Forensic Science International 253 (2015) e16–e19

Contents lists available at ScienceDirect

Forensic Science International

journal homepage: www.elsevier.com/locate/forsciint

Case Report

Barium sulfate aspiration: Severe chemical pneumonia induced by a massive reflux of contrast medium during small bowel barium enema

Lin Zhang, Yi Yang, Ji Zhang, Xiaowei Zhou, Hongmei Dong **, Yiwu Zhou *

Department of Forensic Medicine, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430030, PR China

ARTICLE INFO

Article history:
Received 16 March 2015
Received in revised form 12 May 2015
Accepted 16 May 2015
Available online 27 May 2015

Keywords:
Forensic pathology
Barium sulfate aspiration
Chemical pneumonia
Radiographic complication

ABSTRACT

Barium contrast radiography is a conventional procedure aimed at revealing lesions of the alimentary tract using barium sulfate on X-ray irradiation. Although it is widely used in clinics, adverse effects and complications are observed, such as anaphylaxis, granuloma, fecalithes, abdomen-leaking, embolism, bacterial contamination, and aspiration. We report a case of death due to a massive barium sulfate aspiration resulted from an air-barium double contrast enema radiography. A 25-year-old female patient was hospitalized with symptoms of abdominal distention, nausea, vomiting and diarrhea for three days. A progressive respiratory distress presented only 1 h after a small bowel air-barium double contrast enema. The patient died 11 h later. The result of autopsy revealed the cause of death to be severe chemical pneumonitis induced by gastric fluid which was aspirated into her lungs. Barium sulfate is generally recognized to be chemically inert for the respiratory system, but a mixture of barium sulfate with gastric contents is fatal. Here we intend to suggest that, when determining the potential cause of death, medical examiners should consider a patient's status quo as well as the possible adverse effects and complications caused by the barium sulfate preparation during gastrointestinal radiography.

1. Introduction

Gastrointestinal contrast is a routine examination for medical diagnosis. It has been broadly used in hospitals. The procedure is usually performed with barium sulfate contrast, swallowed or administrated into the esophagus, stomach and duodenum for radiographic development. Barium sulfate is insoluble in water and forms a suspension. It is relatively safe in alimentary radiography because it is not a chemical irritant. Sellink [1] and Herlinger [2] reported in 1974 and 1978, respectively, that the extensive applications of barium ingestion for X-ray visualization can cause adverse effects and complications, such as anaphylaxis, granuloma, fecalithes, abdomen-leaking, embolism, bacterial contamination, aspiration, and even death [3,4]. However, it has not been fully recognized by clinicians and medical examiners [5]. Pulmonary barium aspiration during the examination is not unusual, but fatal cases are rare and they are mostly confined to a radiographic diagnosis [4,6,7]. Tsokos et al. [8,9] reported a case of fatal barium sulfate aspiration with a moderate dose (100 ml) of gastric administration in barium radiography and the patient with gastric cancer died 35 h later.

Here, we report a case of a female patient who died of a massive barium sulfate aspiration due to a small bowel air-barium double contrast enema.

2. Case report

A 25-year-old female patient was admitted to hospital for abdominal distention, nausea, vomiting and diarrhea for three days. She was diagnosed with systemic lupus erythematosus (SLE) 2 years ago and had a medication history of prednisone. Physical examination showed the patient with abdominal distention, shifting dullness and tenderness of the umbilicus and hypogastrium. Intestinal X-ray suggested a small bowel obstruction (SBO). A small bowel air-barium double contrast enema was performed to define the lesion. Local anesthesia by lidocaine spray on the pharynx was performed and an orogastric tube was inserted down to the jejuno–duodenal junction. The procedure lasted for 30 min and approximately 1000 ml of barium sulfate contrast was administrated. The examination reported an inflammatory lesion. One hour after the procedure, the patient complained of

* Corresponding author at: Department of Forensic Medicine, Tongji Medical College of Huazhong University of Science and Technology, No. 13 Hangkong Road, Wuhan 430030, PR China. Tel.: +86 27 83657925; fax: +86 27 83692638.
** Corresponding author.
E-mail addresses: hongmeidong1@hotmail.com (H. Dong), zhouyiwu@outlook.com (Y. Zhou).

http://dx.doi.org/10.1016/j.forsciint.2015.05.016
0379-0738/

Fig. 1. X-ray chest film shows multi-node and patchy consolidation.

palpitations, chest tightness and dyspnea. Her blood pressure (BP) dropped to 90/50 mmHg and the heart rate (HR) increased to 120 bpm. Labored breathing and fine crepitations were detected, especially in the left lung. In 3 h, her situation became worse with a temperature of 39.5 °C and HR of 176 bpm. Mild to moderate moist rale was obvious and an X-ray chest film suggested inhalation and chemical pneumonia (Fig. 1). Tachypnea and cyanosis of her face and lips were apparent and pressure of oxygen was 4.75 kpa. The patient died 11 h after the procedure.

Forensic necropsy was performed 48 h after her death. External examination indicated the patient to be a physically well adult female without any signs of mechanical injury or asphyxia. Internal examination revealed white contrast agents in esophagus, stomach and intestinal canals. An incomplete volvulus of the ascending colon was noted with distinct tissue edema 16 cm away from the appendix. Diffuse inflammatory infiltration was demonstrated microscopically.

Larynx and pulmonary edema was notable while the trachea, main and lobar bronchi were stained with contrast agents (Fig. 2). A 16 cm × 8 cm area filled with a certain amount of white plaques presented in the inferior lobe of the left lung; and a 15 cm × 7 cm area was presented in the right lung as well as the cut sections (Fig. 3). Significant inflammatory cells full of neutrophile granulocytes were infiltrated in most of the alveolar cavities. Yellowish-brown depositions were diffusely found in alveolar

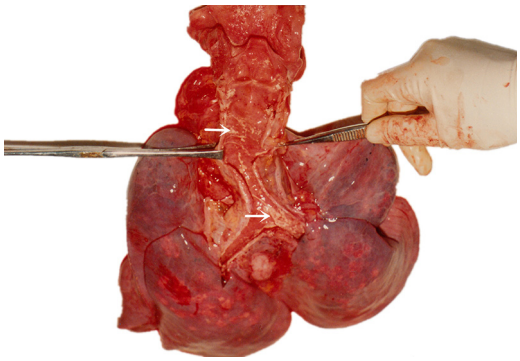

Fig. 2. White discoloration of the trachea and bronchi.

cavities and phagocytosed by macrophages. A fibrinous exudate, fibrinoid necrosis and hyaline membrane formation were observed (Fig. 4). A photo of a stained smear of barium sulfate contrast material is also added (Fig. 5).

The cause of death was determined as severe chemical pneumonia due to gastric fluid and barium sulfate aspiration of barium enema examination for radiographic purpose.

3. Discussion

Barium-containing contrast medium is widely used in gastrointestinal radiography for inflammation, tumor, polypus, diverticulum, varicosity, hernia, fistula, prolapse, volvulus and obstruction. Use of contrast agents enhances visualization of internal structures, and these agents are believed to be bland, defined, feasible and economical materials. Clinically, barium sulfate preparation for oral usage and enema is composed of barium sulfate and additives. The formulation can be tablets, powder, paste or suspension. Because of the variations in enteric mucosa, it is important to justify the stabilization, density, viscosity and chemical composition to achieve a desired result. Currently, nearly a hundred of additives are used in the barium contrast [10]. The application of a specific barium sulfate suspension depends on the target areas in clinics. Despite of little irritation, some of the additives, for instance, deflocculating agent such as sodium citrate, may still induce adverse effects as anaphylaxis or gastrointestinal hemorrhage.

Adverse effects and complications related to barium-containing contrast radiography of the upper gastrointestinal tract occur rarely [11] and most symptoms are mild and self-limited. However, rare complications such as aspiration should be given adequate attention. This complication is found predominantly in infant, old people, sedative takers, and patients with esophageal obstruction, respiratory disorder, dizziness, consciousness

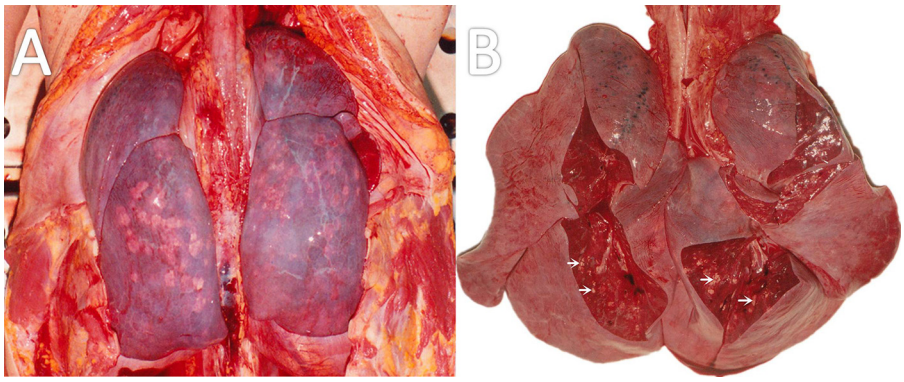

Fig. 3. A certain amount of white plaques presented in the lung (A) and the cut sections (B).