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Using Ultrasound to Improve Diagnostic Confidence and Management of Psoriatic Disease: Highlights From the GRAPPA 2023 Ultrasound Workshop

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ABSTRACT. The sensitivity of ultrasound (US) to detect, characterize, and monitor the relevant pathologies of psoriatic arthritis (PsA), including synovitis, enthesitis, tenosynovitis, and dactylitis, has made it an attractive tool for informing clinical decisions. The Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA) US working group ran 2 sessions during the annual GRAPPA meeting held in July 2023 in Dublin, Ireland. During the first workshop, the group presented 2 topics, followed by a live demonstration and a group discussion. The 2 topics were (1) an overview of the Diagnostic Ultrasound Enthesitis Tool (DUET) enthesitis scoring methodology, and (2) small hand-held probes—will the promise deliver? The live demonstration that followed compared the performance of 2 hand-held US (HHUS) devices vs a console US machine in patients with PsA, and the interactive group discussion considered gaps in the literature and future research suggestions relating to HHUS and its application in psoriatic disease. During the second session, the US working group provided further updates regarding the GRAPPA US studies currently underway or recently completed.

Key Indexing Terms: GRAPPA, psoriasis, psoriatic arthritis, ultrasound

Introduction

Psoriatic arthritis (PsA) affects many structures, making evaluating and diagnosing some patients difficult. Delayed diagnosis is associated with radiographic progression and worse functional outcome.[1] In addition to clinical evaluation, sonography can evaluate multiple disease targets more accurately than clinical examination alone,[2,3] allowing for an earlier diagnosis of PsA. At the Group for Research and Assessment of Psoriasis and Psoriatic Arthritis (GRAPPA) 2023 annual meeting in Dublin, Ireland, an update was provided on the progress of creating a sonographic diagnostic tool for PsA, as well as newer initiatives, including exploring the potential of hand-held ultrasound (HHUS) machines for limited clinical use.

Historically, musculoskeletal US (MSUS) has been performed using conventional portable cart-based US units, which generate high-quality images. Recent development in US technology has led to the emergence of HHUS devices, potentially improving access to diagnostic US at a significantly lower cost.[4]

During the workshop, the group presented 2 topics, followed by a live demonstration of 2 HHUS devices and a group discussion with audience participation. The 2 topics were (1) an overview of the Diagnostic Ultrasound Enthesitis Tool (DUET) enthesitis scoring methodology and (2) small hand-held probes—will the promise deliver? The live demonstration that followed compared the performance of 2 HHUS devices vs a console US machine in patients with PsA, and the interactive group discussion explored gaps in the literature and future research suggestions relating to HHUS and its application in PsA.

During the second US session, Dr. Lihi Eder and Dr. Sibel Aydin presented updates on current GRAPPA US projects, including (1) early results of DUET, (2) a systematic literature review (SLR) on the prevalence and definitions of sonographic elementary lesions for articular and extraarticular structures in PsA, and (3) a survey on the availability of MSUS for psoriatic disease among GRAPPA members and the unmet needs. The results of this study have recently been published.[5]

Summarized below are the key points discussed during the presentations.

Overview of DUET

The first topic in the workshop, presented by Dr. Eder, was an overview of the DUET enthesitis scoring methodology. Enthesitis, which is the inflammation at the insertion of tendon, ligament, and capsule into bone, is a key domain of PsA.

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Conventionally, the presence of enthesitis is ascertained by clinical examination by evaluating for tenderness at the entheseal sites, a method with significant limitations. The greater sensitivity of US compared to clinical examination for detecting enthesitis has been reported in numerous studies.[6,7] However, there is a lack of a validated sonographic enthesitis scoring system that reliably and accurately distinguishes PsA from non-PsA.

The DUET project is a GRAPPA-supported international, multicenter study that aims to develop a new sonographic enthesitis tool to differentiate patients with PsA from those without PsA and to assess the tool's validity and reliability.

An SLR of PsA sonographic enthesitis instruments performed by the DUET investigators identified significant limitations regarding the existing scoring systems.[8] It was noted that numerous studies used tools validated in axial spondyloarthritis (axSpA), a condition in which the distribution of enthesitis differs from PsA, and there was a lack of agreement regarding the number and location of entheseal sites included in each scoring tool.

Following the SLR, a pilot study was conducted in Toronto where 50 patients with PsA and 50 controls underwent sonographic evaluation of 22 entheseal sites. This study identified potential entheseal sites and US lesions with the potential to distinguish PsA from controls. These findings informed the selection of entheseal sites for the DUET study.[9]

A detailed DUET protocol was presented during the GRAPPA 2019 annual meeting in Paris, France.[10] In summary, prospective clinical and sonographic data were collected, and patients were divided into 3 groups: (1) patients with early PsA, (2) patients with psoriasis (PsO) without musculoskeletal symptoms, and (3) patients with noninflammatory rheumatic conditions without PsO. Recruiting sites were carefully selected depending on the availability of experienced sonographers and high-quality US devices. Training materials were developed, and participation in a prestudy training workshop for sonographers was a prerequisite to ensure standardization of US scanning technique and image acquisition. Eight entheseal sites bilaterally (a total of 16) in the upper and lower limbs were evaluated during the DUET study. The scoring of sonographic entheseal lesions is shown in the Figure.[11]

Both local and central readers scored the entheseal lesions. Central reading, carried out independently by 2 readers, will form the basis for the primary analysis and the development of the scoring instrument. Local reading will form part of the secondary analysis to assess the validity and generalizability of the scoring tool. The results of a reliability exercise were recently presented at the American College of Rheumatology Convergence in 2022, where moderate to substantial interrater agreement was achieved for most lesions, especially among central readers.[11]

Study recruitment was successfully accomplished in March 2023, and the scoring of images by central readers has recently been completed. A total of 421 patients were recruited; the study population included 215 patients with early PsA, 100 patients with PsO without musculoskeletal symptoms, and 106 controls with noninflammatory rheumatic conditions without PsO.

Small hand-held probes: Will the promise deliver?

Dr. Aydin presented the second topic, introducing the concept of small HHUS devices.

Technological progress in the field of US has enabled HHUS devices to be created, many of which communicate wirelessly. In recent years, HHUS devices have entered the US market. Their use has been adopted by numerous medical specialties, with key advantages including a significantly lower equipment purchase cost and easier portability than cart-based US machines.[12] However, the performance of HHUS devices in evaluating the 5 targets of sonography (joints, tendon, enthesis, psoriatic plaque, and nail bed and nail plate) in PsA remains to be determined.[13]

Dr. Aydin outlined the methodology of a study by the GRAPPA Ultrasound Working Group that aims at validating HHUS devices for point-of-care use in rheumatology. Patients with peripheral PsA who present to the rheumatology outpatient clinic of 3 sites, which include Ottawa, Toronto, and Jacksonville, Florida, with at least 1 tender and 1 swollen joint, are being prospectively recruited. At recruitment, patients undergo MSUS examination of various anatomic sites according to a prespecified protocol with a standard US machine and a HHUS device.

The scanning protocol for each patient includes 24 joints, 20 entheses, 4 tendons, and 2 nails. A combination of small and large joints and entheseal sites have been included. The examinations are performed in B mode and power Doppler (PD) mode, with both devices and lesions scored using previously validated methods.

Moderate to almost perfect agreement was achieved on an interim analysis based on the reading of images for the first 10 patients, allowing the study to proceed to the next phase.[14]

Comparing the performance of 2 HHUS devices vs a console US machine (live demonstration and interactive group discussion)

To compare the performance of 2 different HHUS devices to a console US machine, MSUS of numerous joints and entheseal sites on patients with PsA was performed live by Dr. Aydin and Dr. Gurjit Kaeley. The examinations were performed in B mode and PD mode with both devices.

This demonstration prompted interactive discussions regarding the role of HHUS in the clinical care of patients with PsA and PsA research.

The key advantages identified included the relatively low cost and portability of HHUS devices.[4] Additionally, as highlighted by other specialties, HHUS devices may facilitate more widespread and enhanced MSUS training for rheumatology trainees.[15] Some specific portable HHUS devices are equipped with the use of artificial intelligence to assist with image optimization and interpretation. These features may improve the consistency of image capture and increase the likelihood of acquiring diagnostically relevant images.[16]

However, whether HHUS devices can be used in the clinical care of patients with PsA to assess structural damage and the presence of inflammatory disease activity remains to be determined. An important concern is whether the Doppler mode

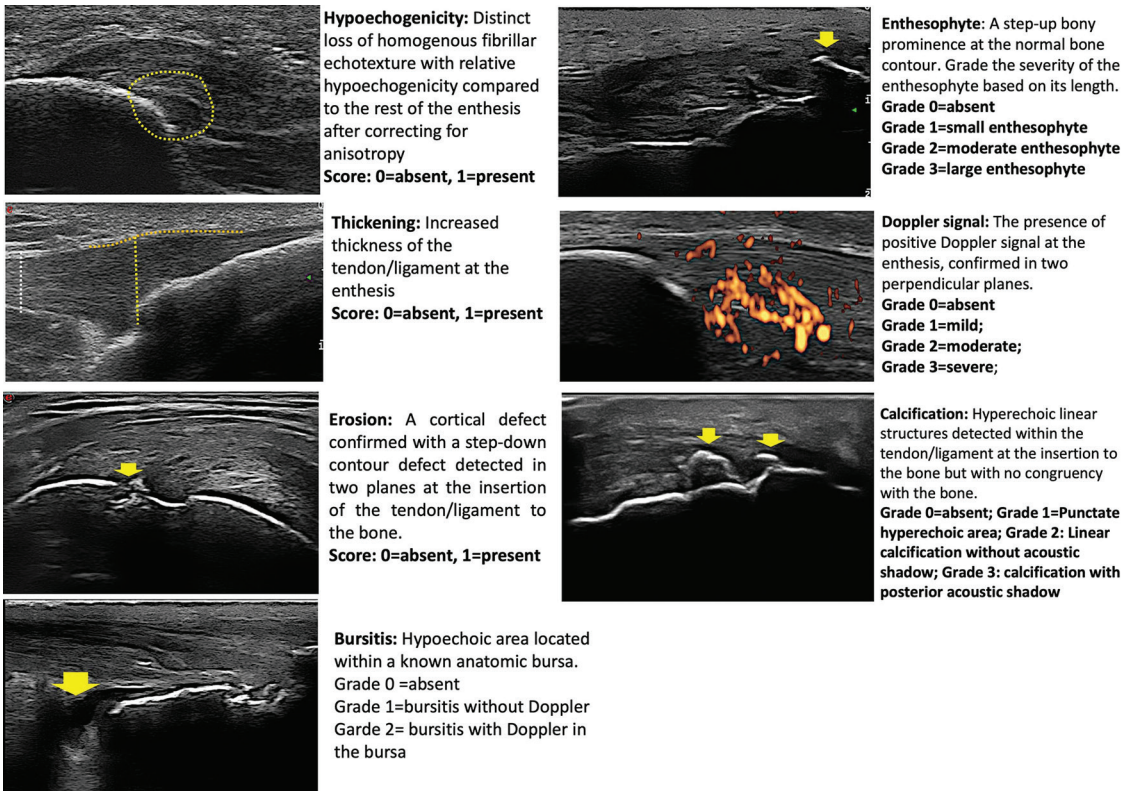

Figure 1. Scoring of sonographic elementary lesions in the DUET study.[11]

(an essential component of MSUS) of HHUS devices can accurately identify the presence of inflammatory lesions. In a recent study, a HHUS device's PD mode did not adequately identify hypervascularization in the joints and surrounding periarticular structures.[17] Whether different HHUS devices have different sensitivities to detect Doppler signal is yet to be explored.

Despite the potential advantages of incorporating the use of portable US devices in rheumatology practice, due consideration should be given to their limitations.

First, these US probes are not designed for prolonged scanning. Depending on the device used, the probe temperature rises after a period of continuous scanning. In the case of specific devices, the automatic cooling function is activated, and imaging must be stopped until the system has cooled down.[16]

Further, the limited battery life of the currently available HHUS probes is a clear disadvantage over standard US systems. This could possibly affect scanning sessions and result in significant interruptions.[16]

Another potential issue with HHUS devices highlighted during the workshop was the relatively heavier weight of some probes, which can result in sonographer fatigue, thus limiting the utility of some devices for more extensive scanning periods.

Notably, most of these US devices incorporate cloud-based storage systems for archiving the acquired examination for future reference. These archiving systems often require a paid subscription service, which adds to the running costs of HHUS probes.[16] In addition, cloud-based storage systems may not be approved by some hospitals due to concerns around privacy.

Finally, the consensus from this workshop was that these HHUS devices may help evaluate a clearcut pathology and help make clinical decisions in resource-limited settings. However, for detailed scanning, formal conventional US equipment is required. A recent survey among GRAPPA members identified the cost of US devices as a significant barrier in clinical practice.[5] This barrier may, at least in part, be removed by the lower acquisition cost of HHUS.

This feedback will guide the development of the research agenda by the US working group.

Conclusion

The needs survey conducted among GRAPPA members clearly shows a thirst for learning and applying US in the care of patients with PsA.[5] Although some of the barriers to the adoption of US may be overcome by using affordable HHUS machines, these devices need to be used judiciously with their limitations in mind. Finally, an important milestone was reached for the DUET study in that it completed all data acquisition and data analysis for the eventual construction of a keenly awaited sonographic diagnostic tool.

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