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Complications of tracheobronchial foreign bodies

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Background/aim: Tracheobronchial foreign bodies may cause several complications in the respiratory system. We aimed to present the complications of tracheobronchial foreign bodies.

Materials and methods: Between January 1990 and March 2015, 813 patients with suspected tracheobronchial foreign body aspiration were hospitalized in our department. Patients with complications related to foreign bodies in airways were included in this study. We retrospectively evaluated the records of patients according to symptoms, foreign body type, localizations, and complications.

Results: A foreign body was found in 701 of 813 patients (86.2%). Complications related to foreign bodies settled in airways were seen in 96 patients (13.7%). The most common complications were atelectasis and pneumonia in 36 (5.1%) and 26 (3.7%) patients, respectively. Other complications were bronchiectasis (n = 12, 1.7%), cardiopulmonary arrest (n = 11, 1.6%), bronchostenosis (n = 3, 0.4%), death (n = 2, 0.3%), migration of foreign body (n = 2, 0.3%), pneumomediastinum (n = 2, 0.3%), tracheal perforation (n = 1, 0.15%), pneumothorax (n = 1, 0.15%), and hemoptysis (n = 1, 0.15%). Coughing (n = 74, 77.1%) and diminished respiratory sounds (59.3%, n = 57) were the most common findings.

Conclusion: Careful evaluation and rapid intervention are life-saving methods in tracheobronchial foreign body aspirations.

Key words: Atelectasis, foreign body, pneumonia

1. Introduction

Foreign bodies in airways may be present with different clinical symptoms (1). Although the majority of cases can be diagnosed correctly in the early period, some patients are misdiagnosed in the acute period (2). The symptoms and findings at the beginning are usually related to airways obstruction. However, lately, suppurative symptoms are seen because of parenchymal damage (3). Furthermore, the incidence of complications of tracheobronchial foreign bodies increase when diagnosis and treatment are delayed (4). The most feared complication in the acute period is cardiopulmonary arrest. In this paper, we aimed to present our experience about the complications of tracheobronchial foreign bodies.

2. Materials and methods

Between January 1990 and March 2015, 813 patients with suspected tracheobronchial foreign body aspiration were hospitalized in our department. Patients with complications related to foreign bodies in airways were included in this study. We retrospectively evaluated the records of patients according to age, sex, symptoms, findings, therapeutic options, foreign body type, localization, and complications. Before interventions, routine radiographs were taken, all patients were examined carefully, and detailed histories were obtained from the patients, parents, or other close relatives. Rigid bronchoscopy was the principal method. Fiberoptic bronchoscopy was used to determine the location of the foreign bodies when rigid bronchoscopy failed. Lobectomy was performed in patients who had irreversible lung diseases. Recommendations of the International Committee for Medical Journal Editors were respected by all authors during manuscript writing.

3. Results

All patients underwent rigid bronchoscopy. A foreign body was found in 701 of 813 patients (86.2%). Complications related to foreign bodies settled in airways were seen in 96 patients (13.7%). Fifty-four patients were male (56.2%) and 42 patients were female (43.8%), and the mean age was 5.2 years (8 month to 83 years). Peak incidence of the complications occurred between 1 and 3 years, accounting for 51.1% of the total number (Table 1). The most common complications were atelectasis, pneumonia, and respiratory distress in 36 (5.1%), 26 (3.7%), and 24 (3.4%) patients, respectively (Table 2).

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Table 1. Age distribution of patients.

Age range	N	%
0–1	15	15.6
1–3	49	51.1
3–10	23	24
10–20	4	4.2
20–30	1	1
30–40	0	0
40–50	1	1
50–60	1	1
>60	2	2.1
Total	96	100

Table 2. Complications of foreign bodies.

Complications	N	%
Atelectasis	36	5.1
Pneumonia	26	3.7
Respiratory distress	24	3.4
Bronchiectasis	12	1.7
Cardiopulmonary arrest	11	1.6
Bronchostenosis	2	0.4
Death	2	0.3
Migration	2	0.3
Pneumomediastinum	1	0.3
Pneumothorax	1	1.5
Tracheal perforation	1	1.5
Hemoptysis	1	1.5

Other complications were bronchiectasis (n = 12, 1.7%), cardiopulmonary arrest (n = 11, 1.6%), bronchostenosis (n = 3, 0.4%), death (n = 2, 0.3%), migration of foreign body (n = 2, 0.3%), pneumomediastinum (n = 2, 0.3%), tracheal perforation (n = 1, 0.15%), pneumothorax (n = 1, 0.15%), and hemoptysis (n = 1, 0.15%). Coughing was the main symptom (n = 74, 77.1%). Diminished respiratory sounds (59.3%, n = 57), fever (39.6%, n = 38), dyspnea (25%, n = 24), cyanosis (14.6%, n = 14), and rhonchi (11.5%, n = 11) were the most common findings (Table 3). The time interval of the symptoms ranged from 30 min to 4 years,

Table 3. Symptoms and physical findings.

Symptoms and findings	N	%
Coughing	74	77.1
Diminished respiratory sounds	57	59.3
Fever	38	39.6
Dyspnea	24	25
Cyanosis	14	14.6
Rhonchi	11	11.5

with a mean of 34.1 days. Twenty-one patients did not have an aspiration history (21.9%).

The chest plain showed atelectasis, pneumonia, radiopaque images of metallic objects, bronchiectasis changes, pneumomediastinum, and pneumothorax in 36 (37.5%), 29 (30.2%), 12 (12.5%), 2 (2.1%), and 2 (2.1%) patients and 1 (1%) patient, respectively. The chest plain was normal in 1 (1%) patient. Before bronchoscopy, the chest plain was not taken in 13 patients because of severe respiratory distress.

The locations of the foreign bodies were the trachea, right bronchial tree, left bronchial tree, and both bronchial systems in 23 (24%), 45 (46.9%), 26 (27%), and 2 (2.1%) patients, respectively (Table 4). Nuts were responsible for majority of the complications (n = 76, 79.2%) (Table 5).

Rigid bronchoscopy indications were positive medical history, symptoms and findings supporting

Table 4. Localizations of foreign bodies.

Localization	N	%
Trachea	23	24
Right bronchial system	45	46.9
Main bronchus	21	21.9
Intermediary bronchus	7	7.3
Middle lobe bronchus	1	1
Lower lobe bronchus	16	1 16.7
Left bronchial system	26	27
Main bronchus	11	11.4
Upper lobe bronchus	2	2.1
Lower lobe bronchus	13	13.5
Both bronchial systems	2	2.1
Total	96	100

Table 5. Types of foreign bodies.

Types	N	%
Nuts	76	79.2
Peanut	49	51
Sunflower seed	14	14.6
Hazelnut	9	9.4
Roasted chickpea	4	4.2
Plastic object	11	11.5
Kidney bean	5	5.2
Headscarf pin	2	2.1
Voice prosthesis	1	1
Fragment of glass	1	1
Total	96	100

the tracheobronchial foreign body aspiration, positive radiologic evidence, and recurrent and/or antibiotic-resistant pulmonary infections. Foreign bodies were extracted by rigid bronchoscopy in all patients. Fiberoptic bronchoscopy was used to determine the location of objects in two patients who had aspirated headscarf pins, because these objects migrated to the distal airways while patients were waiting for the rigid bronchoscopy. In one patient who had referred from another city, pneumothorax was seen on the chest plain before bronchoscopy. After tube thoracostomy, a rigid bronchoscopy was performed under sedoanalgesia because of the presence of laryngectomy, and the foreign body was removed. The tracheobronchial system was then examined and membranous rupture of the trachea was seen. Primary repair was performed under sedoanalgesia. In 2 patients with bronchiectasis, right lower lobectomy was performed. Before lobectomy, patients underwent rigid bronchoscopy and pen caps were extracted.

Hospitalization durations were 1 day, 2 days, and longer than 2 days in 33 (34.4%), 21 (21.9%), and 42 (43.7%) patients, respectively. The longest hospital stay was 22 days and the mean hospital stay was 4.9 days. Twenty five pediatric patients with pneumonia were transferred to the department of pediatrics 1 day after the bronchoscopy procedure. Cardiopulmonary arrest related to asphyxia and hypoxemia occurred in 11 patients in the preoperative period. Nine of them were intubated and resuscitated in the emergency services; the other 2 patients were intubated and resuscitated by paramedics outside the hospital. Although foreign bodies were extracted from these patients, two patients could not be saved. Dying patients were intubated outside the hospital. All foreign bodies in arrested patients had settled in trachea. Extracted bodies were peanuts, kidney beans, and a roasted chickpea in 7 patients, 3 patients, and 1 patient, respectively.

4. Discussion

Complication severity of tracheobronchial foreign body aspiration is usually related to age, type and localization of the foreign body, and the time passed after the aspiration. While mortal complications are seen in the acute period, suppurative complications occur in later years. Life-threatening results after aspirations are usually seen in children because their airway size is smaller than that of adults (5). The most dangerous period is between 1 and 3 years (4). Organic materials are the most common aspirated foreign bodies (6–8). The causes of the high incidence of foreign body aspiration in children are high interest in the environment, immature swallowing reflex, inadequate chewing of foods, and their desire to take objects into the mouth (9).

The worst complications after aspiration are cardiopulmonary arrest and sudden death, and they are seen when big and solid objects settle in the trachea. Nevertheless, swellable organic bodies settled in the right or left bronchial system can leave their location in time and move to the sites that are more proximal (10). As a result, the trachea may be completely obstructed by the foreign body. Furthermore, asphyxial cardiac arrest and sudden death may occur when both main bronchial systems are blocked by smaller foreign bodies. The causes of asphyxial cardiac arrest are alveolar hypoxia and hypercarbia (11). Respiratory and metabolic acidosis occur as a result of hypoxia and hypercarbia and cardiac arrest is seen quickly (11). When cardiopulmonary arrest occurs in patients in the emergency department or clinics, the intubation tube should be pushed to the right or left bronchial system after patients are intubated, and then it must be pulled back up to the top of the carina. This is a life-saving maneuver for foreign bodies settled in the trachea. After resuscitation, rigid bronchoscopy must be performed rapidly. During bronchoscopy, if the foreign body settled in the trachea is organic, it should be pushed to the sites that are more distal and then should be crumbled by forceps. After these maneuvers, fragments of the foreign body must be extracted by suitable forceps and irrigation of the bronchial tree with physiological serum must be performed, and then secretions and small fragments must be suctioned (10). In our series, cardiopulmonary arrest occurred in 11 patients. Two of them were intubated outside the hospital and the others were intubated in the hospital because of the fact that the cardiopulmonary arrest occurred shortly after their arrival at the emergency room. After the intubation, patients were transferred to the operating room rapidly.

We performed the maneuvers mentioned above during bronchoscopy. Despite the fact that all foreign bodies were extracted, patients intubated outside the hospital could not be saved.

Recurrent and/or persistent pneumonia may occur as a result of gastroesophageal reflux disease, tuberculosis, pulmonary hypoplasia, cystic adenomatoid malformation, scimitar syndrome, immunodeficiency, and foreign body in the airway (12). The incidence of recurrent pneumonia related to foreign body aspiration in all recurrent pneumonia cases has been reported as 2.4% in the literature (12). Recurrent or resistant pneumonia related to foreign bodies settled in the airway are usually seen in young age groups. In patients in this group, aspiration history is usually absent because of parents' poor attention to the children. The incidence of pneumonia in foreign body aspiration is between 2.9% and 19% in children and 11.8% in the general population in the literature (1,4,5,10,14,15). Nevertheless, pneumonia incidence in foreign body aspirations was reported as 42.9% in patients younger than 3 years (2). Pneumonia is the most important cause of increased cost in management of tracheobronchial foreign body aspirations. Usually patients with recurrent pneumonia receive extensive medical treatment before bronchoscopy. If these patients continue to receive medical treatment after the procedure, the length of hospitalization is prolonged. In our series, there were 26 patients with recurrent/persistent pneumonia and 25 of them were children. After bronchoscopy, these pediatric patients were transferred to the pediatric department since our hospital is a multidisciplinary center. Pulmonary infections in transferred patients were cured successfully in pediatric clinics and repeated bronchoscopy was not required.

Atelectasis may occur as a result of pulmonary parenchymal compression or airway obstruction (16). This abnormal condition may be seen in several situations such as bronchopulmonary dysplasia, bronchiolitis, asthma, tuberculosis, and foreign body aspirations (17). Foreign body aspirations are the foremost of preventable causes of atelectasis. The clinical symptoms of atelectasis depend on the underlying disease, the amount of affected lung, and the time passed after the atelectasis (16). Though asymptomatic, coughing, fever, wheezing, respiratory distress, and hyperpnoea may be seen. The incidence of atelectasis in tracheobronchial foreign body aspirations is between 4.4% and 41.6% in the literature (1–5,10,13,14,18). In our series, the incidence of atelectasis was 5.1%, and after bronchoscopy, atelectatic lungs reexpanded in all patients. There were no asymptomatic patients. Coughing, diminished respiratory sounds, fever, dyspnea, rhonchi, and cyanosis were the most common findings.

Respiratory distress in tracheobronchial foreign body aspiration is usually seen when the trachea or both main bronchi are occluded by foreign bodies. This condition may be the indicator of cardiopulmonary arrest that will appear soon after. Often, the clear medical history of aspiration is a sufficient reason for urgent bronchoscopy in patients with respiratory distress. Nevertheless, a detailed history must be obtained and a careful physical examination must be done in the absence of a clear aspiration history. Because some bacterial and viral diseases such as croup may mimic foreign body aspirations, unnecessarily performed bronchoscopies may provoke symptoms. Therefore, differential diagnosis is very important in cases of respiratory distress. We found 24 patients with respiratory distress among our patients and, as mentioned above, 11 of them were intubated due to cardiopulmonary arrest that followed the respiratory distress. A clear foreign body aspiration was present in all patients. Rigid bronchoscopy was performed as soon as possible and the objects were extracted in all patients. Localizations of foreign bodies were the trachea, right main bronchus, and both main bronchi in 13 (18.7%), 7 (4.2%), and 4 (2.1%) patients, respectively.

Bronchiectasis is the most frequent complication in tracheobronchial foreign body aspirations in the late period (3). The incidence of bronchiectasis due to foreign bodies settled in airways was reported in a range between 1% and 5.6% in the literature (19,20). Bronchiectasis may be a reversible form the so-called pseudo-bronchiectasis or an irreversible form. Pseudo-bronchiectasis occurs as a result of acute infection or inflammation, and it can regress after the foreign body is removed. Nevertheless, irreversible bronchiectasis can be cured by resection. However, there are studies reporting that severe bronchiectasis may improve after the removal of the longstanding foreign body in airways (21–24). Usually, neglected inorganic foreign bodies cause permanent bronchiectasis in later years (3). In our series, 12 patients had bronchiectasis changes on the chest plain and 10 of them had aspirated organic foreign bodies. In the remaining two patients, lobectomy was performed because of irreversible bronchiectasis. The first of the last two patients was an 18-year-old male and he had a medical history of foreign body aspiration 3 years ago. The second patient was a 22-year-old female with a history of aspiration 4 years ago. Before lobectomy, rigid bronchoscopy was performed and plastic objects were extracted from both patients.

Surgical procedures, thoracic trauma, congenital lesion, sarcoidosis, and tuberculosis may cause bronchial stenosis (25). Although bronchostenosis due to foreign bodies settled in the bronchus is reported as a complication of the foreign body, its true incidence is unknown (26). The principal mechanism in bronchostenosis related to foreign bodies is mucosal inflammation and this situation results in bronchial narrowing. Eventually atelectasis,

pneumonia, and parenchymal abscess occur as results of the retention of bronchial secretions (26). In our series, we found bronchostenosis in 3 patients who aspirated nuts (0.4%). Symptoms of these patients were fever and coughing. Localizations of stenosis were at the right lower lobe and intermediary bronchus in 2 patients and 1 patient, respectively. After bronchoscopy, bronchial lavage was taken and bacteriological examination and PPD tests were done for tuberculosis. Fortunately, all of them were negative.

Foreign body migrations are usually seen with thin objects such as pins. However, as mentioned above, some unfragmented swellable organic bodies such as kidney beans and roasted chickpeas settled in the bronchial tree may leave their sites in time and may move to the trachea, and fatal events may occur (10). Furthermore, some large inorganic bodies can be displaced between the right and left main bronchus and can move from the trachea to the bronchial tree (27,28). In our series, migration was seen in two patients who aspirated headscarf pins. Foreign bodies moved forward while the patients were waiting for bronchoscopy and fiberoptic bronchoscopy was used to determine the localization of the objects. Objects were successfully extracted by these methods in these two patients.

The incidence of pneumomediastinum in foreign body aspirations is between 0.8% and 5.8% in the literature (29,30). General etiological factors in pneumomediastinum are mucosal injury of the tracheobronchial system or the esophagus, mediastinitis, and damage of alveolar structures (31). Sometimes pneumomediastinum may be associated with pneumothorax. Before bronchoscopy, a detailed medical history and a careful physical examination are sine qua non conditions in the presence of pneumomediastinum, because spontaneous pneumomediastinum usually occurs as a complication of asthma in children (30). If asthma is misdiagnosed as foreign body aspiration and bronchoscopy is performed, bronchospasms may be exacerbated. The incidence of pneumothorax related to foreign body aspiration is between 0.48% and 1.9% in reports (32,33). The foreign body blocks the trachea or bronchia and pressure in the lungs rises suddenly because of obstructive emphysema, and, finally, pneumothorax occurs as a result of aspiration (33). Additionally, pneumothorax may occur due to the penetrating effect of the foreign body in the airway. Pointed foreign bodies may cause superficial or deeper injuries in the airway mucosa and hemoptysis or perforation may occur as a result of these damages. However, airway injuries are usually seen related to bronchoscopy procedures (34). In our series, pneumomediastinum was seen in 2 patients (0.3%). The first patient was an 8-year-old male and the second patient was an 83-year-old male. A peanut had occluded the right main bronchus in the pediatric patient and a pointed plastic object had settled in the trachea in the adult. At the same time, pneumothorax was also present in the adult patient. Before bronchoscopy, a right tube thoracostomy was performed, and then the foreign body was extracted under sedoanalgesia since the patient had laryngectomy. Tracheal perforation was repaired primarily under sedoanalgesia. Hemoptysis was seen in a patient who had aspirated a fragment of glass and conservative treatment was sufficient after the object was removed.

Foreign bodies in airways may cause different complications in the acute and chronic periods. The basics of the management of tracheobronchial foreign body aspirations are careful evaluation and rapid intervention. Early diagnosis and treatment reduce the incidence of complications and they may be life-saving in the acute period.

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