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RESEARCH ARTICLE

THE ROLE OF ULTRASONOGRAPHY IN THE MANAGEMENT OF RADIOLUCENT FOREIGN BODIES IN SOFT TISSUES OF EXTREMITIES

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Abstract

Aim: High Resolution ultrasonography has revolutionised the management of non-metallic foreign body removal. USG aids in measuring the depth and size of the foreign body, its depth from the skin surface and any associated collection to perform a less invasive, and easier surgery without the need for any additional radiological investigations like CT scan or MRI both of which are expensive and not easily available.

Material and Methods: 22 patients with mean age of 33.3 years were admitted in our department for foreign body exploration during the years 2020 to 2022. The affected sites were plantar aspect of feet in 9 patients, leg in 4 patients, palm of the hand in 4 patients, fingers in 5 patients. Preoperatively, all patients underwent USG of the affected part. Duration of the surgery and any complications were observed.

Results: The mean patient age was 33.34 years (range 15 to 70). Intraoperatively, we were able to locate and remove foreign bodies in all 22 patients. The actual surgeries lasted less than 15 min in 14 (63.6 %) of the cases and from 15-20 min in 8 (36.6%) cases. Foreign bodies retrieved were wood in 12 (63%), thorn in 4 (21%) and rubber pieces of slippers in 6 (10.5%) patients. No complications were observed in any of the patients.

Conclusion: Ultrasonography is a reliable, cheaper and an easy diagnostic tool for detection and localization of foreign body and should be included in evaluation for clinically suspicious retained non-radiopaque foreign body in soft tissue of extremities.

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Introduction:-

Residual non-metallic foreign bodies inside soft tissue can be a cause of prolonged morbidity if not addressed timely. Patients with foreign bodies often come with prolonged pus discharge, half treated with incorrect location of incisions at some dispensary or a medical shop or being missed by the initial physicians. Detection and localization of non-metallic foreign bodies is a difficult task with conventional radiography. Ultrasonography, CT and MRI are other modes of evaluation but both of CT and MRI are expensive and not easily available. High resolution USG is an effective tool in determining the exact location of foreign bodies. In this study we aim to show that

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ultrasonography is an effective tool for localizing and measuring the depth and size of non-metallic foreign bodies in order to perform less invasive and easier surgery.

Methods:-

The retrospective study was done in 22 patients (14 male and 8 female) who were operated for exploration of foreign bodies. All the surgeries were performed in our department and a proper consent was taken from every patient for participating in the study. The injured site, presentation time after injury, size and depth of the foreign body, duration of surgery and any complications were all recorded. Injured extremity suspected of foreign body were evaluated with Xray followed by high resolution USG using Versana Premiere Advanced System with a high frequency 7 MHz linear transducer. Radiologist measured the size and location and the depth from the skin surface, any associated granuloma or collection and the status of neurovascular structures. All the surgeries were performed under regional blocks/local anaesthesia.

Result:-

The mean patient age was 33.34 years (range 15 to 70). The presenting complaint was pain in 6 patients, pain and induration in 8 patients and sinus discharge in 8 patients. In 9 patients the foreign body was found in the plantar aspect of feet, 4 patients in the leg, 4 patients in palm of the hand, and in 5 patients was found in the fingers. Intraoperatively, we were able to locate and remove foreign bodies in all 22 patients. The actual surgeries lasted less than 15 min in 14 (63.6%) of the cases and from 15-20 min in 8 cases (36.3%). Foreign bodies retrieved were wooden twigs in 12 (54.5%), thorn in 4 (18.2%) and rubber piece (slippers) in 6 (27.3%) patients. (Figures 1-2) Fluoroscopy was not used in any of the cases. No neurovascular injury or any other complication was observed in any of the patients.

Discussion:-

Retained foreign bodies or partially extracting them are often a cause of significant morbidity for the patients in the form of persistent pain, swelling, pus discharge, septic arthritis, osteomyelitis and the need of further extensive surgery.¹⁻⁶ The difficulty in detecting and removing non-metallic foreign bodies during explorations is often time consuming and sometimes futile, even when a foreign body is known to be present.⁷ In order to extract foreign bodies, extended incisions over the entry point are possible, but are prone to serious risks and complications such as migration of the foreign bodies and residual fragmentation.⁸⁻¹⁰ Plain X-ray studies are clearly unreliable for wooden foreign bodies. In one study it was shown that only 15% of wooden foreign bodies were visible on plain radiographs.¹¹ In an in vitro study, ultrasound was the most reliable method for the detection of non-metallic superficial foreign bodies composed of wood or plastic when compared with conventional radiography, xerography, and CT scan.¹² CT and MRI are useful to identify objects, approximate size, and determine relationships to nearby structures, but these are costly investigations and are not available at every centre.¹³

A recent meta-analysis found that ultrasound has 72% sensitivity and 92% specificity for identifying foreign bodies in soft tissues.¹⁴ Ultrasound can effectively measure the length, width, thickness and depth of wood objects.^{13,15} In our study, ultrasound has guided us in determining the site and size of the foreign bodies in every case. Ultrasound is the investigation of choice in patients in whom there is a strong suspicion of a retained foreign body, but which is not seen on a plain radiograph.^{16,17} However, Ultrasound aided detection of foreign bodies also have certain limitations which needs to be kept into consideration like its operator dependent, needs a high-resolution probe, difficult to interpret previously explored sites and presence of pus and granuloma around the foreign body might vary the exact location and size of the foreign body.

Authors performing surgeries due to local inflammatory findings state that, ultrasound depends on the individual radiologist.¹⁸ However, detection of wooden objects using US is a simple method that does not require further specialization. In one study, 10 nurses who received 2 hours of US training were able to detect wooden foreign bodies with 95% sensitivity.¹⁹ Some authors suggest extracting foreign bodies with ultrasound in the operating room.²⁰ However, we believe that if preoperative evaluation is effectively performed, intra-operative ultrasound is not necessary; we did not require ultrasound assistance in any of our cases. In our case series, the feet and hands (82%) were the most affected parts of the body, since they are open to external penetrant injuries. This finding is similar to other case series in the literature.¹⁸ The rough and organic structure of wooden particles provides a favourable environment for germs to reproduce.²¹ Metal objects can remain in tissues without causing any complications, but wooden particles can cause infections and consequently should be extracted. At the time of

surgery, infected tissues such as abscesses were seen around the foreign particles in these 8 cases, demonstrating that each day which passes after trauma increases the likelihood of infection. All of these 8 cases were successfully treated by debridement of the adjacent soft tissues and oral antibiotic therapy. This study has some weak points, namely the limited number of cases and retrospective nature.

Conclusion:-

Retained foreign bodies can lead to local infections; ultrasound evaluation and marking can be used preoperatively to diagnose, identify, and localize foreign bodies in the extremities.

Figures

USG RT HAND FOR LOCALIZATION OF FOREIGN BODY

NAME: [REDACTED] DATE: [REDACTED]
ADDRESS: [REDACTED] REF BY: [REDACTED]

- LINEAR ECHOGENIC SHADOW SEEN WITHIN THE SUBCUTANEOUS PLANES OF PALMAR ASPECT OF RIGHT HAND. THE FOREIGN BODY IS MEASURING APPROX. 20 MM IN LENGTH WITH DEPTH FROM SKIN SURFACE OF APPROX. 3-4 MM.
- NO SURROUNDING COLLECTION SEEN.
- UNDERLYING BONES NORMAL.
- UNDERLYING TENDONS NORMAL.
- NEUROVASCULAR STRUCTURES NORMAL.

IMPRESSION:-

- FOREIGN BODY WITHIN THE SUBCUTANEOUS PLANES OF PALMAR ASPECT OF RIGHT HAND AS DESCRIBED ABOVE.

Figure 1a:- USG Report.



Figure 1b:- Foreign Body(wooden piece).

USG RIGHT FOOT FOR LOCALIZATION OF FOREIGN BODY

NAME:- A. [REDACTED] M

DATE:- 20/10/2022

REF BY:- D. [REDACTED] D)

1. THICK ECHOGENIC LINEAR STRUCTURE SEEN WITHIN THE DEEP SUBCUTANEOUS PLANES OF PLANTAR ASPECT OF RIGHT FOOT (S/O FOREIGN BODY). THE FOREIGN BODY IS MEASURING APPROX. 3 MM IN LENGTH AND 5 MM DEEP TO THE SKIN SURFACE.
2. MILD INFLAMMATION OF THE SURROUNDING SOFT TISSUE SEEN (REACTIVE).
3. NO COLLECTION SEEN.
4. NEUROVASCULAR STRUCTURES NOT INVOLVED.
5. UNDERLYING BONES NORMAL.
6. UNDERLYING TENDONS NORMAL.

IMPRESSION :-

- FOREIGN BODY WITHIN THE SUBCUTANEOUS PLANES OF PLANTAR SURFACE OF RIGHT FOOT AS DESCRIBED ABOVE.

Figure 2a: - USG Report.



Figure 2b:- Foreign Body (Rubber Piece).

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Conflicts of interest:

There are no conflicts of interest.

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