International Journal of Radiology and Diagnostic Imaging

E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2025; 8(1): 105-110
Received: 25-02-2025
Accepted: 27-03-2025

Mahmoud Mustafa Mahmoud Youssef
Diagnostic Radiology Department, Faculty of Medicine, Benha University, Benha, Egypt

Hesham Farouk Hefny
Diagnostic Radiology Department, Faculty of Medicine, Benha University, Benha, Egypt

Asmaa Youssef Elsayed
Diagnostic Radiology Department, Faculty of Medicine, Benha University, Benha, Egypt

Corresponding Author:
Mahmoud Mustafa Mahmoud Youssef
Diagnostic Radiology Department, Faculty of Medicine, Benha University, Benha, Egypt

Role of dynamic ultrasound imaging and ultrasound guided injections in shoulder joint pain

Mahmoud Mustafa Mahmoud Youssef, Hesham Farouk Hefny and Asmaa Youssef Elsayed

DOI: https://www.doi.org/10.33545/26644436.2025.v8.i1b.446

Abstract
Background: Shoulder pain, a prevalent musculoskeletal condition, significantly impacts quality of life. Dynamic ultrasound imaging and ultrasound-guided injections offer potential improvements in diagnosis and treatment, yet their efficacy remains under investigation.
Objectives: To evaluate the efficacy and precision of dynamic ultrasound imaging and ultrasound-guided injections in diagnosing and treating shoulder pain.
Methods: A cross-sectional observational study was conducted with 50 patients experiencing shoulder pain. Inclusion criteria were adults over 18 with chronic pain. Exclusion criteria included recent shoulder surgery, severe systemic diseases, or pregnancy. All patients underwent dynamic ultrasound for injury assessment and ultrasound-guided injections. Outcomes were assessed at baseline and 4-6 weeks post-treatment using VAS, SDQ, and ROM measurements.
Results: Pre-treatment VAS and SDQ scores averaged 7.6 and 70.2, respectively. Post-treatment, VAS decreased to 3.7, and SDQ improved to 40.5 (both $p < 0.001$). ROM improved significantly in all planes ($p < 0.001$). Rotator cuff tears showed the greatest post-treatment improvement (VAS = 3.5 ± 1.0). Corticosteroids showed the lowest post-treatment VAS (3.5 ± 1.0), though injection type differences were not statistically significant ($p = 0.08$). Regression analysis identified pre-treatment VAS as the strongest predictor of post-treatment outcomes ($R^2 = 0.878$, $p < 0.001$).
Conclusion: Dynamic ultrasound imaging and ultrasound-guided injections effectively reduce pain and improve function in shoulder pain patients, with pre-treatment pain scores being a significant predictor of outcomes. Further studies are needed to refine treatment strategies.

Keywords: Dynamic ultrasound imaging, shoulder pain, rotator cuff tears, subacromial bursitis, musculoskeletal disorders

Introduction
Shoulder pain is a common, disabling musculoskeletal condition with significant personal and economic impact Maxwell *et al.* [1]. As the third most frequent physiotherapy complaint, its complexity demands a broad understanding of its effects van Doorn *et al.* [2]. Prevalence varies from 1% to 66% due to the shoulder's complex anatomy and functional dynamics Cadogan *et al.* [3].
Diagnosis traditionally relies on clinical assessment and imaging like X-rays, ultrasound, and MRI, with arthroscopy as a definitive but invasive tool Allen [4] Chaturvedi *et al.* [5]. Limitations include non-specific symptoms, variable test accuracy, and accessibility issues, often delaying diagnosis and treatment Mitchell *et al.* [6].
Dynamic ultrasound offers real-time visualization of musculoskeletal structures during movement, improving diagnostic accuracy Sikdar *et al.* [7]. Ultrasound-guided injections enhance treatment precision by delivering medication directly to the pathology site.
These techniques together provide a safe, effective, and accessible approach to diagnosing and managing shoulder pain, improving outcomes and recovery Chang *et al.* [8].
The aim of this study is to evaluate the efficacy and precision of dynamic ultrasound imaging and ultrasound-guided injections in the diagnosis and treatment of shoulder joint pain.

Patients and Methods
Design and Population
A cross-sectional observational study was conducted involving 50 patients experiencing shoulder pain, admitted to Benha University Hospitals over a period of 12 months starting

from March 2024 to May 2025 after approval of the institutional ethical committee. An informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number.

Eligibility criteria

Inclusion criteria: Adults aged 18 years and older. Patients experiencing shoulder pain for a minimum specified period, such as 3 months, to include those with persistent or chronic conditions. Participants who have tried standard non-invasive treatments (e.g., physical therapy, NSAIDs) without sufficient relief.

Exclusion criteria: Patients who have undergone shoulder surgery within a specified timeframe prior to the study, such as the last 6 months, to avoid confounding recovery effects. Individuals with severe systemic diseases or conditions that may affect shoulder function or pain perception, such as rheumatoid arthritis or neurological disorders. Pregnant women due to potential risks. Known allergies to the agents used in ultrasound-guided injections (e.g., corticosteroids, local anaesthetics).

Assessment

All patients underwent thorough preoperative evaluations, including:

Complete history and physical examinations: Personal, present, past, family, and surgical histories of the patients will be documented. This includes collecting information about the patient's demographics, current health status, medical history, family medical history, and any prior surgical procedures. Clinical Examination**:** A thorough clinical examination of the patients will be conducted to evaluate their general health and assess any physical signs and symptoms related to shoulder pain.

Dynamic Ultrasound Imaging: This technique uses a handheld ultrasound probe to capture real-time images of joint or muscle movement, visualizing tendons, ligaments, muscles, and joints. B-mode imaging assesses tendon integrity and joint structure. Key lesion signs include: rotator cuff tears (tendon discontinuity, abnormal motion), subacromial bursitis (fluid collection, increased Doppler flow), calcific tendinitis (hyperechoic foci, shadowing), bicipital tendinopathy (thickened, hypoechoic tendon), labral injury (irregularity on dynamic imaging), and impingement syndrome (effusion, tendon thickening, altered motion).

Ultrasound-Guided Injections: This technique ensures accurate needle placement for effective delivery of treatments such as corticosteroids, hyaluronic acid, or platelet-rich plasma (PRP) into the target area. The procedure includes patient positioning, aseptic preparation, ultrasound visualization, needle insertion with real-time guidance, and injection. Two approaches were used: in-plane (for continuous needle visualization) and out-of-plane (for alternative trajectories). Dynamic ultrasound confirmed needle placement and monitored agent dispersion within structures like the subacromial bursa or peritendinous area. Injection types included corticosteroids (anti-inflammatory), PRP (regenerative), and other agents (e.g., hyaluronic acid, anaesthetics) for non-candidates of standard therapies. All injections were performed under real-time ultrasound guidance. Baseline assessments included pain (VAS), function (SDQ), and shoulder range of motion (flexion, abduction, extension, internal rotation).

Outcome Measures

Patients were reassessed 4-6 weeks post-treatment with the following: Clinical Outcomes: VAS and SDQ scores to assess pain and shoulder function changes. ROM Measurements: To quantify improvements in shoulder mobility.

Statistical methods

All data were analyzed using standard statistical software. Descriptive statistics included mean ± SD for continuous variables and frequencies/percentages for categorical variables. Paired t-tests compared pre- and post-treatment VAS, SDQ, and ROM measures, while chi-square or Fisher's exact tests analyzed categorical variables like previous shoulder injury and injection types. Pearson correlation coefficients assessed relationships between imaging findings (US and MRI), pain scores, and ROM improvements. Subgroup analyses compared patients with different ultrasound-detected injuries (e.g., rotator cuff tear vs. subacromial bursitis) and injection types (corticosteroid, PRP, other). A p-value < 0.05 was considered statistically significant, with assumptions for parametric tests verified prior to analysis.

Results

The study involved 50 patients (mean age 56.2 ± 7.3 years; 50% male), with 84% right-arm dominance and 56% right shoulder involvement. Mean pre-treatment VAS and SDQ scores were 7.6 ± 0.9 and 70.2 ± 6.5, respectively. ROM values included flexion 130° ± 12, abduction 110° ± 10, and external rotation 30° ± 5. Pain duration averaged 8.5 ± 2.3 months; 52% had prior shoulder injuries and 48% previous treatments. Injections given were corticosteroids (60%), PRP (30%), and hyaluronic acid (10%). Ultrasound revealed rotator cuff tears (40%) as the most common finding Table 1.

Table 1: Baseline demographics, clinical history, pre-treatment clinical measures, US imaging findings, and injection types (n = 50).

Variable		**Value**
Age (years)		56.2 ± 7.3
Gender	Male	25 (50%)
	Female	25 (50%)
Dominant Arm	Right	42 (84%)
	Left	8 (16%)
Affected Shoulder	Right	28 (56%)
	Left	22 (44%)
Outcome Variable	Mean ± SD	Range
VAS Score (Pre)	7.6 ± 0.9	6-9
SDQ Score (Pre)	70.2 ± 6.5	60-80
ROM		
Flexion (°)	130 ± 12	110-150
Abduction (°)	110 ± 10	90-130
Extension (°)	35 ± 5	30-45
Internal Rotation (°)	50 ± 7	40-60
External Rotation (°)	30 ± 5	25-40
Injection Type	Frequency	Percentage (%)
Corticosteroid	30	60%
PRP	15	30%
Hyaluronic acid	5	10%
Variable		Value
Duration of Pain (months)		8.5 ± 2.3
Previous Shoulder Injury		26 (52%)
Previous Treatments		24 (48%)
Variable		Distribution/Mean ± SD
US Findings		Injury Types:
Rotator Cuff Tear		20 (40%)
Subacromial Bursitis		12 (24%)
Calcific Tendinitis		7 (14%)
Bicipital Tendinopathy		4 (8%)
Labral Injury		4 (8%)
Impingement Syndrome		3 (6%)

VAS: Visual Analog Scale (for pain assessment), SDQ: Shoulder Disability Questionnaire (for functional assessment), ROM: Range of Motion, PRP: Platelet-Rich Plasma, US: Ultrasound, SD: Standard Deviation

Post-treatment VAS scores differed significantly by injury type ($p = 0.045$), with rotator cuff tears showing the greatest improvement (3.5 ± 1.0). Injection type showed no significant difference ($p = 0.08$), though corticosteroids had the lowest mean VAS (3.5 ± 1.0) compared to PRP (4.0 ± 1.2) and hyaluronic acid (4.2 ± 1.1) Table 2.

Table 2: Comparison of injury types, injection types, and post-treatment vas scores.

Injury Type	**n**	**Mean Post VAS (± SD)**
Rotator Cuff Tear	20	3.5 ± 1.0
Subacromial Bursitis	12	3.8 ± 1.2
Calcific Tendinitis	7	4.0 ± 1.0
Bicipital Tendinopathy	4	4.2 ± 1.0
Labral Injury	4	4.5 ± 0.8
Impingement Syndrome	3	3.6 ± 0.9
ANOVA p-value		0.045
Injection Type		
Corticosteroid	30	3.5 ± 1.0
PRP	15	4.0 ± 1.2
Hyaluronic acid	5	4.2 ± 1.1
ANOVA p-value		0.08

VAS: Visual Analog Scale (used to measure pain intensity), SD: Standard Deviation, n: Number of patients (sample size), PRP: Platelet-Rich Plasma, ANOVA: Analysis of Variance (a statistical test used to compare means among groups).

Post-treatment, VAS and SDQ scores improved to 3.7 ± 1.1 and 40.5 ± 5.8, respectively. ROM increased across all planes: flexion 160 ± 10°, abduction 140 ± 12°, extension 50 ± 6°, internal rotation 65 ± 6°, and external rotation 45 ± 5° Table 3.

Table 3: Post-Treatment Clinical and Functional Outcome Measures (n = 50).

Outcome Variable	Mean ± SD (Post)
VAS Score (Post)	3.7 ± 1.1
SDQ Score (Post)	40.5 ± 5.8
ROM	
Flexion (°)	160 ± 10
Abduction (°)	140 ± 12
Extension (°)	50 ± 6
Internal Rotation (°)	65 ± 6
External Rotation (°)	45 ± 5

VAS: Visual Analog Scale, SDQ: Shoulder Disability Questionnaire, ROM: Range of Motion

Post-treatment analysis showed significant improvements: VAS decreased from 7.6 ± 0.9 to 3.7 ± 1.1, and SDQ from 70.2 ± 6.5 to 40.5 ± 5.8 ($p < 0.001$). ROM improved in flexion (+30°), abduction (+30°), extension (+15°), internal rotation (+15°), and external rotation (+15°), all with $p < 0.001$ table 4.

Table 4: Comparative pre- vs. post-treatment outcomes

Outcome Variable	Pre-Treatment	Post-Treatment	Mean Difference ±SD	p-value
VAS Score	7.6 ± 0.9	3.7 ± 1.1	-3.9 ± 1.0	< 0.001*
SDQ Score	70.2 ± 6.5	40.5 ± 5.8	-29.7 ± 6.2	< 0.001*
Flexion (°)	130 ± 12	160 ± 10	+30 ± 8	< 0.001*
Abduction (°)	110 ± 10	140 ± 12	+30 ± 9	< 0.001*
Extension (°)	35 ± 5	50 ± 6	+15 ± 4	< 0.001*
Internal Rotation (°)	50 ± 7	65 ± 6	+15 ± 5	< 0.001*
External Rotation (°)	30 ± 5	45 ± 5	+15 ± 4	< 0.001*

VAS: Visual Analog Scale, SDQ: Shoulder Disability Questionnaire, ROM: Range of Motion.

Patients with and without previous shoulder injury showed no significant differences in outcomes. Both groups had similar VAS reductions (4.0 ± 1.0 vs. 4.0 ± 0.9; p = 0.95) and SDQ improvements (30.0 ± 5.5 vs. 29.2 ± 6.1; p = 0.68), with comparable pre- and post-treatment scores across all measures (p > 0.05) Table 5.

Table 5: Subgroup analysis by previous shoulder injury (n = 50)

Variable	Previous Injury (n = 26)	No Previous Injury (n = 24)	p-value
Pre-Treatment VAS	7.8 ± 0.8	7.4 ± 1.0	0.07
Post-Treatment VAS	3.9 ± 1.1	3.5 ± 1.0	0.09
VAS Reduction	4.0 ± 1.0	4.0 ± 0.9	0.95
Pre-Treatment SDQ	71.0 ± 6.0	69.2 ± 7.2	0.15
Post-Treatment SDQ	41.0 ± 5.0	40.0 ± 6.0	0.22
SDQ Reduction	30.0 ± 5.5	29.2 ± 6.1	0.68

VAS: Visual Analog Scale, SDQ: Shoulder Disability Questionnaire

Regression analysis revealed that pre-treatment VAS score showed the strongest association with post-treatment outcomes ($R^2 = 0.878$, $p < 0.001$), followed by age ($R^2 = 0.574$, $p < 0.001$) and duration of pain ($R^2 = 0.546$, $p < 0.001$), indicating that these variables significantly predict treatment response table 6.

Table 6: Correlation between post-treatment vas and (age, duration of pain, and pre-treatment vas)

Variable	R^2	p-value
Age	0.574	< 0.001
Duration of Pain	0.546	< 0.001
Pre-Treatment VAS	0.878	< 0.001

R^2: Coefficient of Determination, VAS: Visual Analog Scale, p-value: Probability Value.

Discussion

Shoulder pain, commonly due to subacromial impingement syndrome (SAPS), affects up to 74% of cases and involves rotator cuff compression causing pain and dysfunction van der Windt *et al.* [9] Michener *et al.* [10]. SAPS arises from tendon degeneration, inflammation, and altered scapular mechanics Rutten *et al.* [11]. Ultrasound offers accurate, dynamic, and radiation-free imaging comparable to MRI Teefey *et al.* [12], and also guides precise injections. Though some studies show no major clinical difference versus blind injections Bloom *et al.* [13], others report better outcomes in defined subgroups Cole *et al.* [14]. Novel injectables like PRP and hyaluronic acid show potential but need further validation. Further research is needed to optimize technique and therapy based on pathology. The aim of this study is to evaluate the efficacy and precision of dynamic ultrasound imaging and ultrasound-guided injections in the diagnosis and treatment of shoulder joint pain.

This study evaluated ultrasound-guided injections for shoulder pain, revealing that injury type affected outcomes, corticosteroids showed a trend toward better results, and baseline pain predicted post-treatment levels. Ultrasound findings were also detailed and are discussed in context with existing literature.

Our analysis showed a statistically significant difference in post-treatment pain across injury types, suggesting that underlying pathology influences response to injection therapy.

Several studies suggest that shoulder pathology type affects treatment outcomes. ElMeligie *et al.* [15] found rotator cuff pathologies often respond better to treatment than more complex intra-articular lesions. Coombes *et al.* [16] observed significant pain relief in patients with subacromial impingement and rotator cuff tendinopathy after corticosteroid injections, while those with labral pathology had less pronounced responses. Lee *et al.* [17] noted variability in injury interpretation when using ultrasound, which could lead to inconsistent outcomes. Our results align with these findings, showing that rotator cuff tears, being clearly defined on ultrasound, predict better pain reduction compared to labral injuries.

In our study, corticosteroid injections showed a trend toward better outcomes compared to PRP and other injections, though the differences were not statistically significant.

Our findings align with Aminzadeh B *et al.* [18], confirming rotator cuff abnormalities as the leading pathology in shoulder pain. Additionally, studies like Farin PU *et al.* [19] report similar frequencies for subacromial bursitis and calcific tendinitis, supporting dynamic ultrasound imaging as a reliable diagnostic tool and highlighting the need for varied therapeutic approaches due to shoulder disorder heterogeneity.

The debate over the superiority of corticosteroids versus PRP for shoulder pain persists. Wu *et al.* [20] found corticosteroids provided rapid short-term pain relief, while PRP may offer longer-term tendon healing benefits, though early differences were not significant. Finnoff *et al.* [21] highlighted corticosteroids as the standard for immediate relief, with PRP emerging for chronic cases. Our findings align, showing no significant short-term advantage, suggesting longer follow-up may be needed to detect differences.

Baseline pain strongly predicts treatment outcomes, with higher pre-treatment pain linked to greater post-treatment pain, supporting findings from Tran G *et al.* [22]. Age and pain duration were less predictive, aligning with Buchbinder *et al.* [23]. These results emphasize the importance of initial pain severity in treatment planning.

Multiple studies, including Tortora S *et al.* [24], highlight dynamic ultrasound's real-time assessment, cost-effectiveness, and high sensitivity for detecting rotator cuff tears and related pathologies, which aligns with our findings on its effectiveness in evaluating tendon integrity and guiding injections.

Shoulder pain from SAPS and rotator cuff disorders affects function and quality of life. Ultrasound advances have improved diagnostics and injection accuracy, but clinical benefits are still being explored. This study compared outcomes of different injection strategies to optimize shoulder pain management.

Limitations include small sample size, short 4-week follow-up, single-center design, high operator expertise limiting generalizability, and heterogeneity in ultrasound-detected pathologies that may confound outcomes.

Conclusion

The study shows that subacromial injection therapy, whether ultrasound- or landmark-guided, significantly improves pain and function in shoulder pathology. While outcomes may vary by underlying condition, overall clinical gains are consistent. The lack of significant differences between injection types supports tailoring treatment to patient needs, clinician expertise, and available resources.

Acknowledgments: There were none to declare.

Declaration of interest statement: None to be declared.

References

1. Maxwell C, Robinson K, McCreesh K. Understanding shoulder pain: A qualitative evidence synthesis exploring the patient experience. Physical Therapy. 2021;101(3):pzab010.
2. van Doorn PF, de Schepper EIT, Rozendaal RM, Ottenheijm RPG, van der Lei J, Bindels PJ, *et al*. The incidence and management of shoulder complaints in general practice: A retrospective cohort study. Family Practice. 2021;38(5):582-588.
3. Cadogan A, Laslett M, Hing WA, McNair PJ, Coates MH. A prospective study of shoulder pain in primary care: Prevalence of imaged pathology and response to guided diagnostic blocks. BMC Musculoskeletal Disorders. 2011;12:119.
4. Allen GM. The diagnosis and management of shoulder pain. Journal of Ultrasonography. 2018;18(74):234-239.
5. Chaturvedi V, Thabah MM, Ravindran V, Kiely PDW. Medical arthroscopy: A tool for diagnosis and research in rheumatology. International Journal of Rheumatic Diseases. 2017;20(2):145-153.
6. Mitchell C, Adebajo A, Hay E, Carr A. Shoulder pain: Diagnosis and management in primary care. BMJ. 2005;331(7525):1124-1128.
7. Sikdar S, Wei Q, Cortes N. Dynamic ultrasound imaging applications to quantify musculoskeletal function. Exercise and Sport Sciences Reviews. 2014;42(3):126-135.
8. Chang KV, Wu WT, Han DS, Özçakar L. Static and dynamic shoulder imaging to predict initial effectiveness and recurrence after ultrasound-guided subacromial corticosteroid injections. Archives of Physical Medicine and Rehabilitation. 2017;98(10):1984-1994.
9. van der Windt DA, Koes BW, de Jong BA, Bouter LM. Shoulder disorders in general practice: Incidence, patient characteristics, and management. Annals of the Rheumatic Diseases. 1995;54(12):959-964.
10. Michener LA, McClure PW, Karduna AR. Anatomical and biomechanical mechanisms of subacromial impingement syndrome. Clinical Biomechanics (Bristol, Avon). 2003;18(5):369-379.
11. Rutten MJ, Jager GJ, Blickman JG. From the RSNA refresher courses: US of the rotator cuff: Pitfalls, limitations, and artifacts. Radiographics. 2006;26(2):589-604.
12. Teefey SA, Rubin DA, Middleton WD, Hildebolt CF, Leibold RA, Yamaguchi K. Detection and quantification of rotator cuff tears: Comparison of ultrasonographic, magnetic resonance imaging, and arthroscopic findings in seventy-one consecutive cases. Journal of Bone and Joint Surgery. American Volume. 2004;86(4):708-716.
13. Bloom JE, Rischin A, Johnston RV, Buchbinder R. Image-guided versus blind glucocorticoid injection for shoulder pain. Cochrane Database of Systematic Reviews. 2012;2012(8):CD009147.

14. Cole BF, Peters KS, Hackett L, Murrell GA. Ultrasound-guided versus blind subacromial corticosteroid injections for subacromial impingement syndrome: A randomized, double-blind clinical trial. American Journal of Sports Medicine. 2016;44(3):702-707.
15. ElMeligie MM, Allam NM, Yehia RM, Ashour AA. Systematic review and meta-analysis on the effectiveness of ultrasound-guided versus landmark corticosteroid injection in the treatment of shoulder pain: An update. Journal of Ultrasound. 2023;26(3):593-604.
16. Coombes BK, Bisset L, Vicenzino B. Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: A systematic review of randomised controlled trials. The Lancet. 2010;376(9754):1751-1767.
17. Chen MJ, Lew HL, Hsu TC, Tsai WC, Lin WC, Tang SF, *et al*. Ultrasound-guided shoulder injections in the treatment of subacromial bursitis. American Journal of Physical Medicine & Rehabilitation. 2006;85(1):31-35.
18. Aminzadeh B, Najafi S, Moradi A, Abbasi B, Farrokh D, Emadzadeh M. Evaluation of diagnostic precision of ultrasound for rotator cuff disorders in patients with shoulder pain. Archives of Bone and Joint Surgery. 2020;8(6):689-695.
19. Farin PU, Jaroma H, Harju A, Soimakallio S. Shoulder impingement syndrome: Sonographic evaluation. Radiology. 1990;176(3):845-849.
20. Zhang C, Wu J, Li X, Wang Z, Lu WW, Wong TM. Current biological strategies to enhance surgical treatment for rotator cuff repair. Frontiers in Bioengineering and Biotechnology. 2021;9:657584.
21. Finnoff JT, Hall MM, Adams E, Berkoff D, Concoff AL, Dexter W, *et al*. American Medical Society for Sports Medicine (AMSSM) position statement: Interventional musculoskeletal ultrasound in sports medicine. PM&R. 2015;7(2):151-168.e12.
22. Tran G, Hensor EMA, Kingsbury SR, O'Connor P, Cowling P, Conaghan PG. The usefulness of ultrasound in predicting outcomes in patients with shoulder pain: A prospective observational study. Rheumatology (Oxford). 2024;63(8):2162-2169.
23. Buchbinder R, Green S, Youd JM. Corticosteroid injections for shoulder pain. Cochrane Database of Systematic Reviews. 2003;2003(1):CD004016.
24. Tortora S, Messina C, Gitto S, Chianca V, Serpi F, Gambino A, *et al*. Ultrasound-guided musculoskeletal interventional procedures around the shoulder. Journal of Ultrasonography. 2021;21(85):e162-e168.

How to Cite This Article
Youssef MMM, Hefny HF, Elsayed AY. Role of dynamic ultrasound imaging and ultrasound guided injections in shoulder joint pain. International Journal of Radiology and Diagnostic Imaging. 2025;8(1):105-110.