Successful Management of Esophageal Perforation Diagnosed 3 Days After Injury Caused by an Explosion in the Workplace: Report of a Case

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Abstract
We report a case of esophageal perforation caused by an explosion, but which was not diagnosed until 3 days after the injury. A 53-year-old worker sustained superficial dermal burns to his trachea, face, neck, and legs during an explosion. The burns were treated conservatively at a local hospital, but he was transferred to our hospital 3 days after the injury, when mediastinal emphysema and bilateral pleural effusion became evident. An esophagogram followed by computed tomography showed an esophageal perforation caused by the blast injury, and we performed an esophagectomy with reconstruction of the gastric tube. After the operation, an X-ray showed a foreign body in the lower abdomen, which we found in the upper thoracic esophagus on the day of injury. We surmised that the patient had inadvertently swallowed a foreign body, which had been heated and scattered by the explosion, and it had melted the upper thoracic esophagus.

Key words Esophageal perforation · Explosion · Foreign body · Delayed diagnosis

Introduction
Esophageal perforation is a life-threatening event requiring emergency management, and is associated with high morbidity and mortality.1 It is classified according to cause as follows: iatrogenic, traumatic, spontaneous (Boerhaave syndrome), foreign body, tumor, and surrounding infection.2

We report a case of esophageal perforation caused by an explosion. This cause is unusual and we surmised that the patient had swallowed a foreign body scattered and heated by the explosion without noticing, and this melted the upper thoracic esophagus.

Case Report
A 53-year-old worker was involved in a workplace explosion, resulting from the mixture of aluminum with water. He suffered superficial dermal burns to his trachea, face, neck, and legs, and was transported to the nearest hospital. Initially, his general status and vital signs were stable and he received conservative treatment for the burns. However, 3 days after the injury, chest X-ray and computed tomography (CT) showed mediastinal emphysema and bilateral pleural effusion, and he was transferred immediately to our hospital.

On admission, his PaO2 and oxygen saturation were low and inflammatory changes were evident (Table 1). A chest X-ray showed dilatation of the mediastinal area (Fig. 1A). We immediately performed a contrast esophagogram and CT, and found that water-soluble contrast medium flowed into the mediastinum and pleural cavity from the medial thoracic esophagus (Fig. 1B–D). We diagnosed an esophageal perforation resulting from the blast injury and performed surgery without further delay.

During the cervical procedure we dissected the cervical esophagus toward the mediastinum; however, the tissue became necrotic in the upper thoracic esophagus. In parallel, a gastric tube was made via the abdominal procedure and we performed an end-to-side anastomosis between the cervical esophagus and the gastric tube, using an end-to-end anastomosis instrument (25mm). The gastric tube was pulled upwards through the retrosternal route. We also performed a right thorac-
otomy through the 5th intercostal space in a posterolateral fashion. We resected the upper thoracic esophagus, which had changed to mucilaginous tissue. Double-lumen tube drains were inserted into the bilateral thoracic cavity. Macroscopically, the resected upper thoracic esophagus had become necrotic tissue (Fig. 2). Microscopically, necrotic changes were seen in all layers with severe neutrophil infiltration and no sign of malignancy.

After the operation, an X-ray showed a foreign body in the lower abdomen (Fig. 3). On re-examining the X-ray films taken in the previous hospital we saw that the foreign body had been in the upper thoracic esophagus on the day of the injury (Fig. 4A), and in the small intestine on the first day after the injury (Fig. 4B). Unfortunately, the foreign body was eliminated before we could retrieve it, but based on the operative findings, on micro- and macroscopic observation of the resected specimen, and on the chest X-ray findings, we surmised that the foreign body had been heated and scattered by the explosion. It then became fixed in the upper thoracic esophagus long enough for it to melt the esophageal tissue. The patient was discharged on postoperative day 38 after a relatively uneventful postoperative course.

Fig. 1A–D. Imaging findings on admission to our hospital. A Anterior—posterior view of the chest shows widening of the mediastinum. B Contrast esophagogram shows leakage at the median thoracic esophagus (arrow) and water-soluble medium flowing into the mediastinum. C, D A computed tomography scan done immediately after the contrast esophagogram shows water-soluble medium flowing into the mediastinum (arrows) (C) and into the bilateral pleural cavity (arrows) (D) from the leakage point. Bilateral pleural effusion can be seen.