AERODIGESTIVE FOREIGN BODY IN PEDIATRICS: A RETROSPECTIVE STUDY IN TERTIARY HOSPITAL

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Declaration

I declare that this paper is a result of my independent research work on the topic entitled "aerodigestive foreign body in pediatrics: a retrospective study in tertiary hospital" in partial fulfillment of the requirements for the sub specialty certificate in General Pediatric Surgery at Addis Ababa University, College of health sciences, Department of surgery, Pediatric surgery unit. This work has not been submitted for a degree to any other university. All the references are also acknowledged.

Dr. Etsub Abebaw

Signature: _____

Date: _____

Confirmation

This is to certify that Dr. Etsub Abebaw has carried out this research work on the topic entitled "aerodigestive foreign body in pediatrics: a retrospective study in tertiary hospital" under my supervision. This work is original in nature and has not been presented for a degree in any university and it can be submitted for the partial fulfillment of the requirements for the award of the specialty certificate for General Pediatric Surgery.

Dr.woubedil kiflu (Assistant professor of pediatric surgery)

Signature: _____

Date: _____

Abstract

Objective – The aim of this research is to assess the outcome and complications of aero digestive foreign body and associated risk factors in pediatric patients in Tikur Anbesa Specialized Hospital.

Method – The medical records of 302 children who were treated for an aero-digestive foreign body during a three-year period were reviewed at TASH. Patient's demography (age, sex,adress), clinical data (Duration of symptoms, vomiting, dysphagia, cough ,fever, fast breathing, preoperative aspiration pneumonia,URTI), image finding, type of foreign body, type and length of the procedure, outcome, intra op and post-op complications ,rate of redo bronchoscopy procedure were analyzed using logistic regression.

Results – The overall rate of removal of FBS in the 1st procedure was 97(95.1%) and 5(4.9%) pushed distally. 66(65.7%) removed with Magill's forceps and esophagoscopy done in 36(35.3%) .28(27.5%) develop complications. from this 20(19.6%) accounted for minimal esophageal mucosal bleeding during the procedure.4 cases(3.9%) have esophageal perforation and managed with chest tube and antibiotics.one case(2.9%)had TEF and 2 managed conservatively.one patient TEF repair through cervical approach. One patient died post esophagoscopic removal of battery from esophagus with hemorrhagic shock 2ndary to AEF. With mortality rate of (1%).

In patents with FBA rigid bronchoscopy done in 195(97.5%) and direct laryngoscopy with Magill's in 5(2.5%).FB removal was not successful in 24(12%) of patients, 1 in laryngoscopic group and 22 in bronchoscopy group. During the procedure 122(61%) develop complications, majority were intra operative complications like laryngospasm in 46(23%), persistent intra operative hypoxia occurred in 93(46.5%), which was associated with intraop bradycardia in 43(21.5%) and intraoperative cardiac arrest in 9(4.5%). Minimal bleeding from the air way mucosa occurred in 13(6.5%) during the procedure. But there was significant bleeding from the air way and death in one patient during removal of sharp FB.in 12 (6%) of patients there was pus in the air way during removal of airway FB in 9(4.5%) pneumothorax occurred in 9(4.5%) of cases .one patient (0.5%) came with pneumothorax preoperatively. two patients had pneumomediastinum, Five (2.5%) develop BPF.72 (36%) had air way edema, 17(8.5%) developed HAP,. One patient (0.5%) develop HIE during the procedure

Our analysis showed in patients with air way FB presence of preoperative infections (AOR 3.086; 95% CI, 1.486; 6.41, P=0.003 and desaturation at presentation (AOR 5.52; 95% CI, 2.555-11.925; P=0.000), had increased risk of complications .patients with complication had prolonged hospital stay (AOR 3.661; 95% CI, 1.327-10.104; P=0.012). Delayed presentation (>24 hours) (AOR 23.135; 95% CI, 4.44-120.54; P=0), sharp and battery foreign bodies (AOR 50.803; 95% CI, 5.742-449.49; P=0) were independent risk factors for occurrence of complications in esophageal FB.

Conclusion – In patients with air way FB presence of preoperative infection and desaturation at presentation had increased risk of complications with significant association .patients with complication had prolonged hospital stay .Delayed presentation (>24 hours),sharp and battery foreign bodies radiolucent FB on imaging, were independent risk factors for occurrence of complications in esophageal FB in children.

Key words; Foreign body; aero-digestive; children, outcome

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Acronyms

AAU……..….. Addis Ababa University

ETB……...Ethiopian Birr

FBA-……..Foreign body aspiration

FBS……foreign body swallow

FB…….. Foreign body

OR…….Odds ratio

SPSS ……....Statistical Package for Social Sciences

TASH……...…..Tikur Anbesa Specialized Hospital

TEF……..Tracheo esophageal fistula

WHO……..World Health Organization

PICU……-pediatric intensive care unit

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1: Introduction

1.1 Background

Aerodigestive foreign body is anything that is inhaled or swallowed into the trachea, bronchi, or esophagus through the mouth or nose (1) foreign bodies in aerodigestive tract are common pediatric emergencies contributing to high morbidity and mortality requiring early prompt diagnosis and treatment. (2; 3; 4). It is the third most common cause of mortality for infants under the age of one and the fourth most common among people aged 1-6. Around 80% of the cases are seen in children aged 0-3 years (2). Because of poverty and illiteracy, the incidence is assumed to be significantly higher in developing nations (3) (5).

The symptoms of foreign body aspiration mostly mimic, upper respiratory tract infection, asthma, and pneumonia resulting in Delayed diagnosis & an increased risk of complications. Nevertheless, a High index of suspicion is the cornerstone of diagnosis. Emergency procedures can save lives and lower mortality and morbidity rates as well. (2; 4; 6)

Rigid bronchoscopy is used to remove tracheobronchial foreign bodies. (7). Magill forceps is an appropriate device to remove FBs from upper esophagus part (8) .Rigid esophagoscopy is a relatively safe and useful procedure in trained hands for the removal of esophageal FBs. (9)

Aerodigestive foreign body complications include esophageal obstructive perforation, intrinsic stenosis, esophageal diverticulum, mucosal ulceration, pneumonia, lung collapse, hypoxic brain injury, and death. Bronchial granulation tissue, bronchial constriction, broncho-oesophageal fistula, and opportunistic fungal infection are additional consequences of delayed foreign body removal (10), (4). Delay in treating airway FB was linked to a higher rate of complications, including air-trapping, pneumonia, and atelectasis, at the time of admission. In addition, the delayed treatment group's operation and hospitalization times were longer than those of the non-delayed treatment group. (11) (12)

Retained button batteries for esophageal FBs must be taken out immediately (1). Button batteries in the upper pediatric aerodigestive tract should be considered a surgical emergency, requiring urgent removal and careful vigilance for complications (12).

For children undergoing foreign-body removal, allergy history, congenital heart disease, a longer retention time of foreign bodies, longer duration of operation, preoperative respiratory infection, are associated with an increased risk of intraoperative cardiac arrest.. Paying close attention to these factors may contribute to improving the outcome of children with FBA (13)

A vegetable foreign body such as a bean, groundnut, or pea is a significant cause of complications due to bronchoscopic extraction (14%) and may need several attempts at complete removal. Bronchoscopy on a younger child especially with a history of a vegetable foreign body inhalation should not be attempted by a less skilled bronchoscopist/anesthetist (14) Management of long-standing esophageal foreign bodies, and sharp objects requires the skills of the most experienced members of the surgical team for a successful outcome (9)

Utmost care must be exercised during bronchoscopy and oesophagoscopy procedures to avoid injuring the underlying structures. Special care should be exercised in children under six years of age. (15)

2: Literature Review

2.1 Outcome and complications of aero digestive FB

A study in India showed, From tracheobronchial FBs cough occurs in (71.4%) followed by hurried breathing (61.9%), and a history of FBA (47.6%).for digestive tract FBs 96.4 % presented with a history of foreign body ingestion. Symptoms like vomiting in (15.7%), and difficulty in swallowing in (15.7%). Cricopharyngeal FB was 84.6%.from a total of 21 patients Bronchoscopy removal was successful in17 (80.6%). In one (4.76%) patient FB was split t into pieces and couldn‘t be retrieved completely. In one child (4.76%) bronchoscopy revealed a tracheal foreign body for which the child required tracheostomy. In children with FBA, 5 children required inotrope support at admission, among them one child died (20%), and one child had hypoxic-ischemic encephalopathy and cardiac arrest but revived and went against medical advice (20%). bronchospasm occur in 85.7% of patients and the most common late complication was pneumonia seen in 9.5% of cases (2)

In another study Among 103 patients with FBA, The most common complication encountered during bronchoscopy was Hypoxia and bradycardia (15.5%) which was treated by oxygen. Although the foreign body was taken out after the bronchoscopy, laryngeal edema, laryngeal spasm and/or bronchospasm with insufficient ventilation were observed in 13(12.6%) patients. Tracheal and bronchial bleeding was seen in 11 (10.7%) patients which was treated conservatively. Infection in 9 (8.7%) patients was treated by intravenous antibiotics. Pneumothorax was seen in 2 (1.9%) patients which required chest intubation. A patient who had pneumomediastinum after bronchoscopy needed no treatment and spontaneously recovered.. (16)

Study from America 450 Patient ages ranged from 0.6 to 18.8 years, with a median age of 1.9 years. The majority of children (71.8%) were under the age of 3 years, and 291 (64.6%) patients were male. The right main stem bronchus was the most common site of the foreign body in 170 (37.8%) of the cases, followed by left main stem bronchus in 105 (23.3%), lobar bronchi in 102 (22.7%), more than one subsite in 44 (9.8%), and trachea/carina in 29 (6.4%). Location of the foreign body had no significant correlation with complications. There were

301 (66.9%) cases of organic versus inorganic objects with no significant association with complications (P 5 0.39). A total of 88 (19.6%) cases were considered complicated, including five (1.1%) deaths and 19 (4.2%) children admitted to the (PICU). Figure 1 demonstrates the frequency of each complication, with the most common being hospital stay greater than 24 hours. There was no difference in length of stay among the specialties (Fig. 2). Table I presents epidemiologic data for children admitted to the PICU. All five fatalities included anoxic brain injury. Using backward-variable selection, three independent predictors of complicated case remained in the multivariable Poisson regression model, including age, whether the incident was witnessed, and radiologic findings (17)

Retrospective case series study from America. From 48 patients with battery ingestion, 20 (24.7%) ingestion was witnessed. The median time from diagnosis to removal was 2.5 hours (range, 0.4–72 hours). The most common symptoms for esophageal/hypo pharyngeal impactions included dysphagia (26.5%), nausea/vomiting (26.5%), drooling (24.5%), cough (18.4%), and fever (18.4%) Almost all esophageal impactions were from, 20-mm (81.8%) lithium batteries. Complications like stricture (28.6%), perforation (24.5%), tracheoesophageal fistula formation (8.2%), pneumothorax (4.1%), mediastinitis (4.1), pneumomediastinum (2%) and bilateral true vocal fold paresis (4.1%) occurred. (12)

Retrospective descriptive study in France, with esophageal battery 25/ 26 batteries had diameters of 20 mm or more. Initial clinical signs were vomiting (38.46%), fever (26.92%), and hyper sialo rhea (26.92%). Median esophageal impaction time was 7 hours & 30 minutes (range, 2 to 72 hours). All 25 have the second endoscopy. The complications rate was 23 %.(2 cases of pneumomediastinum, 2 of inhalation pneumopathy, 2 of stenosis of the superior third of the esophagus, 1 of mediastinitis, and 1 of tracheoesophageal fistula).) (13)

In a study in Mexico, esophageal FBs were removed using a rigid endoscope, and complications were (7.8%), including lacerations in 87 patients, erosions in 84, burn wounds in 20, deep ulcerations in 7, perforations in 4, and mediastinitis, In retropharyngeal abscess, and death in 1 each (19).In another study of Sixty-six patients on aerodigestive FB, the Mortality rate was 1.5% (15)

Study from Saudi Arabia reviewed seventy patients were identified (38 boys and 32 girls). The ages ranged from 5 days to 12 years (mean: 4.4 years). Fifty-three (75.7%) patients presented within 24 hours. Thirteen (18.6%) patients had underlying predisposing factors. The most

common EFB, found in 30 (42.8%) patients, was a coin. Witnessed ingestion of a FB was documented in 52 (74.2%) patients. The most common symptoms were drooling of saliva in 42 (60%) patients, followed by vomiting in 36 (51.4%) patients. Four (5.7%) patients presented with complications secondary to FB impaction, including hypo pharyngeal wall perforation, acquired esophageobronchial fistula, localized esophageal perforation with inflammation, and perforation with stricture formation. The follow-up period ranged from 2 to 12 months, and all patients had complete recovery without any sequelae.Long-retained EFBs are associated with a higher incidence of complications. Rigid esophagoscopy was successful in extracting most of the EFBs and was shown to be a safe and effective procedure. (18)

Another study showed that reported mortality during bronchoscopy is 0.42%. Although asphyxia at presentation or initial emergency bronchoscopy causes some deaths, hypoxic cardiac arrest during retrieval of the object, bronchial rupture, and unspecified intraoperative complications in previously stable patients constitute the majority of in-hospital fatalities. Major complications include severe laryngeal edema or bronchospasm requiring tracheotomy or reintubation, pneumothorax, pneumomediastinum, cardiac arrest, tracheal or bronchial laceration, and hypoxic brain damage (0.96%) (19)

The study by Senkaya et al showed Cardiac arrest was a cause of death of 3 children during bronchoscopy (0.5%) (20)

Retrospective study from Algeria a total of 2624 children (62.34% males and 37.65% females) were aged 4 months to 18 years with 66% between 1 and 3 years. Choking was related in 65% of cases. The delay between aspiration and removal was 2-8 days in 65.8% and within 24 h in 9.2%. In the most cases, the children arrived with cough, laryngeal or bronchial signs and unilateral reduction of vesicular murmur. The examination was normal in 13%. The most common radiologic finding was pulmonary air trapping (40.7%). The aspirated bodies were organic in 66.7%, dominated by peanuts, while sunflower seeds, beans and ears of wheat were the most dangerous. In the other cases, they were metallic or plastic as pen caps and recently scarf pins. The endoscopic removal by rigid bronchoscopy was successful and complete in 97%. Cases with extraction failure (3%) limited to certain FBs, all of them inorganic were assigned to surgery. The complications related to the endoscopic procedure were 0.29% with a mortality of 0.26% (21)

Study in north Ghana, from a total of 33 children with FB aspiration, groundnuts account (39.4%), metallic objects (7, 21.2%), and seeds (3, 9.1%). right main bronchus in (24.2%) of patients, left main bronchus in (24.2%) of patients, and trachea in (21.2%) of patients. 1, Emergency tracheostomy was done to retrieve a FB for failed rigid bronchoscopy. No mortality (22)

Study in Egypt Complications such as laryngotracheal edema (16.6%) and pneumothorax (2.3%) were encountered in patients with FBA (3)

retrospective, cross-sectional study from ken ya reviewed 107 cases, The vast majority of patients were below 3 years of age and 63% of them presented within 3 days after onset of symptoms. The right bronchus was the most frequent destination of inhaled foreign bodies (50.5%) followed by the left bronchus (17.8%) and carina (14.2%) in that order. The turnover of patients with inhaled foreign bodies was high with 86.9% being discharged within 6 days after surgery. The bronchoscopic procedure was uneventful in 76.6% of patients. Repeat bronchoscopy was performed in three patients with one undergoing eventual thoracotomy. Intraoperative cardiac arrest occurred in 5 cases (4.6%) with successful resuscitation in 2 and mortality in three (2.7%) % cases. (23)

146 patients were included with a median age of 32 months. Of these, 90% were asymptomatic at presentation. The main types of FB ingested were: 62% metallic, 14% non-metallic, and 15% food. In the metallic group, the most common FB was a coin, ingested by 45% of children. Radiographs were performed in 94% of patients, with a total of 202 radiographs performed on 137 children. The FB was identified by radiographic means in 68% of cases (39% in the esophagus and 34% in the stomach) and removed endoscopically in 41 patients. Following endoscopy there were minor complications in 7 patients, all of which were managed conservatively. (24)

Study from Sudan showed, the commonest age group between 3–6 years in 64% of patients. Male to Female ratio is1.3:1. F.Bs nose constituted higher percentage in (28%) of cases, F.Bs inhalations were presented in (24.7%), F.Bs ear were presented in (24.7%) and F.Bs ingestion were presented in (22.7%). Regarding the type of inhalations, peanut was presented in (56.8%) of cases and the commonest presenting symptoms was cough in (94%) of patients. (25)

A study in Ethiopia, on FB ingested coin accounts (84.7%), button batteries (5.9%), and (4.7%) metallic materials. (94.1%) were radio-opaque. (78.8%) FBs were lodged in the proximal

esophagus, (12.9%), and in the middle esophagus, (92.9%), FBs retrieved using McGill forceps. Foley's catheter was used in 15 (17.6%) and Oesophagoscopy in 9 (10.6 %) cases. Two patients (1.7%) develop serious post-procedure complications (TEF, upper airway obstruction) which happened among cases of battery ingestion that came 7 days and 12 hours post-ingestion respectively) (26)

A study in TASH, on FBA crops/seeds accounted (for 36.0%) of these, bean is common. Plastic (29.3%) and metallic materials (18.7%). (99.3%) have sudden onset of cough, (56%) have difficulty of breathing and (16.7%) have vomiting. FB was found at the right main bronchus in 34.7% and trachea -28.7%). (40.7%) of them arrived at the hospital within 3-7 days of FBA. Only 21(14%) of patients arrived within 24 hours. Pulmonary infection was detected in (25%) of cases following FBA and other complications associated were atelectasis in (2.6%) of cases, pneumothorax in (2.6%) of cases, pulmonary infection with atelectasis in (1.3%) of cases, pulmonary infection with pneumothorax in (1.3%) case, pulmonary infection with lung collapse in 1 (1.3%), lung collapse in 1(1.3%) and other complication like minor airway edema detected clinically, throat discomfort, the difficulty of swallowing, account 49(64.5%) cases;73(96%) cases had a smooth course in the hospital and discharged within 10 days after bronchoscopic procedures and individualized medical care. 1(1.3%)has passed away (27).

In another study from Ethiopia on FBA, The mean duration of illness was 1.6 +1.9 days with a range of 4.5 hours and 4 months,(18%) reported within 24 hours of the event; plastic tips were retrieved in (22.4%) of patients, seed in 15(19.7%), present with cough (73.7%), shortness of breath in (50%), wheeze in 23(30.3%);chest-ray common findings were (13.2%) lobar pneumonia, (10.5%) radio-opaque FB, (9.2%) hyperinflation, and (5.3%) pneumonia; (28)

In general a patient having a leech in the hypopharynx causes bleeding, leading to spitting of blood or hematemesis and that lying in the larynx gives rise to airway obstruction and change of voice. Diagnosis may be made by indirect laryngoscopy or fibreoptic examination.. Examination under general anesthesia (direct laryngoscopy) is essential and performed as an emergency for diagnosis and removal: Leeches should be suspected as an airway foreign body in patients with a recent history of drinking from stream water (29). Even though leech infestation as a cause of upper GI bleeding is a rare finding, clinicians should be aware of symptoms and have a high index of suspicion in patients from rural areas, where there is no clean and safe drinking water (30)

1.3.2. Associated factors which increase complications

Time of impaction, the anatomic direction of the battery's negative pole, and identifying specific battery parameters were identified as factors that may be employed to predict sequelae. (31)

A retrospective study in France showed Impaction time was ≥ 2 hours in all cases; it was significantly longer in the subgroup with complications 39.7 versus 9.1 hours., and hospital stay was longer (35.6 versus 11 days without home care, and 60.4 versus 27 days with), although the difference was not significant (13). In another study, the frequency of complications increased when the ingested object was a battery when the time elapsed prior to diagnosis was 8-16 hrs. (32) (33).

Repeated esophagoscopy attempts were encountered more in patients with impacted sharp objects (85%) and were recorded significantly among trainee surgeons. Open esophagotomy was carried out in (10%) of difficult cases. Major complications including two iatrogenic esophageal perforations and one death occurred following esophagoscopy by trainee surgeons (9)

Incidence of complication was 8.33% due to sharp the nature of some of esophageal foreign bodies (33), long duration of impaction, late presentation to the hospitals, and lack of appropriate facilities. Prompt endoscopic intervention is the gold standard for all complicated or high-risk situations, with particular relevance to sharp and pointed foreign bodies, such as dentures with protruding hooks, shaving blades, and open safety pins, which increase the danger of perforation (34)

The incidence of postoperative adverse respiratory events was 9.5% in preschool-aged children with inhaled FBs undergoing rigid bronchoscopy. Preoperative respiratory impairment was associated with an increased risk for complications. Pneumothorax occurred in (0.8%) patients. There was 1 (0.2%) death from severe respiratory-related complications. (35)

Risk factors that lead to complications were identified and include age below 1 year, a vegetable foreign body, prolonged bronchoscopy beyond 20 minutes, traumatic procedure by an occasional less experienced endoscopist in the learning phase, occasional less skilled anesthetist, improper instrumentation and delayed patient presentation or delayed referral when pneumonitis has already supervened (36).Seed aspiration is a particularly complex clinical situation, as they contain volatile oils that can cause rapid bronchial damage, along with the

volume expansion of the seeds in the bronchus due to imbibition that can lead to the complete obstruction of the airways (37)

Another study showed there was a significant correlation between, retained foreign bodies in the bronchus of more than 14 days duration and occurrence of complications. Children of less than 3 years of age were more prone to complications than children of older age. But no correlation was found between the nature of the foreign body (organic or inorganic) or the site of the foreign body and the complications (38) .The length of hospital stay was longer in the younger age groups (14)

A retrospective study in China of 220 children with FBA. (46.4%) cases came to the hospital within 24 h. The occurrence rate of complications at admission was significantly higher in the delayed treatment group than in the non-delayed treatment group. The witness rate was significantly lower in the delayed treatment. The median time elapsed between the aspiration event and arrival to the hospital with bronchoscopic service was significantly longer in the referral group than in the direct group. In multivariate analysis, delayed treatment remained an independent risk factor for longer operation time and longer hospitalization time (39) .

Factors that strongly correlated with intraoperative hypoxemia included age, type of FB, duration of surgical procedure, pneumonia before procedure, and ventilation mode. The risk of intraoperative hypoxemia increased as age decreased .No correlation was found between hypoxemia and the presence of an organic FB versus inorganic FB. When the types of plant the seed was listed individually, the risk of intraoperative hypoxemia increased significantly. Seeds lead to chemical pneumonitis, airway swelling, and bleeding, prolong the duration of operation, and increase the occurrence of bronchospasm with manipulation. A longer duration of surgery (>20 min) and pneumonia before the operation also increased the risk of intraoperative hypoxemia significantly. SV Compared with CV (SV-, increased risk of hypoxemia. (40)

Another retrospective study from South Korea showed that impaction duration and sharpness of esophageal foreign bodies were the two important risk factors for the development of major complications. (33) (41). Another study showed the complication rate was found to be twofold higher in patients who underwent bronchoscopy after 24 hours. (42). Retrospective study done in Spain, showed Patients with a delay in treatment beyond 72 h from the aspiration episode increase risk of both intraoperative and postoperative complications (43), In another study, the

risk factors associated with complication after endoscopic FB removal were long duration from ingestion to endoscopy and existence of initial mucosal injury (10)

Risk of complications increase in non-opaque objects, diseased esophagus and for the objects located below the upper third of esophagus. (33)

A study (review) done in the USA concluded - patients with histories of medical or surgical abnormalities of the GI tract, those with symptoms, and those with previous complications of foreign body ingestion. Button batteries, magnets, long objects, or those that are sharply pointed or with a sharp edge, are most prone to complication. (44) (33)

Among the patients who had a perforation, the FB was located in the esophagus in 3 of them (disc batteries), and the fourth patient had a gastrojejunal perforation (17 magnets). 1 death occurred, in a 9-year-old boy with hematemesis and shock secondary to aortoesophageal Fistula because of a coin swallow of 6 months duration, (45)

In another study, Of the 300 patients with FBA showed that a history of allergy, congenital heart disease, preoperative respiratory infection, and poor anesthesia effect were identified as independent risk factors for intraoperative HF in children undergoing FB removal (46).

A retrospective study from America showed, No association between complications and duration of battery ingestion. TEF occurred in patients with times from diagnosis to removal of only 2.5 to 5 hours. No death was reported. Hospital admission (97.8%), 10.4 need MV, 41%-contrast esophagogram done.50% of pts symptoms resolve over < 1 month, 21% still have their symptoms (>36 months) (12). A study from Ethiopia showed 82 % of pts with FBA come after 24 hrs. Because most are referred from far and delays in transportation, late detection, and the parent or caregiver unawareness can be mentioned as possible factors for delayed presentation. (28)

Objectives

General Objective

To assess the outcome and complications of Aero digestive foreign body and associated risk factors in pediatric patients in Tikur Anbesa Specialized Hospital Addis Ababa, Ethiopia, 2023

Specific Objective

To assess the clinical presentation of patients with aerodigestive foreign body

To determine which objects are aspirated and cause esophageal obstruction

To assess successful removal rate of aero digestive foreign body in pediatric patients

To assess Complications (intraoperative & post-operative complications) of aero digestive foreign body

To identify risk factors that increase the occurrence of complication of aero digestive foreign body

Study method

Study setting

Tikur Anbessa Specialized Hospital is located in Addis Ababa Ethiopia and is affiliated with Addis Ababa University School of medicine. It is the largest medical school and tertiary care center in the country. It also has a high pediatric surgery load with more than 1500 procedures performed yearly.

Source population

All pediatric emergency surgical patients seen at TASH during the stated period.

Study population

All children who were diagnosed for aero-digestive foreign body and managed at TASH during the stated period were included.

Inclusion and Exclusion Criteria

Inclusion

Children of age 14 years and below with confirmed aero digestive foreign body (by radiological evaluation or during the procedure) and foreign body removal is done

Exclusion

Children >14 years, patients whose medical records are not complete or lost at the time of data collection

Study design

Hospital based quantitative retrospective study.

Sample size determination

All children with aero digestive FB managed in pediatric surgery department at Tikur Anbesa specialized hospital from January 2019 to December 2023 G.C using consecutive convenient sampling technique.

Study period

The study period was from June 2019 to June 2023 G.C.

Sampling technique

All cases of pediatric aerodigestive foreign body managed (procedures for removal of FB was done) during the study period are included in the study.

Variables

Dependent variable

- Outcome(removal/retained, removed/pushed)
- Length of hospital admission, ICU admission
- Complications

Independent (determinant) Variable

- ✓ Socio-demographic variables (sex, age)
- ✓ Patient factor- clinical presentation, co-existing diseases (previous esophageal surgery or known motility disorder, stricture of the esophagus, or co morbidities(congenital heart disease ,asthma,) duration of presentation , saturation at presentation , witnessed ingestion or aspiration, preoperative infection
- ✓ type of foreign body(organic, inorganic), specific foreign body, Location of foreign body
- ✓ radiological details(-radio opaque/lucent, pneumonia ,collapse ,consolidation
- ✓ Procedural factors: , duration of the procedure, rate of redo procedures ,, type of foreign body removal(procedure) the patients undergone(laryngoscopic -magills,esophagoscopic,bronchoscopic,, bronchotomy

Data management

Epidemiologic, clinical, image findings, procedures, outcome, intraop and post op complications, picu and hospital stays, were collected from each patient's card, OR and ward log books using cheek list tool. The data was then transcribed to IBM SPSS Statistics 25 software for analysis.

Data analysis

Data was analyzed using IBM SPSS Statistics 25. Descriptive statistics of the independent variables was done and correlation was identified. Binary logistic regression analysis was done to identify the risk factors associated with increased hospital stay and complications in managing aerodigestive FB.

Ethical consideration

Confidentiality was maintained throughout the research undertaking. Ethical clearance was acquired from research ethics committee of department of surgery, as well as the institutional review board (IRB) of college of health sciences, Addis Ababa University. The approval from the IRB was used to waiver informed consent to access patient's card from the archive.

Results

1 .Demographics of aerodigestive foreign body

The study included a total of 302 cases of aerodigestive foreign body (FB in the esophagus and tracheobronchial tree) 200 case (66.2%) were FBA & one hundred two (33.8%) cases of foreign body swallow managed at TASH from January 2019 to December 2022.

A total of 397 cases of aero digestive FB cases were identified.73 cards were lost, 9 patients with negative bronchoscopy and 15 cards with incomplete data were excluded.

From total of 302 patients with aero digestive FB, 174 (57.6%) were males and 128 (42.4%) were females with median age of 3 year, range from of 8 month and to 14 years with inter quartile range of 4.5. Male to female ratio was 1.35. Two hundred thirty six (78.1%) patients were aged below five years. Most of the patients, 216 (72%) were living out of Addis Ababa.122 (40.3%) from Oromia, 39(12.9%) Amhara, 37(12.2%) from SNNP.

Age	Frequency	Percent
Up to 3 yrs.	*145*	*48.0*
*3 -5*yr	*91*	*30.1*
6-10 yrs.	*51*	*16.9*
>10 yrs.	*15*	*5*
Total	*302*	100.0

Table 1 age distribution of aero digestive FB

2. Clinical presentation

2.1 Clinical presentation of esophageal FB

From a total of 102 cases, 90 (88.2%) patients had definitive history of FB ingestion. Majority of Patients were symptomatic and only four (3.9%) were asymptomatic. The commonest presenting complaints were 'vomiting' and difficulty of swallowing occurring in 50 (49%) and 45(44%) respectively. and repeated respiratory tract infections, 3(2.9%) were also a presenting features

The duration of presentation in FBS cases ranged from thirty minutes to ten years. In 59(57.8%) patients the duration of ingestion of FB was less than 24 hours.

2.2 Clinical presentation of Air way FB

Of 200 children with FBA, 161 (80%) had chocking history. The commonest presentation was cough in 158(78.4%), fast breathing in 150(75%), vomiting 71(35.2) and, fever 63(31.2%). See (table 2)

Presentation	*Percent*
Cough	*158/200(78.4%)*
Fast breathing	*150/200(75 %)*
Fever	*63/200(31.2%)*
Vomiting	*71/200(35.2%)*
LOC	*28/200(13.6%)*
Stridor	*20/200(9.5%)*
Voice change	*10/200(5%)*
Chest pain	*5/200(2.5%)*
Choking	*161/200(80.5%)*

Table 2-Presentation of patients with FBA

Only 31 %(62) came to the hospital within 24 hours of the event.128(64%)presented within 3 days and two cases(1%) presented after 5 years history of aspiration.(the one with teeth and ball inflator).

Oxygen supplementation through a face mask or nasal prongs was required in 94(47%) cases during the pre-bronchoscopy period .But mechanical ventilation was not required in pre-operative period. On chest examination 131(65.5%) had decreased air entry on the ipsilateral lung, 105(52.5%) wheezing, 35(17.5%) transmitted sound, 37(18.5%) had crepitation

From 200 patents with FBA 112(56%) had preoperative aspiration pneumonia 70(35%) and URTI 42(21%)

3. Type and location of FB

3.1. Esophageal FB

The most common FB ingested was coin in 83 case (81.4%) patients, followed by button batteries 12 (11.8%) and metallic materials 3(2.9%). Other ingested FBs included sharp objects2 (2%), plastic pieces 1 (1%) and papaya fruit chunk 1(1%).

All patients were x-rayed to localize the objects and 70 (68.6%) FBs were lodged in the proximal esophagus, 29 (28.4%) in middle esophagus, 3 (2.9%) in the distal esophagus.

3.2 .Air way FB

The most involved site where foreign bodies were encountered during the bronchoscopic procedure was the right main bronchus 79 (39.7%) followed by the left main bronchus 50 (25%), trachea 18(9%),

Sixty percent of FBA were organic FB. Pea and beans 53(26.5), plastic tips 43(21.5%), seeds 36(18%), Peanuts 17(8.5), were the most frequently encountered FB , followed by sharp (pins) 13 (6.5%), metallic tips 11(5.5%)

4. Image findings

4.1 esophageal FB

On x-ray 100 cases (98%) of esophageal FB were radio opaque.2 cases had barium swallow showed post TEF repair stricture and the other one showed radiolucent FB with zenker diverticulum**.**

4.2 Airway FB

hyperinflation seen in 77(38.5%),normal finding in 47(23.5),radiopaque FB found in 20(10%), atelectasis in 15(7.5%), in 12 case(6%) radiopaque FB with atelectasis, pneumonia with collapse in 8(4%),collapse consolidation in 6(3%), and in 1(0.5%)patient collapse consolidation with radiopaque FB and pneumothorax detected on preoperative imaging **.**

5. Type of procedure

5.1 Esophageal FB

Magill forceps was used in 63(61.8%) and rigid esophagoscopy in 39(38.2%) cases of esophageal FB.

location of FB	Procedure		
	Laryngoscopy +Magill's forceps	Esophagoscopy	total
proximal esophagus	63	7	70
mid esophagus	-	29	29
distal esophagus	-	3	3
Total	63	39	102

Table 3- Location of esophageal FB * way of removal

5.2Air way FB

Rigid bronchoscopy was performed in 195 cases (97.5%), and direct laryngoscopy in 5 cases (2.5%). During Bronchoscopy 107(53.5%) patients took muscle relaxant, (97%) of the time suxamethasone was used.in 83 cases (41.5%) lidocaine infiltration applied during the procedure. Duration of procedure was <20 minute in 44 cases (22%), 20-40 minutes in 86(43%), and it took >1hour in 70 cases (35%).

Type of FB	***bronchoscopy***	***laryngoscopy***	***Thoracotomy***	***tracheostomy & laryngoscopic FB removal***	***Total***
peanut	*17*	-	-	-	*17*
plastic	*40*	*1*	*1*	*1*	*43*
bean,pea,coffee	*53*	-	-	-	*53*
maize, seeds	*35*	*1*	-	-	*36*
sharp	*10*	-	*3*		*13*
leaves	*1*	-	-	-	*1*
balloon inflator	*3*	-	-	-	*3*
Bead	*7*	-	*1*	-	*8*
metallic blunt	*9*	-	*2*	-	*11*
sugarcane fragment	*1*	*1*	-	-	*2*
garlic fragment	*4*	-	-	-	*4*
Stone	*4*	-	-	-	*4*
Teeth	*1*	-	*1*	-	*2*
Bone fragment	*1*	-	-	-	*1*

Leech	-	*1*	-	-	*1*
pepper	*1*	-	-	-	*1*
Total	*187*	*4*	*8*	*1*	*200*

Table 4- Type of air way FB and procedure performed

6. Outcome of Aerodigestive FB

6.1 esophageal FB

In 97(95.1. %) of cases foreign body was removed and in 5(4.9%) foreign body was pushed distally and passed spontaneously per rectum. All Those pushed cases were from mid esophagus

6.2 Air way FB

Overall successful removal of FB during first procedure was 86 %(171/200 cases). In 167 cases (85.6 %) FB removal was successful at first bronchoscopy procedure.

FB removal was not successful in one patient in the laryngoscopy group. This patient had impending RF 2ndary to UAO secondary to plastic FB impacted at larynx. Had cardiac arrest with difficult FB removal then tracheostomy was done and .After 3 days FB removed then discharged

6.3 Redo bronchoscopy

Redo bronchoscopic FB removal was done for 28 cases (14%) after 1st failed bronchoscopy. FB removal was successful in 14/24(75%), but failed in 7 (25%). Re do bronchoscopy was done with in 48hours for 6(27.3%) and after 48 hour for 16 cases (72.7%)

Redo bronchoscopy				
		yes	No	Total
Outcome of 1st bronchoscopy	Removed	6	163	169
	Extraction failure	16	0	16
	Retained	6	4	10
Total		28	167	195

Table 5 -Rate of redo bronchoscopy

6.4. Thoracotomy for Air way FB

Thoracotomy was done for 9 patients (4.5%) with Air way FB.

Bronchotomy and FB removal was done for 7 patients with failed redobronchoscopy.one patient undergo thoracotomy two times on subsequent days because FB was difficult to palpate on the first thoracotomy. The rest Two patients undergo thoracotomy for management of complications one for post bronchoscopic BPF the other for management of lobulated pneumothorax with BPF

7. Complications of Aerodigestive FB

7.1 esophageal FB

Only 28(27.5 %) cases developed complications in FBS group. The commonest complication was minimal esophageal mucosal bleeding during the procedure which accounted for 20cases(19.6%).one patient had TEF(1%) repaired and discharged improved .4 patients(3.9%) had iatrogenic esophageal perforation with pneumothorax and managed with chest tube

One patient (1%) presented with dysphagia and left side neck swelling during feeding with 10 years history of ingestion of plastic toy. Barium showed radiolucent FB with zenker diverticulum.FB removal, diverticulectomy and esophageal repair was done and discharged.

One patient (1%) died on 2nd pod with the dx of hemorrhagic shock 2ndary to AEF + esophageal perforation after presented with button battery ingestion of 5 day duration.

7.2 Air way FB

During the procedure 122(61%) develop complications, majority were intra operative complications like laryngospasm in 46(23%), persistent intra operative hypoxia occurred in 93(46.5%), which was associated with intraop bradycardia in 43(21.5%) and intraoperative cardiac arrest in 9(4.5%). Minimal bleeding from the air way mucosa occurred in 13(6.5%) during the procedure.

In 12 (6%) of patients there was pus in the air way during removal of airway FB which stayed long and which was sucked well no flooding of contralateral air way or suffocation

encountered.in 9(4.5%) pneumothorax detected ,majority diagnosed intra op. and chest tube inserted and managed.one patient(0.5%) came with hydro pneumothorax preoperatively.

This patient presented after aspirated incisor teeth of 5 yrs. duration .bronchoscopic FB removal with suctioning of pus in the RT bronchus and RT chest tube insertion was done. Then decortication, BPF repair and loculated RUL pneumothorax excision done. And discharged after 45 days of hospital stay.

Two patients had pneumomediastinum post bronchoscopic FB removal which was managed conservatively and patient discharged.

Five (2.4%) develop BPF.2 patients (1%) required thoracotomy and BPF repair, the rest 3(1.5%) managed with chest tube.

72(36%) had air way edema and required prolonged dexamethasone and nebulization and two patients required re intubation and MV.

15(7.5%) developed HAP and managed then discharged improved. One patient (0.5%) develop HIE during the procedure**.** Two patients died (1%) on table during bronchoscopic FB removal. Bleeding from the air way result in hypoxia and death in one patient during removal of bronchial FB. The other with organic FB with esophageal intubation arrested on table **See (figure 2)**

Five (2.4%) develop BPF.one patient with FBA (teeth) of 5years with pneumothorax at presentation. The rest 4 are iatrogenic.2 patients (1%) required thoracotomy and BPF repair, the rest 3(1.5%) managed with chest tube.

72(36%) had air way edema and required dexamethasone and nebulization and two patients required re intubation and MV.(one with sharp FB in bronchus presented after 1yr and the second patient with organic FB (peanut)presented after 3 days with duration of procedure of 2hr)

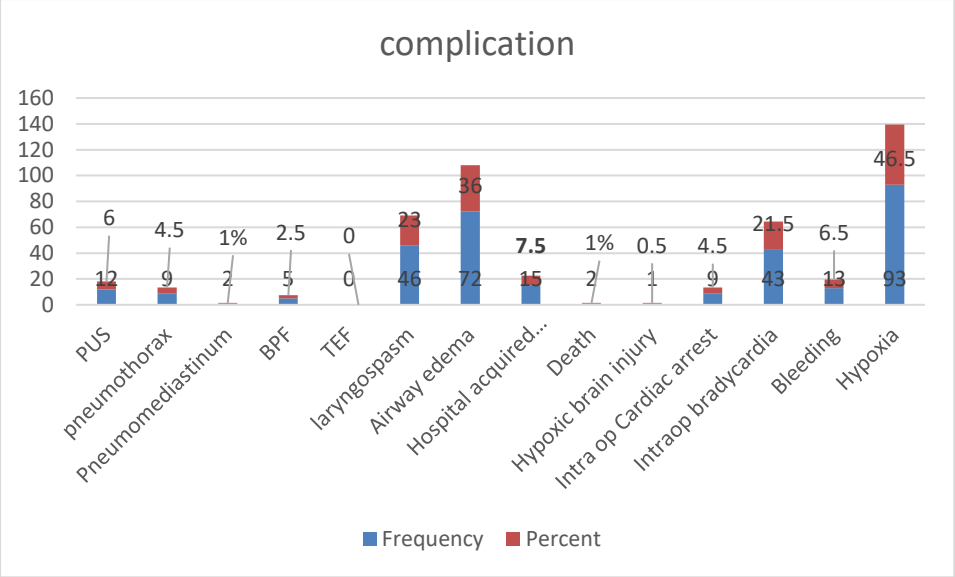

Figure 1-complications of FBA

8. Total hospital stay

8.1 esophageal FB

Majority 72(70%) of patients with FBS were not admitted to wards and were discharged from emergency department after few hours of observation post procedure.14 cases(13.7%) were admitted and stayed 2-5 days in the ward. Eight cases (7.8%) stayed in the hospital >1week.one patient stayed more than a month patient with complication of TEF

8.2. FB in the air way

Twenty five (12.5%) patients with FBA were admitted to PICU post procedure. From these

11 (5.5%) patients required MV post procedure.

Median hospital stay was 3 days with minimum of 1 day and maximum of 45 days with interquartile range of 2day

Factors associated with Air way FB complications

Separate analyses were done to see the association of factors (independent variables) with Airway and esophageal complication. The P values were determined using paired

comparisons using chi-square test. P <0.05 was used to determine significant association.

Variables with p value <0.05 were used for binary logistic regression analysis. .

During the multivariable logistic regression analysis variables like, desaturation at admission and presence of preoperative infection, were found to be significantly associated with increased risk of complication in patents with FBA.

On the other hand, delayed presentation, and type of foreign bodies (battery and sharp FB) were significantly associated with esophageal FB complication

Table 6-Independent variables evaluated using chi square for complications of Air way FB

Variables	No complication n (%) n=66(33%)	There is complication n (%) n=134(67%)	P
Type of FB			
organic	44(36.7%)	76(63.3%)	
inorganic	22(27.5%)	58(62.5%)	0.17
Specific FB			
Blunt	61(33.3%)	122(66.7%)	
Sharp	5(29.4%)	12(70.6%)	0.74
O2saturation|requirment			
maintain	53(50%)	53(50%)	
desaturate	13(13.8%)	81(86.2%)	<0.01
PreoperativeAspiration pneumonia/URTI			
NO	46(52.3%)	42(47.7%)	
YES	20(17.8%)	92(82.2%)	<0.01
Duration of presentation			
Within 24 hrs.	23(37.1%)	39(62.9%)	
After 24 hrs.	43(31.2%)	95(68.8%)	
			0.41
Age(years)			
<1	11(55%)	9(45%)	
>1	55(45%)	122(55%)	0.08
Duration of bronchoscopy			
<1hr	55(42.3%)	75(57.7%)	
>1hr			
	11(15.7%)	59(84.3%)	<0.01

0.02*

Table 7: Result of Binary Logistic Regression Analysis of complications in air way FB in Children

Variables	OR	95% CI	P
Preoperative Aspiration pneumonia	4.01	1.997-8.051	<0.01

Duration of bronchoscopic procedure	0.373	0.165-0.841	0.017
Oxygen saturation at presentation	5.36	2,544-11.291	<0.01

Patients with air way FB who desaturates at presentation were 5 times (AOR= 5.360, 95% CI: 2.544, 11.291) risk of developing airway complication than those who maintained their saturation. Patients who had **preoperative Aspiration pneumonia** were 4 times (OR= 4.010, 95% CI: 1.997, 8.051) risk of developing air way complication than those without infection
And patients with prolonged bronchoscopic procedures (>1hr) had more risk of developing complications.

Factors associated with prolonged hospital stay in FBA

Variables	Hospital stay (<10 day), n (%) n=178(89%)	Stay>10 day, n (%) n=22(11%)	P
Type of FB			
organic	107(89.2%)	13(10.8%)	
inorganic	71(88.8%)	9(11.2%)	0.91
Specific FB			
Blunt	164(89.6%)	19(10.4%)	
Sharp	14(82.4%)	3(17.6%)	0.36
O2saturation			
Maintain	94(88.7%)	12(11.3%)	
Desaturate	84(89.4%)	10(10.6%)	0.87
Preoperative AP/URTI			
NO	82(93.2%)	6(6.8%)	
YES	96(85.7%)	16(14.3%)	0.09
Duration of presentation			
Within 24 hrs.	58(93.5%)	4(6.5%)	
After 24hr	120(86.9%)	18(13.1%)	0.16
Redo bronchoscopy			
No	165(93.8%)	11(6.2%)	
Yes	13(54.2%)	11(45.8%)	<0.01
Duration of bronchoscopy			
<1hr	122(83.8%)	8(16.2%)	
>1hr	56(80%)	14(20%)	0.003

Hospital acquired pneumonia			
No	173 (93.5%)	12(6.5%)	
Yes	5 (33.3%)	10(66.7%)	<0.01
Pneumothorax			
No	176(92%)	15(8%)	
yes	2 (22.2%)	7(7.8%)	<0.01
cardiac arrest			
No	173(90%)	19(10%)	
Yes	5 (62.5%)	3(37.5%)	0.01
Air way edema			
No	121(92.4%)	10(7.6%)	
yes	57 (82.6%)	12(17.4%)	0.03

Patients who undergo redobronchoscopy,presence of HAP and developing pneumothorax were significantly associated risk factors for prolonged hospital stay,>10 days.(p<0.05).see table 7

Variables	OR	95% CI	P
Pneumothorax	49.402	4.374-557.933	<0.002
redo bronchoscopy	0.106	0.028-0.399	0.001
Hospital acquired pneumonia	0.043	0.009-0.216	<0.01

Table 8-binary logistic regression of variables for hospital stay

Factors associated with PICU admission

Variables	No PICU admission n(%) n=162(81%)	PICU admitted n(%) n=38(19%)	P
O2 saturation			
Maintain	87(82%)	19(18%)	
desaturate	75(79.8%)	19(20.2%)	0.6
Intra op Cardiac arrest			
no	160(83.3%)	32(16.7%)	
yes	2(25%)	6(75%)	<0.01
Intra op bradycardia			
no	135(84.4%)	25(15.6%)	
yes	27(67.5%)	13(32.5%)	0.01
Preoperative AP/URTI			
NO	74(84%)	14(16%)	
YES	88(78.6%)	24(21.4%)	0.32
Duration of presentation			
Within 24 hrs	52(83.9%)	10(16.1%)	
After 24hrs	110(79.7%)	28(20.3%)	0.48
Air way edema			
no	111(84.7%)	20(15.3%)	

Yes	51(74%)	18(26%)	0.06
pneumothorax			
No	157(82%)	34(18%)	
Yes	5(55.5%)	4(44.5%)	0.04
Intra op hypoxia			
No	89(83.2%)	18(16.8%)	
Yes	73(78.5%)	20(21.5%)	0.40
Duration of bronchoscopy			
<1hr	110(84.6%)	20(15.4%)	
>1hr			
	52(74.3%)	18(25.7%)	0.07

Table 9

Binary logistic regression was used to identify the independent risk factors associated with PICU admission. Our analysis showed presence of intra op cardiac arrest had significant association (P <0.05)

Presence of cardiac arrest was independent risk factor for requirement of PICU admission. OR=10.714(95%CI: 1.760-65.240) p-value of 0.01

Table 10-Risk factors for intra operative hypoxia

Variables	No hypoxia (%) n=107(53,5%)	There is hypoxia n=93(46.5%)	P
Type of FB			
organic	70(58.3%)	50(41.7%)	
inorganic	37(46.2%)	43(53.8%)	0.11
Lidocaine infiltration			
no	72(53.3%)	63(46.7%)	
yes	35(53.8%)	30(46.2%)	0.86
O2saturation			
maintain	78(73.6%)	28(36.4%)	
desaturate	29(30.9%)	65(69.1%)	<0.01
Preoperative AP/URTI			
NO	56(63.6%)	32(36.4%)	
YES	51(45.5%)	61(54.5%)	0.01
redo bronchoscopy			
No	94(53.4%)	82(46.6%)	
yes			
	13(54.2%)	11(45.8%)	0.94
Laryngo/bronchospasm			
No	96(62.3%)	58(37.7%)	
Yes	11(34%)	35(76%)	<0.01
Air way edema			
No	86(65.6%)	45(34.4%)	
Yes	21(30.5%)	48(69.5%)	<0.01

Duration of bronchoscopy			
<1hr	80(61.5%)	50(38.5%)	
>1hr			
	27(38.6%)	43(61.4%)	0.003*

* = p value < 0.05 Fisher Exact Test

Oxygen saturation at presentation, air way edema and presence of laryngospasm were significantly associated with intra operative hypoxia (p<0.05).see table 7.

Variables	OR	95% CI	P
Airway edema	2.447	1.094-5.471	0.02
Airway spasm	3.607	1.504-8.649	0.004
02 saturation at presentation	5.782	2.951-11.329	<0.01

Table 11-variables significantly associated with intra op hypoxia

Factors associated with increased risk of complications for esophageal FB

.Pediatrics patients who swallow Battery and sharps FB were 84 times (AOR=84.697, 95% CI: 6.537, 1097.449) risk of developing esophageal complication than those who swallowed coin and blunt FB. Patients with esophageal after 5 hour had higher risk of, complication than those presented early

Variables	No Complication (%) n=178(89%)	There is complication, n(%) n=22(11%)	P
Type of FB			
Coin, blunt FB	72(81.8%)	16(18.2%)	
Battery,sharp FB	2(14.3%)	12(85.7%)	<0.01
Type of procedure			
Magill's	57 (90.5%)	6(9.5%)	
esophagoscopy	17(43.6%)	22(56.4%)	<0.01
Witnessed ingestion			
No	2(16.7%)	10(83.3%)	<0.01
Yes	72(80%)	18(20%)	
Duration of presentation			
< 24 hour	55(93%)	4(7%)	
>24 hour	19(44.2%)	24(55.8%)	
			<0.01
Location of esophageal FB			
Proximal	62(88.6%)	8(11.4%)	
Middle	12(41.4%)	17(58.6%)	

distal	0(%)	3(100%)	<0.01

Table 12-chi square test for Factors associated with increased risk of complications for esophageal FB

Variables	OR	95% CI	P
Type of FB(battery)	80.070	7.220-887.997	<0.01
Duration of presentation(>24hour)	13.67	2.052-91.04	0.007

Table 13- factors which has significant association with complications of esophageal FB

Our analysis showed in patients with air way FB presence of preoperative infection and desaturation at presentation had increased risk of complications with significant association (P <0.05). And patients with complication had prolonged hospital stay with P value of <0.05. Delayed presentation (>24 hours) and battery ingestion were independent risk factors for occurrence of complications in esophageal FB. (P <0.05).

:

Discussion

DEMOGRAPHIC

The median age of presentation is 3 year and 78.1% of the cases are below five years. There is slight male preponderance with 57.6% of cases occurred in boys. All these findings are consistent with most reports on pediatrics aerodigestive FB [53] [21] [47]

Most of our patients with FBA ,158 (78.4%) presented with cough, fast breathing in 150(75%) and wheeze in 23(30.3%). Physical examination findings include fever, stridor, retractions, and decreased breath sounds, wheeze, and crepitation. Comparable to study [22]

In our study only 31 %(62) came to the hospital within 24 hours of the event. Similarly (14%) (27) , previous study in our set up (18%) (28) study from Nigeria 8.3% (48)

Foreign bodies were more common on the right side 103 (51.5%), which was found to be consistent with the findings of (sigogren etal,) [17] [22] while others reported no significant preponderance of right or left sides which is similar to that reported by adjeso et al. and [20]. In contrast study from Nigeria reported preferential lodgment of FBs in the left bronchus than the right [47]

Foreign body aspiration

Outcome of FBA

Foreign body removal on the first bronchoscopy was 86%.. which is lower than the previous Study done in our setup which showed (89.4%)[24].another study in china showed success of (99.5%)[33] a success rate of 99.8%.study in India Bronchoscopy removal was successful in17 (80.6 [2].Our redo bronchoscopy rate was 14%, which is higher than the previous study done in our set up (5.2%) [24]

Previous study in our setting showed, the commonest complication was desaturation 51(85%)), persistent hypoxia 34(56.7%), air way mucosal bleeding 34(56.7%), laryngospasm 14 (23.3%), air way or laryngeal edema 13(21.7%), bradycardia 9(15%). There were 2 cases of tracheobronchial fistula with tension pneumothorax. 7 patients needed PICU admission

(12.5%). There was no death (Eseynesh Net al) (49) in our study persistent hypoxia is 48.5%, laryngospasm (23%), air way edema (36%), bradycardia (21%).

Oxygen supplementation through a face mask or nasal prongs was required in 16 (72.7%) cases during the pre-bronchoscopy period (49)
Mechanical ventilation was required in 12 (54.5%) cases in the post bronchoscopy perio
The rate of thoracotomy for aspirated FBs was 4 (3.7%) (49).
Majority of the cases (72.7%) were discharged within five days of hospitalization (49) which is comparable to our study (72.5%)
Complications

Pneumothorax

.In our study Pneumothorax occurred in 9(4.5%) of FBA cases .which is higher than previous study in our set up (2.6%)[21] , (1.9%) (Khan *et al*)[[16] ,Study from Egypt (2.3%), from turkey reported 0.2% (50)

Thoracotomy

Although rigid bronchoscopy remains the 'gold standard' for removal of the foreign body, bronchoscopic removal may fail due to impaction, peripheral location or technical difficulty thus necessitating a thoracotomy (51).rate of thoracotomy in our case is 9(4.5%) which is comparable to previous study done showed 5.2% (28).but it is significantly high than most reports. No patients needed thoracotomies (Khan *et al*)[.[16],Study from turkey showed Thoracotomy rate was 0.6% (50)

FBA	Our study	Tadesse.A et al	**Boufersaoui A et al (Algeria)**	Albirmawy OA et al (study from Egypt)	Righini CA et al (South Africa)	Adjeso T et al (North Ghana)
mortality	3(1.5%)	(1.3%)	0.26%	0	0	0

In this study Mortality rate was 1.5% which is comparable to previous study in our setting (1.3%) [22] Fidkowski et al reported 0.42% (19), from Algeria reported a mortality of 0.26% (21) .no mortality reported from Egypt (52) , North Ghana (22) and South Africa deaths (53)

Hypoxic brain injury occurred in 0.5% which is comparable to other study done in India (0.96%) (19), fidkowski et al reported 0.98% (19)

Hospital stay

(11.5%) cases with FBA stayed in the hospital >10 days. Which is higher than previous study (3.9%) [22] .

Association for risk factors for air way complications

In patients with FBA presence of preoperative infection showed statistically significant increased risk of complications. ($P<0.05$).This signifies occurrence of preoperative Aspiration pneumonia possibly caused by late presentation. A longer duration of surgery (>20 min) and pneumonia before the operation also increased the risk of intraoperative complications (hypoxemia) significantly. (40). Of the 300 patients with FBA showed that a history of congenital heart disease, preoperative respiratory infection, and poor anesthesia effect were identified as independent risk factors for intraoperative hypoxia and cardiac arrest in children undergoing FB removal (46)

Preoperative respiratory impairment was associated with an increased risk for complications. Pneumothorax occurred in (0.8%) patients. There was 1 (0.2%) death from severe respiratory-related complications. (35)

Another study showed Children of less than 3 years of age were more prone to complications than children of older age. But no correlation was found in our study (14)

Study in India showed Risk factors that lead to complications were identified and include age below 1 year, a vegetable foreign body, prolonged bronchoscopy beyond 20 minutes, traumatic procedure by an occasional less experienced endoscopist in the learning phase, occasional less skilled anesthetist, improper instrumentation and delayed patient presentation or delayed referral when pneumonitis has already supervened (36)

Esophageal FB

In patients with FBS in 97(95.1) cases foreign body was removed successfully on the 1st procedure which is comparable to the previous study done in our set up (Taddese, A et al

The most common FB ingested was coin recorded in 72 (84.7%) patients, followed by button batteries 5 (5.9%) and metallic materials 4(4.7%). (94.1%) of them were radio opaque. McGill forceps was used in 53(62.4%), Foley catheter method in 15(17.6%) and rigid oesophagoscopy in 9(10.6%). (26)

(1.7%) children experienced severe complications (esophageal perforation (50), turkey (3.19%) (54)

Coins and disk batteries were the most common blunt objects retained in the esophagus

Mortality was recorded in 1 (1.06%) patient who has co-morbidity. Esophageal perforation from denture impaction was seen in 3 (3.19%), post-operative pyrexia, cardiac arrest, and death was recorded each in 1 (1.06%) of the patients. Importantly 88 (93.62%) of our patients did not develop any complication from either the impacted foreign body or the procedure performed. (54)

Delayed presentation (>24 hours) and sharp and battery foreign bodies were independent risk factors for occurrence of complications in esophageal FB. ($P < 0.05$) (33) A retrospective study from South Korea In multivariate analyses, risk factors for endoscopic complications and failure were sharpness (; $P = 0.034$) and a greater than 12-h duration of impaction (, $P = 0.025$). (41)

Button batteries (also known as disk batteries) pose a substantial risk of mucosal damage when they become lodged in a moist environment, such as the esophagus. Missed esophageal button batteries have been associated with fatal hemorrhage due to created aorto-esophageal fistula.in our study rate of AEF and death was 1%

Study from Mexico, among the patients who had a perforation, the FB was located in the esophagus in 3 of them (disc batteries), and the fourth patient had a gastrojejunal perforation (17 magnets). 1 death occurred, in a 9-year-old boy with hematemesis and shock secondary to aortoesophageal Fistula because of a coin swallow of 6 months duration, (45)

A retrospective study from America showed, No association between complications and duration of battery ingestion. TEF occurred in patients with times from diagnosis to removal of only 2.5 to 5 hours and No death was reported (12). A study (review) done in the USA showed. Button batteries, magnets, long objects, or those that are sharply pointed or with a

sharp edge, are most prone to complication. (44) (33). Another retrospective study from South Korea showed that impaction duration and sharpness of esophageal foreign bodies were the two important risk factors for the development of major complications. (33) (41). In another study, the risk factors associated with complication after endoscopic FB removal were long duration from ingestion to endoscopy and existence of initial mucosal injury (10). In another study, the frequency of complications increased when the ingested object was a battery when the time lapsed prior to diagnosis was 8-16 hrs. (32) (33).

Prompt endoscopic intervention is the gold standard for all complicated or high-risk situations, with particular relevance to sharp and pointed foreign bodies, such as dentures with protruding hooks, shaving blades, and open safety pins, which increase the danger of perforation (34)

Conclusion

The research has identified duration of presentation and type of foreign body is associated with statistically significant risk of complication in esophageal FB. We have also identified pre-operative aspiration pneumonia, oxygen requirement at presentation and duration of bronchoscopy had significant association with complications of FBA. Presence of cardiac arrest was independent risk factor for requirement of PICU admission. And Patients who undergo redo bronchoscopy, presence of HAP and developing pneumothorax were significantly associated risk factors for prolonged hospital stay

Recommendations

Because organic substances are more common foreign bodies to be aspirated, delayed initiation of such type of food, as well as supervising of activities and feeding of children, should be given priority

Keeping small objects away from children

Requires a high index of suspicion for the physician to establish the possibility of foreign body aspiration.

Bronchoscopy should be available at least in referral hospitals

Government must organize regular campaigns and proper education of the public both in the news/print media on the risk of foreign body aspiration especially among the under-five's

The most important issue is to improve prevention techniques, rather than treatment techniques.

In addition, toys and coins must be designed with dimensions that cannot be swallowed.

Early diagnosis and prompt treatment aid in reducing the complications, morbidity, and mortality associated with foreign body aspiration

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For Esophageal FB cheeklist tool

*

❑ **Data collection check list**

1 demographic.1 Age 2 Sex 3 Addresses

2-Presentation

1-vomiting ☐ yes ☐ No 2. Dysphagia ☐ yes ☐ No 3 .Drooling, ☐ yes ☐ No 4. Odynophagia ☐ No

5. Difficult of breathing ☐ yes ☐ No 6. Cough ☐ yes ☐ No 7. Fever ☐ yes ☐ No 8. Hoarse of voice with stridor ☐ yes ☐ No 9. Asymptomatic ☐ yes ☐ No

3-previous esophageal disease 1. Previous surgery (TEF) 2. Esophageal Stricture 3 none

4-Duration of presentation (days)

5. Location of foreign body 1 proximal esophagus 2 mid esophagus3 distal esophagus

6. Image 1. Radiopaque 2. Radiolucent

7. Procedure 1. Removed with Magill's forceps 2. Esophagoscopic removal

8. Type of FB 1. Coin **2**. Battery 3. Sharp object 4 blunt object 5. Food bolus

9-Outcome 1. Removed 2. Pushed

10-Complication

1. Esophageal Perforation with pneumothorax

2 Mediastinitis 3 Peumomediastinum 4. TEF 5 AEF 6 Death

7None 8. Minor esophageal mucosal Bleeding/oozing

9. Aspiration pneumonia

11. Esophageal stricture with esophageal diverticulum

12-Total hospital Stay

13. Is ingestion of foreign body Witnessed? 1-yes 2. No

DATA COLLECTION CHEKLIST FOR FBA

Part I: Background information of participant patient

1, no…….

2, Age:

3, Sex: 1. Male, 2. Female

4 Addresses: 1. Addis Ababa 2. Oromia region **3**. Amhara region 4. South region 5. Somali.region. 6. Tigray 7 afar

Part II: test questions

***1. Presentation*:** 1. Cough: yes ☐ no ☐ 2. Shortness of breath: yes ☐ no ☐ 3. Vomiting: yes ☐ no ☐ 4. Fever: yes ☐ no ☐

5 .brief loss of conciseness: yes ☐ no ☐ 6 .asymptomatic: yes ☐ no ☐

2. Duration of presentation: 1. within 24 hour **2**. 2-3 day **3**. 4-5 day **4** .6-10 days

3. Choking: 1 witnessed 2 not witnessed

4. Physical examination: 1. Decrease air entry : yes ☐ no ☐ 2. Wheezing : yes ☐ no ☐ 3 .transmitted sound : yes ☐ no ☐ 4. Crepitation : yes ☐ no ☐

5. Preoperative oxygen saturation: 1. Maintain its saturation with atmosphere air 2.80-90% 3.70-80% 4. <70%

6. Image finding: 1. Normal x-ray 2. Lobar pneumonia 3. Hyperinflation 4. Radiopaque FB 5. Atelectasis 6.collapse Consolidation 7. Pneumothorax

7. Delay of presentation

1-family (if FB is not suspected or, if they didn't seek medical advice because of financial reason, or, if they Ignored it) 2-delay referral 3-distance 4. Patient was asymptomatic 5. No delay (if they came to our hospital with in 24 hour)

8. Preoperative infection: 1-Aspiration pneumonia **2**-URTI **3**-NONE

9-foreign body location: 1. Right main bronchus 2 .Left Main bronchus 3. Tracheas 4. Larynx 5. Right lobar bronchus

6. Left lobar bronchus **7.** Distal bronchial trees 8-carina

10. Procedure: 1. Bronchoscopy removal **2**. Bronchotomy **3**. Laryngoscopic removal using forceps

11. Procedure duration; 1. < 20 minute 2.20-60 minute 3. 1-2 hours 4.> 2 hours

12-Type of FB: 1. Organic 2. Inorganic

13 -Specific foreign bodies: 1. Pineault 2. Plastic 3. Coffee, bean, pea 4. Sharp material 5. Seeds

14-lidocane infiltration used during removal: 1. No **2**. Yes

15- Suxamethasone used: 1. No 2. Yes

16- outcome: 1. Removed 2. Extraction failure **3** Retained fragment

17-redo bronchoscopy: 1. No 2. Yes

18-Timing of redo bronchoscopy 1-with in 24 hour after the 1st bronchoscopy 2 on 2nd post procedure day

3-after 72 hour from the first bronchoscopy

19-nebulization required postoperatively with dexamethasone or adrenaline: 1. None 2. 24hr **3.2**-3 days 4 ;> 3 days

20. PICU STAY: 1. None 2. < 48 hour 3.3-5 day **4**.>5 day

21-was on MV: 1. None 2. <48hr **3.3**-5 days 4.>5 day

22. **Total hospital stay:** 1. <48 HR **2.3**-5 Day **3**. 6-10 Day 4.>10 Day

23-Dexamethasone requirement post operatively: 1; None **2;** 24hr; **3.2**-3 day 4.> 3 days

24- Complication: 1-yes 2-no 1. Pneumothorax. Yes ☐ no ☐ 2. Pneumohemothorax yes ☐ no ☐ 3. Pneumomediastinum yes ☐ no ☐ 4. Mediastinitis yes ☐ no ☐ 5 TEF yes ☐ no ☐ 6. Laryngospasm yes ☐ no ☐ 7. Air way edema yes ☐ no ☐ 8. Hypoxic brain injury yes ☐ no ☐ 9. Hospital acquired Pneumonia yes ☐ no ☐ 10. Deaths yes ☐ no ☐ 11. Cardiac Arrest yes ☐ no ☐

25-persistent Hypoxia: 1. none 2.80-90% 3.70-79% 4. <70%

Assurance of investigator

The undersigned agrees to accept responsibility for the scientific, ethical and technical conduct of the research proposal and for provision of required progress reports as pre terms and conditions of the research and publication Addis Ababa University

Name of primary investigator Dr. **Etsub Abebaw**

Date_____ Signature_____

Approval of the Advisor(s)

_____

_____

Advisors

Name	Signature	Date
1._____	_____	_____
2._____	_____	_____