Ultrasound in Rheumatology

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Objectives

• Introducing arthritis
• Inflammatory arthritis
• Rheumatoid arthritis
• Other inflammatory arthritides
• Role of US in early diagnosis
• Role of US in disease management
• Hints and tips
Introducing arthritis

‘Acute or chronic inflammation of one or more joints, usually accompanied by pain and stiffness, resulting from infection, trauma, degenerative changes, autoimmune disease, or other cause’

- Osteoarthritis
- Inflammatory arthritis
Inflammatory Arthritis

People seeking help from GP/year

- Rheumatoid arthritis – 350,000
- Gout – 250,000
- Ankylosing spondylitis – 115,000
- Juvenile Idiopathic arthritis – 12,000
- Rarer disorders – Lupus, polymyalgia rheumatica
Rheumatoid arthritis (RA)

- Chronic, progressive auto immune disease
- Affects around 600,000 people in the UK, most commonly women and between 40 and 60 years of age
- Primarily affects synovial joints producing an inflammatory response
- Causes swelling, effusion, synovitis and can lead to bone destruction
- Common sites: Wrists, MCPjs 2&3, elbows, knees, ankles, MTPjs
Treatment for RA

• Early diagnosis
• Aggressive treatment
  – DMARDS
  – Anti TNF
  – Biologic therapy
  – Steroid
Diagnosis of RA

- Can be difficult
- Combination of symptoms, family history, lab tests and imaging
- Blood tests may be negative or inconclusive
- X rays show damage already done
Ultrasound

- Safe
- Well tolerated
- Relatively cheap
- Reproducible
- Shows early stages of ‘inflammation’
Ultrasound appearances
Synovial hypertrophy/synovitis

• Synovial hypertrophy – primary event visible on imaging

• Hyperaemia - sign of active disease

• Grade of hypertrophy/activity equates to the level of disease/activity
Ultrasound appearances
Tenosynovitis

- Inflammation of the sheath lining
- Hypoechoic, hyperaemic lining
- Effusion

- Know your anatomy....
Ultrasound appearances

Bone erosion

- Progressive destruction
- Targets articular cartilage
- May be seen earlier on US than x ray
- Detection of flow within erosion — a sign of active destruction
Ultrasound technique

• Equipment
  – Mid to high end machine
  – High frequency transducers
  – Doppler sensitivity to low flow (PRF etc)
  – Thick gel, light pressure
Protocol

- Small joints and tendons
  - hands
  - feet
  - symptomatic joints?
  - large joints?

- Scan in two planes –
  Find activity in LS, grade in TS
Grading of synovial hypertrophy on grey scale and synovitis on Doppler

**Grey scale grading**
- Grade 0 - no synovial thickening
- Grade 1 - minimal synovial thickening without bulging over the line linking tops of the bones
- Grade 2 - synovial thickening bulging over the line linking tops of the periarticular bones
- Grade 3 - synovial thickening bulging over the line linking tops of the periarticular bones with extension

**Power Doppler grading**
- Grade 0 - no flow in the synovium
- Grade 1 - single vessel signals
- Grade 2 - confluent vessel signals in less than half of the area of the synovium
- Grade 3 - vessel signals in more than half of the area of the synovium.

Berner Hammer 2011
Patient position

- Comfort
- Stability
- Ergonomics
Pitfalls – patient position

neutral position

flat position

Husic et al 2017
Pitfalls - steroids

- Oral, intramuscular or infusion will temporarily reduce inflammation and hyperaemia.
- Decrease in inflammation is associated with a decrease in Doppler signal.
- Use of steroids prior to a scan may mean that a scan appears normal when in fact, there is significant inflammatory arthritis.

A. Active synovitis before steroid treatment,
B. 4 weeks after steroids
C. 12 weeks after treatment
Other inflammatory arthritides

• Seronegative spondyloarthropathy
  – Psoriatic arthritis
  – Ankylosing spondylitis
  – Enteropathic arthritis

• Common sites
  – Wrists - synovitis
  – Hand/wrist tendon/sheaths – tenosynovitis
  – Extensor enthesitis proximal interphalangeal joints (PIPJs)
  – Achilles/plantar fascia enthesitis
  – Interdigital bursitis
  – Subacromial bursitis

Achilles enthesitis
Crystal arthropathy - Gout

• Acute attacks
• Elevated levels of uric acid
• Deposited on cartilage (double contour) and within soft tissues (tophi)
• Common sites
  – 1st MTPj
  – knees
Crystal arthropathy - Pseudogout

- Acute attacks
- Calcium pyrophosphate dehydrate crystals
- Deposited within cartilage
- Common sites
  - Wrist - TFCC
  - Knees - menisci
Role of US in early diagnosis

- Nice Guidelines
- Early referral to rheumatology
- Early synovitis clinics
- Accurate diagnosis
- Alternative diagnoses
Role of ultrasound in disease management

• RA patient, on Anti TNF – no clinical signs, ‘asymptomatic’

• RA patient, on Anti TNF - no clinical signs, ‘symptomatic’
Ultrasound guided aspiration/injections

- Increase accuracy – confirm effusion
- Increase safety
- Increase patient satisfaction
- Reduce procedural pain scores

Sibbett 2009

- Improve patient outcome?
Who should image/inject these patients?

- **Radiology**
  - Radiologists
  - Sonographers

- **Rheumatology**
  - Rheumatologists
  - Rheumatology nurses
  - Physiotherapists
  - Occupational therapists
  - Podiatrists
Advantages of a Multidisciplinary team

- Robust service
- Skills used appropriately
- Financially viable
RWT Musculoskeletal ultrasound team
Comparative Annual Cost of Injection Service

Assumes 1200 Injections taking 30 mins each = 600 Hours

- **£30,000** Consultant Rheumatologist
- **£19,900** 90% Consultant Sonographer / 10% Dr
- **£14,750** 10% Dr / 20% CS / 70% Nurse
Who injects? - the choice

Purely therapeutic

- Diagnosis already made
- Decision to inject already made
- Direct drug to a specific site

Pre requisite: Skills in ‘blind’ joint injections
Requires training in: US instrumentation, US anatomy, needle guidance

Diagnostic and therapeutic

- Diagnosis not made
- Decision to inject dependent on scan
- Direct drug to site of pathology on US

Pre requisite: Skills in diagnostic MSK ultrasound
Requires training in: Joint injections
Our model of training for those with injecting skills:

Certificate in focused Ultrasound Practice
• 5 mandatory study days - Principles of ultrasound
• Self directed study- 120 hours
• 2 assignments - Ultrasound physics based
• Portfolio – Reflective diary, case report, practice log book
• 1 area – 30 hours mentored clinical training, 30 patients
Our model of training for those with ultrasound skills:

**Principles and Practice of Joint and Soft Tissue Injection**

- 4 mandatory study days – techniques, asepsis, management of anaphylactic shock, pharmacology, precautions, professional issues
- Portfolio – critical thinking, evidence of formal training, 10 cases, experiential learning, reflection.
- Assignment in topic related to joint injections
How?

- Mentor
- Core subject assessed/achieved
- Ongoing training – each area assessed separately
- Allows ‘stepped’ approach
Clinical Governance

- Medical lead with ultrasound competency
- Contact with Radiology
- Providing a constant service
- Competency
- Machine/Images/Reports
- Protocols – training and delivery
  - RCR publications and guidance
  - Clinical competency
Ultrasound diagnosis + injection

• RA patient with elbow pain
• Request
  – ? Synovitis. If so, for steroid injection
Ultrasound guided elbow injection
Ultrasound diagnosis

- New patient
- Request
  - ? Synovitis MCPjs
  - Refer to rheumatology nurse for IM steroids
In conclusion

• GP requests – NICE guidelines
• Discuss with Rheumatology
• Revise anatomy – bone and soft tissue
• Ask questions
• If in doubt..raise the possibility of an inflammatory condition
Be careful.....
Always use Doppler...
The aim
To avoid this..

Thank you
Any Questions?
Useful references


**Wakefield RJ** *et al* Musculoskeletal Ultrasound Including Definitions for Ultrasonographic Pathology OMERACT SIG. *Journal of Rheumatology* 2005

**Rusmir H** *et al.* Joint positions matter for ultrasound examination of RA patients—increased power Doppler signal in neutral versus flat position of hands *Rheumatology* 2017; 56: 13121319