

A Comparative Study of Ultrasound Guided Versus Blind Surgical Removal of Foreign Bodies in Western Nepal

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Abstract Ultrasound is effective in localization and removal of foreign body. This study was done to evaluate the role of ultrasonography in localization of foreign body and to compare the ultrasound guided foreign body removal with that of conventional surgical exploration without ultrasound guidance. This prospective study was conducted between September 2013 and July 2015. Patients more than 14 years of age old with clinical suspicion of retained foreign body were included in our study. Ultrasonography was done using 7.5 to 10 MHZ probe in Sonoace X6 and Logiq P3 machines. After exact localization patients were randomly selected into two groups. In the first group, removal was done using ultrasonography guidance by a radiologist using a standard technique. In the second group, removal was done by referring surgeon. Statistical analysis was done using SPSS 18. Age of the patients ranged from 15 to 85 years with the mean age of 37.7 ± 17.7 years. M: F ratio was 2.2:1. Most common location of retained foreign body was foot. Most common type of retained foreign body was wooden piece. Sensitivity of ultrasound in detection of retained foreign body was 96.8%. There was no statistical difference between the length of foreign body as measured by ultrasonography before removal and by scale after removal. Duration required for removal of foreign body under ultrasonography guidance was significantly less. Post-operative scar was smaller in patients with ultrasound guided removal. In conclusion, ultrasound has a sensitivity of 96.8% in localization of foreign body. Ultrasonography guided removal of foreign body reduces the operation time with reduction in the post-operative scar.

Keywords: foreign body, removal, ultrasonography

Cite This Article: Prakash Sharma, Prasanna Ghimire, Amar Gurung, Chandra Bahadur Mishra, Subita Lalchan, Subash KC, Merina Gyawali, and Prabhat Kumar Tiwari, "A Comparative Study of Ultrasound Guided Versus Blind Surgical Removal of Foreign Bodies in Western Nepal." *American Journal of Public Health Research*, vol. 3, no. 5A (2015): 186-189. doi: 10.12691/ajphr-3-5A-39.

1. Introduction

Penetrating injury with retained foreign body in the soft tissue is frequently encountered in clinical practice.

If the foreign body remains undetected and retained within the soft tissue, it leads to serious infections and inflammations. Radiographs are frequently taken to locate the radio-opaque foreign body whereas radiolucent foreign body goes undetected. Ultrasound plays an important role in the detection and removal of such radiolucent foreign bodies. Ultrasonography has a sensitivity of 95% to 100% for detection of foreign bodies [1,2,3]. Computed tomography (CT) and Magnetic resonance imaging (MRI) are also effective but not widely used. On ultrasound, radiolucent foreign body appears as a hyperechoic focus with or without distal acoustic shadowing [3]. Sometimes these hyperechoic foci are surrounded by hypoechoic

halo which represents edema, abscess or granulation tissue [1,4]. Beside localization of foreign body, ultrasound can also be used in assistance and verification of the foreign body removal.

Present study was done to evaluate the role of ultrasound in localization of foreign body and to compare the ultrasound guided foreign body removal with that of conventional surgical exploration without ultrasound guidance.

2. Materials and Methods

This prospective study was conducted in the department of Radiology and imaging at Manipal teaching hospital and Metrocity Hospital Pokhara from September 2013 to July 2015. Patients more than 14 years old with clinical suspicion of retained foreign body were included in our study.

Informed consent was obtained in all patients before the procedure.

Ultrasonography was done using 7.5 to 10 MHZ probe on Sonoace X6 and Logiq P3 machines. Scanning was performed at the region of interest in multiple planes. Exact localization of foreign body was done and length of foreign body, its distance from skin surface, distal acoustic shadowing, halo surrounding the foreign body and condition of the adjacent tendons and vessels were noted.

Almost half of the patients were randomly selected for ultrasound guided removal and rest of the half were sent to the referring surgeon for removal under local anesthesia without ultrasound guidance.

Ultrasound guided removal was done in the ultrasound room. After preparing the part with antiseptic solution, foreign body was exactly localized. About 2-4 ml of local anesthesia (2% lignocaine) was injected around the foreign body. Small incision enough for the surgical forceps to be inserted or wide enough for the large foreign body to pass through was made. Incision was made over the lateral edge of the foreign body with scalpel. Procedure was conducted under constant ultrasound guidance. Tip of the forceps was advanced till the edge of the foreign body. Arms were slightly opened removing the soft tissue surrounding the foreign body. Finally, foreign body was grasped and removed along with the forceps. Incision site was sutured or left open depending on the presence or absence of associated abscess. Length of the incision, duration of surgery, actual length of the foreign body after removal was recorded in both the group.

Prophylactic antibiotic was given to all the patients. Both the groups were followed up till 4 weeks with regular dressing.

Statistical analysis was done using SPSS 17. T test was used to calculate the statistical significance between the techniques of removal of foreign body with and without ultrasonographic guidance. Paired t test was used to calculate the statistical significance between the lengths of the foreign body as measured by ultrasound and by scale after removal.

3. Results

A total of 40 patients suspected of retained foreign body were sent to the department of Radiology and Imaging for their localization. Out of the 40 patients, retained foreign body in the soft tissue was diagnosed by ultrasonography in 31 patients. Ultrasonography missed one retained foreign body which was seen in Radiographs and was finally removed by surgery. There was one over diagnosis of foreign body by ultrasound. Surgery failed to remove foreign body. Statistical analysis was done in 32 patients. Sensitivity of ultrasound in detection of retained foreign body was 96.8%.

Table 1. Age group

Age Group(Years)	Frequency	Percentage
14 to 20	6	18.8
21-40	11	34.4
41-60	12	37.5
61-80	2	6.2
More than 81	1	3.1

Age of the patients ranged from 15 to 85 years with the mean age of 37.7 ± 17.7 years. Most of the patients were in the age group 41 to 60 years (Table 1).

About 68.8% of our patients were male with M: F ratio of 2.2:1 (Figure 1). Most of our patients presented late (Table 2).

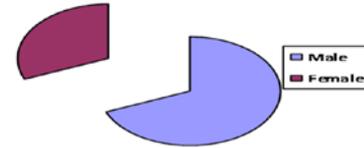


Figure 1. Distribution of patient according to sex

Table 2. Duration of symptoms

Days	Frequency	Percentage
Less than 3	7	21.9
3-10	7	21.9
More than 10	18	56.2

Most common location of retained foreign body was foot (Table 3). All the patients had history of pain and swelling at the site of retained foreign body (Figure 2).

Table 3. Location of foreign body

Site	Frequency	Percentage
Cheek	1	3.1
Finger	5	15.6
Forearm	2	6.2
Hand	5	15.6
Inguinal Region	1	3.1
Thigh	1	3.1
Leg	4	12.5
Thigh	1	3.1
Foot	13	40.6



Figure 2. Swelling over the dorsum of right hand



Figure 3. Linear echogenic structure representing foreign body within the dorsum of hand



Figure 4. Removal of foreign body under ultrasonography guidance

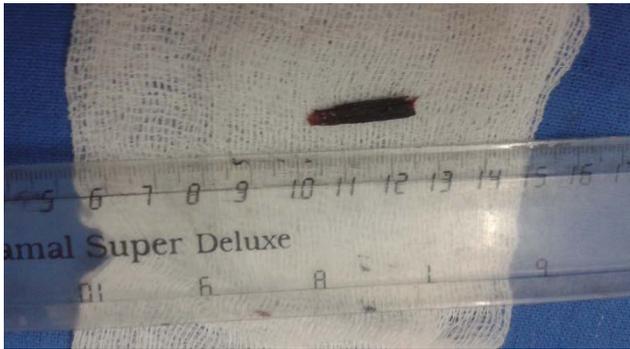


Figure 5. Foreign body removed after surgery

About 29 patients had history of prick. Discharging wound was seen in 12 patients (37.5%).

Mean length of the foreign body as measured by ultrasonography was 1.6 ± 0.5 cm. Collection was seen surrounding the foreign body in 13 patients (40%). Foreign body appeared echogenic in all the patients (Figure 3).

Wooden piece was retrieved in most of the patients (Table 4) (Figure 5).

Table 4. Type of retained soft tissue foreign body

Foreign Body	Frequency	Percentage
Glass	2	6.2
Needle	1	3.1
Thorn	5	15.6
Wooden Piece	24	75

There was no injury to the adjacent tendons and blood vessels in any of the cases.

Actual length of the foreign body as measured by scale after surgical removal was 1.7 ± 0.61 cm. The difference between the length of the foreign body as measured by ultrasonography and by scale after removal was not statistically significant ($P < 0.15$).

Duration required for removal of foreign body under ultrasonography guidance was 12 ± 4.6 min (Figure 4). Similarly, mean duration required for removal of foreign body without ultrasound guidance was 26.8 min ± 11.9 min. No complication was noted during the procedure. The difference between the two groups was statistically significant ($P < 0.0001$). Mean length of the incision during removal of foreign body under ultrasound guidance was smaller as compared to conventional surgery (15 mm vs. 30 mm).

4. Discussions

Retained soft tissue foreign body is frequently encountered in the clinical practice. Ultrasonography helps in the localization and removal with a sensitivity of 90 to 100 % and specificity of 96% [6,7]. In the present study sensitivity of ultrasound in detection of retained foreign body was 96.8%.

Most of the patients were male which is comparable to other studies [5]. Even in children retained foreign body was more common among males [3]. Male patients are more involved in outdoor works as compared to females.

Retained superficial foreign bodies can be classified as [5]

Organic- like wood, thorns

Inorganic- like plastic and glass pieces

Metallic- like needle and wire

In the present study most common foreign body removed was wooden piece which was similar to other studies [1,3,4,5]. Glass piece was seen as a common foreign body in a study by Callegari et al [6].

Foot was the commonest site of retained foreign body which was similar to other study [4].

Sonography is cheap, readily available and provides important information regarding the depth, size and anatomical relationship of foreign body with surrounding structures.

Retained soft tissue foreign body appears hyperechoic with or without posterior acoustic shadowing. In the present study, all of the foreign bodies appeared hyperechoic which is similar to previous studies [4,8,9]. Distal acoustic shadowing was not seen in two of our cases.

Ultrasonographic appearance of the foreign body varies according to the evolution time. In the acute stage (less than 3 days), foreign body appears as a bright echogenic area due to trapping of air within the material. In the sub-acute stage (3 to 10 days), hypoechoic rim appears surrounding the foreign body. This is due to the presence of edema, pus or granulation tissue surrounding the foreign body. In the chronic stage (after 10 days), granulation tissue appear as hypoechoic halo surrounding the foreign body [10]. Most of our patients presented in the late stage which is similar to study by Casadei GF et al [11].

Ultrasound-guided removal of foreign body is more effective than surgical exploration without ultrasound guidance. It is inexpensive with low risk of complication. In the present study duration of operation was also comparatively less with ultrasound guidance which is similar to other studies [5]. Post-operative scar was smaller in patients with ultrasound guided removal compared to conventional surgical removal. Post-operative small residual scar of ultrasound guided removal of foreign body had little or no aesthetic impact. Inadvertent injury to surrounding tendons and neurovascular structures during surgical removal is also reduced due to real time feature of ultrasonography. Bleeding is also considerably minimized [12]. All the foreign bodies detected by ultrasonography were superficial due to low velocity of impact.

Due to the real time property of ultrasonography, time taken for removal of foreign body was less than without ultrasonography guidance.

In conclusion, ultrasonography is a safe and effective tool in the localization of soft tissue foreign body with a sensitivity of 96.8%. There is a significant reduction in the time for removal of foreign bodies with the use of ultrasonography guidance.

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