EQUIPMENT REVIEW

The use of a metal locator in an accident and emergency department

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SUMMARY

During the past year the removal of metallic foreign bodies in an accident and emergency department has been aided by the use of a metal locator.

INTRODUCTION

The removal of metallic foreign bodies from various parts of the body is part of the daily work load of the accident and emergency department. Localization prior to removal is aided by X-rays with markers or image intensification. An alternative method involves the use of a metal locator.

Metal locators have been used extensively in the removal of intraocular foreign bodies (Bronson & Turner, 1972), but use in accident and emergency is very uncommon. The authors describe their experience with the Roper-Hall Electro-acoustic Discriminator and Locator (manufactured by Keeler) in the accident and emergency department.

METHOD

Between June 1985 and June 1986 the locator was used on 18 patients. Initially, an X-ray was taken to confirm the presence and approximate location of a metallic foreign body, and to determine its size, shape and orientation.

The Roper-Hall Electro-acoustic Discriminator and Locator (Fig. 1) consists of a small coil in the probe head with another coil remote from the head. The inductance of these coils is balanced. When a ferrous object enters the magnetic field of the probe the inductance increases. This increase is converted into an audible high-pitched monotone. A non-ferrous object decreases the inductance which is converted into an audible

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bleeping tone. Both these changes in inductance are also converted into a deflection of the meter needle thereby giving a visual display.

There are three probes available, a large probe with a long range, a pencil probe for localizing more precisely and a spatula probe which is more useful in ophthalmology. The large probe must be less than 7 cm from the foreign body for it to be detected. For very deep objects, an incision may have to be made before the probe is used. No object is too large but anything less than 1 mm is difficult to detect. There are no body tissues which would 'insulate' the probe from the foreign body.

Our patients underwent surgery with a local anaesthetic without the need for further X-rays. The large probe was used to locate the foreign body before the skin was prepared and the position of maximum signal with minimum sensitivity noted. The skin was prepared and the local anaesthetic injected. The incision was made towards the foreign body according to its orientation and local anatomical considerations.

If the foreign body was not immediately found, the pencil probe was inserted into the finger of a sterile surgeons' glove, and the position of the foreign body found again and noted. The dissection was continued towards this new position. This was repeated until the foreign body was found and removed.

RESULTS

The data for the 18 patients with metallic foreign bodies are shown in Table 1. All the foreign bodies were removed.

Fig. 1 The Roper-Hall Metal Locator and accessories.

DISCUSSION

While metal locators have been used in ophthalmology for more than 40 years (Bronson & Turner, 1972; Sutton, 1979; Roper-Hall, 1957), their use in the accident and emergency department is uncommon. The traditional method of X-ray with markers prior to removal, in addition to the diagnostic X-ray, is uneconomical and subjects the patient to unnecessary radiation. The removal of the foreign body should take place soon after the latest X-ray so that it does not change position. Furthermore, a radiograph magnifies a foreign body and this may present problems for the surgeon in removing smaller objects.

Image intensification has been applied clinically since the tube for fluoroscopic image amplification was invented in the late 1930s. The use of an image intensifier requires space to accommodate the equipment and time to set it up. If hospital policy permits only a radiographer to set up and operate the equipment, this may be a limitation. This technique does, however, offer the surgeon immediate visual confirmation of the foreign body's location.

A small hand-held image intensifier, the Lixiscope (available from Nuclear Data Inc.), may be useful to identify small foreign bodies in the extremities (Daniels & Mason, 1985) but per operative localization is difficult (DHSS, 1985). One of the

Table 1 Metallic foreign bodies removed

	Type of foreign body	Site	Size (cm)	Time to remove (min.)
1	Sewing needle	Sole of foot	1.25	2
2	Sewing needle	Sole of foot	2.0	10
3	Sewing needle	Sole of foot	2.0	2
4	Sewing needle	Sole of foot	2.0	15
5	Sewing needle	Sole of foot	2.5	15
6	Fragment of sewing needle	Great toe	1.0	5
7	Broken sewing needle	Great toe	1.0	10
8	Steel ball	Scalp	0.4	1
9	Air gun pellet	Face	0.3	10
10	Air gun pellet	Forearm	0.3	10
11	Metal fragment	Forearm	0.4	2
		radial aspect		
12	Flake of chrome	Index finger	0.3	2
		distal phalanx		
13	Metal fragment	Little finger	0.4	2
14	Metal fragment	Index finger	0.3	2
		D.I.P.J.		
15	Metal fragment	Upper eye lid	0.2	5
16	Metal fragment	Index finger	0.3	6
17	Pin head	Index finger	0.5	3
18	Wire and broken sewing needle	Knee pre-patella	2.5	10
			3.0	

difficulties is the laterally reversed image which requires additional practice to become familiar with its use and the screen is difficult to see in bright light (DHSS, 1985). The Lixiscope cannot be sterilized and thus cannot be used readily if aseptic technique is to be maintained. A sterile cover is available but this is expensive relative to a surgeons' glove. Replacement of the radioactive source is required every 120 days whether use or not; the dose of radiation for a 10–15 s exposure is equivalent to half the dose received during a single conventional X-ray of an extremity. (DHSS, 1985).

It is not always possible to predict whether an aid for localization is required. The author's indications for using the metal locator are that the foreign body is (1) metallic (2) entirely within the body, (3) not palpable through the skin and (4) other metallic objects, such as bone plates, are outside the range of the probe. This range varies as the sensitivity is adjusted and with the size of the foreign body.

Fig. 2 shows the range for a given size of sphere with maximum sensitivity. On minimum the range can be as low as 2 mm for a steel sphere of 2 mm diameter, thus localizing to within 2 mm of the foreign body's position.

When the large probe is used on high sensitivity, other metallic objects may be detected. To overcome these problems remove watches and jewellery, and keep the sensitivity as low as possible.

The Roper-Hall Metal Locator is the size of a small suitcase, is instantly ready for use and there is no radiation. A second operator is useful but not necessary with the foot-operated reset switch. It is simple to use and has no revenue costs except, perhaps, that of a surgeons' glove. The initial cost is approximately £ 4000. To defray the expense the machine can be used by different specialties within the hospital or by several hospitals within a district or even region, as is the case for the South East Thames Region.

The authors feel that there is a useful role for the metal locator in the accident and emergency department for the removal of metallic foreign bodies.

Fig. 2. Maximum range for detection of a steel sphere of given size. A = long range probe, B = short range probe.

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