

## Case Report

# Barium bronchogram following aspiration of contrast: a case report

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### ABSTRACT

Barium swallow remains the simplest most commonly performed examination of the upper GIT, providing both anatomic and functional information about the oropharyngeal and esophageal apparatus. Barium aspiration as a complication of this procedure is not new, but its dynamics and clinical implications continue to evolve. We present a case study involving a 57-year-old Nigerian male who was referred for barium swallow to evaluate the upper GIT on account of clinical history of chronic dysphagia. Initial clinical work –up based on the patients' symptom was equivocal in the distinction of oropharyngeal and esophageal dysphagia, thus justifying the need for a simple radiological procedure such as barium swallow. During the procedure, barium was visualized to have been aspirated into the lungs. The need to understand the patients underlying history, experience in performing the procedure and early recognition of the signs of aspiration are emphasized. It also underscores the need to exercise caution, especially in patient's whose symptoms are equivocal, and when oropharyngeal dysphagia is suspected. The classical radiological appearances of barium pneumonitis, its implications and outcome are presented.

**Keywords:** Barium, bronchogram, aspiration, pneumonitis.

## INTRODUCTION

The evaluation of dysphagia in patients is a challenge commonly encountered in family practice, and its diagnosis, treatment and rehabilitation requires the contribution of multidisciplinary specialists (Aattonen LM et al., 2009; Barloon TJ, 1996). A thorough clinical examination is necessary to distinguish oropharyngeal from oesophageal dysphagia. (AGAM, 1999; Marshal JB, 1989). In many cases, examination consists of proper patient history, physical and neurological examination, videofluorographic, esophagoscopy, manometry and radiological procedures. (Aattonen LM et al., 2009; Trate DM et al., 1996). In our environment, apart from physical examination, a contrast study such as barium swallow is often the investigation of choice in diagnosis of upper gastrointestinal tract disorders. Barium swallows though a simple procedure has the advantage of providing both anatomical and functional information of the oropharynx and thoracic esophagus. Furthermore, the procedure does not require more than basic radiological equipment and uses Barium sulphate which is relatively available, cheap and its solubility properties make it a contrast of choice. Aspiration of barium is relatively rare, but remains the major complication of this procedure (Constantine et

al., 2007; Penington GR, 1994). In a review of over 300 prior cases of Barium studies in our facility, no case of barium aspiration was noted.

### Case study

A 57 years old male patient was referred from a community hospital by a primary care physician for barium swallow on account of a history of chronic dysphagia. Initial clinical evaluation revealed no evidence of neurological deficit, or neuromuscular dysfunction. Patient complained of a lumpy feeling in the throat, as well as difficulty and pain during swallowing. Patient had noticed few episodes of vomiting after a meal, but no cough or feeling of regurgitation at the time of investigation. No change in voice was noticed. Patient was known to tolerate fluid and fluid-like diets.

Previous investigations such as radiography of the chest and lateral soft tissue of the neck were unremarkable. The clinical details available to us prior to the investigation did not specify if dysphagia was of oropharyngeal or oesophageal origin. On presentation,

our patient showed a slight loss of weight which he attributed to poor feeding on account of the dysphagia. He was afebrile and stable and on no medications such as antihistamine or anticholinergics. Vital signs were reasonably normal (Bp= 129/ 80; temperature 36.5 degree celcius, and pulse of 78). Barium swallow was performed using a barium suspension mixed with spring water to make a 60-80ml solution. To ensure ease of swallowing by patient, the barium solution was made to be light in consistency.

Patient was kept in an erect position. Radiographs were taken in oblique and lateral projections using a mobile X-ray machine manufactured by GE (General Electric) of USA, with a calibrated capacity of 125kv and 100mAS. Patient experienced bouts of coughing during the swallowing stage of the barium sulphate solution resulting in aspiration. Patient showed signs of choking, and the investigation was immediately terminated. Radiographs taken immediately after the swallowing showed irregularities in the oesophagus and a significant amount of barium within the lung fields. There were segmental consolidations and patchy opacities in the basal and lower lung fields consistent with barium pneumonitis. Our patient was immediately taken to an ICU for resuscitation.

Patient continued to have bouts of coughing, followed with hemoptysis for the next 12 hours. There was no sign of infection, but patient was however given antibiotic cover, and monitored in the hospital. There was no available facility for bronchoscopy or esophagoscopy. Follow-up chest CT was recommended but was not performed due to affordability by the patient.

Patient was therefore treated conservatively and discharged 48 hours later when symptoms have completely resolved. A follow up chest X-ray performed two weeks later showed progressive but incomplete resolution of the opacities. Patient was eventually referred for out-patient chest physiotherapy, with progressive improvement and no significant sequelae till date.

## DISCUSSION

The evaluation of the causes of dysphagia poses a challenge to the primary care physician, often necessitating a multi-disciplinary approach and a variety of procedures. (Aatonen LM et al., 2009; Barloon TJ et al., 1996; Agam, 1999). Dysphagia can be classified as either oropharyngeal or esophageal and their precise distinction is important. (Agam, 1999). A physical examination when combined with good clinical history is sufficient to make the initial suggestion and provide guide to the precise confirmatory test. (Barloon TJ et al., 1996). Patients with oropharyngeal dysphagia often present with symptoms immediately after swallowing. Some common symptoms include difficulty in transferring food from mouth to the pharynx, dryness of eyes or mouth,

distorted speech, neuromuscular dysfunction, cough or hoarseness of voice. Most of these symptoms were absent in our case. Oro pharyngeal and esophageal disorders involve different phases of swallowing. (Marshall JB, 1989). Apart from, dysphagia and gradual weight loss, our patient presented with none of these classical symptoms. The initial evaluation of oropharyngeal dysphagia include careful patient history, physical and neurologic examination and videofluoroscopic study to check pharyngeal dynamics. The initial clinical examination of our patients was equivocal in the distinction of oropharyngeal from esophageal dysphagia, thus justifying the need for a barium study. Literature has revealed that Barium swallow and esophagoscopy is usually the procedure of choice in esophageal dysphagia. It remains the investigation of choice in the diagnosis of anatomical and functional disorders of the upper GIT, and allows assessment of gastroesophageal reflux. It is also a good method of studying swallowing mechanism and follows up of patients with swallowing disorders (Gustafson yoshida N et al., 1990). To perform a good Barium swallow, it is important that the practitioner understands the functional phases and anatomy of swallowing process, as well as a good clinical history of the patient. In principle, the intricacies of the procedure and goals of the study must be clear before embarking on it (Furlow B, 2004). Barium aspiration is a well documented, but rare complication, and the risk is higher in patients with dysphagia arising from a dysfunction of the swallowing tract (Constantine Katsanoulas et al., 2007; Tamm I and Kortsik C, 1999).

The risk of Aspiration is higher in conditions that impair the functional ability or distort the anatomy of the oropharynx and esophagus. It is also more common in disorders of the CNS such as Parkinson's disease and cerebral palsy, gastroesophageal reflux, in the extremes of age, broncho-oesophageal fistula, alcoholism, head and neck cancer and psychological illness. (Tamm I, Kortsik C, 1999; Venkatraman B et al, 2005; Voloudaki A et al., 2003). The radiological changes following barium aspiration may be classical and the position of the patient may determine the distribution of changes. This is illustrated by the radiological appearances shown in this case (Figures A to C).

The basal segments of the lower lobes tend to be involved when the patient is in erect position or the middle lobe if the patient inclines forward as occurs during vomiting or coughing. If the patient lies in a recumbent position, barium tends to accumulate in the posterior segments of the upper lobe and superior segments of lower lobe (Tamm I and Kortsik C, 1999, Voloudaki A et al., 2003). Apart from aspiration, barium sulfate powder or particles have been known to be inhaled, a condition called Baritosis or pneumoconiosis. Because barium sulphate is relatively non-irritant, even pneumoconiosis is known to be a potentially reversible



**Figure A.** Barium is noted in the basal lung fields



**Figure B.** Diagram shows barium within the lung fields and in the stomach



**Figure C.** Diagram showing barium bronchogram

disease sparing the alveolar architecture. Consequently, aspiration of barium into the lungs is not expected to cause severe lung injury, at worst evoking minimal stromal reaction with formation of reticulin fibres. The course of the disease is usually benign and particulate barium sulphate may remain in the lungs for years without producing symptoms, abnormal physical signs or increasing the likelihood of developing pulmonary or bronchial infections.

Nonetheless, literature has revealed many important sequelae to barium aspiration including acute inflammation (Constantine Katsanoulas et al., 2007; Tamm I and Kortsik C, 1999; Gray C et al., 1989), severe local reaction in the lungs in experimental studies (ginia AZ et al., 1985) and even death (Fruchter and DraguR, 2003). The smaller the quantity of barium sulphate aspirated, the better the clinical picture. (Nelson SW et al., 1976). The classical radiological appearance as exemplified in our case is a fine pattern of reticulo-nodular opacities. In our own case, the bronchial markings were well delineated. Many authors believe the striking appearance is caused by the high atomic number of barium (Tamm I, Kortsik C, 1999; Voloudaki A et al., 2003). Elimination of aspirated barium may be slow, initially achieved through coughing or transportation through the ciliated epithelium and its associated mucous lining followed by swallowing. Alternatively, there may be accumulation of barium in the alveolar spaces and peri bronchial interstitial tissue with consequent fibrosis (12). The noted radiological appearance on plain X-ray or HRCT may depend on the time of examination (Venkatraman B et al., 2005; Voloudaki A et al., 2003). A plain chest radiograph is sufficient to make the diagnosis as shown in our case. HRCT is useful in severe cases or in assessing long term prognosis (Voloudaki A et al., 2003). HRCT was suggested in our case, but was not done as patient could not afford the cost of procedure. From a radiological standpoint, the appearances may be confusing in the absence of a clear clinical history with alveolar microlithiasis with similar paving pattern in the lower lobes, deposition of calcium within the lung in patients with hypercalcemia, pulmonary ossifications of various causes, hemosiderosis, silicosis and barium pneumoconiosis. (Venkatraman B et al., 2005; Voloudaki A et al., 2003).

There is no universal guideline for the treatment of patients with barium aspiration. Management will depend in most cases on the presenting symptoms, clinical condition and the facilities available. For instance, bronchoscopy may be suggested if hypoxemia and dyspnea accompany massive aspiration (Trate DM et al., 1996). If infection is suspected, microbiology testing is advocated. Our patient was immediately transferred to the intensive care unit, where resuscitative measures were undertaken. In our case, a bronchoscope was not immediately available, so the patient was managed conservatively. Broncho-alveolar lavage is not

recommended because of the danger of dissemination of the contrast medium into the bronchoalveolar systems (Nelson SW et al., 1976). Tammi et al recommends antibiotic treatments with anaerobic coverage if infection is contemplated. In one reported extreme case with persisting dysphagia, percutaneous endoscopic gastrostomy was performed (Venkatraman B et al., 2005). This the authors noted, poses a risk of potential long term gastrostomy feeding.

There is need to perform a risk assessment prior to referral of patients for Barium swallow and to exercise care during the procedure. This is especially true if there is underlying history of upper GIT dysfunction, or dysphagia from long term progressive muscle dysfunction in children or adults (Hill M et al., 2004). Some authors have advocated the use of modified techniques using video fluoroscopic methods to define anatomy and physiology of the patient's oropharyngeal apparatus. To eliminate the likelihood of aspiration, they suggested postural changes, sensory enhancement techniques and swallowing maneuvers as ways of reducing the risk (Logemann JA, 1997).

There is need to understand patient's clinical history, exercise care and expertise as well as tailor the examination to suit individual patient need (Ekberg and Olsson, 1997). In some selected cases, pre-treatment with anti reflux agents may be advisable.

## CONCLUSION

Complications of barium sulphate aspiration depend upon the density and quantity of the aspirated solution, the extent of tracheobronchial distribution and the general physical condition of the patient and position of the patient during aspiration. In such cases as ours, early treatment and close follow up with chest physiotherapy are mandatory to prevent progression towards fibrosis. Apart from other factors predisposing to aspiration, particular caution should be taken when performing barium swallow, especially when the patient's clinical history is insufficient or equivocal.

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