



Rare Lung, Pleura, and Airway Disorders



Pill aspiration: Central Airway manifestations

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OBJECTIVES:

- Identify and assess patients with pill aspiration
- Understand the etiologies and mechanisms of airway injury after pill aspiration
- Recognize the therapeutic options for pill aspiration



7% of aspirated foreign bodies (FB) are medicinal pills

Pill aspiration causing central airway injury and consequent late manifestation is an uncommon condition

Risk factors

- Neurological conditions like stroke, Parkinson's disease
- Dental procedures
- Common loss of consciousness states like (syncope, mechanical falls)
- Improper way to take a medication (in supine position)



Pills causing airway inflammation		
Alendronate	Aminophenazone	Barium sulfate
Bismuth subgallate	Charcoal	Cholestyramine
Ferrous sulfate	Gastrografin	Hytrast/Dionosil
Kaolin-Pectin	Mercury	Metformin
Mineral oil	Meprobamate	Nifuroxazide
Nortriptyline	Phenobarbital	Phenytoin
Pomegrante pill	Potassium chloride	Quinine
Sevelamer	Tetracycline	



- Obstructive symptoms
- Penetration syndrome
 - Choking sensation
 - Intense coughing
 - Wheezes
 - Difficulty of breathing
- Localized airway injury depending on a specific aspirated pill
- Systemic effects



Pill aspiration: Central Airway manifestations Mechanisms of injury

Systemic effects	Obstruction	Inflammation	Local effects
Amiodarone	Aspirin	Charcoal	Pentamidine
ACE inhibitors	Endoscopy capsule	Potassium preparations	Acetylcysteine
Cocaine	Ciprofloxacin	Ferrous sulfate	Insulin
Epinephrine	Cocaine bag	Barium sulfate	Inhaled corticosteroids
Cocaine	Sucralfate	Diatrizoic acid	
Heroine		Alendronate	
Rapamycin		Propylidone	
Serolimus		Pomegrante supp.	



Pill aspiration: Central Airway manifestations Diagnosis

All conventional methods of diagnosis of FBs can be used including

- Detailed medical history
- Only 9% of patients recall the aspiration
- 62% of patients have aspiration more than a month before seeking medical help
- Chest xray imaging (CXR)
- Chest computed tomography (CT) imaging
- Flexible and rigid bronchoscopy



Pill aspiration: Central Airway manifestations Diagnostic pitfalls

- High index of clinical suspicion is required for diagnosis
- CXR can be normal in 28% of patients with FB aspiration according to one study
- Some pills (ferrous sulfate, potassium pills) are rapidly disintegrates in airways and sometimes can not be find during bronchoscopy
- There are some reports that on PET/CT scan site of iron pill injury are fluorodeoxyglucose (FDG) avid and can mimic malignancy



Some pills have different mechanism of injury: Ferrous sulfate and potassium chloride:

- Disintegrates in airways quite rapidly due to acidic pH
- Causes rapid tissue injury by releasing of free radicals (oxidation of Fe^{2+} form to Fe^{3+})



Airway injury due to ferrous sulfate aspiration can be divided into two stages early and late

- Early stage
 - Mild airway erythema and inflammation (yellowish or golden, sometimes greenish pigmentation)
 - Severe mucosal injury (sloughing, necrosis, ulceration)
- Late stage
 - Fibrosis and narrowing of airways
 - Severe stenosis or complete obstruction of airways due to scar formation

BMJ case reports. 2012;2012:bcr2012007329

Respirology. 2003;8(4):541-3

Journal of Bronchology & Interventional Pulmonology. 2003;10(3):210



Iron pill aspiration syndrome first proposed by Lee et al. and consists of triad of

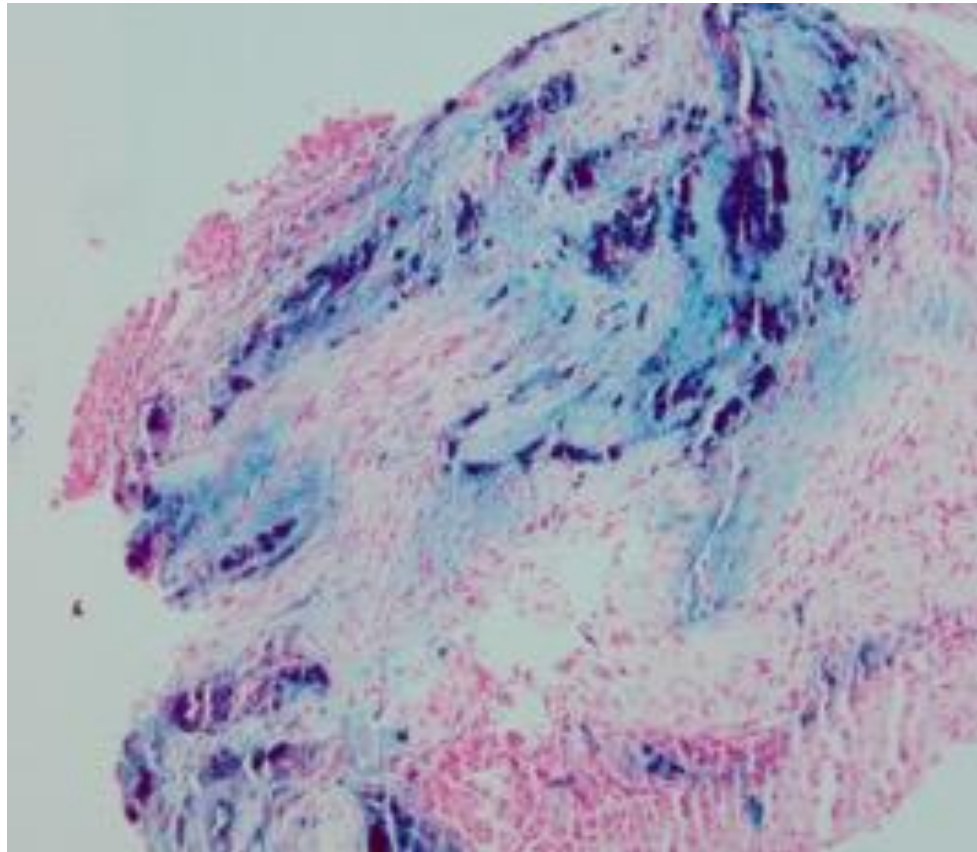
- I. Aspiration event of iron pill
- II. Airway inflammation with bronchial stenosis
- III. Iron deposits in bronchial biopsy specimen even in the absence of actual iron tablet in airways



- Specific golden or yellowish airway mucosal pigmentation at the site of injury
- Prussian blue or Perls Prussian blue used for detection of iron in biopsy specimen
- Early histological examination may show squamous metaplasia of epithelium
- Late histological examination significant for scarring and fibrosis



Pill aspiration: Central Airway manifestations Iron pill aspiration: Histological findings

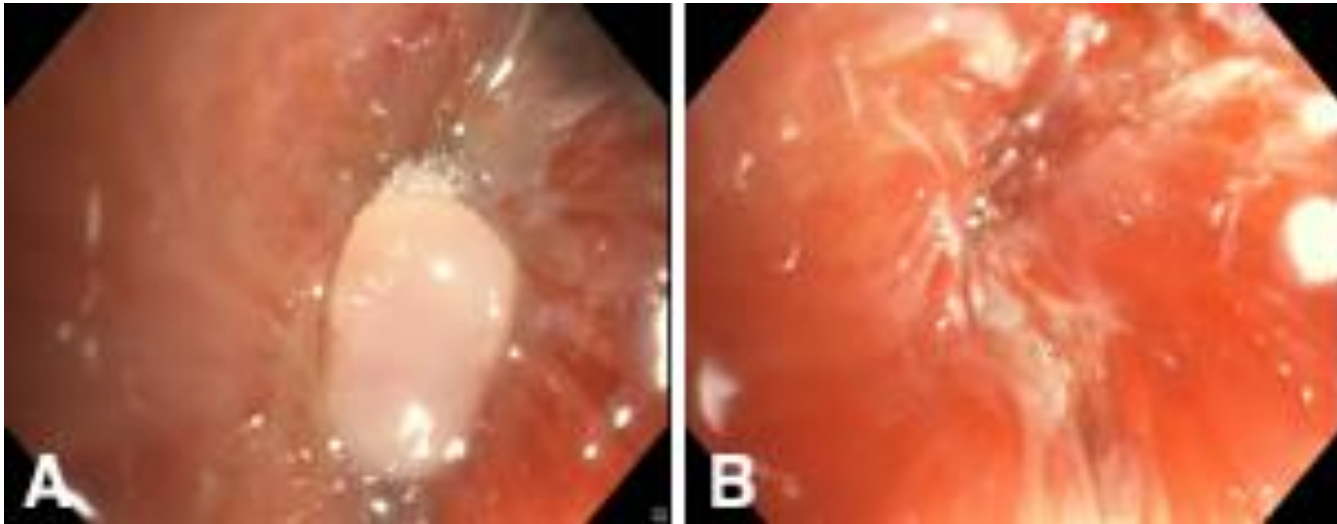


Courtesy of Dr. Harris

Endobronchial biopsy of the bronchus intermedius - Histopathology positive for Prussian blue stain



Pill aspiration: Central Airway manifestations Iron pill aspiration



*Courtesy of Dr.
Harris*

A. Endobronchial ovoid lesion in the right bronchus intermedius (BI) B.
Near total occlusion of the BI by a stricture and severe inflammation noted
after removal of the lesion



Stricture at bronchus intermedius with erosion of mucosa. Center of picture showing right middle lobe lumen with narrowing and mucosal changes; at 4 o'clock, lumen of right lower lobe can be seen.

Delgado et al. 2012;3(4):34–36.



- Treatment of IPA can be divided into two categories
 - I. Immediate
Includes urgent bronchoscopy and removal of iron tablet, prevention of further damage of airway mucosa by washing the area
 - II. Treatment of late sequela of IPA
Mostly includes management of airway stenosis by using different bronchoscopic modalities



Prevention of airway stenosis and fibrosis

- Early removal of aspirated tablet and bronchial wash to prevent further oxidative damage of airway mucosa
- Use of topical mitomycin C to inhibit fibroblast activity and limit granulation tissue formation (case reports with variable success)
- Use of topical (submucosal injection, inhalation) and systemic steroids for prevention of excessive granulation (case reports with variable success)
- Use of antibiotics for post obstructive pneumonia and prevention of further bronchial mucosal inflammation



IPA and related complications

- Airway mucosal necrosis, ulcerations and permanent stenosis and atelectasis of affected part of the lung
- Significant morbidity related to complete airway obstruction and massive hemoptysis necessitating surgical lung resection
- Hemoptysis due to ulceration of mucosa, fatality related to massive hemoptysis due to ulceration into the pulmonary vasculature



Advance bronchoscopic management includes

- Flexible bronchoscopic debridement with forceps
- Rigid bronchoscopy with debridement
- Rigid bronchoscopy with dilation by using beveled tip of scope
- Balloon bronchoplasty with dilation of stenotic airway using controlled radial expansion (CRE) balloons



Advance bronchoscopic management includes

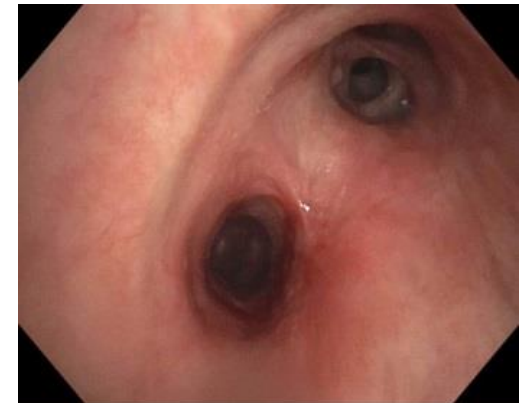
- Argon plasma coagulation (APC)
- Debridement by cryotherapy system
- Laser modalities
- Airway stenting with nonmetallic stents



Pill aspiration: Central Airway manifestations Iron pill aspiration: Advanced treatment modalities



E and F. A studded silicone stent was placed in the BI just distal to the right upper lobe opening, terminating proximal to the right lower lobe opening



Bronchoscopic image showing the patent bronchus intermedius after stent removal a year later.

Figures: courtesy of Dr. Harris



Pill aspiration: Central Airway manifestations Summary

- Prevention of aspiration by prescribing liquid formulation and proper technique of taking pills (taking pills in upright position)
- As early as possible removal of aspirated pill to prevent further damage and obstructive complications
- Awareness of possibility of airway necrosis and possible penetration to adjacent structures, late airway stenosis
- Bronchoscopic advance modalities should be treatment of choice in cases with airway obstruction due to scarring



Question 1:

- A 60-year-old lady with history of stroke, hypertension, and anemia presented to the emergency department with acute cough after taking her medications. The patient does not know if she choked on medications but her cough persisted since the event last night without any improvement. She denies shortness of breath, hemoptysis or any other symptoms. Lung auscultation showed no rales with normal breath sounds. Vital signs were within normal limit. Plain chest film was normal.

What would be the next step?



Question 2:

- A 78-year old female patient with multiple co-morbidities presented with symptoms and signs of acute pneumonia. Her medications included metoprolol, aspirin, atorvastatin, ferrous sulfate, and metformin. This was her third pneumonia in 2 months and plain chest film showed right lower lobe consolidation. Bronchoscopy showed evidence of right lower lobe complete obstruction and no airway lumen could be identified. Endobronchial biopsy was negative for malignancy and was consistent with acute inflammatory changes.

What would be the next step to establish the etiology of airway obstruction?



Question 3:

- A 72-year old male presented to the emergency department for worsening dyspnea, cough and wheezing. The patient was diagnosed with Iron pill aspiration and bronchoscopy was performed a month back showing severe inflammation of bronchus intermedius and no foreign body was found or removed then. Endobronchial biopsy was positive for Prussian blue stain. Chest computed tomography showed a severely narrowed bronchus intermedius and post obstructive changes.

What is the next appropriate step?



Answers:

Question 1: The next step would be flexible bronchoscopy to evaluate for foreign body aspiration. A possible cause for her cough is pill aspiration given that her cough started immediately after taking her medications. Given that her medications may have included iron pills, an urgent bronchoscopy should be performed to extract a possible iron pill and prevent pill disintegration into the airway mucosa which could result in serious complications.

P Lee et al. *Chest* 121 (4), 1355-1357
Annals of Thoracic Medicine - Vol 9, Issue 1, January-March 2014
Somalaraju et al. **JOBIP**. 24(2):163-165, April 2017.



Answers:

Question 2: The next step is to request special stain for Iron deposits. Prussian blue stain is diagnostic for iron deposits in the airway mucosa. Iron deposits in the airway mucosa may persist for months after the iron pill aspiration event, therefore, endobronchial biopsy for Prussian blue stain is indicated for this patient.



Answers:

Question 3: The patient showed undergo and advanced bronchoscopic intervention using one or multiple modalities. These include airway dilation using balloon bronchoplasty or rigid bronchoscopy, electrocautery, endobronchial laser, topical mitomycin C, and airway stenting. The purpose of such intervention is to keep the airway patent, and to prevent surgical lung resection.

P Lee et al. Chest 121 (4), 1355-1357
Caterino et al. Respir Med Case Rep. 2015; 15: 33–35.
Kinsey et al. Chest. Jun 2013;143(6):1791-1795



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