Musculoskeletal Ultrasound in the Diagnosis and Interventional Management of Common Pain Disorders - Analysis from a Physiatry Pain Clinic

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ABSTRACT

Objective: To determine the practical applications of musculoskeletal ultrasound (MSK US) in the precise diagnosis and optimal interventional management of painful musculoskeletal conditions within Physical Medicine and Rehabilitation (PMR) clinics in Pakistan.

Study Design: An observational study.

Place and Duration of the Study: Department of Physical Medicine and Rehabilitation, Combined Military Hospital, Mangla, Pakistan, from January 2023 to March 2024.

Methodology: A total of 402 patients presenting in the PMR pain clinic who underwent diagnostic MSK US examination and/or interventional procedure under ultrasound (US) guidance during year 2023-24, were enrolled. All US examinations and procedures were performed after getting written informed consent from the patients. The collected data were analysed to see the pattern of the most commonly presenting MSK diagnoses and the utility of US in the identification and treatment of diverse pain disorders.

Results: A total of 402 patients including 238 (59.2%) males and 164 (40.8%) females with a mean age of 51.2 years (ranging from 15-92 years) were examined using US. The main diagnoses were knee osteoarthritis (26.4%), rotator-cuff syndrome (18.9%), and adhesive capsulitis (12.9%). The US-guided interventions were categorised into three main groups including the joints (33.8%), soft tissues (50.5%), and peripheral nerves (15.7%). Among the patients presenting at the PMR pain clinic for MSK US, 75.1% culminated in interventions, whereas 24.9% were treated conservatively.

Conclusion: Musculoskeletal US is a time-efficient and reliable entity to diagnose and treat common pain disorders and help PMR clinicians to confirm the clinical diagnoses promptly and guide the needle while avoiding iatrogenic damage to the surrounding vital structures.

Key Words: *Musculoskeletal, Ultrasound, Interventional, Pain disorders, PMR clinic, Pakistan.*

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INTRODUCTION

The use of musculoskeletal ultrasound (MSK US) has extended and improvised in the last two decades, because of the availability of high-end ultrasound machines, which improve the accuracy of procedures, while also being cost-effective, convenient, and free from ionising radiation.[1-3] The safety of the overall procedure depends upon avoiding inadvertent damage to surrounding neurovascular and vital structures, where US has proven its crucial role in the identification of vital structures and determining the optimal trajectory for needle placement.[4] Patient satisfaction has been enhanced due to the convenience, real-time imaging, and visual bio-feedback of the procedure.[5]

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The practical application of the MSK US has gained a boost among pain and rehabilitation medicine physicians due to its precision and accuracy. In Pakistan and other developing countries, ultrasound use has emerged as a relatively inexpensive modality with promising results.[6] Still, its widespread use is hampered by a lack of proper training and expertise. In a PMR setting, the utility of MSK US is not only limited to pain interventions, but it has a pivotal role in spasticity management in guiding phenol or botulinum toxin injections, and needle guidance while performing the electro-diagnostic studies.[7,8]

To the authors' knowledge, this is the first study documenting MSK US diagnosis as well as interventional procedures in the domain of PMR in Pakistan. There is only one study from the country, where diagnostic US has been used to determine the percentage of different regional pathologies.[6] The purpose of this study was twofold; the first was to document the MSK US utility in the diagnosis of musculoskeletal pain disorders in a PMR clinic. The second was to raise awareness among PMR and pain physicians in Pakistan, to use MSK US in identification and management of patients in PMR clinics which may lead to improved accuracy and reduced number of patient visits.

METHODOLOGY

All subjects who underwent MSK US examination (n = 402) in the PMR department of the Combined Military Hospital from 5 January 2023 to 5 March 2024 were enrolled. The subjects were patients from all age groups of both genders enrolled from the PMR department or referred from medical, surgical, or paediatric outpatient departments for whom ultrasound was considered necessary for their diagnosis and further management. Hospital Ethics Committee approval was taken (RC No. Trg-01/2023), and written informed consent from all patients was obtained. The patients who had local swelling, surgery, open wound, or infection at the site of US to be performed were excluded. Demographic and clinical data concerning age, gender, presenting complaints, regional diagnosis, and previous imaging modalities and interventions, if any, were recorded. All US examinations and procedures were performed by a single rehabilitation medicine physician, after getting written informed consent from the patient by using the Sonoace X6 (Medison Co., Ltd, Korea) with linear (5-12 MHz) and curved (3-7 MHz) probes as per the requirement. Visual analogue scale (VAS), patient satisfaction, and complications were recorded. The collected data were analysed using IBM SPSS Statistics version 27.0 and were categorised into groups to see the pattern of the most commonly presenting disorders.

RESULTS

A total of 402 patients including 238 (59.2%) males and 164 (40.8%) females with a mean age of 51.2 years (ranging from 15-92 years) were examined using US and were offered conservative (pharmacotherapy, physiotherapy, and activity modification/orthotic supports *etc*.), or interventional procedure on the spot. The interventions were categorised into three main groups including the joints (33.8%), soft tissues (50.5%), and peripheral nerves (15.7%). Of note, 75.1% of US examinations culminated in interventions, whereas 24.9% were treated conservatively. The most common diagnosis was osteoarthritis of the knee joint, followed by rotator cuff pathologies and adhesive capsulitis (Table I). The interventional procedures included intra-articular injections, diagnostic blocks, soft tissue local anaesthetic/corticosteroids injections, platelet-rich plasma (PRP) injections, and nerve blocks using LA with or without corticosteroids or chemical neurolysis with aqueous phenol (Table II).

Table I: Frequency of common disorders requiring MSK US examination and interventions.

Frequency of common disorders requiring ultrasound examination and interventions	Number	Percentage (%)
Osteoarthritis of knee	106	26.4
Rotator-cuff syndrome	76	18.9
Adhesive capsulitis	52	12.9
Synovitis/tenosynovitis/bursitis/ligament sprain	32	8.0
Miscellaneous: Foreign body, tibiotalar joint effusion, carpometacarpal joint arthritis, ulnar nerve snapping/neuropraxia at elbow *etc.*	32	8.0
Cervicogenic headache	14	3.5
Carpal tunnel syndrome	13	3.2
Internal knee derangement	13	3.2
Myofascial pain syndrome	12	3.0
Lateral/medial epicondylitis	10	2.5
Sacroiliac joint dysfunction/sacroiliitis	10	2.5
Greater trochanteric pain syndrome	7	1.7
Dequervain's tenosynovitis	4	1.0
Piriformis syndrome	4	1.0
Plantar fasciitis	4	1.0
Ganglion	4	1.0
Osteoarthritis hip	3	0.7
Meralgia paresthetica	3	0.7
Trigger finger	3	0.7
Total	402	100

Table II: Ultrasound-guided interventions performed at PMR clinic.

Ultrasound-guided interventions	Number	Percentage (%)
Knee intra-articular injection	99	24.6
Subacromial-subdeltoid bursa injections	62	15.4
Genicular nerve block	49	12.2
Glenohumeral joint injections	35	8.7
Miscellaneous: Acromioclavicular joint, carpometacarpal joint, biceps tendon sheath, coccygeal infiltration, coraco-humeral ligament injection, nerve blocks (ilioinguinal/iliohypogastric, lateral femoral cutaneous nerve of thigh, intercostal nerves, axillary nerve, lateral pectoral nerve, sural nerve hydro dissection), iliopsoas bursa, radiocapitellar joint, morton neuroma injection	28	7.0
Suprascapular nerve (SSN) block	25	6.2
Greater occipital nerve (GON) block	21	5.2
Myofascial trigger point/interfascial plane inj	14	3.5
Joint fluid aspiration	12	3.0
Sacroiliac joint (SIJ) injection	11	2.7
Greater trochanteric (GT) injection	10	2.5
Pes anserine bursa injection	7	1.7
Common extensor tendon (CET) injection	6	1.5
Piriformis injection	6	1.5
Carpal tunnel injection	4	1.0
First dorsal compartment injection	4	1.0
Phenol motor point block	3	0.7
A1 pulley injection	3	0.7
Hip intra-articular injection	3	0.7
Total	402	100.0

DISCUSSION

In this study, the authors aimed to highlight the importance of MSK US in painful musculoskeletal conditions in a PMR pain clinic and to document the common painful disorders and their interventions being performed by the PMR physicians in Pakistan.

The age distribution ranged from 15-92 years with a mean age of 51.18 years. This diversity is due to the vast range of disorders being dealt within PMR clinics worldwide.[5] Out of 402 patients, 59.2% were males and 40.8% were females in this study.

Herein, the most commonly evaluated structures included joints, soft tissues including tendons, ligaments, bursae, muscles, synovium, labrum, cartilage, and nerves. All the interventions were categorised under three main groups including the joints (33.8%), soft tissues (50.5%), and peripheral nerves (15.7%).

Of note, the most common diagnosis was knee osteoarthritis, followed by rotator-cuff syndrome (secondary to supraspinatus tears, bursitis, calcific tendinitis, *etc.*) and adhesive capsulitis (Table I).

Concerning the commonly injected areas in this study, the most commonly presented joint was the knee, whereas the shoulder was seen at the top of the list in some other studies. (Table II). It may be due to the increased prevalence of knee osteoarthritis in the local population as the prevalence of OA knee in the Pakistani population has been documented to be 26.67% per 1,000 people,[9] as compared to the global burden of OA knee i.e., 22.9% over 40 years of age.[10] It is important to highlight that it is not only age that affects the knee degenerative changes, but sarcopenic obesity that exacerbates the overload on the knee joint and therefore augmenting and speeding up the degenerative changes.[11]

When combined, the intra-articular shoulder joint injection and subacromial subdeltoid bursa injections make up a total of 97 (24.1%) cases, which is almost comparable to the knee joint 99 (24.6%). Apart from precise visualisation of the supraspinatus tendon's structure and function, US is helpful in the identification of pathological changes such as architectural alterations within the tendons, disruption, fluid collection, and cortical irregularities of underlying bones, hence aiding in overall diagnosis of the condition and clinical decision making on how to proceed in the management algorithm.[12] Studies have demonstrated that most of the US-guided interventional procedures around the shoulder are more accurate and effective than blinded injections. Furthermore, both intra-articular and peri-articular shoulder procedures can be easily performed with real-time visualisation to ensure correct needle placement.[13]

The common musculoskeletal disorders included lateral and medial epicondylitis, carpal tunnel syndrome, deQuervain's tenosynovitis, greater trochanteric pain syndrome, iliotibial band friction syndrome, peroneal tendinitis, and plantar fasciitis. Among the degenerative disorders, apart from knee OA, hip joint and carpometacarpal joints were injected with good pain relief and reduction in the use of oral analgesics. Regarding the hip joint, as it is a deep joint and surrounded by important neurovascular structures lie in the needle path, the US guidance improved safety and accuracy in providing access to the hip joint and avoiding damage to the tendons, bursae, and nerves of the hip area.[14]

Cervicogenic headache interventions, mainly greater occipital nerve block at C1-C2 level between the inferior oblique muscle (IOM) and the semispinalis capitis muscle (SSC),[15] were quite rewarding in terms of pain relief and reduction in the number of visits of the patient. In some cases of cervicogenic pain, the fascial plane injections between paravertebral, upper trapezius, and sternocleidomastoid muscles were also performed with good outcomes.[16]

Myofascial pain is a very common musculoskeletal pain disorder originating from muscle and surrounding fascia.[17] Patients usually present with localised pain around shoulder, scapular, and head and neck regions with trigger points or taut bands within the muscle belly.[18] In PMR setting, the fascial plane injections are accompanied by comprehensive physiotherapy plan to get long-term results.

In this study, out of all MSK US examinations, 75.1% underwent interventional management and 24.9% were treated with conservative management consisting of a comprehensive rehabilitation plan including identification of the risk factors, patient education, preventive measures, and modification of activities, pharmacotherapy, physiotherapy, occupational therapy, and use of splints/orthoses.[19,20] The diagnostic MSK US has significantly improved the decision-making process for managing common pain disorders in the authors' PMR clinic. For focal pathologies such as tenosynovitis requiring localised treatment, the most appropriate intervention was performed, considering the patients' age and comorbidities. For generalised conditions such as primary generalised osteoarthritis or fibromyalgia, conservative treatment was initially tried. If symptoms persisted, the most severely affected region or joint was targeted. The cases requiring surgical intervention including those with foreign bodies (e.g., glass or wood were referred to the surgical department after diagnosing MSK US.

Concerning the use of injectate, a variety of available injectable solutions were used according to the indication and the region involved including corticosteroids, 5% aqueous phenol, platelet rich plasma (PRP), dextrose water, *etc*.

The limitation of this study was that it was conducted in secondary care hospital. Consequently, the majority of the patients were from the authors' own PMR department, followed by those from surgical, medical, and paediatric outpatient and inpatient departments.

The established role of MSK US in PMR clinics facilitates prompt diagnosis and precise real-time interventions. The present study's findings suggest that integrating MSK US into routine care can improve clinical practice and patient outcomes in Pakistan and other low- and middle-income countries.

CONCLUSION

MSK US offers real-time visualisation of joints, ligaments, tendons, and nerves, making it invaluable in PMR for its wide range of applications. Its use should be promoted and integrated into PMR training to confirm diagnoses, assess symptom severity, and perform accurate US-guided interventions, reducing the risk of iatrogenic injury. While the learning curve for MSK US training is lengthy, passion and determination can lead to mastery. The authors strongly recommend that PMR physicians pursue appropriate training and find licensed mentors to acquire this skill set. Implementing MSK US in patient care can reduce costs and improve the outcomes of pain interventions.

ETHICAL APPROVAL:
Ethical approval was taken from the CMH Mangla Ethics Committee (RC no. Trg-01/2023, Dated: 1 January 2023).

PATIENTS' CONSENT:
Informed written consent was obtained from the patients to publish the data concerning this study.

COMPETING INTEREST:
The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
SR: Conception, design of the work, analysis, interpretation of data, drafting, and revision of the work.
MAA: Conception and drafting.
WI: Drafting of the work and data analysis.
All authors approved the final version of the manuscript to be published.

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