SHORT COMMUNICATION

Respiratory-aspirated 35-mm hairpin successfully retrieved with a Teflon® snare system under fluoroscopic guidance via a split endotracheal tube: a useful technique in cases of failed extraction by bronchoscopy and avoiding the need for a thoracotomy

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ABSTRACT. Respiratory foreign body aspiration (FBA) is a common global health problem requiring prompt recognition and early treatment to prevent potentially fatal complications. The majority of FBAs are due to organic objects and treatment is usually via either endoscopic or surgical extraction. FBA of a straight hairpin has been described as a unique entity in the literature, occurring most commonly in females, particularly during adolescence. In the process of inserting hairpins, the pins will typically be between the teeth with the head tilted backwards, while tying their hair with both hands. This position increases the risk of aspiration, particularly if there is any sudden coughing or laughing. To our knowledge, this is the first case report of a 35-mm straight metallic hairpin foreign body that has been successfully retrieved by a radiological snare system under fluoroscopic guidance. This was achieved with the use of a split endotracheal tube, and therefore avoided the need for a thoracotomy in an adolescent female patient.

Received 4 May 2011
Revised 20 November 2011
Accepted 24 November 2011

DOI: 10.1259/bjr/45761403

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Respiratory foreign body aspiration (FBA) is a common global health problem requiring prompt recognition and early treatment to prevent fatal complications. In the United States, 1.4 in 100 000 deaths are related to FBA [1]. The peak incidences occur in the second year and sixth decade of life, with an overall 3:2 male predominance. The majority of these are due to organic objects that lodge in the peripheral airways (segmental and subsegmental bronchi) in 26% of child and 57% of adult cases [2]. Presentations include sudden onset of choking and intractable cough with or without vomiting, named “penetration syndrome” (49%); isolated cough (37%); fever (31%); wheeze (26%); and massive haemorrhage (8%). Some patients may be asymptomatic (2%). Straight pin FBA has been described, as a unique entity in the literature with few retrospective series; the largest of these reviewed 62 patients over 20 years [3]. They account for 2.7% of all FBAs and occur most commonly in adolescent girls, who place pins between their teeth with their head tilted backwards, while tying their hair with both hands and then suddenly starting to cough or laugh [4].

Radiographic findings range from normal appearances to a visible foreign body (FB), with potential associated

features such as air trapping, atelectasis, pneumonia, pneumothorax, pneumomediastinum, bronchiectasis, pulmonary abscess and tracheoesophageal fistula [5]. If the diagnosis is in doubt, some institutions advocate the use of the CT technique of virtual bronchoscopy for confirmation and mapping [6]. Current treatment options include bronchoscopy using grasping forceps or a magnetic extractor, or surgery with or without fluoroscopic assistance [7–9].

Case report

A 19-year-old female with no past medical history presented with a sudden onset of coughing following accidentally aspirating a metallic hairpin. The patient was clinically stable and a chest radiograph showed a 35-mm metallic linear FB overlying the left heart border (Figure 1). This was confirmed on CT to lie in the anteromedial segment of the left lower lobe bronchus, with air trapping peripheral to this. Two attempts at removal—first by flexible and then rigid bronchoscopy—were performed, but in each case the FB could not be directly visualised. The initial failed direct visualisation under bronchoscopy suggests that this FB was relatively peripheral and awkwardly positioned. In neither instance was fluoroscopic screening used to help

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Figure 1. Frontal chest radiograph showing an aspirated 35-mm linear foreign body projected over the left heart border.

localisation, which may have been of assistance. Following the failed bronchoscopic attempts at retrieval, the patient was subsequently referred to interventional radiology in order to avoid a thoracotomy.

The authors anticipated difficulty finding and catheterising the bronchiole in question, and therefore the patient was placed under general anaesthetic with a split endotracheal tube *in situ* (Figure 2).

The patient was ventilated via the contralateral lung, and a 10F sheath was inserted through the other lumen of the endotracheal tube and into the left main bronchus

under fluoroscopic guidance. This was followed by a catheter and Amplatz GooseNeck® snare system (Microvena, St Paul, MN), which were manoeuvred into the anteromedial segment of the left lower lobe bronchus which contained the metallic FB (Figure 3a). Contrast injection was not needed to aid direction of guide-wire and catheter. The snare grasped the proximal portion of the FB; however, it proved difficult to remove. Even though the proximal portion of the hairpin FB was grasped, the inherent angulation of the snare loop relative to the wire stem and insertion catheter meant that the very tip of the FB could not be grasped, and this sharp tip of the FB kept impacting into the bronchial wall. The sharp end of the hairpin pointed towards the central airways. In addition, the distal end seemed relatively fixed, precluding free passage and removal (Figure 4).

In order to avoid a thoracotomy, a second attempt to remove the FB radiologically was requested. On this occasion the patient was again ventilated with a split endotracheal tube but both lungs were ventilated and a Teflon® (DuPont, Wilmington, DE) snare system (EN Snare™ system; Angiotech, Sarasota, FL) was used (Figure 3b–d). The split endotracheal tube allowed easy access to the left main bronchus. The combination of these modifications in technique allowed the proximal tip of the FB to be successfully snared, disengaged from the bronchus, enclosed within the sheath and extracted (Figure 5). The straighter configuration of the Teflon snare system allowed the very tip of the FB to be grasped and enclosed in the snare. This and the increased bronchial dimensions as a consequence of the ventilated left lung allowed the FB to be successfully extracted without the sharp tip impacting on the bronchial wall. The hairpin was removed unfragmented (Figure 6) and the need for a thoracotomy in a 19-year-old female patient was avoided. There were no clinical sequelae following removal of the FB.

Figure 2. Photographs of (a, b) 35-Fr/Ch split endotracheal tube (Broncho-Cath; Tyco Healthcare Group, Mansfield, MA), which was used to ventilate the contralateral lung on the first snare attempt and both lungs on the second snare attempt; compared with (c) 7.5-mm internal diameter high-contour oral/nasal tracheal tube cuffed; and (d) 10-Fr/Ch suction catheters.

Figure 3. Promotional photographs of the (a) Amplatz GooseNeck™ snare system (Microvena, St Paul, MN) and (b–d) Teflon® (DuPont, Wilmington, DE) snare system (EN Snare™ system; Angiotech, Sarasota, FL).

Figure 4. Single fluoroscopy image showing the initial unsuccessful attempt of pin retrieval by the Amplatz GooseNeck™ snare system (Microvena, St Paul, MN).

Figure 5. Single fluoroscopy image showing successful snaring of the foreign body with the Teflon® (DuPont, Wilmington, DE) snare system (EN Snare™ system; Angiotech, Sarasota, FL) and removal via a vascular sheath inserted through one lumen of the split endotracheal tube.

Figure 6. Photograph showing the 35-mm aspirated hairpin that was successfully retrieved without fragmentation or clinical sequelae.

Conclusion

To our knowledge, this is the first case report of a 35-mm straight metallic hairpin FB that has been successfully retrieved by a radiological Teflon snare system under fluoroscopic guidance via a split endotracheal tube, avoiding the need for a thoracotomy in an adolescent female patient. However, the authors wish to acknowledge past reports documenting previous radiologically assisted retrieval of airway FBs [10, 11]. The main benefit of this case is to stimulate innovation in interventional radiology to help patients, with a low rate

of complications. The authors believe that a key factor in the success of the second attempt was the different design of the snare. This technique is most likely to be used in young patients and the radiation dose was within acceptable limits, which only further supports the use of this technique.

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