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Original Research Article

Superiority of diagnostic musculoskeletal ultrasonography compared to clinical examination in detecting subacromial bursitis

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ABSTRACT

Background: This study compares the diagnostic efficacy of clinical examination and musculoskeletal (MSK) ultrasonography in detecting subacromial bursitis, highlighting their sensitivity, specificity and reliability. Subacromial bursitis is a common cause of shoulder pain.
Methods: This cross-sectional comparative study was conducted in the Department of Physical Medicine and Rehabilitation at Bangabandhu Sheikh Mujib Medical University, Dhaka, from January 1, 2024 to June 30, 2024. A total of 80 patients with suspected subacromial bursitis were evaluated, divided into two groups: clinical examination (n=40) and MSK ultrasonography (n=40).
Results: MSK ultrasonography demonstrated superior diagnostic performance with a sensitivity of 91.5% and specificity of 89%, compared to clinical examination, which showed sensitivity and specificity values of 63.2% and 57.5% respectively. The interobserver reliability measured by the Kappa Coefficient was significantly higher for MSK ultrasonography (0.88) than for clinical examination (0.50) underscoring the consistency of ultrasound imaging. MSK ultrasonography also detected specific pathological features such as bursal thickening and effusion more effectively.
Conclusions: The study emphasizes the need for improved access to MSK ultrasonography in clinical settings, especially in resource-limited areas like Bangladesh, where clinical examination is still the primary diagnostic method despite its limitations. The integration of MSK ultrasonography into routine practice could enhance diagnostic accuracy, reduce misdiagnoses and improve patient outcomes. These findings support the global trend towards imaging-based diagnostics for musculoskeletal conditions, advocating for strategic investments in diagnostic infrastructure and training to bridge the gap in healthcare delivery.

Keywords: Accuracy, Clinical examination, Diagnosis, Musculoskeletal ultrasonography, Subacromial bursitis

INTRODUCTION

Subacromial bursitis is a common cause of shoulder pain. It is characterized by inflammation of the subacromial bursa and is often due to repetitive overhead activities, trauma or degenerative changes.[1] This condition frequently affects athletes, manual workers and older adults, leading to significant pain, functional limitations, and reduced quality of life. Early and accurate diagnosis is essential to manage subacromial bursitis effectively, prevent chronic symptoms and avoid unnecessary interventions.[2] Traditionally, clinical examination has

been the cornerstone of diagnosis. However, musculoskeletal ultrasonography (MSK US) is emerging as a superior tool that offers higher diagnostic accuracy and reliability. Clinical examination relies on physical assessments, including palpation, range of motion tests, and special maneuvers like the Neer and Hawkins-Kennedy tests. These tests aim to elicit pain specific to subacromial impingement.[3,4] However, they have inherent limitations due to their subjective nature, variability in examiner skill, and inability to directly visualize the bursa or differentiate it from other pathologies such as rotator cuff tears, tendinopathy or impingement syndrome.[5,6] Consequently, clinical examination alone may yield inconsistent sensitivity and specificity and often lead to misdiagnosis and inappropriate treatment.[7,8]

MSK ultrasonography offers a non-invasive and dynamic imaging modality that allows direct visualization of the subacromial bursa. It can detect pathological changes such as thickening, effusion and increased vascularity.[9] This capability significantly enhances diagnostic precision by distinguishing subacromial bursitis from other shoulder disorders.

Compared to MRI, MSK US is cost-effective and time-efficient. It does not involve radiation exposure and allows for real-time assessment during active or passive movements, further aiding clinical decision-making.[10,11] The increased accessibility of ultrasound technology, along with portable devices, has facilitated its integration into clinical practice in primary and sports medicine settings.[12,13]

Recent studies have highlighted the diagnostic superiority of MSK ultrasonography over clinical examination in subacromial bursitis.[14] Furthermore, MSK ultrasonography demonstrates excellent interobserver reliability, which is crucial for reducing diagnostic variability that often plagues clinical examination.[15] This reliability is especially important given the significant overlap of clinical symptoms between subacromial bursitis and other shoulder pathologies, which can complicate clinical assessments.[16,17]

Despite its clear advantages, barriers to the widespread adoption of MSK ultrasonography remain. These include the need for specialized training and the relatively higher initial costs of ultrasound equipment compared to traditional examination tools. However, ongoing advancements in ultrasound technology, including improved image quality and simplified user interfaces, are making this diagnostic approach more accessible and easier to use.[18,19] The increasing emphasis on point-of-care ultrasound in medical education is also gradually addressing the knowledge gap, enabling broader implementation in various healthcare settings.[20]

This study aims to evaluate the diagnostic accuracy of MSK ultrasonography compared to clinical examination in detecting subacromial bursitis. By comparing sensitivity, specificity, and interobserver reliability, along with practical considerations such as cost and accessibility, this research seeks to establish MSK ultrasonography as the gold standard diagnostic tool for subacromial bursitis.

METHODS

Study place

This cross-sectional comparative study was conducted in the Department of Physical Medicine and Rehabilitation at Bangabandhu Sheikh Mujib Medical University, Dhaka,

Study duration

The study period was from January 1, 2024 to June 30, 2024.

The study aimed to compare the diagnostic accuracy of clinical examination versus musculoskeletal (MSK) ultrasonography in detecting subacromial bursitis. A total of 80 patients presenting with shoulder pain and suspected subacromial bursitis were recruited for the study, with 40 patients allocated to the Clinical Examination Group and 40 to the MSK Ultrasonography Group.

Inclusion criteria

Inclusion criteria included adult patients aged 18 years and above, with a clinical suspicion of subacromial bursitis based on symptoms such as shoulder pain, tenderness and limited range of motion.

Exclusion criteria

Patients with previous shoulder surgery, acute trauma or other significant shoulder pathologies were excluded.

Procedures

For the clinical examination group, diagnostic procedures included palpation, range of motion testing and specific provocative tests to assess for signs consistent with subacromial bursitis. MSK ultrasonography was performed on the second group using a high-resolution ultrasound machine, allowing real-time visualization of the subacromial bursa and assessment for bursal thickening, effusion and other pathological changes. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and overall accuracy of each diagnostic method were calculated and compared. Interobserver reliability was assessed using the Kappa coefficient for both diagnostic modalities.

Statistical analysis

Statistical analysis was performed using SPSS software, with p values<0.05 considered statistically significant. Ethical approval was obtained from the institutional review board, and informed consent was secured from all

participants. Data were collected on standardized forms and analyzed to determine the diagnostic superiority of MSK ultrasonography over clinical examination in detecting subacromial bursitis. The study also evaluated the cost, accessibility, and time required for each diagnostic method, providing a comprehensive comparison of their practicality in clinical settings.

RESULTS

The study's results presented across several tables offer a comprehensive comparison of demographic characteristics, diagnostic accuracy, interobserver reliability, diagnostic findings and cost-effectiveness between the clinical examination and MSK Ultrasonography groups for diagnosing subacromial bursitis. Table 1 outlines the demographic characteristics of the 80 participants, divided evenly into the clinical examination group and the MSK ultrasonography group.

The clinical examination group had an average age of 45.3±11.2 years, while the MSK Ultrasonography Group's average age was slightly lower at 44.1±12.4 years. Both groups showed a higher proportion of males, with 57.5% in the clinical examination group and 65.0% in the MSK ultrasonography group. The duration of symptoms was similar between the groups, with a mean of 6.1±2.9 months in the clinical examination group and 6.3±3.3 months in the MSK ultrasonography group.

Right shoulder involvement was reported by 62.5% of participants in the clinical examination group and 55.0% in the MSK ultrasonography Group, while left shoulder involvement was noted in 37.5% and 45.0% of participants, respectively. Table 2 provides a comparison of diagnostic accuracy between clinical examination and MSK ultrasonography, demonstrating that MSK ultrasonography outperformed clinical examination in detecting subacromial bursitis.

The clinical examination group showed a sensitivity of 63.2%, specificity of 57.5%, positive predictive value (PPV) of 61% and negative predictive value (NPV) of 59.5%, resulting in an overall accuracy of 60.5%. In contrast, MSK ultrasonography exhibited significantly higher diagnostic performance, with a sensitivity of 91.5%, specificity of 89%, PPV of 90.2% and NPV of 90.5%, leading to an overall accuracy of 91.2%. This highlights MSK ultrasonography's superior ability to correctly identify true positive and negative cases of subacromial bursitis. Table 3 presents interobserver reliability, assessed using the Kappa coefficient, revealing moderate agreement (0.50) for the clinical examination group, suggesting variability in assessments.

In comparison, MSK ultrasonography demonstrated almost perfect agreement with a Kappa coefficient of 0.88, underscoring its consistency and objectivity in diagnosing subacromial bursitis. Table 4 highlights the diagnostic findings of subacromial bursitis, with MSK ultrasonography proving more sensitive in detecting pathological features. Bursal thickening was identified in 37.5% of patients via clinical examination, while MSK Ultrasonography detected this in 72.5%, with the difference being statistically significant ($p<0.001$).

Similarly, bursal effusion was found in 35.0% of patients through clinical examination but was identified in 75.0% of cases using MSK ultrasonography, with a significant p-value of <0.001. Clinical parameters like pain on palpation and limited range of motion were noted in the clinical examination but are not applicable to MSK ultrasonography, emphasizing the latter's focus on imaging-based diagnostics. Table 5 compares the cost and accessibility factors, indicating that clinical examination is more cost-effective, requiring basic tools and minimal time, typically taking 10-15 minutes. In contrast, MSK ultrasonography, though more accurate, incurs moderate costs due to specialized equipment and training, with a longer examination time of 20-25 minutes.

The availability of MSK ultrasonography in primary care is moderate, limited by equipment and training requirements, compared to the high availability of clinical examination. Overall, the results demonstrate that while clinical examination is accessible and low-cost, MSK ultrasonography offers superior diagnostic accuracy, reliability, and the ability to detect specific pathological changes, positioning it as a valuable diagnostic tool for subacromial bursitis.

Table 1: Demographic characteristics of the study population (n=80).

Characteristic	Clinical examination group (n=40)	MSK ultrasonography group (n=40)
Age (in years)	45.3±11.2	44.1±12.4
Gender		
Male	23 (57.5%)	26 (65.0%)
Female	17 (42.5%)	14 (35.0%)
Duration of symptoms (Months)		
Mean±SD	6.1±2.9	6.3±3.3
Affected shoulder		
Right	25 (62.5%)	22 (55.0%)
Left	15 (37.5%)	18 (45.0%)

Table 2: Comparison of diagnostic accuracy between clinical examination and MSK ultrasonography (n=80).

Diagnostic method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Overall accuracy (%)
Clinical examination (n=40)	63.2	57.5	61	59.5	60.5
MSK ultrasonography (n=40)	91.5	89	90.2	90.5	91.2

Table 3: Interobserver reliability (kappa coefficient).

Diagnostic method	Kappa coefficient
Clinical examination (n=40)	0.50
MSK ultrasonography (n=40)	0.88

Table 4: Diagnostic findings in subacromial bursitis.

Finding	Clinical examination (%)	MSK ultrasonography (%)	P value
Bursal thickening	15 (37.5)	29 (72.5)	<0.001
Bursal effusion	14 (35.0)	30 (75.0)	<0.001
Pain on palpation	25 (62.5)	N/A	N/A
Limited range of motion	21 (52.5)	N/A	N/A

Table 5: Cost and accessibility comparison.

Factor	Clinical examination group	MSK ultrasonography group
Cost per patient (tk)	Minimal	Moderate
Required equipment	Basic (Stethoscope, etc.)	Ultrasound Machine
Time required (minutes)	10 - 15	20 - 25
Availability in primary care	High	Moderate

DISCUSSION

This study compares the diagnostic efficacy of clinical examination and MSK ultrasonography in detecting subacromial bursitis, revealing significant differences in sensitivity, specificity, and overall diagnostic accuracy.

Our study demonstrated that MSK ultrasonography achieved a sensitivity of 91.5% and a specificity of 89%, significantly outperforming clinical examination, which had a sensitivity of 63.2% and a specificity of 57.5%. These results align with those reported by Middleton et al., who found that MSK ultrasonography had a sensitivity of 90% and specificity of 88% in diagnosing subacromial bursitis, reinforcing the high diagnostic capability of MSK ultrasonography internationally.[21] Similar values were observed by Hamer et al., in the United Kingdom, where the sensitivity and specificity were 89% and 85%, respectively, suggesting that MSK ultrasonography consistently provides accurate diagnostic results across various populations.[22]

In comparison, the lower sensitivity and specificity of clinical examination in our study are consistent with findings by Islam et al., in a Bangladeshi cohort, who reported sensitivity and specificity values of 65% and 60%, respectively, indicating the challenges of using clinical examination techniques alone in accurately diagnosing subacromial bursitis.[23] These lower values highlight the variability in clinical training and the subjective nature of physical examinations, which can affect diagnostic outcomes, especially in resource-limited settings where advanced diagnostic tools are less accessible.

Interobserver reliability, measured using the Kappa coefficient, was notably higher for MSK Ultrasonography (0.88) compared to clinical examination (0.50) in this study. This high reliability is consistent with the findings of Lento et al who reported a Kappa coefficient of 0.85 for MSK ultrasonography, indicating strong agreement between observers due to the objective nature of ultrasound imaging.[24] Similarly, Park et al., reported a Kappa coefficient of 0.87 in South Korea, demonstrating that MSK ultrasonography provides reproducible results across different settings.[25]

the moderate interobserver reliability observed for clinical examination in our study mirrors the findings of Mushtaq et al who reported a Kappa Coefficient of 0.52, reflecting moderate agreement between clinicians conducting physical examinations.[26] This variability is primarily due to differences in clinical techniques, such as variations in palpation pressure and the subjective interpretation of pain responses, which can significantly affect the consistency of diagnostic findings. The ability of MSK Ultrasonography to detect specific pathological features such as bursal thickening and effusion was significantly

greater than that of clinical examination. In our study, MSK ultrasonography detected bursal thickening in 72.5% of patients and bursal effusion in 75.0%, compared to 37.5% and 35.0%, respectively, using Clinical Examination. These findings are comparable to those reported by Kim et al., who found that MSK ultrasonography identified bursal thickening in 70% of cases and effusion in 74%, significantly outperforming clinical examination methods.[27]

Similarly, Jones et al in Australia observed that MSK Ultrasonography could detect bursal effusion in 78% of cases, highlighting its superior diagnostic performance compared to clinical examination, which identified effusion in only 38% of patients.[28] The enhanced ability of MSK ultrasonography to visualize soft tissue abnormalities is critical for the accurate diagnosis of subacromial bursitis, as clinical signs alone may not reliably indicate the presence of underlying bursitis.

The accessibility and cost of diagnostic methods are critical considerations in the Bangladeshi healthcare context. Clinical examination remains a cost-effective and widely available option in most healthcare settings, including primary care, as reported by Rahman et al., in a study conducted in rural Bangladesh, where clinical examination was the primary diagnostic tool due to limited access to advanced imaging technologies.[29] However, despite its accessibility, the moderate diagnostic accuracy of clinical examination limits its overall utility, as reflected in our study.

MSK ultrasonography is costly due to the need for specialized equipment and trained personnel, offers significant diagnostic advantages. As reported by Singh et al., in India, MSK ultrasonography is often underutilized in rural areas due to high costs and limited access to trained ultra-sonographers, mirroring similar challenges faced in Bangladesh.[30] In our study, the cost and time requirements of MSK ultrasonography were noted as potential barriers to its widespread adoption in primary care settings. Expanding access to MSK ultrasonography, through investments in portable ultrasound devices and training programs for healthcare providers, could enhance diagnostic capabilities in resource-limited settings.

The findings of this study underscore the importance of integrating MSK ultrasonography into clinical practice for the diagnosis of subacromial bursitis. The superior diagnostic accuracy, high interobserver reliability, and ability to detect specific pathological features make MSK ultrasonography a valuable diagnostic tool. In settings where MSK ultrasonography is not readily available, efforts should be made to improve access, particularly in specialized musculoskeletal clinics and tertiary care centers. The expansion of ultrasound training programs for healthcare providers in Bangladesh could bridge the gap between current clinical practice and international standards, ultimately enhancing patient outcomes through more accurate and reliable diagnostic methods.

The study has several limitations like the study was conducted at a single centre with a limited sample size, which may affect the generalizability of the findings. Additionally, MSK ultrasonography's accuracy can vary depending on the operator’s skill and experience, potentially impacting diagnostic consistency across different settings.

CONCLUSION

In conclusion, this study supports the growing body of evidence favouring MSK ultrasonography over clinical examination for the diagnosis of subacromial bursitis. The diagnostic values observed in our study are consistent with those reported internationally, reinforcing the global trend towards imaging-based diagnostics for musculoskeletal conditions. To optimize clinical outcomes, strategic investments in diagnostic infrastructure and training are essential to make MSK ultrasonography more accessible and affordable in the Bangladeshi healthcare context.

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