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Original Research Article

COMPARATIVE EVALUATION OF ULTRASONOGRAPHY AND CONVENTIONAL RADIOGRAPHY FOR DETECTING BONE FRACTURES AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Bony fractures are common presentations in emergency and outpatient departments and require early and accurate diagnosis to prevent complications and guide appropriate management. Conventional radiography is commonly used as the first-line imaging modality for suspected fractures; however, it has limitations such as radiation exposure, need for patient positioning, and reduced sensitivity for subtle or occult fractures. Ultrasonography is a rapid, portable, radiation-free, and bedside imaging modality that can detect cortical discontinuity, step-off deformity, periosteal elevation, hematoma, and soft tissue swelling. **Aim:** To comparatively evaluate ultrasonography and conventional radiography for detecting bone fractures at a tertiary care hospital. **Materials and Methods:** This hospital-based comparative observational study included 72 patients with clinically suspected bony fractures. All patients underwent detailed clinical examination followed by imaging with both ultrasonography and conventional radiography of the suspected fracture site. Ultrasonography was performed using a high-frequency linear transducer in longitudinal and transverse planes. Conventional radiography was performed using standard views according to the anatomical region involved. Findings of USG were compared with conventional radiography. Data were analyzed using IBM SPSS Statistics version 27.0. Sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy, and kappa agreement were calculated. A p-value of less than 0.05 was considered statistically significant. **Results:** Out of 72 patients, conventional radiography detected fractures in 52 patients (72.22%), while ultrasonography detected fractures in 56 patients (77.78%). The most common age group was 21–40 years, comprising 24 patients (33.33%), and males were more commonly affected, with 46 patients (63.89%). Fall was the most common mode of injury, seen in 30 patients (41.67%). The most common suspected fracture site was forearm/wrist/hand, involving 18 patients (25.00%). Ultrasonography showed 51 true positive, 15 true negative, 5 false positive, and 1 false negative cases. The sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of USG were 98.08%, 75.00%, 91.07%, 93.75%, and 91.67%, respectively. Kappa agreement was 0.779, indicating substantial agreement. McNemar's test showed no statistically significant difference between USG and conventional radiography (p=0.219). **Conclusion:** Ultrasonography demonstrated high sensitivity and diagnostic accuracy in detecting bony fractures and showed substantial agreement with conventional radiography. USG can be used as a useful adjunct for rapid bedside fracture evaluation, while conventional radiography remains essential for confirmation and treatment planning.

INTRODUCTION

Bony fractures are among the most frequent consequences of trauma and represent a major cause of pain, disability, loss of function, emergency department attendance, hospital admission, and socioeconomic burden. They may occur in any age group and may result from falls, road traffic accidents, sports injuries, assault, occupational trauma, or domestic injuries. The clinical

presentation varies according to the anatomical site, mechanism of injury, age of the patient, and severity of trauma. Pain, localized tenderness, swelling, deformity, restricted movement, bruising, crepitus, and inability to bear weight are common clinical indicators; however, clinical examination alone is often insufficient to confirm or exclude a fracture with certainty. Hence, imaging remains an essential component in the evaluation of patients with suspected skeletal injury.[1]

Conventional radiography is traditionally considered the first-line imaging modality for suspected fractures because it is widely available, relatively inexpensive, rapid, and familiar to clinicians. Standard radiographs provide useful information regarding fracture presence, site, alignment, displacement, angulation, comminution, joint extension, and associated dislocation. In most tertiary care hospitals, X-ray imaging forms the basis of initial decision-making in trauma care, orthopedic referral, immobilization, reduction, and operative planning. Despite these advantages, conventional radiography has important limitations. It involves ionizing radiation, requires patient positioning that may be difficult in painful injuries, and may miss subtle, undisplaced, occult, cartilaginous, or early cortical injuries, especially when fracture lines are not clearly projected on standard views.[2]

Ultrasonography has emerged as a useful adjunctive imaging modality in musculoskeletal trauma because it is radiation-free, portable, repeatable, inexpensive, and capable of real-time bedside assessment. In fracture evaluation, USG allows visualization of the superficial cortical surface of bone and surrounding soft tissues. Fractures may appear as cortical discontinuity, step-off deformity, angulation, periosteal elevation, local hematoma, and adjacent soft tissue swelling. The modality is particularly attractive in emergency settings, pediatric patients, pregnant patients, and situations where repeated radiographs are undesirable. Point-of-care ultrasonography also has the advantage of being performed at the bedside, allowing rapid integration of clinical findings with imaging findings during the same patient encounter.[3]

The principle behind fracture detection by USG is based on the strong echogenic interface between bone cortex and adjacent soft tissue. Normal bone cortex appears as a bright continuous hyperechoic line with posterior acoustic shadowing. Any disruption in this line suggests cortical breach. Unlike radiography, which depends on projectional visualization through a two-dimensional image, ultrasonography evaluates the cortical surface dynamically in longitudinal and transverse planes. It may also reveal indirect signs of injury such as periosteal fluid, soft tissue edema, hematoma, and localized tenderness during probe compression. These features make USG potentially valuable for detecting superficial fractures of the forearm, wrist, hand, clavicle, ribs, ankle, foot, and selected pediatric fractures.[4]

In recent years, the role of USG in fracture diagnosis has gained increasing attention, particularly for distal forearm injuries and pediatric trauma. Several recent investigations have assessed whether USG can be used as an alternative or complementary tool to radiography in selected fracture patterns. The growing interest is due to the need for faster diagnosis, reduced radiation exposure, improved patient comfort, and better access to imaging in busy emergency departments. In a tertiary care hospital, where patient load is high and rapid decision-making is essential, USG may provide clinically useful information before or alongside radiography, especially when radiology services are delayed or when positioning for X-ray is difficult because of pain.[5]

The comparison between ultrasonography and conventional radiography is clinically important because both modalities have different strengths. Radiography provides a broader overview of bone alignment and deeper skeletal structures, whereas USG provides high-resolution assessment of the superficial cortex and adjacent soft tissues. Radiographs are useful for classification and treatment planning, while USG may help in rapid screening, identifying cortical breaks, and detecting associated soft tissue changes. Therefore, USG should not be viewed only as a replacement for X-ray but also as a complementary modality that may improve early evaluation of suspected fractures in selected anatomical regions.[6]

MATERIALS AND METHODS

This was a hospital-based comparative observational study conducted to comparatively evaluate ultrasonography and conventional radiography for detecting bone fractures at a tertiary care hospital in patients presenting with clinical suspicion of fracture following trauma. A total of 72 patients with suspected bony fractures were included in the study. Patients presenting to the emergency department or outpatient department with clinical features suggestive of fracture, such as pain, swelling, tenderness, deformity, restricted movement, or history of trauma, were evaluated. Both adult and pediatric patients were considered eligible, provided they fulfilled the selection criteria.

Inclusion Criteria: Patients of either sex presenting with clinical suspicion of bony fracture were included in the study. Patients with recent trauma, localized bony tenderness, swelling, deformity, functional limitation, or inability to bear weight were enrolled. Only those patients who underwent both ultrasonography and conventional radiography for the same suspected fracture site were included.

Exclusion Criteria: Patients with compound fractures requiring immediate surgical intervention, polytrauma patients who were hemodynamically unstable, patients with previously operated fracture sites, old fractures, pathological fractures, and

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patients with inadequate imaging records were excluded from the study. Patients who did not provide consent were also excluded.

Methodology: All patients underwent detailed clinical assessment before imaging. Relevant history regarding mode of injury, site of pain, duration since trauma, swelling, deformity, limitation of movement, and functional disability was recorded. Local examination was performed to assess tenderness, crepitus, swelling, bruising, deformity, abnormal mobility, and neurovascular status.

Ultrasonography Technique: Ultrasonography was performed using a high-frequency linear transducer. The suspected fracture site was scanned in both longitudinal and transverse planes. The cortical surface of the bone was carefully assessed for discontinuity, step-off deformity, periosteal elevation, hematoma, and adjacent soft tissue swelling. The corresponding normal side was examined when required for comparison. Dynamic assessment was avoided in painful or unstable injuries.

Conventional Radiography Technique: Conventional radiography was performed using standard X-ray views according to the anatomical region involved. At least two orthogonal views were obtained wherever possible. Radiographs were evaluated for cortical break, fracture line, displacement, angulation, comminution, involvement of joint surface, and associated soft tissue swelling. Additional views were taken when clinically indicated.

Parameters Assessed: The main parameters assessed were the presence or absence of fracture, site of fracture, cortical discontinuity, fracture line visibility, displacement, angulation, comminution, periosteal reaction, hematoma, and soft tissue swelling. Diagnostic parameters including sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of ultrasonography were calculated by comparing USG findings with conventional radiography findings.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 27.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean and standard deviation. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were calculated for ultrasonography using conventional radiography as the reference standard. Agreement between ultrasonography and conventional radiography was assessed using the kappa coefficient. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 72 patients with clinically suspected bony fractures were included in the study. Conventional radiography detected fractures in 52 patients (72.22%), while ultrasonography detected fractures in 56 patients (77.78%). Table 1 shows the distribution of patients according to age, sex, and mode of injury. The highest number of patients belonged to the 21–40 years age group, with 24 patients (33.33%), followed by the 41–60 years age group with 20 patients (27.78%). Fractures on X-ray were also most commonly seen in the 21–40 years age group, accounting for 18 patients (25.00%). However, the association between age group and fracture detection on X-ray was not statistically significant, as the p-value was 0.584. Male patients were more commonly affected than female patients. Out of 72 patients, 46 patients (63.89%) were males and 26 patients (36.11%) were females. Among males, fractures were detected on X-ray in 35 patients (48.61%), while among females, fractures were detected in 17 patients (23.61%). The association between sex and fracture detection was not statistically significant, with a p-value of 0.484. Fall was the most common mode of injury, seen in 30 patients (41.67%), followed by road traffic accidents in 18 patients (25.00%), sports injuries in 13 patients (18.06%), and assault or other causes in 11 patients (15.28%). Fractures were most frequently detected among patients with a history of fall, with 24 patients (33.33%) showing fracture on X-ray. However, the mode of injury was not significantly associated with fracture detection, as the p-value was 0.304.

Table 2 shows the distribution of suspected fracture sites and compares fracture detection by conventional radiography and ultrasonography. The most common suspected fracture site was the forearm, wrist, or hand, seen in 18 patients (25.00%). Among these, X-ray detected fractures in 14 patients (19.44%), while USG detected fractures in 15 patients (20.83%). The ankle and foot were the second most common sites, involving 16 patients (22.22%). X-ray detected fractures in 12 patients (16.67%), whereas USG detected fractures in 13 patients (18.06%). In elbow injuries, both X-ray and USG detected fractures in 8 patients (11.11%), showing complete similarity between the two modalities for this site. For shoulder and clavicle injuries, X-ray detected fractures in 7 patients (9.72%), while USG detected fractures in 8 patients (11.11%). For leg and knee injuries, X-ray detected fractures in 7 patients (9.72%), whereas USG detected fractures in 8 patients (11.11%). In rib injuries, both imaging modalities detected fractures in 4 patients (5.56%). Overall, X-ray detected fractures in 52 patients (72.22%), while USG detected fractures in 56 patients (77.78%). Although USG detected slightly more fractures than X-ray, the difference was not statistically significant, as the overall p-value was 0.219.

Table 3 compares different clinical findings with fracture detection on conventional radiography. Localized tenderness was the most common clinical finding, present in 68 patients (94.44%). Among these, 51 patients (70.83%) had fractures on X-ray, while 17 patients (23.61%) did not show fracture. The p-value was 0.062, which was close to statistical significance but did not reach the conventional

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significance level. Swelling was present in 57 patients (79.17%). Out of these, 46 patients (63.89%) had fractures on X-ray and 11 patients (15.28%) had no fracture. The association between swelling and fracture detection was statistically significant, with a p-value of 0.003. Restricted movement was observed in 32 patients (44.44%). Among them, 28 patients (38.89%) had fractures on X-ray, while only 4 patients (5.56%) had no fracture. This association was statistically significant, with a p-value of 0.016. Visible deformity was present in 18 patients (25.00%). Fracture was detected on X-ray in 17 of these patients (23.61%), while only 1 patient (1.39%) with deformity did not show fracture. This finding was statistically significant, with a p-value of 0.016. Crepitus was present in 16 patients (22.22%). Out of these, 15 patients (20.83%) had fractures on X-ray and 1 patient (1.39%) did not have fracture. Crepitus was significantly associated with radiographic fracture detection, with a p-value of 0.031.

Table 4 shows the direct comparison between ultrasonography and conventional radiography for fracture detection. Out of 52 patients in whom fracture was detected on X-ray, USG also detected fracture in 51 patients (70.83%). These were considered true positive cases. Only 1 patient (1.39%) had fracture on X-ray but was not detected by USG, representing a false negative case. Among 20 patients who did not show fracture on X-ray, USG correctly identified no fracture in 15 patients (20.83%). These were true negative cases. However, USG detected fracture in 5 patients (6.94%) who did not show fracture on X-ray; these were considered false positive cases when conventional radiography was taken as the reference standard. Overall, USG detected fractures in 56 patients (77.78%), while X-ray detected fractures in 52 patients (72.22%). McNemar's test showed a p-value of 0.219, indicating that there was no statistically significant difference between USG and conventional radiography in overall fracture detection.

Table 5 shows the diagnostic performance of ultrasonography compared with conventional radiography. Ultrasonography showed 51 true positive cases, meaning that it correctly detected fractures in 51 patients who also had fractures on X-ray. It showed 15 true negative cases, meaning that USG correctly ruled out fracture in 15 patients who had no fracture on X-ray. There were 5 false positive cases, where USG suggested fracture but X-ray did not show fracture. There was only 1 false negative case, where USG missed a fracture that was detected on X-ray. Based on these findings, the sensitivity of USG was 98.08%, indicating that USG was highly effective in identifying patients with fractures. The specificity of USG was 75.00%, showing that USG was moderately effective in correctly identifying patients without fractures. The positive predictive value was 91.07%, meaning that when USG detected a fracture, there was a high probability that the patient actually had a fracture on X-ray. The overall diagnostic accuracy of USG was 91.67%, showing strong performance of ultrasonography in fracture detection. The kappa agreement was 0.779, indicating substantial agreement between ultrasonography and conventional radiography. The p-value was 0.219, suggesting that the difference between the two modalities was not statistically significant.

Table 1: Distribution of patients according to demographic and clinical characteristics

Variable	Total patients, n (%)	Fracture on X-ray, n (%)	No fracture on X-ray, n (%)	p-value
Age group				**0.584**
≤20 years	16 (22.22%)	13 (18.06%)	3 (4.17%)	
21–40 years	24 (33.33%)	18 (25.00%)	6 (8.33%)	
41–60 years	20 (27.78%)	14 (19.44%)	6 (8.33%)	
>60 years	12 (16.67%)	7 (9.72%)	5 (6.94%)	
Sex				**0.484**
Male	46 (63.89%)	35 (48.61%)	11 (15.28%)	
Female	26 (36.11%)	17 (23.61%)	9 (12.50%)	
Mode of injury				**0.304**
Fall	30 (41.67%)	24 (33.33%)	6 (8.33%)	
Road traffic accident	18 (25.00%)	14 (19.44%)	4 (5.56%)	
Sports injury	13 (18.06%)	8 (11.11%)	5 (6.94%)	
Assault/others	11 (15.28%)	6 (8.33%)	5 (6.94%)	

Table 2: Distribution of suspected fracture sites and detection by imaging modality

Anatomical site	Total suspected cases, n (%)	Fracture detected by X-ray, n (%)	Fracture detected by USG, n (%)	p-value
Forearm/wrist/hand	18 (25.00%)	14 (19.44%)	15 (20.83%)	0.705
Ankle/foot	16 (22.22%)	12 (16.67%)	13 (18.06%)	0.690
Elbow	10 (13.89%)	8 (11.11%)	8 (11.11%)	1.000
Shoulder/clavicle	9 (12.50%)	7 (9.72%)	8 (11.11%)	0.590
Leg/knee	11 (15.28%)	7 (9.72%)	8 (11.11%)	0.637
Ribs	8 (11.11%)	4 (5.56%)	4 (5.56%)	1.000
Total	**72 (100.00%)**	**52 (72.22%)**	**56 (77.78%)**	**0.219**

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Table 3: Comparison of clinical findings with fracture detection on conventional radiography

Clinical finding	Present, n (%)	Fracture on X-ray, n (%)	No fracture on X-ray, n (%)	p-value
Localized tenderness	68 (94.44%)	51 (70.83%)	17 (23.61%)	0.062
Swelling	57 (79.17%)	46 (63.89%)	11 (15.28%)	**0.003**
Restricted movement	32 (44.44%)	28 (38.89%)	4 (5.56%)	**0.016**
Visible deformity	18 (25.00%)	17 (23.61%)	1 (1.39%)	**0.016**
Crepitus	16 (22.22%)	15 (20.83%)	1 (1.39%)	**0.031**

Table 4: Comparison between ultrasonography and conventional radiography in fracture detection

USG finding	X-ray fracture present, n (%)	X-ray fracture absent, n (%)	Total, n (%)
Fracture detected on USG	51 (70.83%)	5 (6.94%)	56 (77.78%)
Fracture not detected on USG	1 (1.39%)	15 (20.83%)	16 (22.22%)
Total	**52 (72.22%)**	**20 (27.78%)**	**72 (100.00%)**

McNemar's test p-value = 0.219, indicating no statistically significant difference between USG and conventional radiography in overall fracture detection.

Table 5: Diagnostic performance of ultrasonography compared with conventional radiography

Diagnostic parameter	Value
True positive	51
True negative	15
False positive	5
False negative	1
Sensitivity	98.08%
Specificity	75.00%
Positive predictive value	91.07%
Negative predictive value	93.75%
Diagnostic accuracy	91.67%
Kappa agreement	0.779
p-value	0.219

DISCUSSION

In the present study, fractures were detected by conventional radiography in 52 of 72 patients (72.22%), while ultrasonography detected fractures in 56 patients (77.78%). This indicates that USG identified slightly more suspected fractures than X-ray, although the difference was not statistically significant. Similar findings were reported by Marshburn et al. (2004), who evaluated 58 patients with suspected long-bone fractures and found that ultrasound had a sensitivity of 92.90% and specificity of 83.30% for fracture detection. Compared with their study, the present study showed a higher sensitivity of 98.08%, while specificity was slightly lower at 75.00%, suggesting that USG was very effective in identifying fractures but produced a few additional positive findings when X-ray was taken as the reference standard.[7]

In relation to age distribution, the maximum number of patients in the present study belonged to the 21–40 years age group, comprising 24 patients (33.33%), followed by the 41–60 years age group with 20 patients (27.78%). Fractures on X-ray were also most common in the 21–40 years age group, with 18 patients (25.00%), although the association between age and fracture detection was not statistically significant (p=0.584).

Waterbrook et al. (2013) also studied traumatic long-bone injuries in an emergency department population and enrolled 106 patients, with 147 long-bone ultrasound examinations and 42 radiographic fractures, giving a fracture prevalence of 29.00%. Their study reported ultrasound sensitivity of 90.20% and specificity of 96.10%, whereas the present study had a higher fracture prevalence of 72.22% on X-ray and higher sensitivity of 98.08%, probably reflecting inclusion of patients with strong clinical suspicion of fracture.[8]

Male predominance was observed in the present study, with 46 males (63.89%) and 26 females (36.11%). Fractures were detected on X-ray in 35 males (48.61%) and 17 females (23.61%), but sex was not significantly associated with fracture detection (p=0.484). Frouzan et al. (2017) assessed 100 emergency trauma patients with upper and lower extremity long-bone injuries and reported that radius fracture was the most frequent upper-limb fracture, accounting for 27.00%, while tibia and fibula fractures were the most frequent lower-limb fractures, accounting for 89.20%. They found ultrasound sensitivity, specificity, PPV, and NPV of 95.30%, 87.70%, 87.20%, and 96.20% for upper-extremity long bones, respectively. In comparison, the present study showed a comparable sensitivity of 98.08% and PPV of 91.07%, supporting the usefulness of ultrasound across both male and female trauma patients.[9]

Regarding mode of injury, fall was the most common mechanism in the present study, observed in 30 patients (41.67%), followed by road traffic accidents in 18 patients (25.00%), sports injuries in 13 patients (18.06%), and assault or other causes in 11 patients (15.28%). Fractures were most frequently seen in patients with fall, with 24 cases (33.33%) showing fracture on X-ray, although the association was not statistically significant (p=0.304). Avci et al. (2019) also evaluated point-of-care ultrasound in long-bone

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fractures and reported that radiography identified 43 fractures, while ultrasound showed sensitivity of 95.30%, specificity of 85.50%, PPV of 83.70%, and NPV of 96.00%. The present study had similar high sensitivity (98.08%) and high NPV (93.75%), indicating that USG is particularly useful for excluding fracture in trauma patients when the sonographic cortical outline is intact.[10]

The most common suspected fracture site in the present study was the forearm/wrist/hand, seen in 18 patients (25.00%), where X-ray detected fractures in 14 patients (19.44%) and USG detected fractures in 15 patients (20.83%). This finding is comparable with Neri et al. (2014), who studied hand fractures in children and enrolled 204 patients, among whom 79 fractures of the phalanges or metacarpals were detected by standard radiography. In their study, ultrasound performed by an expert radiologist showed sensitivity of 91.10% and specificity of 97.60%, while ultrasound performed by emergency physicians showed sensitivity of 91.50% and specificity of 96.80%. The present study showed a higher overall sensitivity of 98.08%, and the slightly higher USG detection in forearm/wrist/hand injuries supports the role of USG in detecting cortical breach in superficial bones.[11]

In the present study, ankle and foot injuries were the second most common suspected sites, involving 16 patients (22.22%); X-ray detected fractures in 12 patients (16.67%), while USG detected fractures in 13 patients (18.06%). Elbow and rib injuries showed equal detection by both modalities, while shoulder/clavicle and leg/knee injuries showed slightly higher detection by USG. Chartier et al. (2017), in a systematic review and meta-analysis of point-of-care ultrasound for long-bone fractures, included 30 studies with 3506 patients and an overall fracture rate of 48.00%. They reported that ultrasound sensitivity ranged from 64.70% to 100.00% and specificity from 79.20% to 100.00%. The present study's sensitivity of 98.08% falls near the upper end of this range, while specificity of 75.00% was slightly lower, likely due to the five USG-positive but X-ray-negative cases.[12]

Clinical signs showed important associations with radiographic fracture detection in the present study. Localized tenderness was present in 68 patients (94.44%), but its association with fracture was not statistically significant (p=0.062). In contrast, swelling was present in 57 patients (79.17%) and was significantly associated with fracture detection (p=0.003). Restricted movement was present in 32 patients (44.44%), visible deformity in 18 patients (25.00%), and crepitus in 16 patients (22.22%), all showing significant associations with X-ray-confirmed fracture. Douma-den Hamer et al. (2016) analyzed 16 studies including 1204 children and 641 distal forearm fractures, reporting pooled ultrasound sensitivity of 97.00%, specificity of 95.00%, positive likelihood ratio of 20.00, and negative likelihood ratio of 0.03. The present findings support this evidence, as clinically suspicious cases with swelling, deformity, and crepitus were strongly associated with fracture, and USG showed high sensitivity for detecting these lesions.[13]

Direct comparison between USG and X-ray in the present study showed 51 true positive cases (70.83%), 15 true negative cases (20.83%), 5 false positive cases (6.94%), and only 1 false negative case (1.39%). McNemar's test showed p=0.219, indicating no statistically significant difference between USG and conventional radiography. Yousefifard et al. (2016) reported in their systematic review and meta-analysis of thoracic bone fractures that ultrasonography had pooled sensitivity of 97.00% and specificity of 94.00%, while chest radiography had sensitivity of 77.00% and specificity of 100.00%. Their finding that ultrasound had higher sensitivity but radiography had very high specificity is similar to the present study, where USG detected more cases than X-ray but had lower specificity because of false positive findings.[14]

The overall diagnostic performance of USG in the present study was strong, with sensitivity of 98.08%, specificity of 75.00%, PPV of 91.07%, NPV of 93.75%, diagnostic accuracy of 91.67%, and kappa agreement of 0.779, indicating substantial agreement with conventional radiography. Zhao et al. (2019), in a meta-analysis of ultrasound for hand fractures, included 7 studies with 842 participants and reported pooled sensitivity of 91.00%, specificity of 96.00%, positive likelihood ratio of 20.66, and negative likelihood ratio of 0.09. Compared with Zhao et al., the present study showed higher sensitivity but lower specificity, suggesting that USG was highly reliable for identifying fractures in clinically suspected cases, while conventional radiography remains important for confirmation, anatomical classification, displacement assessment, and treatment planning.[15]

CONCLUSION

Ultrasonography showed high sensitivity and diagnostic accuracy in detecting bony fractures when compared with conventional radiography. Although USG detected slightly more fractures than X-ray, the difference was not statistically significant. The substantial agreement between both modalities suggests that USG can be a useful adjunct to conventional radiography, especially for rapid bedside evaluation. However, conventional radiography remains important for confirming fracture pattern, displacement, alignment, and treatment planning.

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