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CORRESPONDENCE: OUR EXPERIENCE

Oxford radiographic chart of foreign bodies

1 | INTRODUCTION

Dear Editor,

ENT surgeons frequently treat adults and children with impacted upper aerodigestive tract (UADT) foreign bodies. Typically, assessment is based on a focused history and examination including flexible nasal endoscopy. Frequently, a lateral soft tissue radiograph is performed when the foreign body is not immediately recognised, this is used to locate the foreign body and detect soft tissue signs associated with foreign body impaction or complication.

Not all foreign bodies are radio-opaque, and historical studies have looked at the relative radio-opacity of frequently ingested fish bones and metallic foreign bodies.[1-3] To our knowledge however, there is no comprehensive tool available for the identification of most radio-opaque foreign bodies encountered in clinical practice. A tool of this kind would be valuable to emergency medicine clinicians, radiologists and ENT clinicians assessing radiographs performed for these patients.

This study aimed to identify the relative radio-opacity of commonly encountered foreign bodies in the UADT to aid clinicians in the interpretation of lateral soft tissue radiographs performed for suspected foreign body impaction.

2 | METHODS

Ethical considerations—Beef flank used instead of human patients. A veterinary clinic was used as local hospital departmental health and safety guidelines did not allow for the radiography of non-human subjects.

A database of UADT foreign bodies was compiled after surveying ENT colleagues in the Thames Valley Region. There were a total of 32 foreign bodies identified (Figure 1); these were procured from local shops and households.

The items were equally spaced and placed on an A4-sized piece of boneless beef flank alongside a radiopaque marker (Figure 1).

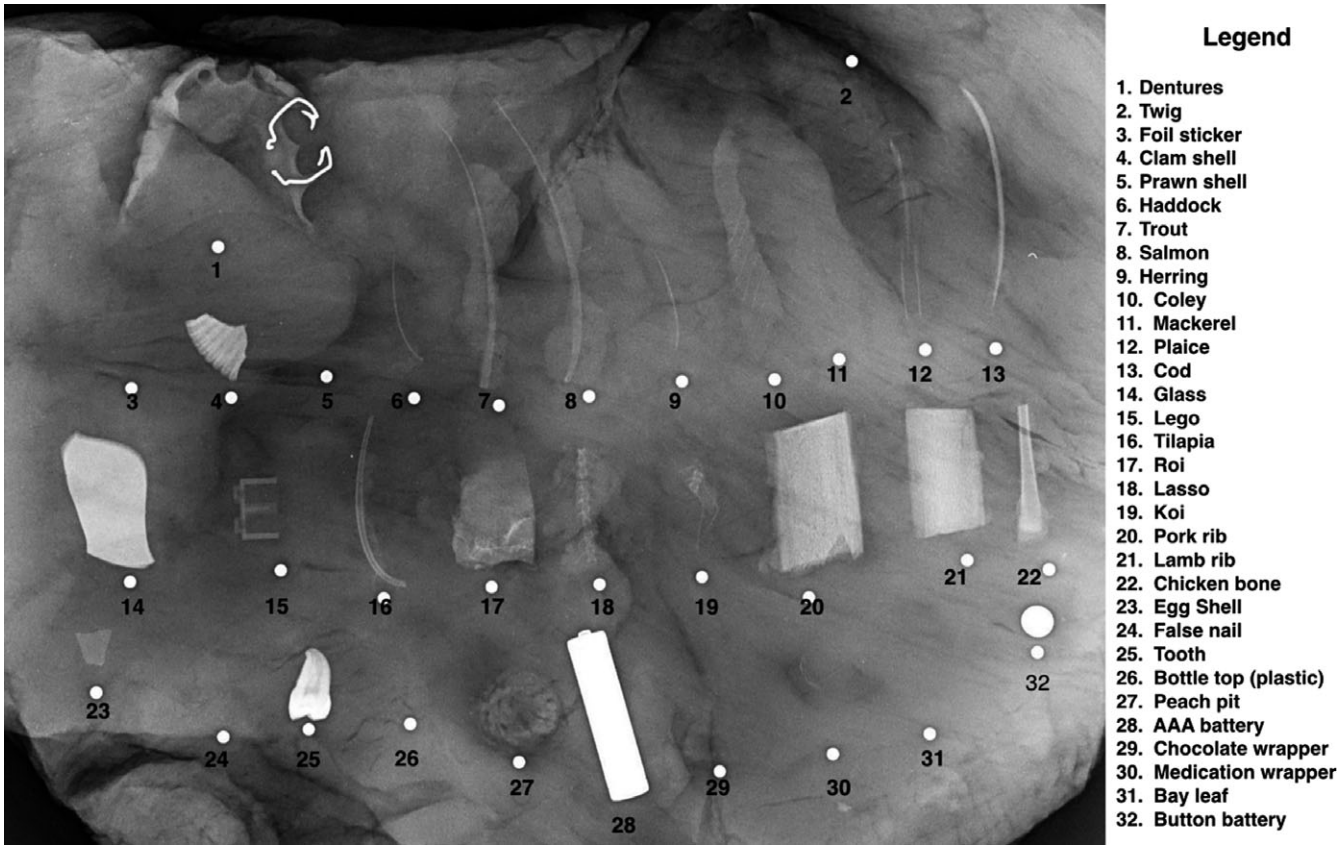

FIGURE 1 Oxford radiographic chart of foreign bodies

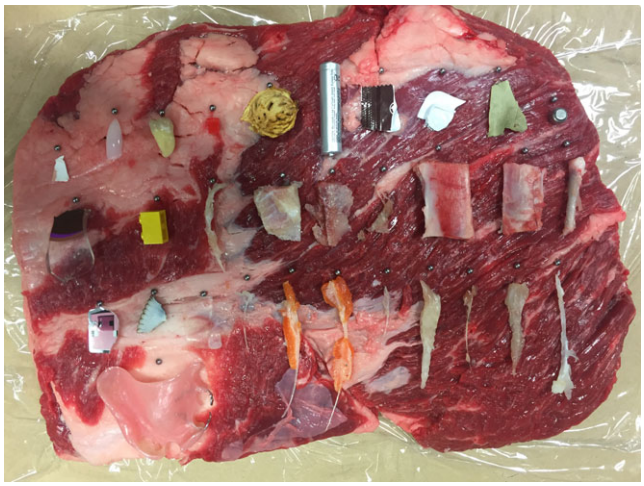

FIGURE 2 Foreign bodies placement on beef flank

Beef was selected as it provided a piece of soft tissue large and uniform enough to accommodate the number of foreign bodies. The meat was professionally cut to 3.5 cm thick. The thickness was based on the average distance from skin to pharynx as measured in 3 neck computed tomography scans. The beef and foreign bodies were bound with plastic wrap (Figure 2).

Appropriate radiograph settings were obtained from our radiology department. The meat and foreign body model was turned over and three digital radiographs were performed at a local veterinary clinic using a HF200A+ Digital X-Ray Apparatus (Veterinary X-Rays, High Wycombe) at 60 kV/7.98 mAs, 44 kV/2.36 mAs and 42 kV/2.36. The radiograph with an exposure most similar to human radiographs (60 kV/7.98 mAs) as determined by a head and neck radiologist was selected for final analysis.

ImageJ (National Institute of Health, USA) was used to measure the relative image intensity of each foreign body to its surrounding tissues. The intensity of human thyroid, cervical spine vertebrae and pork rib in situ was also measured as a control using human lateral soft tissue radiographs. The most radiopaque foreign body (AAA battery) was given a score of 100, and the relative opacity of each subsequent foreign body was given as a proportion of that. The results were assigned to one of four categories; highly visible (100%-40%), visible (39%-13%), minimally visible (12%-1%) and unable to visualise (0%) (Figure 3).

Keypoints

- The Oxford radiographic chart of foreign bodies is a useful clinical tool for identifying the radio-opacity of foreign bodies
- It may be used in all emergency departments with radiography facilities.
- The methods can easily be replicated if desired
- Foreign body shape can alter visibility despite known opacity
- This tool should be used as an aid and does not replace appropriate clinical examination

3 | RESULTS AND DISCUSSION

Both adult and pediatric patients can present with foreign bodies in the UADT. Identifying these on a radiograph can be challenging. This study aimed to identify the relative radio-opacity of commonly encountered foreign bodies in clinical practice.

The highly visible items were items with significant mineral (calcium) or metallic components (i.e. batteries). Many of the fish bones (haddock, trout, salmon, herring, coley, plaice, cod, tilapia, roi) and some inorganic materials (lego, egg shell, peach pit, dentures) were clearly visible, the latter likely due to their identifiable shape. The prawn shell, twig, koi, lasso, false nail, plastic wrapper and medication wrapper were all visible, albeit with difficulty and the assistance of the radiopaque marker. The foil sticker, mackerel bone and bay leaf were not identifiable even with the assistance of a radiopaque marker and prior knowledge of their arrangement. The pork rib had a similar relative opacity on the human lateral soft tissue radiograph (47.7) as it did on our model (54.4). This allows us to infer that the other items would

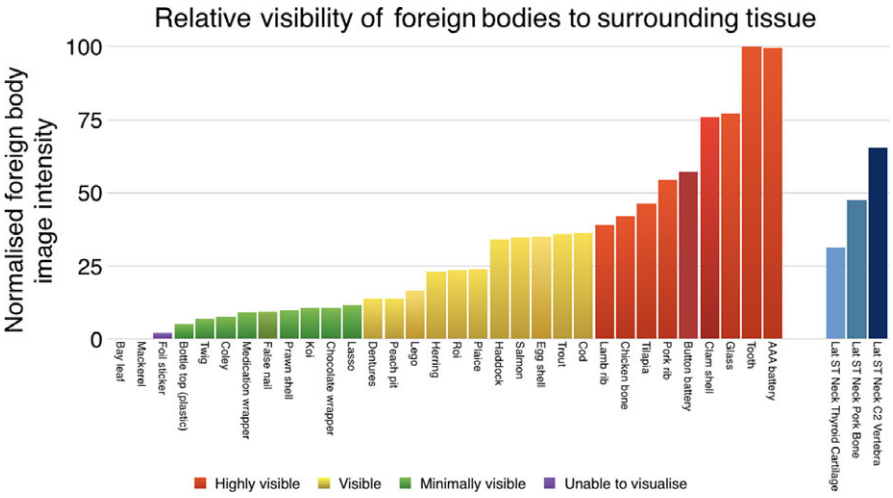

FIGURE 3 Relative visibility of foreign bodies to surrounding tissue

Oxford Radiographic Chart of Foreign Bodies

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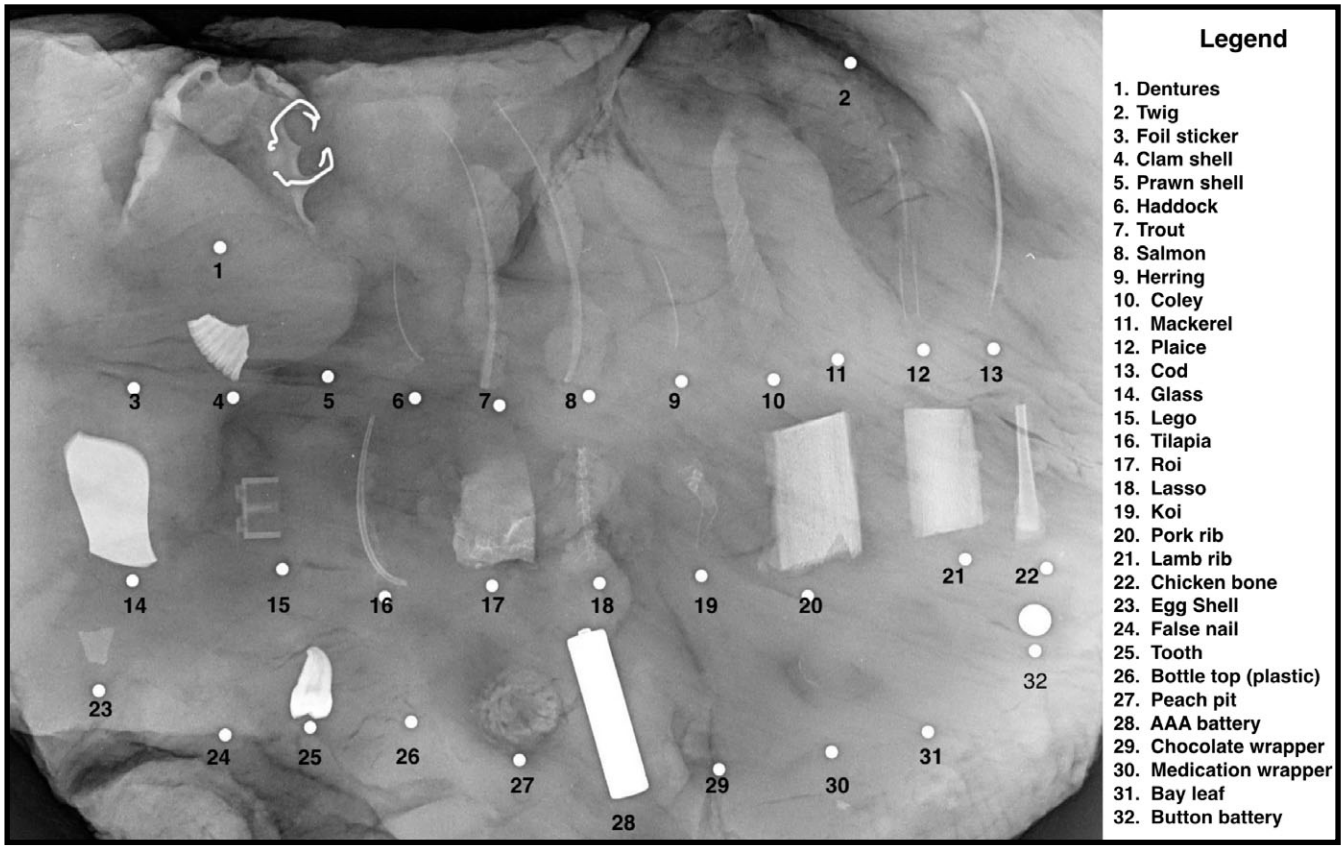

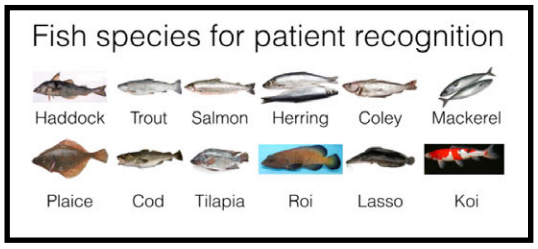

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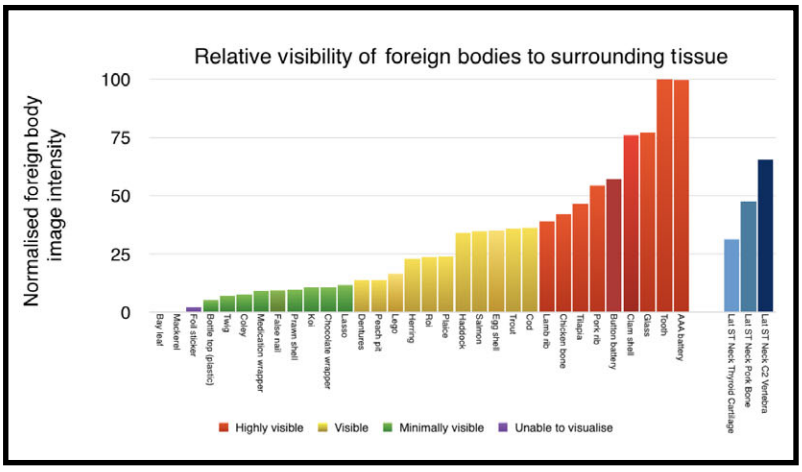

FIGURE 4 Oxford radiographic chart of foreign bodies aide for emergency departments

have a relatively similar visibility in-situ compared to surrounding structures, though they may be slightly more radiolucent.

As the tissue was not uniform in its fat content and lacked skin tissue which would effect X-ray penetrance, this study was limited by the use of beef flank instead of patients. Performing a clinical study of this type, however, would not be practical nor ethical. Nevertheless, we accept there may be some differences in the radio-opacity of the minimally visible objects used in this study in patients as compared to our model. However, given the lack of published evidence regarding this important clinical question we feel there is merit in sharing these results with your readers as a clinical tool and have created a downloadable poster that might be used in emergency departments around the world (Figure 4).

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CONFLICT OF INTEREST

The authors of this study have no conflict of interest to declare.

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