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● Original Contribution

COMPARISON BETWEEN SEVERAL ULTRASOUND HAND JOINT SCORES AND CONVENTIONAL RADIOGRAPHY IN DIAGNOSING HAND OSTEOARTHRITIS

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Abstract—This is the first study to investigate the usefulness of a standardized ultrasound (US) examination protocol in diagnosing hand osteoarthritis (OA). We conducted a cross-sectional study including 62 patients, ultimately diagnosed with hand OA based on imaging evidence of osteoarthritic changes with the particular distribution required for fulfilment of American College of Radiology diagnosis criteria. We compared a 32-joint US score (wrists, metacarpophalangeal [MCP], proximal interphalangeal [PIP] or distal interphalangeal [DIP] and carpometacarpal [CMC]-1 joints), with smaller, predefined joint scores, assessing 22 joints (wrists, MCPs and PIPs or PIPs, DIPs and CMC-1), 10 joints (MCP 2–3, PIP 2–3 and CMC-1 or PIP 2–3, DIP 2–3 and CMC-1) and 6 joints (DIP 2–3, CMC-1), respectively. The US findings were correlated with radiographic scores for erosions and osteophytes. Radiographic osteophyte scores correlated well with all the US scores mentioned earlier ($R = 0.381$ to 0.645 , $p < 0.05$), despite low sensitivity for detection of osteophytes (43.5%) and erosions (28.9%), compared with the 32 joint US score. Both 10 joint US protocols (assessing MCP 2–3, PIP 2–3 and CMC-1 or PIP 2–3, DIP 2–3 and CMC-1 joints) performed better than conventional radiography, by identifying osteophytes in an additional 25.6% and 23.9% of patients, respectively. The conclusion of this study is that the US examination of 10 preselected hand joints is more sensitive than conventional radiography in diagnosing hand OA in patients who do not fulfill American College of Radiology clinical criteria, a finding likely to have practical implications for facilitating diagnosis of hand OA. (E-mail: c.ciurtin@ucl.ac.uk) © 2017 World Federation for Ultrasound in Medicine & Biology. All rights reserved.

Key Words: Hand osteoarthritis, Ultrasound, Power doppler, Conventional radiography.

INTRODUCTION

Hand osteoarthritis (OA) diagnosis is based on a combination of clinical and imaging features and assessment of risk factors, together with clinical associations and outcomes (Zhang et al. 2009). The American College of Rheumatology (ACR) classification criteria for hand OA are frequently used as diagnostic criteria (Altman et al. 1990). In the context of a characteristic clinical picture and absence of additional features of other inflammatory arthritides, the diagnostic of hand OA is straightforward (Altman et al. 1990).

The challenges encountered by the clinician are related to the difficulty to diagnose hand OA confidently when no clear clinical picture exists and patients describe in-

flammatory hand pains. In absence of established Heberden's and Bouchard's nodes or bony enlargement and characteristic involvement of proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints, thumb base and index and middle metacarpophalangeal (MCP) joints, the early diagnosis of hand OA is more difficult. The European League Against Rheumatism (EULAR) initiative is aimed at helping clinicians to diagnose hand OA rather than classifying it, by identifying clinical subsets, which help differentiating OA from other hand joint pathology (Zhang et al. 2009). A Framingham analysis of incidence of hand OA showed an age-standardized prevalence of 44.2% in women and 37.7% in men (Haugen et al. 2011).

In terms of imaging hand OA, it is widely accepted that radiography is the gold standard and that other imaging techniques are rarely indicated for diagnosis (EULAR recommendation 9) (Zhang et al. 2009). Recent studies evaluated the role of ultrasound (US) examination of hand joints in diagnosing hand OA and predicting the disease

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progression (Mancarella et al. 2010; Mathiessen et al. 2016). In a large general population study, hand OA was detected by US in a proportion of up to 70% and was more frequently found at the DIP level (Abraham et al. 2014).

In a real-life context, clinicians face the difficulty to differentiate between OA and other hand arthropathies, in particular when the clinical examination is equivocal (e.g., no obvious bony enlargement with the characteristic distribution for hand OA). Despite recent effort in establishing US scores for hand OA (Keen et al. 2008), no guidelines recommend a certain US protocol for hand examination in OA.

Our study aimed to investigate the usefulness of a standardized US examination protocol for hand joints in diagnosing OA when the clinical picture is equivocal and to compare different US scores. In addition, we correlated the US findings with clinical, inflammatory and radiographic parameters. We also aimed to establish the proportion of patients with imaging evidence of osteophytes with the distribution required for diagnosis of hand OA, identified by various hand US protocols versus conventional radiography, to assess whether a simplified US examination protocol can have clinical utility for early diagnosis of hand OA.

METHODS

Patient recruitment

This is a prospective, cross-sectional study, which evaluated patients referred to our US rheumatology outpatient clinics, presenting with hand joint pain and no obvious clinical signs of synovitis, gouty tophi or osteophytes to support a diagnosis of inflammatory, crystal arthropathy or OA. As these patients did not fulfill the clinical ACR classification criteria for hand OA, they needed an US scan and additional investigations to facilitate diagnosis. For each patient, a set of demographic, clinical and laboratory data were recorded at the time of the scan, as well as their provisional diagnosis. Patients ultimately diagnosed with another hand pathology were excluded. Included in the final analysis were 62 patients diagnosed with hand OA based on EULAR recommendations (Zhang et al. 2009). All the patients were assessed clinically at the time of their US scan, and had the laboratory tests results done within 8 wk of the US scan.

Ethical issues

The data were collected as a standard of practice in our rheumatology department. The study analyzed the results of the US examinations of patients seen in our US clinics during the period January 2015–December 2017, using our local US clinic proforma. The study was approved by the local ethics committee (ref. 13/LO/0999). Each participant consented to take part in the study.

Disease assessment

We collected information about disease duration (in mo), clinical joint examination findings including hand tender joint count (TJC) and hand swollen joint count (SJC), as well as a patient-reported global assessment score. All patients included in the final analysis had bilateral hand radiographs (postero-anterior view) within 12 mo of the US scan.

Additional data about the high-sensitivity C-reactive protein, erythrocyte sedimentation rate, presence of rheumatoid factor, anti-citrullinated cyclic peptides antibodies and anti-nuclear antibodies were also collected at the time of the scan (needed to exclude associated hand joint pathology).

Ultrasound examination

We used an established protocol of US examination of hands comprising 32 joint assessments (dorsal longitudinal and transverse views of wrists and MCP, PIP, DIP and carpometacarpal 1 [CMC-1] joints). The presence of active joint inflammation was defined as Power Doppler (PD) signal within a region of gray-scale (GS) synovitis, which was graded 1–3; synovial thickening GS synovitis was graded 1–3; and joint effusion as present or absent, per the Outcome Measures in Rheumatoid Arthritis Clinical Trials (OMERACT) definitions developed for rheumatoid arthritis (RA) (Mandl et al. 2011). Erosions were defined as an intra-articular discontinuity of the bone surface that is visible in two perpendicular planes (Wakefield et al. 2005), and osteophytes as characteristic cartilage pathology as defined by OMERACT/Osteoarthritis Research Society International initiative (Iagnocco et al. 2012). US examination was performed by the same clinician (C.C.), with 6 y of experience in running weekly US clinics. Figure 1 shows examples of hand OA US features scored according to OMERACT/Osteoarthritis Research Society International protocols. For the diagnosis of OA on US, we considered mandatory the presence of osteophytes, associated or not with joint erosions, effusion, synovial hypertrophy or PD signal. The osteophytes were defined as hyperechoic signal in the area of the attachment of the joint capsule to the bony cartilaginous margin that correspond with the eventual appearance of osteophytes visualized on the conventional radiography, as previously described (Moller et al. 2008). US examination was performed using an Logiq S8 US machine (GE Medical Systems Ultrasound and Primary Care Diagnostics, Wauwatosa, WI, USA), equipped with a multi-frequency linear matrix array transducer (8–22 MHz). B-mode and PD machine settings were optimized for all US examinations.

For the conventional hand radiography osteophyte scoring, we used the Kellgren-Lawrence method to assess for the presence of osteophytes (Kellgren and Lawrence

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