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Original Article

Role of HRUS in Detection and Localization of Foreign Bodies

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Abstract

Prick injuries with metallic and non-metallic foreign body are commonly encountered cases in surgery and orthopedics OPD. Detection and localization is difficult task with conventional radiography. Ultrasonography, CT and MRI are other modes of evaluation but CT and MRI are expensive and not easily available.About 35 patients were evaluated with USG (7.5-10 MHz Linear probe) and X-ray for clinically suspicious non-radiopaque foreign body in soft tissue and extremities. Clinical presentation, symptoms anatomical location, and foreign body retrieved after surgery were recorded. X-ray detect only 3 foreign bodies where as HRUS detected 34 patient. Most of the cases FBs were present in ankle and foot. Majority of the foreign bodies were plant thorn and wood pieces.

Plain X-ray is not sensitive for detection of non-radiopaque foreign bodies but USG is sensitive and specific for detection and localization in that cases.

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Introduction

Prick injury with metallic or non-metallic foreign bodies are commonly encountered cases in surgery and orthopedic OPD; such injuries are inspected and palpated and a conventional radiograph is routinely obtained which helps in detection of fractures and radiopaque foreign body such as metal and glass.[1]

Detection of retained non-radiopaque foreign body like wooden pieces, thorns lodged inside or in between soft tissue is difficult by conventional radiography. Specially when patient present with pain, recurrent swelling or discharge but forget or are not aware of prick injury, diagnoses of often missed or delayed leading to multiple unsuccessful explorations which prolongs morbidity and increases treatment cost [2]

In USA missed foreign bodies are reported to account for a large number of lawsuits and are 2nd most common cause of litigation against emergency department physician [3]

In view of the limitations of radiography other imaging modalities are needed for prompt diagnosis of radiolucent foreign bodies. Computer Tomography and MRI are useful in such situations but have intermediate sensitivity [4]

Use of CT involvements radiation exposure and extra cost. Similarly high cost and limited availability restrict the use of Magnetic Resonance Imaging (MRI). Sonography has emerged as a preferred imaging modality in this setting[5]

Many in vitro experiments and human studies have reported high sensitivity of sonography in detection of soft tissue foreign bodies. USG has

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been reported to show the shape and location of oft tissue foreign bodies[6]

Most of the available literature on the use of USG in detection of soft tissue foreign bodies has emerged from western countries. The purpose of this study was to determine the utility and efficacy of USG in detecting soft tissue foreign bodies in human.

Material and Methods

A retrospective study on 35 patients referred to our centre of Nuclear Medicine and ultrasound, Rajshahi from to evaluation of foreign bodies from January 2010 to June 2010. Patient were evaluated for clinically suspicious non- radiograph foreign body

in extremities and face by ultrasonography and conventional radiography.

Ultrasonography was obtained with 7.5 to 10 MHz linear transducer of SONOLINE ULTRASOUND SYSTEMS OF SIEMENS & TOSHIBA JUST VISSION 400. In ultrasound linear lesion with distal acoustic shadow and surrounding hypoechoic area was suggesting of foreign body. Localization of foreign body was done in relation to skin depth and surrounding muscle, bone or tendon. Details of history of prick injury, symptoms duration of presentation, clinical, sonographic findings and surgical findings were recorded.

Result

Total 35 patients of suspected foreign bodies were evaluated and high resolution ultrasound was performed to detection of soft tissue foreign bodies. Among them 25 were male and 10 were female. Age distributions of the patient were range from 3 yrs to 60yrs.

Among 35 cases maximum foreign bodies were thorn and wooden piece. Main occupation of the study groups were farmers and labors. Presentations of the patients were different.

Table I & II shows occupation and presenting feature of our study groups. In our study most of the patients were present with pain and foreign body sensation (48.57%).

Table 1: Occupational status of the patients

Sl no.	Occupation	Number of patients (n)	Percentage (%)
1	Farmers and labors	18	51.43%
2	House wife	06	17.14%
3	Carpenters	05	14.28%
4	Students	04	11.43%
5	Driver	01	2.86%
6	Blacksmith	01	2.86%
	Total	35	100%

Table 2: Presenting feature of the patients with FBs (Foreign Body):

Sl no	Features	Number of patient (n)	Percentage (%)
1	Pain with foreign body sensation	17	48.57%
2	Visible swelling/lump	09	25.72%
3	Neurological feature(tingling or numbness sensation)	06	17.14%
4	Non-specific	03	8.57%
	Total	35	100%

Among 35 cases about 29 patients were undergo surgery. Exploration revealed different type of FBs from several anatomical sites. Most of the cases FB removed from foot and ankle.

Table 3: shows the position of FBs:

Sl. no	Location of FBs	Numbers of patients (n)	Percentage (%)
1	Foot and ankle	12	41.4%
2	Dorsum of hand and fingers	06	20.7%
3	Knee and calf	03	10.34%
4	Forearm	05	17.24%
5	Back	01	3.4%
6	Head	01	3.4%
7	Lips	01	3.4%
	Total	29	99.88%

All the cases in this study were diagnosed by clinical evaluation, plain X-ray and HRUS (High Resolution Ultrasound). Different types of FBs were removed from patient's body. Nature of FBs were depends upon occupation of them. Most of the cases FBs were plant thorn as because majority of the cases patient were labor and farmers.

Fig-2 & 3 shows FBs in the foot and ankle. Fig- 4 shows FB in dorsum of hand.

HRUS is a very sensitive diagnostic method to detect FBs within the extremities and superficial part of the body.

Table 4: shows nature of FBs & compression between Plain X-ray and HRUS in their detection:

Sl no.	Type of FBs	No of patient (n)	Plain X-ray	HRUS
1	Plant thorn	22	0	22(100%)
2	Wood piece	07	02(28.57%)	06(85.71%)
3	Metallic spice	04	02(50%)	03(75%)
4	Sewing needle	01	01(100%)	01(100%)
5	Glass	01	01(100%)	01(100%)
	Total	35		

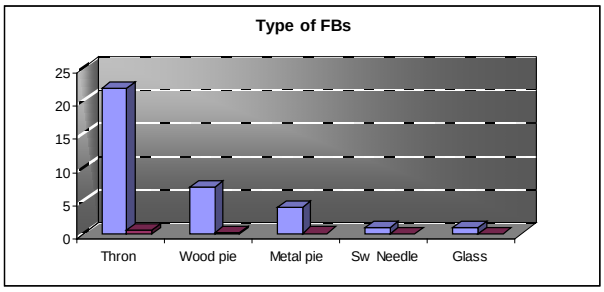

Fig- 1: Bur-diagram shows different FBs.

Discussion

Penetrating injury to hands and feet are the most common causes of hospital emergency room visit and an important health hazard might be removed by the patient themselves or the primary health providers. However it reported that 15 -38% of the foreign bodies get overlooked at the time of initial examination and wound management depending upon the clinical acumen of the health provider and availability and use of imaging facilities[7]

Retained foreign body in the soft tissue can lead to significant morbidity along with loss of time and money of the patient. It is not uncommon to forget about the incident of penetrating injury and remain undetected for long time till pain, swelling or discharging wound appear. In such cases, detection of non-radiopaque foreign body in soft tissue becomes extremely difficult. Several imaging modalities are available for detection and localization of non-radiopaque foreign body in soft tissue. Conventional plain radiography or xeroradiography is less effective. Ex vivo tissue study conducted by Oikarnen et al and Manthey DE et al found conventional radiography is not able to detect radiolucent foreign body at all[8].

No radiolucent foreign body was detected in plain radiography in our study population.

Fig-5 Plain X- rays shows no foreign in the dorsum of leg.

Xeroradiography though provide better edge enhancement, is not commonly available in all radiographic department, require special equipment has 20 time radiation exposure than plane X-ray and reported to show negative result in 80 % patient[9]

CT scan, MRI and USG are other investigation modalities advocated for evaluation non-metallic foreign body. CT and MRI are useful to identify objects, approximate size and determined relationship to nearby structures. To identification of FBs is difficult on MRI imaging when the structure is very small and no associated abscess or fluid collection. CT and MRI are expensive and impractical for the routine use[10]

Several studies have tested the effectiveness in detecting and localizing of non- radiopaque FBs in soft tissue with ultrasonography has variable success. Gilbert FJ et al reported detected non-radiopaque FB by 10MHz transducer in 21 true positive and 3 false positive; 25 true negative and 1 false negative in 50 patients with sensitivity of Ultrasound 95.4%[11]

USG is found to be 95% sensitive for suspected retained foreign body in the hand by Crawford R et al when plan Radiograph were normal and was also accurate in predicting the FBs exact location, size, depth, orientation and relationship to other structure[12]

In this study all the cases were diagnosed by HRUS both opaque and non-opaque FBs. Plain X-ray couldn't detect non-opaque FBs.

Fig- 2, 3 & 4 show FBs in the extremities but no foreign body in plain X-ray.

For reliable detection of soft tissue FBs, the suspected area should be scan in both axial and sagital plans. Detection of FBs depends on echogenicity, posterior acoustic shadowing, rteverbations and development of a hypoechoic ring or granuloma around the FBs[13]

USG findings may be falsely negative if the FB is too small, deep seated and adjacent to bone or deep to the subcutaneous gas[14]

False positive result for an FB likely occurs in the presence of calcification, scar tissue or air in soft tissue[15.]

Indeed all 01 FB missed by us due to very deep seated; 02 case were diagnosed as FBs but after surgery no FB was present i.e. 02 false positive case.

It is not surprising to see plant thorns and wooded piece as common for FBs because majority population of our country leaves in village and cultivation is main source of income.

Tab-III & IV shows type of FBs and their anatomical site as well as sensitivity of HRUS and plain X-ray in case of FBs detection.

We are also able to report precise location of the FB. This type of investigation is to great help to the surgeon leading to decrease dissection, blood loss, surgical time and complication. USG has been shown to be a clinically useful tool for detecting and removal of wooden FBs[16]

In our study all surgery were performed in OPD of Surgery, Rajshahi Medical College Hospital. No significant blood loss and tissue damage were occur. All operation was done by using local anesthesia. No further complications were detected.

Pic-a) & b) show operative field and FB after removal.

Sensitivity of HRUS is in this study is 96.9% and specificity is 94.4 %.

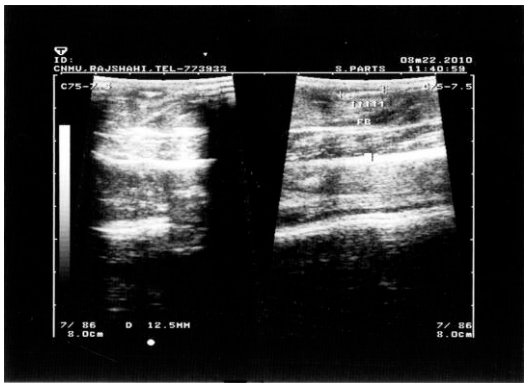

Fig- 2: FB in left foot.

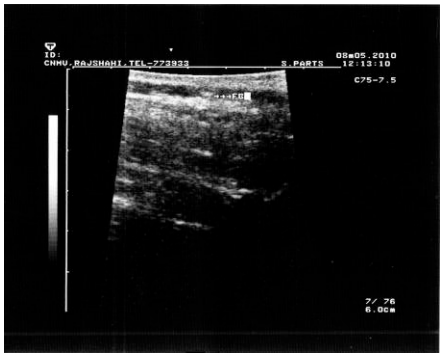

Fig-3: FB in dorsum of right hand

Fig-4: Plain X -Ray of hand

Fig- 5: Plain X - ray of foot.

Pic- a): Operative field

Pic b): Foreign body

Conclusions

HRUS is superior to conventional radiography for detection of non-radiopaque foreign body. It is less expensive and easily available unlike CT scan and MR imaging and is not associated with radiation hazard. Early detection of non-radiopaque soft tissue foreign body by USG can reduce prolonged morbidity to the patient & related complication

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