

# Ultrasound white paper review

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# *disclosures*



Consultant: Genzyme

REVIEW ARTICLE

**Ultrasound in American Rheumatology Practice**

Report of the American College of Rheumatology

Musculoskeletal Ultrasound Task Force

American College of Rheumatology (ACR) Musculoskeletal Ultrasound Task Force

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# MSUS Task Force Timeline

- 2/07 CORC project proposal
- 10/07 Task Force convened
- 1/09 first draft submitted to ACR
- 1-9/09 vetting, revisions, review
- 10/09 submitted to AC&R, rejected
- 12/09 resubmitted
- 2/09 accepted pending (21) revisions

# Aim of TF report: address concerns of American rheumatologist considering US

- Technical aspects
- Capabilities of US
- Impact of US on rheumatology practice
- Educational issues

# Technical concepts in US

3 pages

- Topics
  - Basics of US physics
  - Frequencies required for MSUS
  - Color Doppler
- not covered
  - Equipment
  - Documentation requirements\*

# US of MCP synovitis in RA



gray-scale



power Doppler

# US visualization of MS structures – 4½ pages

- Knowledge base in structural visualization
- US reproducibility in dx testing (11 studies)
- US performance as a dx test: validity
  - US vs MRI (14 studies)
  - US vs XR (6 studies)
  - US vs clinical dx (4 studies)
  - US vs pathology (8 studies)

**Table 1.** Upper extremity pathologies identified by musculoskeletal US

| <b>Joint</b> | <b>Pathologies</b>   |   |  |
|--------------|--|---|--|
| Shoulder     | <b>Axillary recess:</b><br>-Effusion<br>-Synovial proliferation  | <b>Cartilage lesions</b>  | <b>Loose body</b>  |
|              | <b>Osteochondromatosis</b>   | <b>Calcifications</b>   | <b>Deltoid muscle:</b><br>-Hematoma<br>-Tear   |
|              | <b>Rotator Cuff:</b><br>-Tear<br>-Calcific tendonitis  | <b>Humeral head:</b><br>-Bony lesion (erosion, osteophyte)<br>-Irreg. contour   | <b>Biceps:</b><br>-Tear<br>-Tenosynovitis  |
|              | <b>Bursitis:</b><br>-Subacromial<br>-Subdeltoid  | <b>Acromioclavicular joint:</b><br>-Synovial proliferation<br>-Effusion<br>-Dislocation   | -Effusion<br>-Dislocation  |
| Elbow        | <b>Humero-radial and humero-ulnar joints:</b><br>-Synovial proliferation<br>-Effusion<br>-Bony lesions<br>-Loose joint body                            | <b>Lat/medial epicondylitis</b>   | <b>Subcutaneous tissue:</b><br>-Tophi<br>-Rheumatoid nodule  |
|              |  | <b>Oleocranon fossa:</b><br>-Bursitis<br>-Synovial prolif.  | <b>Ulnar nerve:</b><br>-Structural change<br>-Compression  |
|              |  | <b>Oleocranon bursa:</b><br>-Bursitis   |  |
| Wrist        | <b>Radio-ulno-carpal joint:</b><br>-Synovial proliferation<br>-Effusion<br>-Calcifications<br>-Bony lesions<br>-Ganglion<br>-Triangular fibrocartilage | <b>Carpal tunnel:</b><br>-Tenosynovitis<br>-Structural changes<br>-Ganglion   | <b>Extensor tendons:</b><br>-Tenosynovitis<br>-Structural changes<br>-Ganglion<br>-Rheumatoid nodule |
|              | Hand   | <b>Joints:</b><br>-Effusion<br>-Synovial cysts<br>-Synovial proliferation<br>-Cartilage thinning/lesions<br>-Bone lesions (erosion, osteophytes)<br>-Ganglion | <b>Articular dislocation</b>   |
|              |  | <b>Peri-articular lesions:</b><br>-Calcinosis<br>-Crystal deposition<br>-Rheumatoid nodules   |  |

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**Table 2.** Lower extremity pathologies identified by US

| Joint | Pathologies  |   |  |
|-------|--|---|--|
| Hip   | <b>Joint effusion</b><br><b>Synovial proliferation</b><br><b>Osteochondromatosis</b>   | <b>Bony lesion:</b><br>-Erosion<br>-Osteophyte<br>-Irreg. bone surface<br>-Slipped capital femoral epiphysis  | <b>Cartilage lesion</b><br>Calcifications<br><br><b>Infection</b><br><b>Loose prosthesis</b><br><b>Loose body</b>                              |
|       | <b>Bursa:</b><br>-Trochanteric<br>-Iliopectineal   |   |  |
| Knee  | <b>Supra/parapatellar pouch:</b><br>-Synovial prolif.<br>-Synovial folds<br>-Effusion  | <b>Popliteal sulcus:</b><br>-Bursitis<br>-Synovial proliferation  | <b>Tuberosity of tibia:</b><br>-Irreg. bony contour<br>-Infrapatellar bursitis   |
|       | <b>Quadriceps tendon:</b><br>-Tear (partial/complete)<br>-Enthesopathy   | <b>Patellar ligament:</b><br>-Tear (partial/complete)<br>-Enthesopathy  | <b>Ligaments:</b><br>-Tear or Lesion   |
|       | <b>Femoropatellar joint:</b><br>-Irreg. contours<br>-Bony lesions  | <b>Deep infrapatellar bursa and subcutaneous prepatellar bursa:</b><br>-Bursitis  | <b>Meniscus (lat/medial):</b><br>-Lesion or Cyst<br><br><b>Popliteal fossa:</b><br>-Popliteal cyst<br>-Vessel compression                      |
|       |  |   |  |
| Ankle | <b>Talocalcaneonavicular joint:</b><br>-Synovial prolif.<br>-Effusion<br>-Cartilage lesions<br>-Bony lesions<br>-Loose joint bodies<br>-Osteochondro-matosis | <b>Muscles (tibialis anterior &amp; posterior, peroneus):</b><br>-Tenosynovitis<br>-Tear<br>Achilles tendon nodules:<br>-tophi<br>-rheumatoid<br>-xanthomas | <b>Achilles tendon:</b><br>-Calcification<br>-Tear<br>Tendonitis/paratendonitis<br>-Enthesopathy<br>-Bursitis<br>(retrocalcaneal, superficial) |
|       |  |   |  |
| Foot  | <b>Joints:</b><br>-Effusion<br>-Synovial proliferation<br>-Cartilage lesions<br>-Bone lesions (erosion, osteophytes)   | <b>Plantar fascia:</b><br>-Plantar fasciitis  | <b>Calcaneus:</b><br>-Calcification of plantar fascia<br>-Ossification (calcaneus spur)<br>-Bony lesions<br>-Erosions                          |
|       | <b>Subcutaneous tissue:</b><br>-Gout tophi   | <b>Tendons:</b><br>-Tenosynovitis<br>-Tear<br>-Enthesopathy   |  |

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**Table 3.** Definitions of musculoskeletal pathologies shown by US in inflammatory joint diseases (OMERACT)

| <b>Pathology</b>     | <b>Definition</b>   |
|----------------------|---|
| RA Bone Erosion      | An intraarticular discontinuity of the bone surface is visible in two perpendicular planes.   |
| Synovial Fluid       | Abnormal hypoechoic or anechoic intraarticular material (relative to subdermal fat, but sometimes may be isoechoic or hyperechoic).<br>Displaceable, compressible, but without Doppler signal.  |
| Synovial Hypertrophy | Abnormal hypoechoic (relative to subdermal fat, but at times may be isoechoic or hyperechoic) intraarticular tissue that is nondisplaceable and poorly compressible, which may exhibit Doppler signal.  |
| Tenosynovitis        | Hypoechoic or anechoic thickened tissue, with or without fluid within the tendon sheath, seen in two perpendicular planes. May give Doppler signal.   |
| Enthesopathy         | Abnormally hypoechoic (loss of normal fibrillar architecture) and/or thickened tendon or ligament at its bony attachment (may occasionally contain hyperechoic foci consistent with calcification), seen in two perpendicular planes, which may exhibit Doppler signal and/or bony changes including enthesophytes, erosions or irregularity. |

# US performance as a dx test: US vs clinical dx

- RA finger & toes jts: 50% more than PE ascertained tender/swollen
- Early oligoarthritis:
  - 33% of painful jts not clinically inflammed
  - 13% of assx jts
  - 66% of pts had subclinical ds on US
- Knee RA:
  - 2X more suprapatellar fluid collections
  - 5X more Baker's cysts
- Enthesitis (chest wall): PE 72% senst, 63% spec

# Potential impact of US on clinical practice

2 ½ pages

- The undiagnosed case
- Inflammatory arthropathies
- Crystal related arthropathies
- OA

# Potential impact on practice: the undiagnosed case

- Pathoanatomy at painful site
- Change in site-specific diagnosis
- Subclin synovitis in the pt with vague c/o
- Dx features at identified site
  - Enthesopathy
  - Crystals
  - Tendon specifics

# Potential impact on practice: inflammatory arthropathies

- Synovial disease: existence, type, severity, consequences
  - Missed or misassessed by PE
  - ?prognostic features
  - Detection of erosions
- Pathoanatomy of regional flares
- JIA

# Potential impact on practice: crystal related arthropathies

- Urates
  - “double contour sign”
  - Tophi
    - Sensitive to change w/rx
    - “pre-clinical” detection
- Calcific
  - Different patterns than with urates
  - Different locations with affected tissues

# US as an outcome measure - 2 ½ pages

- US use in determining outcome measures
  - Differing needs of clin practice & research
  - OMERACT filters
  - Pitfalls of earlier studies
- Sonographic pathology and outcomes
  - Erosions
  - Synovitis
  - Synovial fluid

# US-guided procedures

2 ½ pages

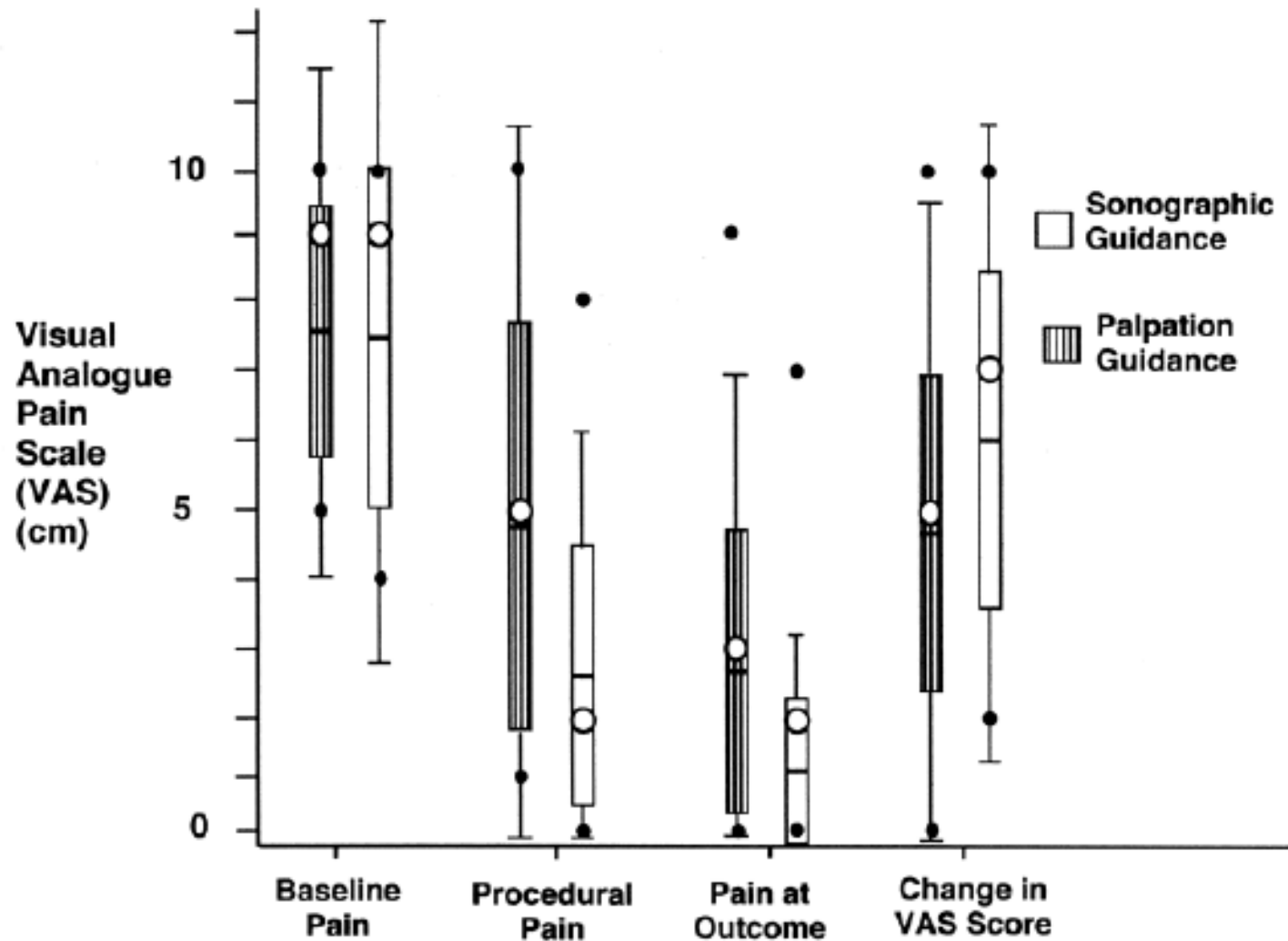
- Accuracy of arthrocentesis
  - Inaccuracy of blind approaches
  - Superiority of US to blind in comp studies
  - Correl of accurate placement w/response
- Safety advantages
  - Additional structures (hip, Baker's cysts, carpal tunnel, ?facets)
  - Avoids cartilage, tendons, extraarticular placement
- Techniques
  - 1-step vs 2-step
  - Calcinosis penetration and lavage
  - PNT
  - Synovial biopsy

# Does Sonographic Needle Guidance Affect the Clinical Outcome of Intraarticular Injections?

WILMER L. SIBBITT Jr, ANDRES PEISAJOVICH, ADRIAN A. MICHAEL, KYE S. PARK, RANDY R. SIBBITT, PHILIP A. BAND, and ARTHUR D. BANKHURST

- 150 subjects (148 completed)
- joints
  - knees – 62    wrists - 29    shoulder – 22    hip – 16
  - elbow – 8    ankles – 4    IP or MTP – 8
- randomly assigned: US-guided or blind (“palpation guided”)
- Outcomes
  - Immediate: volume SF obtained, procedural pain
  - 2 weeks: VAS pain, change in pain score from baseline

# Outcome after injections: US-guided vs blind



all  
 $P < 0.01$

# Educational considerations - 2 pages

- Availability of post-graduate training
- Regulating bodies/certification processes
- E. Kissen program
- US in rheum fellowship
  - PD survey (10/07)
  - Challenges
- US in undergrad education
- Future

# Conclusions

- 2 pages

- US powerful tool in practice of rheumatology
- Training hurdles exist
- Cost-effectiveness data lacking
- US component of, not replacement for, comprehensive approach to dx & mgmt
- Future
  - Learn US & incorporate new techniques
  - US as outcome measure
    - Expanded use
    - Need for standardization
  - Cooperation with radiology
  - Development & Implementation of curriculum

# Postscript: roles for ACR

- Work closely with AIUM
- Address concerns about over utilization (?ethics courses)
- Encourage development at academic rheumatology training centers
- Address payment issues with insurance companies