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Implication of Ultrasonography in Detection of Retained Soft Tissue Foreign Bodies in Children: a Hospital Based Study from Western Nepal

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Abstract The purpose of this study was to evaluate the sensitivity of sonography for detection of soft tissue foreign body and the common locations of foreign bodies in children. Children up to 14 years presenting to Radio diagnosis and Imaging department between August 2013 and May 2015 with diagnosis of retained foreign bodies embedded in soft tissue at various locations were included. All patients had both radiographs and ultrasound done. Location, size, depth, orientation and the relation to the adjacent structures were noted. Foreign bodies were then removed either by ultrasound guidance or by surgical exploration. Mean age of the patient was 10±3.7 years. Time of presentation ranged from 1 day to 35 days. Mean duration was 10 days. Pain and swelling were the presenting symptoms in all the patients. Sensitivity of ultrasound in detecting foreign body was 100%. There was no statistical difference between the length of the foreign bodies as measured by ultrasound and scale, after removal. Ultrasound is a cheap, readily available and effective modality for evaluation of retained foreign body in children.

Keywords: *Foreign Body, Children, Ultrasound*

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1. Introduction

Penetrating injury with pointed objects continues to be a common problem in Nepal. Retained foreign body following such injury in children is not very commonly encountered in clinical practice. Detection and removal of these foreign bodies are essential to prevent the complications like abscess, sinus formation, osteomyelitis and inflammation. Radiographs are routinely taken in many cases to rule out radio-opaque foreign body; however radiolucent foreign bodies, such as wood splint and thorn are usually missed by radiographs. Imaging modalities like ultrasound, CT and MRI can be used for this purpose. Retained foreign body in the pediatric population is not studied in our part of the world. Ultrasound is cheap and readily available in many hospitals and clinics, hence use of of ultrasound in the detection and removal of foreign body is increasing.

The purpose of this study was to evaluate the sensitivity of sonography for detection of foreign body embedded in soft tissue at the the common sites in children.

2. Materials and Methods

Fourteen children up to 14 years of age were referred to the Radio diagnosis and Imaging department of Manipal Teaching Hospital between August 2013 and May 2015 for diagnosis and localization of retained foreign bodies. All the patients had traditional radiographs and ultrasound done. Ultrasound was performed with either Sonoace X6 or GE Logiq P3 by a radiologist with seven years experience using high frequency (12 Mhz) transducer in sagittal, coronal and axial planes. All the radiographs were reviewed by the radiologist. An ultrasound was done; location, size, depth, orientation and the relation to the adjacent structures were noted. Exact site was marked with a permanent marker. Foreign body was then removed either by ultrasound guidance or by surgical exploration. Length of the removed foreign bodies were measured with a scale.

Written consent was obtained from all the guardians or parents of the patients.

The study protocol was approved by institutional research committee.

Data were analyzed by SPSS. Paired T test was used to calculate the statistical significance of length of foreign bodies by ultrasound and by scale.

3. Results

Fourteen children (10 males and 4 females) were included in the study. Mean age of the patient was 10±3.7 years. Age ranged from 3 years to 14 years. Time of

presentation ranged from 1 day to 35 days. Mean duration was 10 days. Pain and swelling was the presenting symptoms in all the patients. History of the prick was noted in most of the patients (11 patients) as shown in Figure 1.

Figure 1. Penetrating injury on the sole of left foot

Three patients denied of having any history of prick. Patients without a history of prick presented later than patients with history of prick.

Five of the patients presented with a history of discharging wound. Conventional radiograph was normal in 13 patients. In one of the patients a glass piece was detected as a foreign body on radiographs. All the 14 patients were diagnosed to have a foreign body by ultrasound. One patient who had presented following road traffic accident was suspected to have a retained glass piece on the cheek. On ultrasound the diagnosis was a foreign body. But during ultrasound assisted surgical exploration no foreign body was found.

Length of the foreign body as given by ultrasound ranged from 0.6 cm to 4 cm (mean length was 1.82 ±0.91 cm). Actual length of the foreign body as measured after removal ranged from 0.6 cm to 3.6 cm (Figure 2). The mean length was 1.86±0.89 cm. There was no statistical significance between the length of the foreign body as measured by ultrasound and scale after removal (p = 0.57).

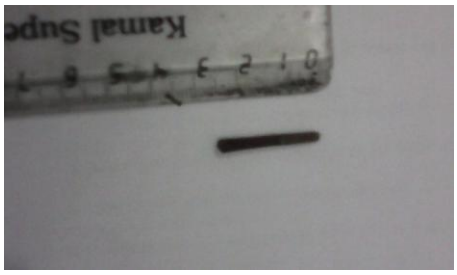

Figure 2. Wooden splinter after removal surgically

The smallest foreign body was a glass piece which measured 6 mm in length present in the sole of right foot. Surgery revealed the most common retained foreign body to be a wooden splinter (Table 1).

Table 1. Type of foreign body

Type of foreign bodies	Number of Patients
Wooden splinter	10
Glass piece	1
Maize Stem	1
Thorn	1

There was a false positive case of retained foreign body in ultrasound. Sensitivity of ultrasonography in detection of foreign body was 100 %.

The most common location of foreign body was foot and ankle (Table 2).

Table 2. Locations of foreign bodies

Locations of foreign bodies	Number of Patients
Foot and ankle	7
Buttock	1
Arm	1
Forearm	1
Hand	1
Cheek	1
Submandibular region	1

All of the foreign bodies were hyperechoeic in ultrasonography as shown in Figure 3.

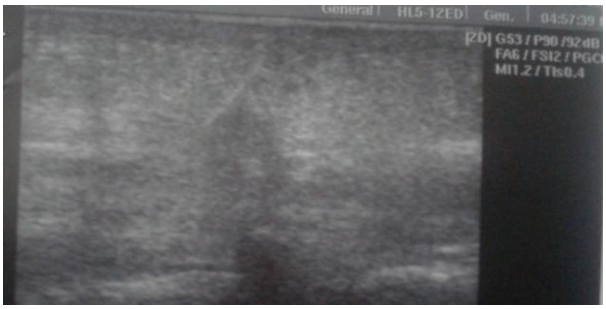

Figure 3. Linear echogenic structure oriented obliquely in the sole of left foot representing foreign body

A total of 9 patients had hypoechoeic halo. Posterior acoustic shadowing was seen in 9 out of 12 organic objects.

Collection was noted surrounding the foreign body in four patients as shown in Figure 4. There was no vascular injury in any case. Adjacent tendons in the hands and feet were normal.

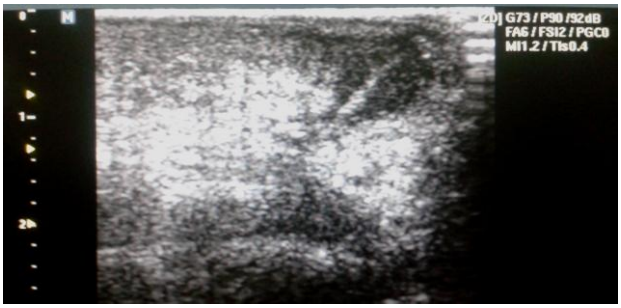

Figure 4. Linear obliquely oriented foreign body on the sole of right foot with surrounding minimal collection

4. Discussion

Ultrasound is the first choice in diagnosing and localizing the radiolucent foreign body with a sensitivity of 90% to 100% and specificity of 96%. [1,2].

In this study overall sensitivity was 100%. Ultrasound has a positive impact in determining the presence or

absence of foreign body. It can more precisely locate foreign body [3].

Sonography was first described for foreign body removal in 1978 [4].

Superficial foreign body can be grouped into the following categories:

Organic- e.g. wood, plant material like thorn

Inorganic- e.g. Glass, Plastic

Metallic- wire, needle.

Most common foreign body removed surgically was organic (wooden piece) which is similar to Mohammadi et al [5] and Crawford R et al [6]. In contrast to this Callegari et al [7] found a glass piece as a common foreign body. In our study only one case presented with a glass piece as foreign body.

Most of our patients were above the age of 10 years. This may be due to the reason that older children may be more involved in outdoor activities as compared to younger children. Male children were more commonly involved as compared to female children as male children are more active and involved in outdoor activities. In contrast to a study by Gustavo et al [8], where most of the patients were adult population, in our study children presented immediately (3 to 10 days) to seek medical attention.

According to the evolution of injury the condition may be classified into following stages: [8]

Acute: injury less than 3 days

Intermediate: 3 to 10 days

Chronic: Injury more than 10 days

Most of our patients were in the intermediate stage in contrast to a study by Gustavo et al [8], where most of the patients were adult population who presented in the later stage (more than 10 days).

The sonographic appearance of organic foreign bodies(FB) vary according to the evolution time [7,10].

In the acute phase, as in our case they appear as bright echogenic area with posterior acoustic shadowing. This is mainly due to the air that is trapped within the material.

At the end of this stage, there may be a hypoechoic rim surrounding the foreign body which may be due to edema, pus or granulation phenomena. In the intermediate stage (3 to 10 days) the halo becomes more marked, and the echogenicity of the material decreases.

In the chronic stage (after 10 days) dense granulation tissue is seen surrounding the foreign bodies which appears as a hypoechoeic halo [10].

Since most of the cases in this study presented in the intermediate and chronic phase, hypoechoeic halo was seen surrounding the foreign body in 9 cases.

Posterior acoustic shadowing was seen in 9 out of 12 organic objects that was similar to the previous study [5] that demonstrated posterior acoustic shadowing in 15 out of 17 patients of wooden foreign bodies.

Similarly, Gilbert et al [9] have shown posterior acousting shadowing in 11 patients out of 17 wooden foreign bodies. This is due to the orientation of the foreign bodies relative to the sound beam and chronicity of the retained FB. Retained wooden FB absorbs fluid, which alters its imaging characteristics [5].

Sometimes problem occurs due to near field acoustic dead space which can be overcome by using interposed liquids in latex gloves, intravenous bags, or a water bath [11,12,13].

Foreign body must be differentiated from hyperechoeic structure like scar tissue, bone, articular surface, gas bubble, intermuscular fascia etc. A thorough knowledge of the regional anatomy is also important to prevent false positive result. In the study, one false positive ultrasonography could be attributed to air trapping in the soft tissue following penetrating injury by glass piece during road traffic accident.

Foot and ankle were the most common location of retained foreign body which is similar to other studies [14].

There was no statistically significant difference between the size of the foreign bodies as measured by ultrasound and by scale after surgical removal.

5. Conclusion

Ultrasound is a cheap, readily available modality for evaluation of retained foreign body in children with an overall sensitivity of 100 %. Foot and ankle was the most common location with organic material being the commonest object.

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Declaration of Conflicting Interests

The authors declare that there is no potential conflicts of interest with respect to the research, authorship and /or publication of this article.

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