foreign bodies induce hasty gagging and chocking reflex. The symptoms worsen as the objects pass down deep to vocal cord and epiglottis. Other clinical features includes — paroxysmal cough , wheezing sound while breathing , intractable coughing followed by vomiting , dystopia, hypoxia, hypercapnia , cyanosis, etc (6). There seems to be little erythema or redness at the location of lodgement if the foreign body lodges for a shorter amount of time. If the foreign particle is imbedded for an extended time, granulation tissue or inflammatory polyps have the best likelihood of developing, culminating in irreversible bronchial stenosis(10). Afterwards symptoms are caused by the foreign body's airway blockage, irritation, or injury, and they vary depending on where it lodges.

(a) Foreign substances presents in the larynx.

A huge foreign body may completely clog the airway, resulting in abrupt death unless immediate resuscitation procedures are followed. A partly lodged foreign body will induce throat discomfort or pain, hoarseness, croup cough, aphonia, dyspnea, wheezing, and hemoptysis.

(b) Foreign body in the trachea.

Coughing and hemoptysis are the only symptoms of a sharp foreign body. A loose foreign substance, such as a seed, can slide up and down the trachea between the undersurface of the vocal cord and the carina, causing a "palpatory thud" and "audible slap." It is also possible to have asthmatic wheeze. The best way to hear it is with the patient's mouth open.

(c) A foreign body in the bronchial passage.

Most foreign bodies approach the right bronchus since it has a larger reach and is closer to the tracheal lumen. A foreign material can fully block a segmental or lobar bronchus, resulting in clogging of a check valve, allowing only air in but not out or atelectasis, potentially cause obstructive emphysema. A spontaneous pneumothorax might develop from a partially deflated emphysematous bulla. A foreign body may think about moving from one side to the another, altering external signs. A foreign body that becomes lodged in the lung might cause pneumonitis, lung abscess or bronchiectasis.

AT DIFFERENT LEVELS, SYMPTOMS AND SIGNS OF FOREIGN BODIES

Location of alien bodies Symptoms and warning signs

1. Larynx obstructs completely, resulting in death.

- Partial obstruction: strider, hoarseness, coughing, and respiratory trouble

2. Trachea - choking, striding, wheezing, coughing, palpatory thud, audible slap

3. Bronchi - a "triad" of coughing, wheezing, and decreased air access into the lungs.

- Respiratory distress with foreign bodies swelling - emphysema, lung collapse.

- Bronchiectasis, lung abscess or pneumonia.

COMPLICATIIONS:

Allergic reactions / anaphylaxis

Pneumonia

Epiglottitis

Retro pharyngeal abscess

Bronchitis

Atelectasis

Chronic obstructive pulmonary disease

Pulmonary embolism

Vocal cord dysfunction or paralysis

Vascular ring

Swyer james syndrome

Bilateral lungs infection

Bilateral asthma

Pulmonary slings

Bronchogenic cyst lymphadenopathy

Esophageal foreign bodies

Lung hyperinflation

CONSULTATION

Interventional pulmonology, otolaryngology, cardiothoracic surgery.

DIAGNOSIS

In toddlers who had foreign bodies removed, the outcomes of inspiratory and expiratory chest radiographs were typically favorable. Almost in all of the occurrences, foreign bodies were removed after positive fluoroscopy findings. Foreign bodies were discovered and removed successfully in these cases.

Peanuts, biological agents, other nuts, coins, popcorn, seeds, plastic objects, and pins were among the most frequently encountered things. In more than half cases, foreign bodies were discovered in the right bronchus, whereas left bronchus cases were slightly less in number, and very few in the trachea and hypo-pharynx(11).

FLUOROSCOPY

Fluoroscopy may be attempted if a newborn or toddler is suspected of aspirating a foreign body but a chest x-ray is indeterminate.

TREATMENT

Bronchoscopy is considered as one of the gold standard for tracheobronchial foreign object diagnosis, with the extra advantage of potentially eliminating the foreign bodies from the tracheobronchial tree(12). Prompt endoscopy with the Hopkins rod bronchoscopic system in patients with suspected BFBs will result in fewer tracheobronchial foreign object complications(13).

Two different types of methods to treat the tracheobronchial foreign bodies aspiration are —

Anesthesia method

Under emergency conditions, all patients (paediatrics and geriatrics) undergo surgical intervention after anesthesia with IV ketamine and midazolam. Patients were instructed to see an empty stomach before to surgery. The preoperative fasting interval for solid meals was 12 hours and for beverages it was 6 hours. 0.01 mg/kg body weight) of atropine was given intramuscularly 30 minutes before surgery to decrease bronchial secretions and minimize postoperative pneumonia. Sevoflurane was inhaled all throughout procedure, and 1 % of lidocaine was administered over the inner surface of the throat(4).

Surgical method

FBs were removed using a variety of approaches, including —

1. Direct bronchoscopy.
2. Rigid laryngoscopy.
3. Tracheotomy.

Depending on the severity of the clinical situation. Rigid bronchoscopy is the most common surgical technique we are using on our patients. A rigid bronchoscope was introduced into the airway while the patient was anesthetized , and mechanical breathing was restored by attempting to link a computerized jet ventilation equipment to the rigid bronchoscope's side arm. Throughout the treatment, patients' blood oxygen levels remained above 80%. When the FB blockage configuration was detected, the bronchoscope being instantaneously implanted above the FB.. A gripping forceps was used for the first time(4).

PROGNOSIS

Children with foreign body aspiration have a better prognosis if it is removed early and without complications. After foreign body aspiration, the majority of people who seemed responsive at an emergency department have a positive prognosis. Acute inhalation of a much big particle that obstructs the trachea or proximal airway can be lethal. Everyone recovered completely without any medical complications, with the exception of one kid who died of respiratory failure among a group of 94 children who all came three days after aspiration(14).

PREVENTION

In children, foreign bodies are a potentially lethal event that happens and requires immediate identification and treatment. Prevention is the most important factor in minimizing morbidity. Because prevention is the key to managing these sorts of accidents, more emphasis should be put on caregiver education. Prevention of foreign body aspiration is preferable to treatment. Public awareness through the media should bring attention and aid in the prevention of FB inhalation. Shlizerman et al. discovered that well-defined public education programs can result in prevention.
It is crucial to evacuate the foreign body as soon as possible and soothe the patient to avoid any complications. Rigid bronchoscopy is frequently utilized in children, but in adults, both rigid and fiberoptic bronchoscopy may indeed be performed if aspirations occur(7).

Quantitative measurements, including as significant changes in product design and public education campaigns, have been developed to decrease choking risks and prevent undesirable consequences. Primary care physicians play an essential part in expanding education efforts at each child's office visit by assisting parents with anticipatory guidance about choking concerns. Foods with small spherical shapes, such as nuts and seeds, are more prone to induce tracheal constriction and suffocation. All of these meals should be avoided until the youngster can appropriately chew them while sitting. Around the age of five, chewing and swallowing become more coordinated. As a result, caregivers should recommend that children under the age of four never consume nuts or other round, crunchy foods, making prevention the most effective therapy for foreign body injuries(15-18).

CONCLUSION:

According to the findings of this study, while diagnosing these symptoms, it is crucial to review the history, particularly any first indications of aspiration, coughing, wheezing, or respiratory problems. Preventing foreign-body aspiration and paying attention to the patient's history are the greatest ways to avoid serious problems caused by it.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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