Foreign Body Aspiration of Grass Inflorescences as a Cause of Hemoptysis*

Bettina C. Hilman, M.D., F.C.C.P.;† Frank T. Kurzweg, M.D.;‡ Walter W. McCook, Jr., M.D.;§ and Arthur E. Liles, M.D.||

Although the sparsity of reports in the literature suggest aspiration of grass inflorescence is rare, in certain areas of the southern United States, aspiration of this type of foreign body is not so uncommon. Four cases of aspiration of *Hordeum pusillum*, often referred to as "cheat grass" are reported: three of the four patients had hemoptysis. The highest incidence of inhaled foreign bodies usually occur in young children, but all our four patients were older children or adolescents. The clinical manifestations of grass inflorescences are of the following two types: (1) the "lodging" type in which inflorescences remain in the respiratory passages causing bronchial obstruction with pneumonitis; and (2) the "extrusive" type in which the inflorescences migrate into the periphery of the lung and through the chest wall.

The aspiration of grass inflorescences (spikes) as foreign bodies in the respiratory tract is uncommon as indicated by the rarity of reports in the literature. The Grass family (Poaceae) is a large one, which includes all of the common cereals and it is characterized by flowers borne in spikelets of bracts. Chevalier Jackson, in 1952, made a comprehensive review of the literature and found a total of only 35 cases. The two distinct clinical types of cases were (1) the "lodging" type in which inflorescences remain in the respiratory passages, and (2) the "extrusive" type in which the inflorescences migrate to the periphery of the lung, penetrate the lung parenchyma, pleural layers, intercostal muscles, and finally protrude through the skin of the chest wall. Twenty-eight of these 35 cases were of the extrusive type. Jackson proposed that the fate of an inflorescence entering the respiratory tract was dependent upon the botanic characteristics of the grass.

Woolley, in 1955, reported three additional cases of segmental bronchiectasis due to aspiration of grass inflorescences; only one of these three cases presented with hemoptysis. Initial bronchoscopy was unsuccessful in all three cases. The grass foreign bodies were removed during subsequent bronchoscopies in two of the cases; the other case required segmental resection for removal of the inflorescence three years after aspiration.

Choremis et al, in 1964, found only 45 cases in a review of the literature and reported two cases of spontaneous elimination of inhaled grass inflorescences through the chest wall in preschool children. One followed aspiration of a wheat stem and the other aspiration of a grass inflorescence belonging to the species *Hordeum murinum*.

In the southern United States, *H. pusillum* grows abundantly, and grass aspiration may not be so rare. This type of grass belongs to the Barley tribe, and thus is referred to as "little barley" and is known locally as "creep grass," "cheat grass," or "foxtail." The complete seed head or inflorescence has its seeds arranged radially and symmetrically around a single spike with the tip of the seed distal to the base. This arrangement facilitates the migration of the inflorescence in the direction of the base. Any force causing movement of the spikelet will propel the inflorescence in one direction only; retrograde movement is prevented by the sharp, stiff, trailing spikelets. The movement of this type of grass inflorescence in the bronchial tree is similar to that on an open safety pin; however, the grass inflorescence has a more active forward motion with an immobile trailing spike.

The mobile characteristics of the inflorescence has given rise to several games. The grass head, when placed on a flat nonrigid surface, creeps forward when the surface is moved. In a more daring game, the inflorescence is placed on the tongue and the word, "cheep," repeated which causes the inflorescence to creep toward the base of the tongue. The "chicken" is the individual who gives up before the inflorescence has reached very far toward the...
back of the tongue; any involuntary gasp can easily cause the inhalation of the grass inflorescence.

Because of the shape of the grass inflorescence, the degree of bronchial obstruction may not be sufficient to lead to an early diagnosis. It may be difficult to detect the inflorescence, even with bronchoscopy. The clinical signs are often bizarre and may pose a difficult diagnostic problem. The occurrence of hemoptysis can be a clue to the diagnosis of foreign body as a cause of persistent pneumonitis.

**Case Reports**

**Case 1**

A seven-year-old white boy was admitted to the hospital with the chief complaint of hemoptysis of one week's duration, with no previous history of recurrent respiratory infections, cough, or weight loss. On physical examination, he was afebrile with a respiratory rate of 20 per minute and had rales in the lateral basal segment of the right lower lobe. His weight was 20.8 kg (3rd-10th percentile). No clubbing was recorded in this admission, although it was noted on subsequent admissions. White blood cell count on this initial admission was 18,300/cu mm with 52 percent neutrophils, 21 percent lymphocytes, 1 percent basophils, 16 percent eosinophils, 6 percent stabs, and 4 percent monocytes. Hemoglobin value was 12.7 gm/100 ml. Chest roentgenogram revealed an infiltrate in the right lower lobe (Fig 1). Tuberculin skin test (PPD-T 5TU) was negative. All gastric washings and sputum cultures were negative for mycobacteria and fungi. Throat culture revealed normal flora with *Hemophilus influenzae* and coagulase positive staphylococci. No antibiotic therapy was given during this initial admission. The patient was discharged after hemoptysis ceased. He continued to have some hemoptysis after discharge; but he did not seek medical attention for this until six months later when his hemoptysis became worse.

Physical examination at his second admission again revealed rales in the right lower lobe, predominantly in the anterior, lateral, and posterior basal segments. All cultures for fungi and mycobacteria were negative. White blood cell count on this admission was 12,000/cu mm with 1 percent basophils, 5 percent eosinophils, 55 percent neutrophils, 1 percent stabs, 32 percent lymphocytes, and 6 percent monocytes. Serum immunoglobulins revealed IgG was 1610 mg/100 ml; IgM, 178 mg/100 ml, and IgA, 187 mg/100 ml. Sweat electrolytes and nitrotetrazolium blue dye reduction test were normal. He was uncooperative in performing pulmonary function studies except for a peak expiratory flow rate of 160 L/minute. No history of foreign body aspiration was obtained at bronchoscopy, and examination of the main orifice to the right lower lobe showed a moderate amount of purulent material but no blood; the mucosa was granular and friable. Cultures of the purulent material from the right lower lobe revealed a few *D pneumoniae*, type III, and numerous *Hemophilus influenzae*. Cultures for fungi and mycobacteria were negative. He was placed on bronchial drainage to the right lower lobe and ampicillin therapy which was continued throughout the three weeks of hospitalization. He was re-admitted for bronchograms under local anesthesia, which revealed saccular bronchiectasis of the right lower lobe, involving the anterior, lateral, and posterior basal segments.

Because of persistent rales and infiltrate in the right lower lobe, he underwent right lower lobe resection for saccular bronchiectasis of the right lower lobe, one year after his initial admission for hemoptysis. On opening of the segmental bronchus to the lateral basal segment of the right lower lobe, an intact grass inflorescence with small rigid spikelets was found in the same area as a filling defect noted on bronchograms (Fig 2). He had an uneventful postoperative course. He was seen for follow-up three weeks after the operation and was found to be asymptomatic with his chest clear to auscultation and percussion.

**Case 2**

A 13-year-old white boy was admitted to the hospital with

![Figure 1. Chest roentgenogram, PA and lateral views, case 1.](http://journal.publications.chestnet.org/pdftoasx?url=/data/journals/chest/21162/)
cough, fever (38.7°C), malaise, and right-sided chest pain. Physical examination revealed rales and decreased breath sounds over his right lower lobe and limitation of motion of the right hemi-thorax. His peripheral white blood cell count ranged from 10,500 to 14,000/cu mm with a normal differential. Chest x-ray film revealed pneumonitis of right lower lobe with an associated pleural thickening and some loss of volume. The patient was given parenterally administered penicillin and became afebrile in four days.

Approximately two months later, he presented with the complaint of early morning cough which was productive of blood-tinged sputum. On his way to the hospital for admission, he coughed up the blood with an intact inflorescence of “cheat grass.” He received ampicillin during his hospitalization and was discharged afebrile four days later. His chest roentgenogram on discharge was clear except for residual pleural thickening in the right costophrenic angle.

CASE 3

A 14-year-old boy was admitted for evaluation of the right lower lobe pneumonia and hemoptysis. Review of his history revealed that he had had an episode of pleurisy five months prior to this admission, and one month after, the possible aspiration of a “cheat grass” inflorescence. Because of persistence of symptoms, he was re-admitted for bronchoscopy. Bronchoscopy, however, failed to reveal evidence of a foreign body. Bronchograms were performed which confirmed saccular bronchiectasis of the anterior basal segment of the right lower lobe. Peripheral white blood cell count on his admission was 10,150/cu mm with a normal differential; hemoglobin and hematocrit values were normal. The patient had a thoracotomy with right lower lobe resection. Inspection of gross specimen revealed a thick wall cavity containing old blood and purulent material with a well-preserved grass inflorescence.

CASE 4

A 14-year-old white boy was admitted to the hospital with cough and pain in left lower chest but no fever. Physical examination revealed a tender 3-cm soft-tissue mass over the left tenth rib in the posterior-axillary line. Chest x-ray film showed pneumonitis in the left lower lobe and erosion of the cortex of the 10th rib on the left.

By history, he had developed a persistent cough, left lower chest pain, and fever approximately six months prior to this admission. Chest x-ray film at that time had revealed pneumonitis of the left lower lobe. Several days prior to the initial episode of the left lower lobe pneumonitis, he had a history of possible aspiration of a “cheat grass” inflorescence. After this retrospective history was obtained, a bronchogram was performed which demonstrated failure of filling of the bronchus to the left lower lobe. At the time of incision and drainage of the mass over the tenth left rib, a piece of “cheat grass” was extruded when the periosuteum was incised and the granulation tissue removed.

DISCUSSION

The clinical manifestations produced by aspiration of grass inflorescences are of two types, depending on the characteristics of the species of grass inhaled: (1) airway obstruction with obstruction hyperinflation and infection; and (2) migration to the periphery of the lung and extrusion through the chest wall. Three of our patients presented with obstruction-infection and only one as the one-way penetration of lung periphery tissue.

If the inflorescence has spikelets which are close together and soft, such as that of timothy grass, the inflorescence will soften with moisture and will not penetrate into the lung periphery. These spikelets may lodge in the bronchial tree and occlude it; a chest roentgenogram taken during expiration may reveal obstructive hyperinflation, due to a ball-valve type obstruction. Pneumonitis distal to the obstructing foreign body is the most common roentgenographic presentation; however, atelectasis distal to the obstruction may develop.

If the spikelets are stiff and do not become soft when moistened, respiratory and coughing actions can cause the inflorescence to move forward with a “one-way travel” to penetrate lung tissue and ultimately extrude through the chest wall. The spikes prevent retrograde movement, and the constricting forces of the bronchial tree on respiration and coughing cause the inflorescence to be propelled forward on the acutely angled spikes. The spikelets of barley grass are firm and short and set at an acute angle to a rigid stem. Inflorescences of this species migrate into the periphery of the lung beyond the range of the bronchoscope.

These clinical pictures with obstruction-infection and penetration of lung tissue have been described in the literature.14 Many of the case reports are of infants or young children; however, all four of our patients were in the older age group. All cases were boys ranging in age from 7 to 14 years. In this region of the southern United States, boys of this age spend
a great deal of time out of doors and frequently chew on grass stems or place them in their mouths during games related to creeping qualities of the grass inflorescence.

The initial symptoms of choking, gagging, coughing, and dyspnea are practically never absent, but may be ignored or unelicited by an incomplete history or lack of suspicion of foreign body aspiration. After the initial symptoms of the aspiration, there is a symptomless interval. After the asymptomatic period, the patient often develops a cough productive of purulent or blood tinged sputum or frank hemoptysis. The history of aspiration of grass was obtained readily from both 14-year-old patients. The history of aspiration was obtained in the 13-year-old only after he coughed up the inflorescence two months later, and the history of aspiration was obtained from the youngest patient, only after discovery of the inflorescence on resection of the right lower lobe.

Pulmonary abscesses are rare. Grass inflorescences may be aspirated into the right lower lobe, and the patient may present with signs and symptoms of tense right abdominal muscles which may lead to the mistaken diagnosis of acute appendicitis. The diagnosis may be difficult to make either because the young patient does not recall the aspiration of the grass or is perhaps reluctant to admit it. Woolley reported that inhalation of grass inflorescence was seasonal; this fact may be helpful in making the diagnosis. Three of our cases were determined to have aspirated in the spring, one in April, and two in May.

The duration of the course from inhalation of the inflorescence to resolution of the problem varies greatly. For instance, from inhalation to extrusion of the inflorescence from the chest in Watson's case was less than two weeks. In the two cases reported by Choremis et al., the time from inhalation to extrusion through the chest wall was ten days in the case of a 24-year-old boy who aspirated a spikelet of _H. murinum_ and two months in the three-year-old girl who aspirated a wheat stem. In our patient, the interval was five months.

In those patients with obstruction-infection in whom a lobectomy is required, the inflorescence is easily recognizable and still appeared intact several months or longer after inhalation. Woolley reported the inflorescence was fully preserved when removed over three years later.

Chest roentgenograms taken in both inspiration and expiration may help document the diagnosis of an obstruction due to a nonradiopaque foreign body. Perfusion scans as described by Rudavsky et al. should be helpful. If the inflorescence has lodged in a major bronchus, the symptoms generally will be more pronounced, and bronchoscopy is likely to be performed earlier and the grass inflorescence seen and removed. After the inflorescence has migrated to the smaller bronchi, which it may do very rapidly, the yield at bronchoscopy is small. The foreign body was not identified at bronchoscopy in any of our patients.

REFERENCES