

Ingested Metal Foreign Body – Paediatric Full Clinical Guideline

Reference no.: CH CLIN C17/Oct 21/v004

1. Introduction

Ingestion of a metallic foreign body (MFB) is a common CED presentation. Coins account for approximately 60% of these, and batteries for between 1-5% of all metal foreign bodies ingested.^{1,2} Children often attend following witnessed ingestion with no symptoms however they may also present with stridor, respiratory symptoms, choking, drooling, dysphagia or refusal of feeds.

2. Aim and Purpose

This guideline is to support the management of asymptomatic children following the ingestion of a metal foreign body. It aims to provide instructions in the use of a hand held metal detector (HHMD), and to reduce unnecessary investigations and interventions.

The emergency management of symptomatic children is not detailed in this guideline except under the Hazardous Metal FB section.

Do not send home a child who is coughing, choking, drooling or refusing to eat/drink after a suspected ingestion without a senior review.

3. Definitions, Keywords

Keywords:

- Foreign body ingestion
- Hand held metal detector
- Battery/batteries
- Magnet/magnets

4. Management of Ingested Metal Foreign Body

Use the HHMD to localise the MFB. The HHMD works best with coins but can be used for any object containing a significant amount of metal. It is particularly useful for aluminium objects which are often radiolucent (not visible on X-ray). Please see below for advice on batteries, magnets and sharp objects. Overall, the sensitivity of the HHMD for both detecting and localising coins is estimated to be >99%.³ The HHMD is thought to be less reliable for non-coin MFBs.

Children presenting to Minor Injuries Units who meet criteria for X-ray should be referred to the nearest Emergency Department (RDH or QHB).

Using the HHMD

First, isolate the child from all metal. The child must be undressed of all clothes with metal in them: beware metal buttons and poppers. Belts, zips, necklaces, and earrings are common sources of metal. Ask a parent to take off all rings, bracelets, watches and jewellery. Then ask them to hold the child out in front of them, off the floor. This is because chairs, beds, hospital trolleys and floors are full of metal objects. Switch it on and sweep the metal

detector over the child's neck, chest, and abdomen, both front and back. Keep the detector mobile and as close to the patient's skin as possible (touching the skin where possible).

The device will beep if it encounters any metal object. This may be very subtle, and may need repeated sweeps to find the object.

This procedure could be done during triage or streaming assessment. A doctor should decide the location of the object. This is likely to take less than one minute.

The important decision is whether the beep is above or below the external landmarks for the diaphragm. The potential obstruction points are all above the diaphragm, particularly at the gastro-oesophageal junction.

4.1 Non-hazardous metal foreign body e.g suspected coin ingestion (Excluding batteries, magnets or sharp objects) (See Appendix 1)

If the detector does not beep, either:

- 1) The child has not swallowed anything or
- 2) The metal detector has not picked it up.

You need to make a judgement on the risk that something has actually been ingested, through taking of a careful history. Added to this, consider the amount of metal in the object (NB. aluminium has a low radiodensity and will not therefore show up on x-ray but will be clearly identified by HHMD scanning). The body habitus of the patient is also crucial: profound obesity with the resultant increase in scanner to object distance will give a false negative and an x-ray should be performed if there is any doubt.



Negative HHMD

If the object is thought to be a non-hazardous MFB then the child should be allowed to eat and drink. If there are no problems with eating and drinking then they can be discharged.

Positive HHMD - Object localises above the diaphragm :

Organise a CXR. If the MFB is visible above the diaphragm then arrange review by ENT team.

If the MFB is lodged in the oesophagus but the child is well then they should be admitted under the ENT team. Spontaneous passage of the object often occurs following a period of observation for 12-24hrs, which may be appropriate for non-hazardous MFBs (but see hazardous MFBs below).

If the object is not visible on CXR but the HHMD is consistently positive, consider the presence of an aluminium foreign body.

Positive HHMD - Object localises below the diaphragm:

Blunt objects which are expected to be less than 5cm in length (approximately twice the size of a 50 pence coin) should pass through the GI tract within 2 weeks. Do not recommend that parents check for the passage of the object by examining stools. This is both messy and unreliable causing unnecessary reattendance at CED (there are exceptions to this – see below).

In all children that are discharged, give advice to return immediately to CED if the child develops abdominal pain, vomiting, abdominal distension or rectal bleeding.

4.2 Hazardous Metal Foreign Body

Urgent intervention (i.e. immediate discussion with ENT or paediatric surgical teams) may be required in the following cases⁴:

- When there is a disk battery in the oesophagus
- Sharp objects of greater than 5cm in the oesophagus or stomach
- When symptoms suggest near-complete oesophageal obstruction (patient cannot swallow secretions)
- Where clinical features suggest obstruction or intestinal inflammation (vomiting, fever)
- When there is ingestion of more than one magnet, or a magnetic and other metal foreign body

Radiological interpretation of X-rays is by UHDB on-call radiologists in hours at all sites and out of hours at Royal Derby Hospital (RDH), and by 4-ways reporting out of hours at Queen's Hospital Burton (QHB).

4.2.1 Batteries (See Appendix 2)

Button batteries can cause catastrophic haemorrhage from the GI tract⁵. Consider a swallowed button battery in a child presenting with GI bleeding, the ingestion may have been unwitnessed and therefore absent in the history.

Batteries can cause erosion of tissues due to the electrical discharge of the battery itself. Burns, ulceration and perforation can occur within 2-4 hours if the battery is lodged in the oesophagus. Batteries lodged within the oesophagus must be removed within 2 hours. Clinically significant oesophageal injury is more likely with:

- Large button batteries > 20mm
- New batteries – “dead batteries” still retain enough voltage and storage capability to generate an external current so remain a concern

Leakage occurs in acidic environments – seal or crimp of battery may erode releasing Na or K hydroxide. Alkaline solutions react with exposed proteins on mucosal surface of GI tract causing liquefaction necrosis and saponification of lipid membranes. Absorption of heavy metals from broken or fragmented batteries (Li and Hg) may also be an issue.

Check

Assess airway for obstruction ensuring nothing is stuck in the piriform fossa. Examine the mouth for signs of chemical burns which may indicate the battery was leaking before ingestion.

Identify

Type of battery (from the packaging or from a matching battery) and determine whether it is new or used. Discuss with NPIS if mercury battery or fragmented battery. Gives further management advice and provides a list of battery codes and contents. Telephone the national poisons information service (NPIS) for further advice if required.

X-ray

CXR to ensure the battery has gone through the oesophagus into the stomach (X-ray the abdomen as well as the chest in older children to ensure that an adequate image is obtained). **If it remains in the oesophagus it must be removed immediately.** Most batteries pass from the stomach without difficulty, but if a mercury battery remains in the stomach for more than 24 hours and/or is leaking it should be removed (limit for non-mercury batteries is up to 48 hours). Endoscopic or magnetic removal should be considered in the first instance. The NPIS can provide further specific advice.

The HHMD can be unreliable in detecting some batteries.

Watch for

Fever, abdominal pain, vomiting or blood in the stools. Consider the need for estimation of blood and urine mercury concentrations, although this is unlikely to be required for modern batteries (see Toxbase⁶)

If the battery is below the diaphragm on CXR (see handout which can be printed out. See appendix 1) **and the child is asymptomatic**, the family can be sent home with advice to carefully examine the child's stool. The child should return for review after 48 hours. HHMD to localise the battery, and XR to confirm its position should be used at this point to ensure movement of the battery from the stomach.^{6,7} If a battery is still in the stomach at 48 hours then consider endoscopic removed.

Guidance on whether to ensure ultimate passage of a battery from the lower GI tract varies. Consider HHMD +/- AXR if there has been no proven passage of the battery after 14 days.

4.2.2 Magnets (See Appendix 3)

Possible ingestion of even one magnet should be taken very seriously. If more than one magnet or if other metal has also been ingested alongside a magnet then there is a high risk of intestinal obstruction/perforation. In one study over half of all magnet ingestions involved >1 magnet and of these children a third required surgery.⁸

The HHMD should not be used for children with suspected or known magnet ingestion. All patients require chest and abdominal radiographs. Abdominal radiographs should be performed with the child supine; chest x-ray should be performed with the child sitting or standing and should include the diaphragm (even if captured on the chest x-ray as the object may move with repositioning of patient and therefore be missed). If one or more magnets is seen on the abdominal radiograph, a lateral view must be performed to assess number and

position of the magnets: two magnets in alignment could appear as a single object on the AP view, which could lead to a delay in diagnosis and increased risk of serious complications. Contrary to other ingested foreign bodies, passage beyond the stomach should not be used as a criterion supporting low risk of serious complications.

Symptomatic children with confirmed magnet ingestion should be discussed with the paediatric surgical team urgently to plan further management which may include urgent transfer.

Asymptomatic children who have ingested a single magnet may be suitable for discharge home from the Emergency Department if the following criteria are met:

- Single magnet
- Tolerating oral diet
- Presented within 24 hours of ingestion
- No significant comorbidities
- Parent/carer able to observe child closely for deterioration (no need to inspect faeces)

If discharge criteria are not met but the child is asymptomatic, the child should be admitted for observation. Discuss with the paediatric surgical team: the child may be suitable for admission to RDH or QHB, with urgent transfer to the paediatric surgical centre if there is any deterioration.

All asymptomatic children who have ingested a single magnet require serial radiographs to track the progress of the magnet. The first serial radiograph should be at 6-12 hours from first imaging. If the magnet was present on first chest radiograph, repeat the chest +/- abdominal radiograph. If the magnet was seen on the abdominal radiograph, repeat abdominal radiograph only. Serial radiographs should be performed with the child in the same position as the first. Serial radiographs should be continued 6-12 hourly until the magnet has passed through the stomach and then demonstrated progress through the small bowel. If the magnet has stopped progressing, or if there is doubt about whether to discontinue serial radiographs, this should be discussed with the paediatric surgical centre.

Children discharged from RDH CED should return to RDH CED for serial x-rays and review. Children discharged from QHB ED should be referred to PAU for serial x-rays and review by paediatrics team.

4.2.3 Sharp objects

Anything sharp has a greater risk of puncturing some part of the alimentary canal and getting stuck. However, if any object has passed through the stomach, it is likely to pass. Advice to parents should be to return at once if there are any further symptoms. A "long" chest X-Ray (including the neck as well as the chest) should be performed if there is doubt, with consideration of discussion with surgical teams (ENT or other).

4.2.4 Large objects

It is thought that objects that are longer than 6cm or wider than 2cm are unlikely to pass through the pyloric sphincter and so should be removed from the stomach.

4 References

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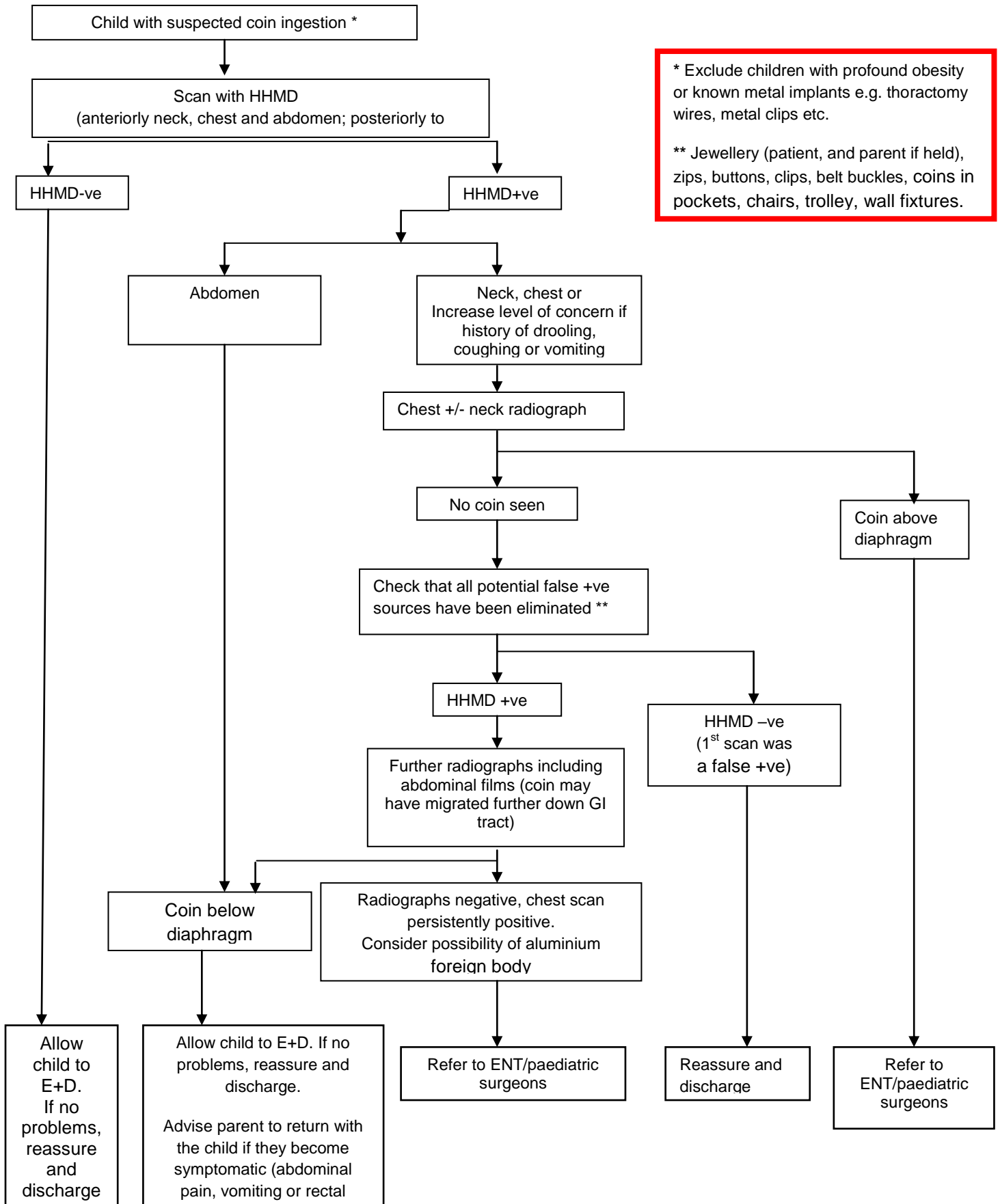
5 Documentation Controls

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		July 2021	Dr E Ivey, Dr J Surridge	Amendment to magnet ingestion guidance as per NPSA alert
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Training and Dissemination: email to relevant staff groups				
Development of Guideline: Dr J Surridge Job Title: Consultant in Paediatric Emergency Medicine				
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6 Appendices

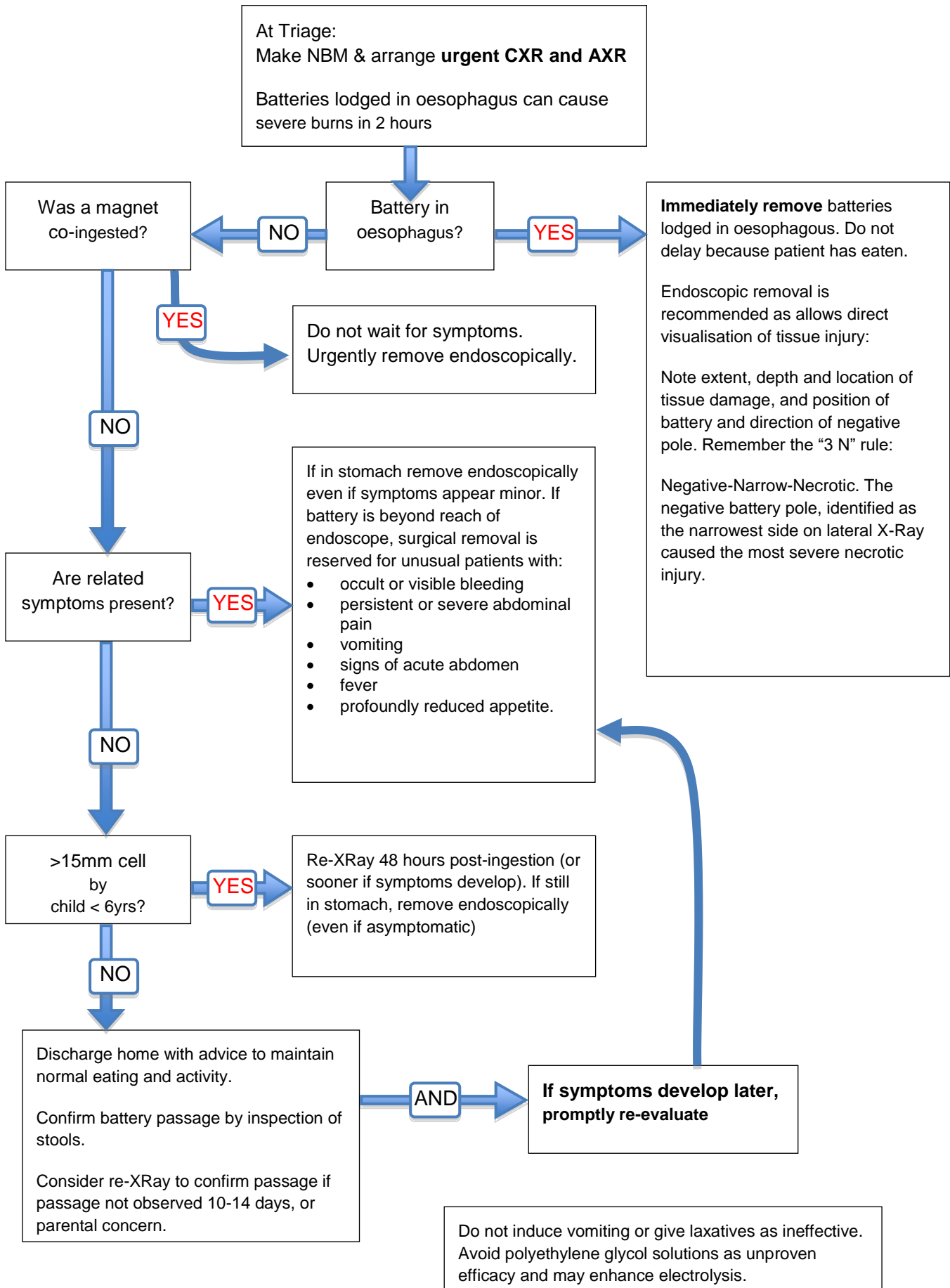
Appendix 1: The investigation of children with suspected coin ingestion³.



* Exclude children with profound obesity or known metal implants e.g. thoractomy wires, metal clips etc.

** Jewellery (patient, and parent if held), zips, buttons, clips, belt buckles, coins in pockets, chairs, trolley, wall fixtures.

Appendix 2: Button battery ingestion



Appendix 3: Magnet ingestion

