Ultrasonography in the Diagnosis and Management of Spondyloarthritis

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Overview

• MSUS is an excellent tool to study extraspinal manifestations of spondyloarthropathy
  – Use in Diagnosis of SpA
  – Use in Monitoring and Treatment of SpA
    • Ie. Scoring systems (GUESS)

• Unique features of SpA
  – Dactylitis

• Future research and applications
What Can US Assess in SpA?

- Peripheral Joints
- Tendons
- Enthesis

GRAPPA (Group for Research and Assessment of Psoriasis and Psoriatic Arthritis)
Ultrasound in SpA

• Frequency of abnormal peripheral entheses is very high among SpA patients

• Abnormal entheses uniformly found in SpA, irrespective of disease type

• May be only manifestation of SpA in early disease

Clinical Impact of Early Diagnosis

• Improved outcomes for patients with Rheumatoid arthritis well established.

• What about patients with Spondyloarthritis?


Delayed diagnosis of PsA is associated with worse long-term outcomes

Association of clinical features with >6 month delay in diagnosis (univariate analysis model)

<table>
<thead>
<tr>
<th>Clinical Feature</th>
<th>Odds Ratio (95% CI)</th>
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<tr>
<td>Erosions</td>
<td>4.6 (2.5–8.2)</td>
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<td>Number of deformed joints</td>
<td>1.1 (1.0–1.1)</td>
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<tr>
<td>Sacroiliitis</td>
<td>2.3 (1.2–4.4)</td>
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<td>Arthritis mutilans</td>
<td>10.6 (1.4–80.6)</td>
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<td>Functional disability</td>
<td>2.2 (1.3–3.6)</td>
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<tr>
<td>DMARD/anti-TNF free</td>
<td>0.4 (0.2–0.9)</td>
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</table>

*p<0.05; **p<0.01; ***p<0.001

*Clinical features recorded as percent, unless otherwise stated
DMARD, disease-modifying antirheumatic drug;
HAQ, health assessment questionnaire; OR, odds ratio

Enthesitis Clinical Evaluation

• Tenderness at enthesial insertion site

• MEI – 66 enthesis sites – most comprehensive

• Commonly used: more paired down versions such as LEI (Leeds Enthesitis Index) – 6 most commonly involved sites in PsA *

• Pitfall: overlap with FMS tenderpoints near lateral epicondyle, medial femoral condyle

• - Need for MSUS

*Healy 2008
2005
Enthesopathy OMERACT Definition

- Tendon or ligament insertion into the cortical bone** which is abnormally hypoechoic (loss of normal fibrillar architecture) and/or thickened. Seen in 2 perpendicular planes and may exhibit Doppler signal and/or bone changes, including enthesophytes, erosions or irregularity.

** Occasionally may contain hyperechoic foci consistent with calcifications.


Enthesitis: Traditional View

Achilles Tendon

Long Axis

Enthesitis

Calcaneus

1. Hypoechoogenicity and increased thickness of the tendon insertion
   – Lack of the homogeneous fibrillar pattern
   – Increased thickness of the tendon/ligament/capsule insertion

2. Enthesophytes

3. Calcifications

4. Erosions—OMERACT definition

5. Doppler signal at enthesis ~ <2 mm near the bony cortex
   – The Doppler signal must be at the enthesis, different from reflecting surface artifact or nutrition vessel signal, with or without cortical irregularities, erosions or enthesophytes.
Ultrasound in SpA

- Hallmark of inflammatory peripheral enthesitis is vascularization at cortical bone insertion as seen by power doppler

- Detection of any vascularized enthesis by PDUS has good sensitivity/specificity for dx SpA

- Technique is sensitive to change: disappearance of vascularization with anti TNF Rx and reappearance with relapse

Achilles Enthesitis

Hypoechogenecity and increased thickness

Vascularity within body of tendon

GRAPPA (Group for Research and Assessment of Psoriasis and Psoriatic Arthritis)
Achilles Enthesitis

Achilles Enthesitis

Calcaneal Erosion

GRAPPA (Group for Research and Assessment of Psoriasis and Psoriatic Arthritis)
Enthesitis: Bone Abnormalities

GRAPPA (Group for Research and Assessment of Psoriasis and Psoriatic Arthritis)
Enthesitis Scoring Systems
Glasgow Ultrasound Enthesitis Scoring: GUESS

*Most frequently used Scoring system available

US examination at the following 5 sites:

- Superior pole of patella (quadriceps insertion)
- Inferior pole of patella (patellar ligament origin)
- Patella ligament insertion at tibial tuberosity
- Achilles tendon
- Plantar aponeurosis

Scoring on US: bursitis, tendon thickness, enthesophyte and bone erosion

D’Agostino MA, ibid

* Gandjbakhch et al Arthritis Research and Therapy 2011
Examination done bilaterally
• Inferior pole of calcaneus: plantar aponeurosis enthesis
• Superior pole of calcaneus: Achilles tendon enthesis
• Tibial tuberosity: distal patellar ligament enthesis
• Inferior pole of patella: proximal patellar ligament enthesis
• Superior pole of patella: quadriceps tendon enthesis
• Olecranon tuberosity: triceps tendon enthesis

Score: tendon structure and thickness, bursitis 0 or 1; power doppler and erosion 0 or 3; calcification 0 to 3

Value >18 cut off point with sensitivity 83%, specificity 83%

Clinical Application

• MASEI can differentiate between healthy patients, patients with psoriasis, and patients with PsA.
  
  – Cut off of >= 20 used for calculation
  – Sensitivity 30%
  – Specificity of 95% to differentiate PsA from PsO

• No significant difference was found in patients with BMI > 30

BMI and Enthesitis Scoring

- The GUESS score, which primarily analyzes lower body entheses, has been correlated with BMI, and an association between the thickness of the Achilles tendon and BMI has previously been noted. [Balint 2002, Gisondi 2008]

- May not apply for any patient with BMI > 30!
Glasgow Ultrasound Enthesitis Scoring System (GUESS)

Superior pole of the patella—quadriceps tendon enthesis
- Quadriceps tendon thickness ≥6.1 mm
- Suprapatellar bursitis
- Superior pole of patella erosion
- Superior pole of patella enthesophyte

Inferior pole of the patella—proximal patellar ligament enthesis
- Patellar ligament thickness ≥4 mm
- Inferior pole of patella erosion
- Inferior pole of patella enthesophyte

Tibial tuberosity—distal patellar ligament enthesis
- Patellar ligament thickness ≥4 mm
- Infrapatellar bursitis
- Tibial tuberosity erosion
- Tibial tuberosity enthesophyte

Superior pole of the calcaneus—Achilles tendon enthesis
- Achilles tendon thickness ≥5.29 mm
- Retrocalcaneal bursitis
- Posterior pole of calcaneus erosion
- Posterior pole of calcaneus enthesophyte

Inferior pole of the calcaneus—plantar aponeurosis enthesis
- Plantar aponeurosis thickness ≥4.4 mm
- Inferior pole of calcaneus erosion
- Inferior pole of calcaneus enthesophyte
Suprapatellar Longitudinal

- Suprapatellar bursitis
- Superior pole of patella erosion
- Superior pole of patella enthesophyte
- Quad tendon thickness ≥6.1 mm
Suprapatellar bursitis

- Abnormal hypoechoic or anechoic intraarticular material that is compressible and displaceable, without Doppler signal.
Infrapatellar Long-Proximal

- Assess the origin of the ligament at the patella
- Patellar ligament thickness ≥4 mm
- Inferior pole of patella erosion
- Inferior pole of patella enthesophyte
Infrapatellar Long-Distal

- Patellar ligament thickness ≥4 mm
- Infrapatellar bursitis
- Tibial tuberosity erosion
- Tibial tuberosity enthesophyte
Infrapatellar Transverse

- May demonstrate fluid in the infrapatellar bursae
Infrapatellar Enthesitis

Longitudinal

Transverse
Ankle – Posterior Longitudinal

- Achilles tendon thickness ≥5.29 mm
- Retrocalcaneal bursitis
- Posterior pole of calcaneus erosion
- Posterior pole of calcaneus enthesophyte

Images: Kohler, M
Achilles Enthesopathy/Enthesitis

Retrocalcaneal bursitis
• Plantar aponeurosis thickness ≥4.4 mm
• Inferior pole of calcaneus erosion
• Inferior pole of calcaneus enthesophyte
Enthesopathy Plantar Fascia

Long Axis

Short Axis

GRAPPA (Group for Research and Assessment of Psoriasis and Psoriatic Arthritis)
US for Enthesopathy

- 35 SpA patients
- Mean GUESS Score = 6.9
  (total possible = 36)
- Abnormality detected by US in 56% of sites and by clinical exam in 22%
- 2011 Tinazzi et al: GUESS score predictive of subsequent PsA (PsO cohort) 9.5 vs 6.6
- Eder 2012 Average GUESS for HC 4.4 vs. 8.9 for PsA, 5.6 for PsO

Clinical Relevance

“The identification of enthesitis in patients with psoriasis is becoming increasingly significant, because studies have suggested that higher enthesitis scores detected by the GUESS system, and the involvement of joints using both greyscale and power Doppler US signals is predictive of the development of PsA in patients with psoriasis.”

MASEI and PsA damage

• Higher MASEI score associated with more peripheral joint damage and a greater chance of patients developing joint ankyloses and/or arthritis mutilans.

• Also associated with greater axial damage, thus demonstrating the importance of not only diagnosing a patients with PsA, but also identifying patients with enthesitis.

Where we are Currently

• A proper US index for enthesitis could be used to diagnose early PsA and thereby improve patient outcomes.

• Currently, no index exists that accounts for the Delphi exercise update to the OMERACT definition for enthesitis, and no consensus for the best index has been reached. [Micu 2016]
Case

- 35 yof presents with 4 mo of swelling of her right thumb
- Interfering w her time at the gym
- Does have history of psoriasis
Images

Extensor Tendinosis/Paratenonitis

Flexor Tenosynovitis
Dactylitis

- Characteristic feature of SpA
- Painful or relatively assx chronically swollen digit
- Occurs in 16 – 48 % of PsA patients
- May be sole manifestation
- Ddx: TB, Syphilis, Gout

Olivieri, I et al J Rheumatol 2007
Taylor W et al Arthritis Rheum 2006
Dactylitis Old Concepts

Predominantly flexor tenosynovitis

Dactylitis

Diffuse Soft Tissue Swelling

Synovitis

Contralateral Normal Toe

Plantar Tenosynovitis

## Content Validity

### Ultrasound / MRI Definition of Dactylitis or of Its Elementary Components Demonstrated by Study

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### Elementary components

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Nail Changes

Oblietration of nail bilayer and increased nail bed thickness

Fibers of extensor tendon merge with proximal nail matrix

Images: GRAPPA, Kaeley, G
Palmar Plate Inflammation

Metacarpal Head - MH
Base of proximal phalange - Pb
Palmar Plate - PP
Volar recess - R

Images: GRAPPA, Kaeley, G
Differentiation of Inflammatory Arthritis

• Early RA vs PsA: Dorsal MCP involvement
  – 2.5% of patients with RA
  – 54.1% of patients with PsA

Enthesitis Images (Finger DIP/Dorsal)

MP = Middle phalanx, DP = Distal phalanx,
* = Enthesophyte at Extensor tendon insertion onto distal phalanx, ** = enthesopathy of extensor tendon (thickened, hypoechogenic, loss of fibrillar architecture)
BMI and Enthesitis Cont

• US indices should focus more on the smaller, peripheral joints commonly affected in PsA and not expected to be affected by BMI.

New role: Axial evaluation?

- Sacroiliitis and spondylitis: may be a future role for contrast enhanced color doppler of SI joints

Summary

• Sonography depicts extraspinal manifestations of spondyloarthropathy
  – Synovitis, erosions, osteoproliferation
  – Enthesitis—including ultrastructural changes of surrounding tissues
  – Power Doppler allows detection of vascularity without use of contrast
Thank you!