Massive barium sulfate aspiration during upper gastrointestinal contrast material study in an elderly patient with dysphagia

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Barium sulfate is an inert material used as a radiographic contrast medium during upper gastrointestinal contrast studies for evaluation of patients with dysphagia. Oral barium aspiration is an uncommon but well-reported complication of this procedure. While barium aspiration of small amounts may not cause any symptoms, massive barium aspiration can be life-threatening, particularly in elderly patients with multiple comorbidities. In this case report, we describe an elderly patient with multiple comorbidities who presented with thyrotoxicosis and dysphagia, and then died after massive barium aspiration. Despite administration of intensive medical care with ventilator support and therapeutic bronchoalveolar lavage to remove the aspirated barium, the patient died of multiple organ failure 9 days after barium aspiration. Clinicians should pay attention to elderly patients with predisposing factors for aspiration in whom upper gastrointestinal barium contrast studies are indicated, and should consider other diagnostic tools for evaluation of dysphagia in this population.

Keywords: Aspiration, Barium sulfate; Multiple organ failure

INTRODUCTION

A barium swallowing test is generally safe, but aspiration during upper gastrointestinal contrast material studies is a well-reported complication [1]. However, occurrence of massive barium aspiration can be life-threatening with a mortality rate exceeding 50% from the development of shock, secondary pneumonia, or acute respiratory failure [2].

We describe an elderly patient with multiple comorbidities

who presented with uncontrolled thyrotoxicosis with dysphagia in whom the aspiration of large amounts of barium during an upper gastrointestinal radiographic contrast study led to a fatal clinical course.

CASE

A 66-year-old man presented to the emergency department with a 2-week history of progressively worsening difficulty with swallowing foods and liquids, and intermittent nasal regurgitation. The patient reported associated symptoms of generalized weakness, palpitation, and dyspnea, but denied diplopia, dysarthria, and extremity weakness or numbness. He has been diagnosed with Graves' disease for 30 years and had several episodes of thyrotoxicosis with congestive heart failure and atrial fibrillation requiring hospitalization. His other medical history included alcoholic liver cirrhosis, chro-

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nic obstructive pulmonary disease, and mitral valve replacement. Three months earlier, he had undergone radioiodine I-131 treatment, and has been managed on a saturated solution of potassium iodide and propranolol.

On physical examination the patient was alert without signs of baseline cognitive impairment. He was afebrile with a pulse of 143 beats per minute, respirations of 20 beats per minute, pulse oximetry of 97% on room air, and blood pressure 140/60 mmHg. After an evaluation of his laboratory values, the patient was diagnosed with thyrotoxicosis based on the results of thyroid function test, which showed thyroid stimulating hormone 0.025 mIU/mL (range, 0.35-4.94 mIU/mL), free T4 5.86 ng/dL (range, 0.70-1.48 ng/dL), and total T3 8.0 ng/mL (range, 0.58-1.59 ng/mL), and was admitted for management of thyrotoxicosis and nutritional support.

Despite the addition of methimazole 30 mg 3 times daily upon admission, weakness and dysphagia progressed. On hospital day 2, a barium esophagogram was performed for evaluation of dysphagia (Fig. 1). During the study, he aspirated a large amount of barium sulfate, and became distressed with oxygen saturation of 87% at room air. On examination, his temperature was 36.7°C; pulse 110 beats per minute; blood pressure 110/70 mmHg; respiratory rate 30 breaths per minute.

Fig. 1. Esophagography. Single contrast study showed minimal aspiration but no significant filling defect or transition delay.

Fig. 2. After barium aspiration, chest X-ray showed endobronchial deposition of barium sulfate in the whole lung.

His oxygen saturation improved to 90% with a reservoir mask of oxygen flow rate of 15 L per minute, but showed signs of accessory respiratory muscle retractions. While the esophagogram showed no significant filling defect, the chest radiograph performed after the esophagogram demonstrated a fulminant endobronchial deposition of barium sulfate, highlighting his bilateral airways and bronchial tree of the whole lung (Fig. 2).

Due to the worsening hypoxia, the patient was transferred to the medical intensive care unit (ICU), where he underwent endotracheal intubation and mechanical ventilator support at 30 minutes after barium aspiration. Thirteen hours after intubation he remained in severe respiratory failure with high ventilator requirements (oxygen saturation below 90%). Therapeutic bronchoscopy was performed and large amounts of barium sulfate were removed during lavage. However, complete removal of aspirated barium contrasts was not feasible because the lavage was limited by hypoxemia. Tracheo-esophageal fistula was not seen on bronchoscopy. Despite the continued intensive care with fluid resuscitation, vasoactive agents, antibiotics, and renal replacement support, the patient died of multiple organ dysfunction in ICU on day 9.

DISCUSSION

Metabolic myopathy affects 60-80% of thyrotoxic patients and men are affected more commonly than women [3]. While an enlarging cervical or retrosternal goiter may cause direct impingement of the esophagus, muscle weakness from thyrotoxicosis can cause bulbar muscle wasting, resulting in oropharyngeal or esophageal dysmotility [4,5]. It is usually associated with thyroid crises or chronic thyrotoxic myopathy and acute bulbar palsy, abrupt in onset and fatal, is a rare pattern [5,6]. Oropharyngeal weakness causing dysarthria and dysphagia can be seen with myasthenia gravis, which can develop in 3-10% of patients with hyperthyroidism, or thyrotoxic hypokalemic periodic paralysis, therefore it is important to distinguish these entities [7].

In the elderly population, the influence of the normal aging process on the oropharyngeal swallow by age-related alterations in somatosensory cortical activation during swallowing [8] and impairment of pharyngeal bolus clearance associated with concomitant medical illnesses [9] has been well described.

On the other hand, there are different comorbid disease

associations with dysphagia based on age, and their prevalence varies among age groups [6]. In particular, the prevalence of dysphagia associated with esophageal malignancy ranges from 53-93% with the average age of 63-65 years [10]. Therefore, evaluation to rule out esophageal structural lesions is often the first step in studies to evaluate a cause of dysphagia following detailed history taking and physical examination, particularly in an elderly population.

Among various diagnostic techniques, the initial test is often a barium swallow or an endoscopic examination. In cases of dysphagia to both solids and liquids and suspicion of a motor disorder, as in our patient, a barium swallow provides more useful information by evaluating both esophageal structure and peristalsis [11]. Although rare, oral barium sulfate aspiration is a well-documented complication of upper gastrointestinal studies using contrast material. Barium sulfate, a relatively insoluble salt form of barium, is an inert material that does not usually cause significant chemical pneumonitis [12], thus it is used as a radiographic contrast media which produces “white-out” appearance on chest radiographs. In fact, earlier reports on patients undergoing inhalation bronchography with barium contrast before bronchoscopy was available suggested negligible impact of barium on pulmonary tissue [13,14]. Conversely, Voloudaki et al. suggested that barium particles seem to be phagocytosed by alveolar macrophages, which can potentially cause interstitial fibrosis, seen as centrilobular micronodules on high resolution computed tomography scan [15].

Aspiration of small amounts of barium during diagnostic procedures is occasionally reported, usually from incidental detection on routine chest radiograph without causing any symptoms. Nevertheless, barium aspiration can be varied by the individual status of oropharyngeal functional integrity which can be affected by various conditions, including age, neuromuscular dysfunction, alcoholism, malignancy, and psychological illnesses, as well as the concentration or volume of barium aspirated [16]. A large amount of contrast aspiration can disturb the gas exchange through occupying alveolar spaces, causing a shunt effect and ventilation/perfusion mismatch [17]. In fact, combined aspiration of gastric contents and large amounts of barium can lead to life-threatening conditions with a mortality rate of 30-50% [2,18-20]. According to the limited number of reported cases, barium aspiration seems to be more problematic with greater morbidity and

mortality in elderly patients with comorbidities [18].

In the current patient, the main cause of dysphagia appears to be metabolic myopathy involving oropharyngeal and/or esophageal segments from uncontrolled thyrotoxicosis. This and multiple other comorbidities of the patient may have contributed to the massive aspiration that occurred during barium esophagogram. In addition, inefficient expectoration of the aspirate due to his worsening condition may have aggravated the lung lesion, despite the postural drainage maneuver. There is little data on the optimal management for barium aspiration following a contrast study. Empirical use of antibiotics is recommended since aspirate may contain gastric content. In cases of massive barium aspiration affecting almost the entire respiratory trees, therapeutic use of fiberoptic bronchoalveolar lavage to remove the barium may be helpful, although there are opposing views regarding this therapeutic approach concerning the possibility of further dissemination of the barium [16].

Barium swallowing test is a useful diagnostic tool for evaluation of dysphagia. Despite the inert character of barium sulfate per se, massive aspiration of barium is usually accompanied by aspiration of gastric content and can be potentially life-threatening, particularly in patients with multiple underlying disorders. Although postural techniques may minimize the risk of aspiration during barium studies, other diagnostic tools for evaluation of dysphagia should be considered in elderly patients with multiple comorbidities associated with increased risk of aspiration.

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