Erciyes Tıp Dergisi 14: 72-82, 1992

FOREIGN BODIES OF THE UPPER AERODIGESTIVE TRACT + A Clinical Study

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Summary: A foreign body lodged in the aerodigestive tract of a child often poses a difficult medical problem. We reviewed a series of 412 children who. attended to our department between 1981 and 1991 with the diagnosis of a foreign body (FB) in upper aerodigestive tract. Children between the ages of one and five years were the most commonly affected (64 %). History of FB could be obtained in 98 percent of the cases. Cough (76 %), decreased unilateral breath sounds (60 %) and wheezing (62 %) were the syptoms and signs of tracheobronchial FBs; hypersalivation (72 %) and dysphagia (20 %) were the symptoms and signs of esophageal FBs. Obstructive atelectasis and emphysema were the radiological findings of the 42 percent of inhaled FBs. Esophageal FBs were demonstrable on plain films in cases. Bronchoscopy demonstrated the inhaled FB in the right main bronchus in 200 cases. The most localization of ingested FBs was cervical narrowing at the 84.4 percent of the esophageal FBs. Open-tube bronchoscopy and esophagoscopy were the methods of choice for FB extractions.

Key words: Foreign body, aerodigestive tract.

The pediatric population represents a significant proportion of referrals for the thoracic surgeon. Children present challenging diagnostic and therapeutic problems which often require specialized training and equipment. The aspiration or ingestion of a FB often illustrates this point. A chart review was undertaken at our department of any child with a diagnosis of tracheobronchial or esophageal FB, who underwent endoscopy. From this data, several points regarding epidemiology, diagnosis, subsequent management and findings were elicited.

MATERIAL AND METHODS

The medical records at the department of Thoracic and Cardiovascular Surgery of Erciyes University Medical Faculty in Kayseri with the diagnosis of FB of the upper aerodigestive tract are reviewed. Children with pre-existing related problems were excluded. Any child with a nonrelated diagnosis was included. The chart review covered a ten year period up to November, 1991.

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FINDINGS

Four hundred and twelve cases of FB aspiration and ingestion have required endoscopic procedures for diagnosis end management. Of these, 348 were tracheobronchial and the remaining 64 were esophageal. Males outnumbered females 1.2:1. The ages of the patients ranged from three days to 16 years. However, 64 % were between the ages of one and five years (Figure 1). The mean age for bronchial FBs was 27 months, and for esophageal FBs, 60 months.

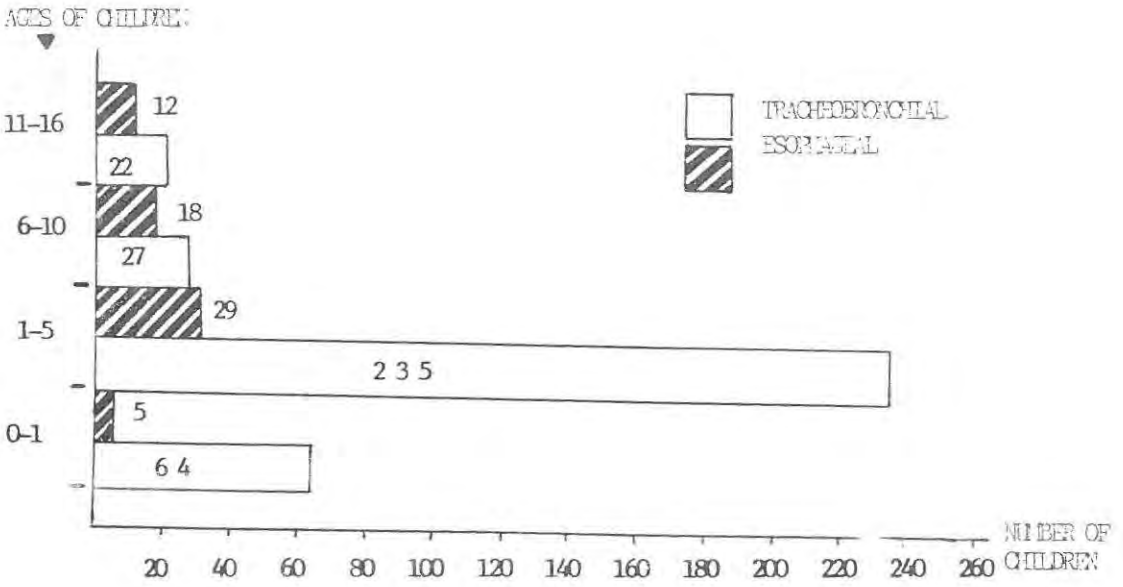

Figure 1. Age distribution of children in chart review.

History-taking in this age group was often quite difficult. The description of a witness of the ingestion proved to be the key to diagnosis many times. For esophageal FBs, 54 of 64 children (84.4 %) had been seen to ingest an object (Table I)

Auscultation of the chest proved most reliable for tracheobronchial FBs (Table II). Sixty-nine per cent of children exhibited decreased air entry one side and subsequently proved to have a FB on that side. Other findings included an audible stridor and wheezing in over 90 % of the cases. Surprisingly, neither fever nor tachypnea was a consistend finding. The physical examination was generally unrewarding for esophageal FBs.

In almost all cases, radiographic investigations were obtained (Table III) Radiopaque FBs were readily identified in 20 % of cases. A plain chest X-ray was often suggestive of the

Table I. Presenting smptoms.

Symptoms	n	%
Tracheobronchial FBs		
History of aspiration	340	98
Cough	264	76
Wheezing	215	62
Choking	96	27
Stridor	111	32
Esophageal FBs		
History of ingestion	54	84
Dysphagia	13	20
Odynophagia	9	14
Drooling	46	72
Pain	8	12

Table II. Presenting sings of bronchial FBs.

Sign	n	%
Unilateral decreased air entry	240	69
Wheezing	215	62
Crackles	111	32
Audible inspiratory stridor	111	32
Fever	39	11
Tachypnea	60	17

Table III. Radiological findings.

Finding	n	%
Tracheobronchial FBs		
Obstructive atelectasis	57	9.8
Obstructive emphysema	83	11.3
Pneumonic infiltration	42	61.1
Foreign body seen on plain X- ray	28	8.0
Mediastinal shift to right or left	31	9.0
Holzknecht's sing*	11	0.2
Normal radiography	96	27.6
Bronchiectatic changes	10	3.0
Esophageal FBs		
Foreign body seen on plain X- ray	54	84.4
Foreign body with braium swallow	5	7.8
Normal radiography	5	7.8

* This sign, especially examined, was determined by means of inspiratory / expiratory graphies, found at one in six patients who had a FB into the left main bronchus.

diagnosis of tracheobronchial FB. In a six cooperative child, inspiratory/expiratory films were attempted. Radiography was normal in 27.6 %, obstructive emphysema was found in 23.8 % of the cases.

While tracheobronchial FBS were lodged in the right main bronchus, esophageal FBs were localized into cervical narrowing (Figure 2). In most of the cases aspirated FB was removed endoscopically and thoracic exploration was needed (Figure 4). Table IV outlines the applied management. There were no surgical and endoscopic complication except a child aspirated a bead. A child aspirated cement powder unfortunately expired of respiratory failure (Figure 5).

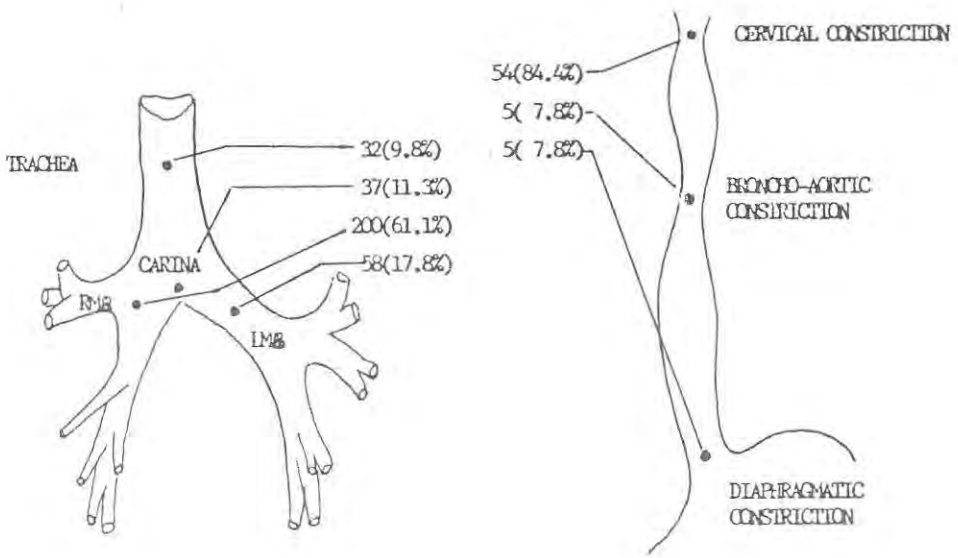

Figure 2. Anatomical localization of the FBs.

sunflower seeds, a widely consumed as a dried fruit. In the esophagus, 64 % of all FBs were coins (Figure 3).

Both bronchoscopy and esophagoscopy were effective in most cases. Twenty-one (% 5) bronchoscopic procedures were negative. In one patient ingested wire peg could not be

DISCUSSION

The leaning of little children who imitate the parent who holds a needle, a nail or a screw in his mouth and the tendency to put whatever comes into their grasp into their mouths is one of the significant reasons of FBs in upper aerodigestive tract. In our series, infants

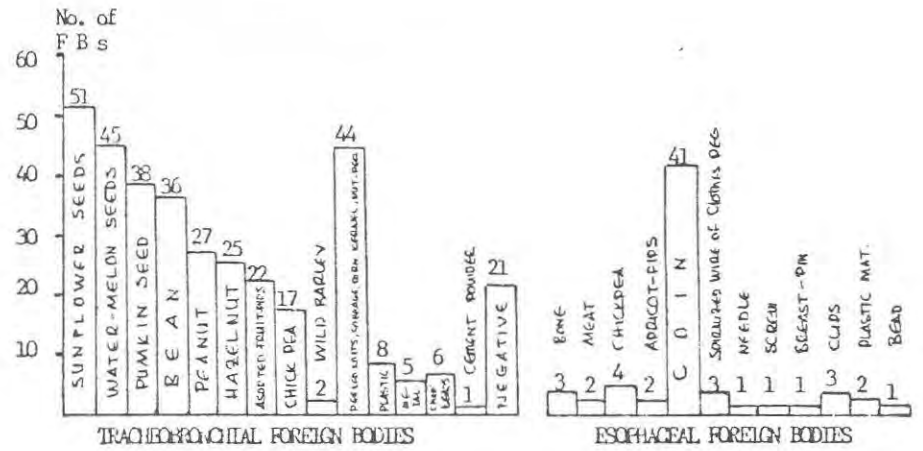

Figure 3. Nature of 412 aspirated and ingested FBs.

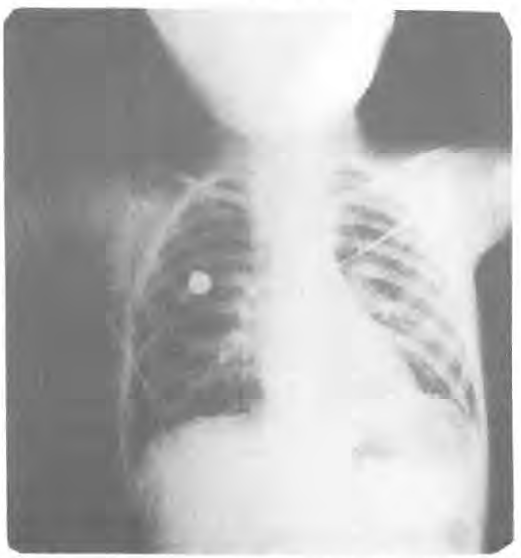

Figure 4. Roentgenogram illustrating a spiralized wire of clothes peg at the level of anatomical narrowing of the esophagus.

between 1 to 5 years were containing sixty-four percent of our cases.

In our series the boys outnumbered the girls 1.2:1. This male predominance seems consistent with many previous studies (17,30). Early diagnosis is essential in the aspiration of FB. The ignorance and the delay in treatment is dangerous and can lead a fatal outcome (36). Therefore, in pediatric age group the aspiration of FB is one of the most urgent conditions (2,3,5,17). We intervened on every patient suspected our diagnosed FB. The frequency and the pattern of inhaled FBs do not show any significant difference in various papers (2, 5, 6, 30).

Most of our patients applying with aspiration are from rural areas, so they show the resemblance with the other studies that find bronchial aspirated FBs in lower

Table IV. Treatment.

Applied procedure	n	%
Tracheobronchial		
Bronchoscopic intervention	322	92.52
Nonbronchoscopic intervention*		
Thoracotomy-bronchotomy	3	0.86
Surgical treatment of complications		
Pulmonary resection-lobectomy	2	0.57
Esophageal		
Nonoperative procedures		
Removal by esophagoscopy**	33	51.56
Removal by Magill forceps	25	39.06
Pushing the FB into the stomach***	3	4.68
Operative interventions		
Thoracotomy-esophagotomy	1	1.56

* Urgently applied extremely dyspneic two patients with inhaled FB, Heimlich maneuver performed in the trime until the bronchoscopy but it was failures

** Two FBs, were seen in the esophagus before endoscopy but were not seen during esophagoscopy, were excluded. They were ssen in the stomach after endoscopy.

*** These FBs pushed into the stomach were chickpea, marble and plastic objects.

socioeconomical group (7,23). At this point we emphasize the importance of social medicine and public health like the others (20).

In our series there was a slight predominance for lodgement in the right main-stem bronchus (RMB) (% 61). This has been explained by a combination of there factors: (1) large diameter, (2) greater airflow, (3) diverges from the trachea at a less acute angle than the left (17). In the adult population, right-sided FBs become even prevalent. Most autors feel symetrical bronchial angles in children up to 15 years of age account for the more equal distribution (10). Esophageal FBs usually lodge at certain anatomical points, which are cricoid (C6), thoracic inlet (T1), aortic arch (T4), tracheal bifurcation (T6) and hiatus (T10/11). In our cases, the most common site of impaction in the esophagus was the cervical segment immediately below the cricopharyngeus muscle (% 84). The author felt that large objects lodge here because of weakness in peristalsis (17). Some claim that 33-80% of FBs in the esophagus are seen et this site (17,25).

Inhaled FB causes theree types of obstruction

Figure 5. Roentgenogram demostrating a "cement bronchography". The patient was five-year-old boy who aspirated cement powder.

in the bronchus: (a) In the bypass-valve obstruction; FB permits the air in and out, and chest graphy is normal (27.6 % of our series), (b) In the check - valve obstruction; FB allows the air into the distal lung, but on expiration the air can not egress because of the swollen mucosa in cantact with the FB and besides the contraction of bronchial wall, and consequently obstructive emphysema occurs. To a study obstructive expiratory emphysema is able to be seen radiologically at 95 % of the cases (18) (We found obstructive emphysema in the 23.8 % of our cases), (c) Stop-valve obstruction; the FB obtructs the lumen completely, and it does not permit the air ingress or engress so obstructive atelectasis occurs (16.4 % of our cases). This happens mostly with radiopact subjects like coins as it has been observed in many other studies (15).

In the diagnosis of bronchial FBs, we did not use the techniques of computed tomography, xeroradiography and pulmonary scanning (29). Plain radiography with clinical findings were generally sufficient for diagnosis. Inspiratory/expiratory films were not satisfactory, and they were not studied except for six patients. The roentgenographical findings are known to give out clues in most series over 80 percent of the cases (36). In our series, radiography was diagnostic in 72.4 % of bronchial FBs and in 84.4 % of esophageal FBs.

In inhaled FBs, the removal of FB from bronchial tree is the only choice (2,3,6,20,23,24,32). In esophageal FBs, the indication of the urgent removal of FB can be summarized as follow: (a) a sharp-edged or tipped FBs because of its potential for

esophageal-wall penetration and perforation, (b) little button batteries, such as those used in digital watches and calculators, because of potential caustic erosion and perforation of the esophagus (30). Many cases of upper airway obstruction due to esophageal FBs have been reported (1,23).

If the esophageal FB smooth and is nontoxic, the retardation of removal may be excused because most of the flat surfaced objects pass through the stomach spontaneously. The principles of management on esophageal FBs are: (a) the removal of FB, (b) the pushing the FB into the stomach, and (c) surgery. The removal of FB either by endoscopy or by Magill forceps was succesful in most of our cases (90 %).

Endoscopy is carried out only under sedation and topical anesthesia in most of the adults, but hospitalization and general anesthesia is necessary in children. Just after the patient is anesthetized, the esophageal FBs seen during laryngoscopy are removed by Magill forceps (1). The extraction of esophageal FBs using baskekt or Foley catheter under topical anesthesia and flouroscopic control were succesful procedures (8,28,31). However, attempts at postural drainage or Fogarty catheter removal are felt to be associated with a complication rate higher than endoscopy (7,9,16). In the presence of metallic FBs in the esophagus, magnetic removal may be tried (13).

Rigid bronchoscope provides the FBs to be remarked, and different kinds and sized forceps can be used (17). We tried the Fogarty baloon catheter especially on aspirated beads on some children, but with failure, and we gave up this procedure considering its complications (7,9).

Some noninvasive, phanmacological and mechanical procedures have been tried to facilitate the passage of FB's into the stomach, such as; (a) giving tartaric acid and sodium bicarbonate facilitating carbon-di-oxyde gas tensicn in the esophagus (27), (b) injecting intravenous glucagon to help the lower esophageal sphincter dilatation (34), (c) proteolytic enzymes, (d) sublingual nitroglycerine to eliminete the smooth muscles spasm (12,14), (e) various neutralizing agents such as 0.25 % acetic acid, orange juice, Mylenta II and normalsaline (28), and (f) peroral bouginage (15).

In cases delayed 48 hoursor more, FBs like bean, chickpea etc. are removed by breaking them into piences since they derarange in shape and become swollen. When the smaller pieces go further down in the bronchial tree the procedrue is usually unsuccesful (20). In one of our patients who inhaled a ball-valve the FB could be visualized radiologically but could not be seen during bronchoscopy since it was embeded in granulation tissue. It was recognized during the excision of the granulation tissue. This FB was removed at the same time.

Indications of bronchotomy for inhaled FBs have decreased recently (2,3,16). The removal of FB by bronchotomy was required in three our cases. In this cases, the aspirated FBs were a little stone and beads. In the series of Brown and Clark (6), bronchotomy rate was 1.6 percent. The surgical therapy in unremovel and complicated esophageal FBs is required for reparing of a large perforation or a tracheobronchial fistula (TEF), and for draining of a mediastinal abscess (11,33).

The complications of FBs of upper aerodigestive tract may be serious and fatal. In our cases with FB aspiration, subglottic

edema, atelectasis, pneumonia, bronchiectasis, respiratory failure were the observed complications. A two-year old boy inhaled too much cement powder from a falling cement bag upon him expired because of acute respiratory failure. The roentgenography of this patient showed that bronchial tree was thoroughly covered with cement which was also observed at bronchoscopy. In our patients, the other extreme complications such as abscess formation or diffuse pulmonary edema (20,21), pneumothorax (20, 36) or false aneurysm (35) did not occur.

Esophageal FBs can cause serious complications from esophagitis to death. Among these burning, strictures, perforation, mediastinitis, sepsis, subcutaneous emphysema, aortoesophageal fistula, TEF, pneumonia, massive exanguination, cardiac tamponade, paraesophageal and retroesophageal abscess (19,21,26) and lung abscess (22) are reported. There is no esophageal complication in our series.

Postendoscopic complications relating to bronchoscopy are rare. Subglottic edema should always be considered a possible complication of bronchoscopy particularlry in inants and children. Severe bronchospasm may occur in asthmatic patients during the bronchoscopy (4). For these reasons to our patients, after bronchoscopy, we routinely give cold mist and cortisone intravenously. Our only complication resulting with death happened in a threeyear-old girl who aspirated bead. This patient died because of diffuse bronchospasm during bronchoscopy (mortality rate 0.4 percent). Mortality rate is almost the same in various publications (3,24). Bronchial perforation and bleeding are the other rare complications of bronchoscopy (4).

Esophagoscopy is technically more difficult than to perform bronchoscopy and carries risk of serious complications, even in the hands of an experienced endoscopist. Perforation commonly occuring in the upper narrowing of esophagus, developed in none of our patients. The perforation rate is 0.25 per cent in literature (4).

In conclusion the findings presented in this paper reassert rigid bronchoscopy /esophagoscopy as a safe and succesful method of foreign body removal from the upper aerodigestive tracth in children. Early diagnosis and punctual management result in fast recovery and short hospital stays. When an infant or younger child presents with a history indicative of aspiration, a practised endoscopist should be consulted. A negative clinical exam and roentgenographic study should not entirely exclude the possibility of a foreign body. Finally, care taken by parents and social physicians can decrease the incidence of this problem significantly.

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