

MUSCULOSKELETAL RADIOLOGY

GPCME - ROTORUA 2010

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Objectives

- Discuss:
 - commonly used imaging modalities in the musculoskeletal system
 - broad applications
 - primary care availability
 - what to use and when
 - ultrasound
 - playtime

ACKNOWLEDGEMENTS

see it all



MEDISON



ACKNOWLEDGEMENTS



INDICATIONS FOR IMAGING

- CLINICAL
- Pain
- Loss of function
- Mass, swelling
- Instability
- NON CLINICAL
- Expertise
- Protocol
- Greed
- Bulk billing VS Insurance



AVAILABLE METHODS

- History and exam
- Plain radiograph
- Arthrography
- USS
- CT
- MRI
- Scintigraphy
- CT PET & MR PET



CLINICAL TESTING

Tests Used in Shoulder Evaluation and Significance of Positive Findings		
Test	Maneuver	Diagnosis suggested by positive result
Apley scratch test	Patient touches superior and inferior aspects of opposite scapula	Loss of range of motion: rotator cuff problem
Neer's sign	Arm in full flexion	Subacromial impingement
Hawkins' test	Forward flexion of the shoulder to 90 degrees and internal rotation	Supraspinatus tendon impingement
Drop-arm test	Arm lowered slowly to waist	Rotator cuff tear
Cross-arm test	Forward elevation to 90 degrees and active adduction	Acromioclavicular joint arthritis
Spurling's test	Spine extended with head rotated to affected shoulder while axially loaded	Cervical nerve root disorder
Apprehension test	Anterior pressure on the humerus with external rotation	Anterior glenohumeral instability
Relocation test	Posterior force on humerus while externally rotating the arm	Anterior glenohumeral instability
Sulcus sign	Pulling downward on elbow or wrist	Inferior glenohumeral instability
Yergason test	Elbow flexed to 90 degrees with forearm pronated	Biceps tendon instability or tendonitis
Speed's maneuver	Elbow flexed 20 to 30 degrees and forearm supinated	Biceps tendon instability or tendonitis
"Clunk" sign	Rotation of loaded shoulder from extension to forward flexion	Labral disorder

CLINICAL EVALUATION

- No data on the accuracy of history
- Limited evidence for tests of impingement, rotator cuff tear eg Neer, Speed, Hawkins.
- Impingement tests: often sensitive, but not specific
- Cuff tests: Dropping sign, Hornblowers accurate for non-operative tears of t. minor and infraspinatus. Internal rotation lag sign accurate for supraspinatus tears



Luime J Diagnostic Evaluation of shoulder pain



Plain x-rays

For joints like the ankle, elbow or wrist we always take 3 views as a minimum

AP, lateral and oblique

3 views: AP, oblique and lateral



Advantages of plain x-rays

- Quick
- Available
- Not expensive
- Relatively low radiation
- Often forgotten in our high tech world

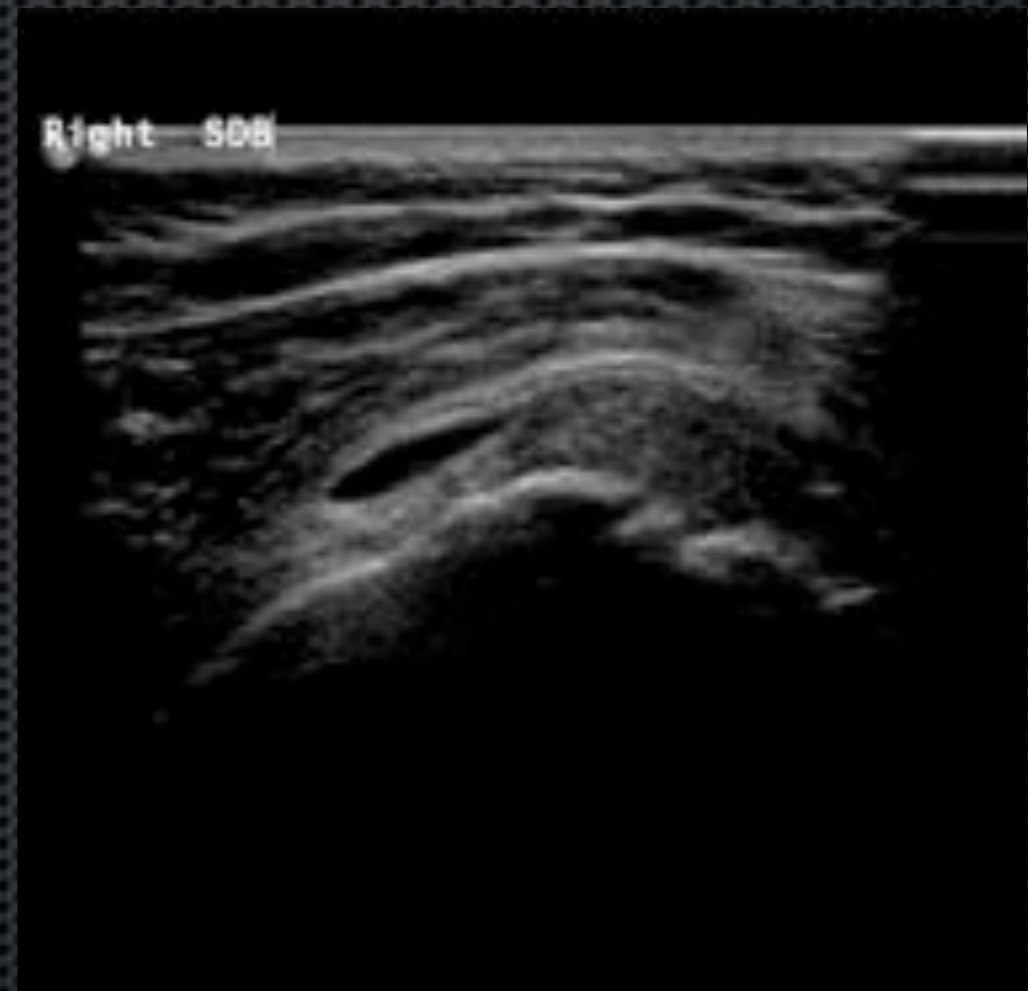
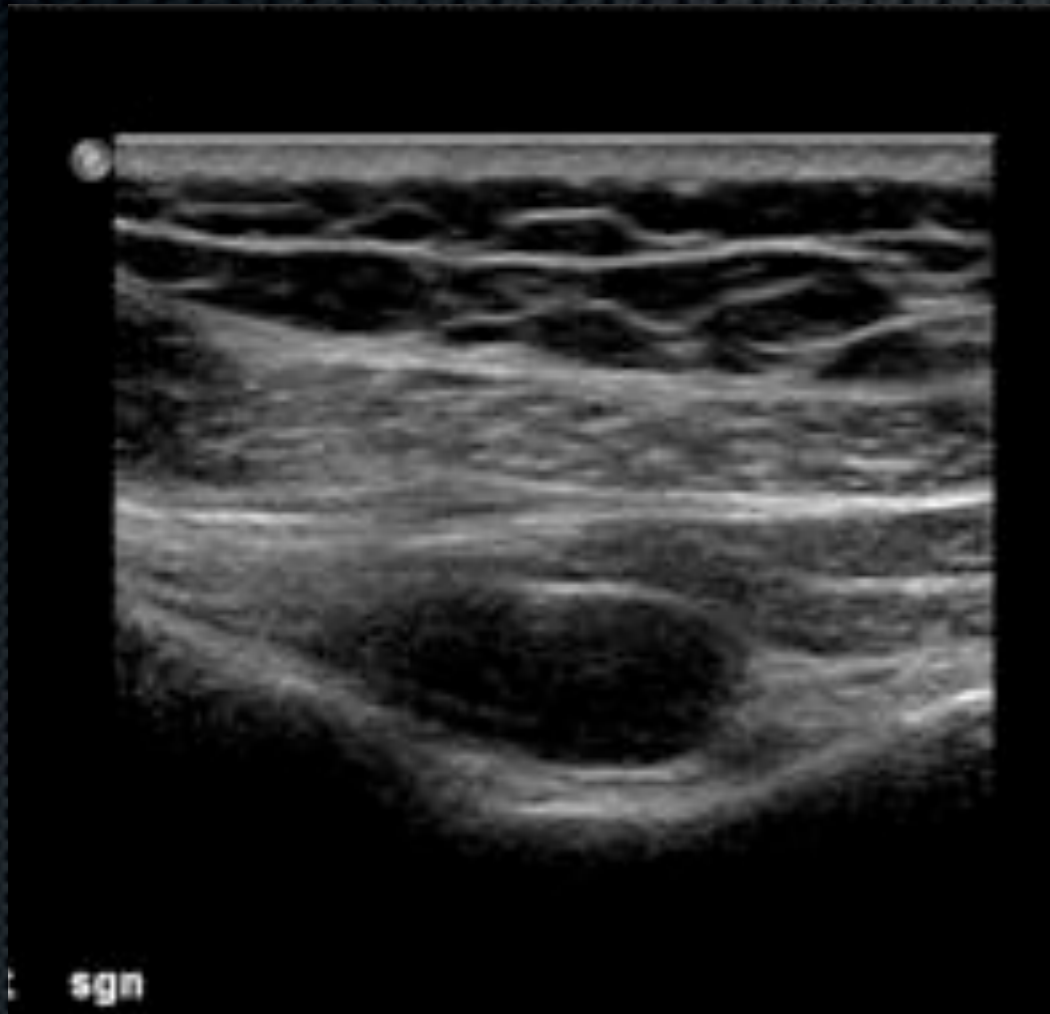
Disadvantages of plain x-rays

- Projectional technique
- Not 3 dimensional
- Can miss pathology
- May still require other imaging studies
- Children are incompletely ossified
- Beware osteopenic elderly bones

USS Pros & Cons

- Cheap
- Portable
- Well tolerated
- Available
- Dynamic
- Free Hx and Exam
- Accurate?
- Better resolution
- No needles
- Operator dependent
- Variable criteria
- Restricted window
- Restricted patient
- Consistency of subjective interpretation

USS MADE FOR FLUID



THE OTHER SHOULDER

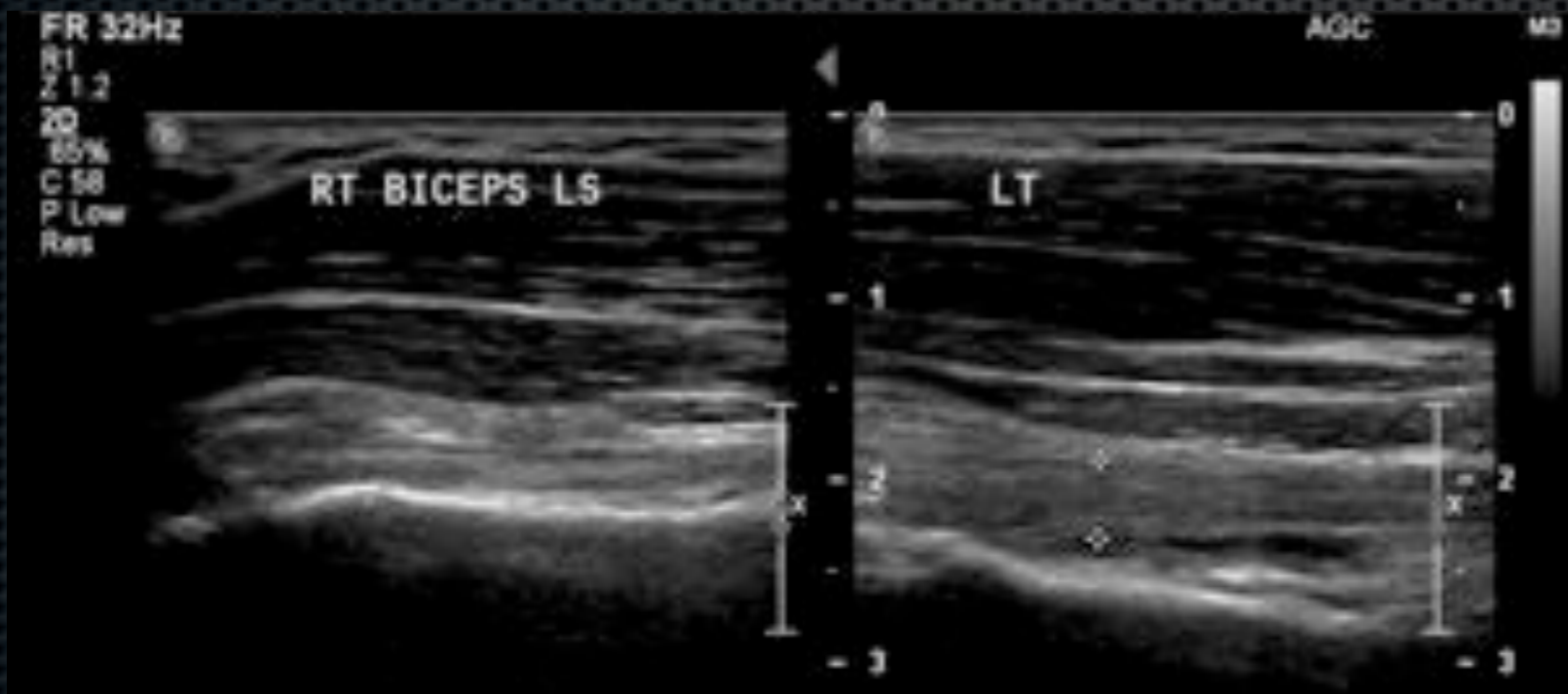
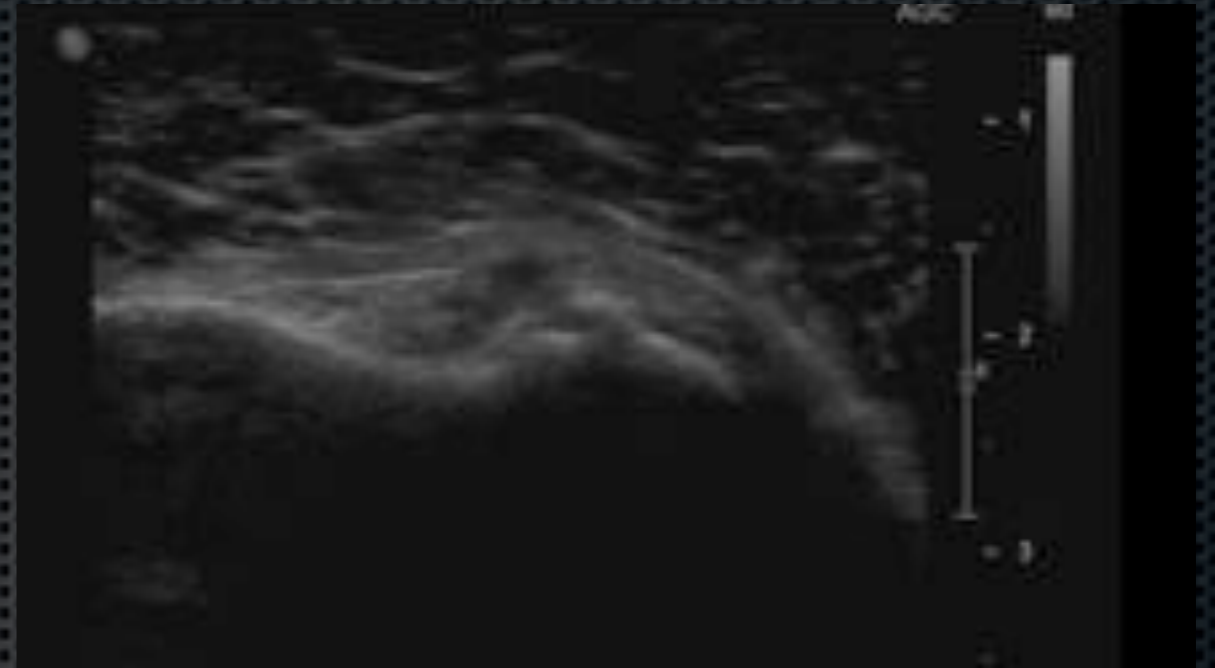
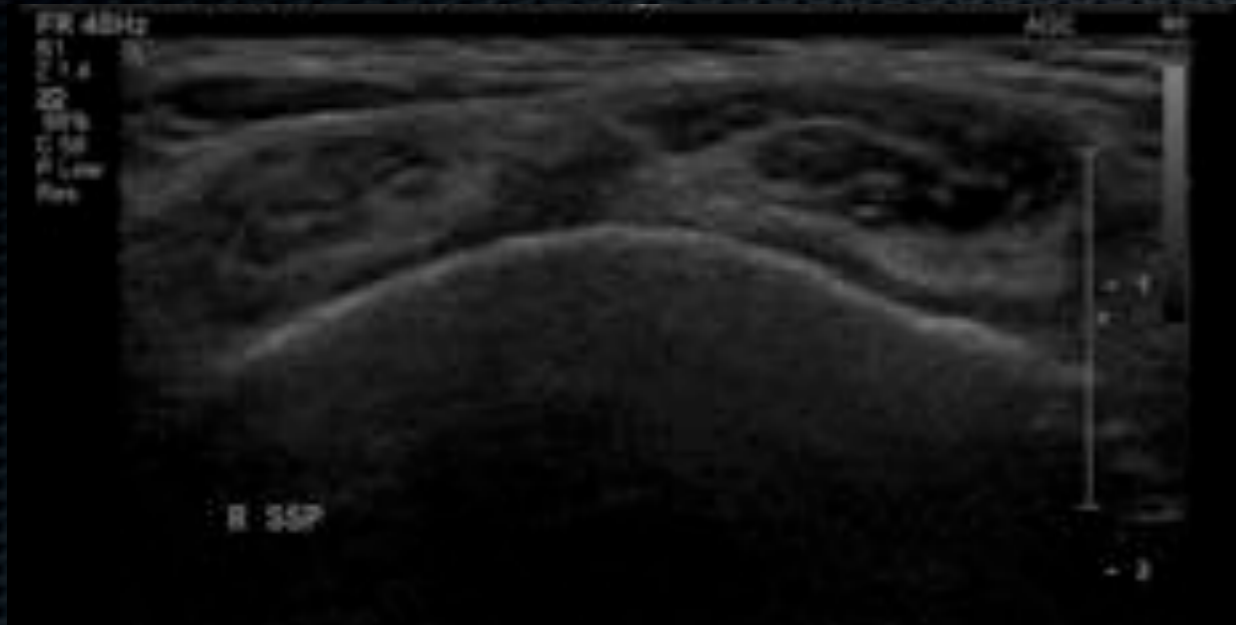
ASYMPTOMATIC



THE OTHER SHOULDER

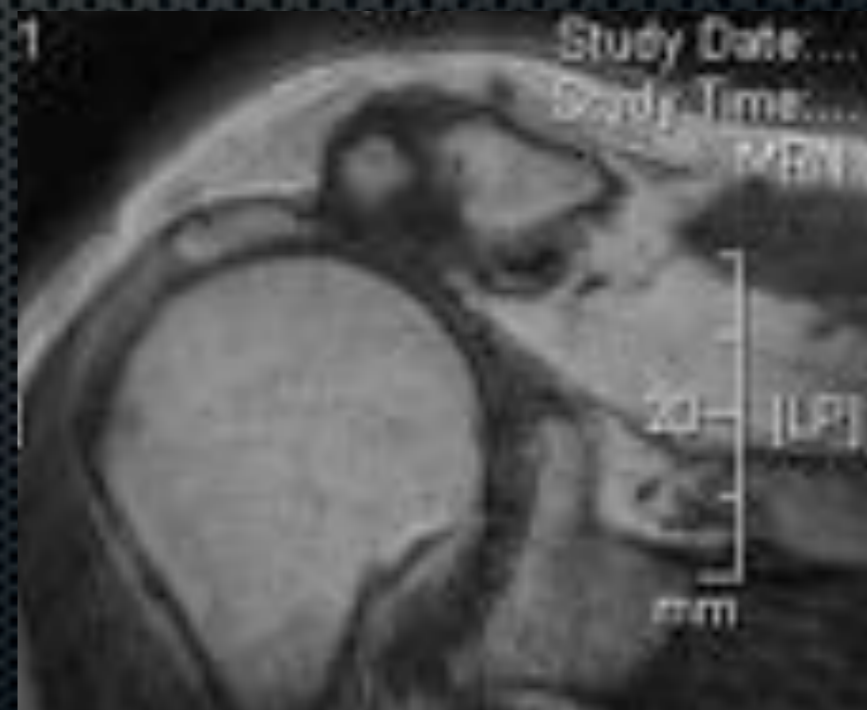
- 40% of overhead athletes had evidence of RC tear in dominant arm – without symptoms! *AOSforSM 2003*
- Patients referred with pain - 53% had tears in asymptomatic shoulder *JBJS 2005 87-B*
- Asymptomatics 34% RC tears. Very few < 40, 50% > 60

76 YR OLD MALE



Complete massive
tear on the left,
asymptomatic
Normal power ,
range of motion –
ABLE TO DO
50 PUSH UPS

CHRONIC MASSIVE TEAR



Scintigraphy

- Most common = Bone Scan
- Very sensitive for skeletal pathology
- Mildly sensitive for soft tissue pathology
- Usually nonspecific as an isolated test
- Mostly patient friendly; no significant environmental exposure
- Small-moderate expense

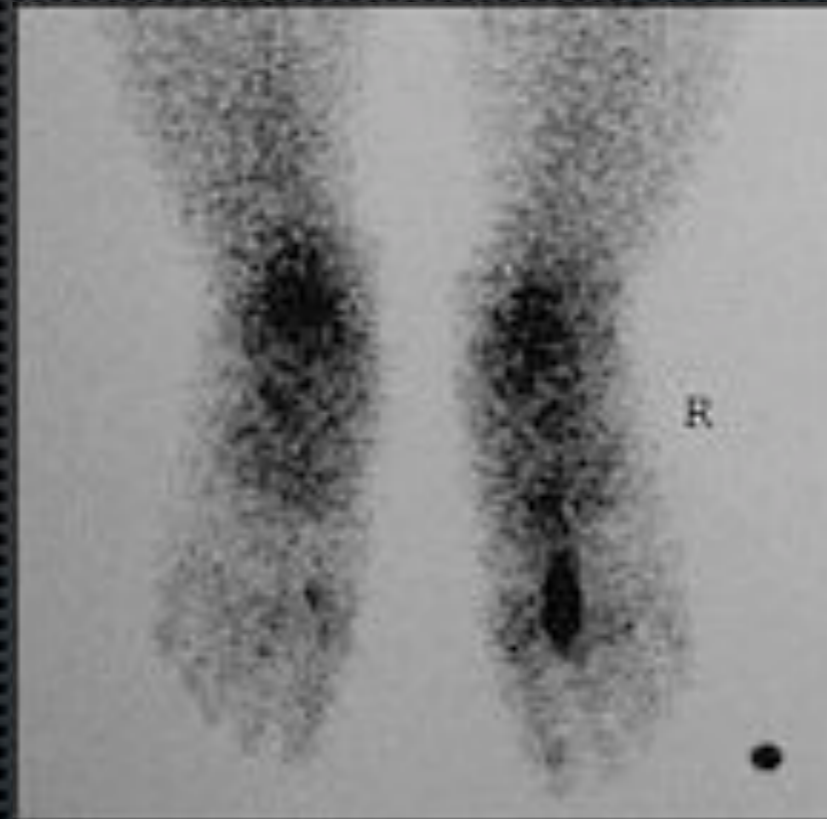
Scintigraphy

- Excellent for specific pathologies
 - Osteomyelitis
 - Metastases – Not Multiple myeloma
 - Occult fracture
- Reasonably reassuring
 - Normal is usually normal

Nuclear Scintigraphy



2nd MT stress fracture



CT SCAN





Multiplanar reconstruction: a longitudinal cross section

This CT shows a fracture through the medial cunieform

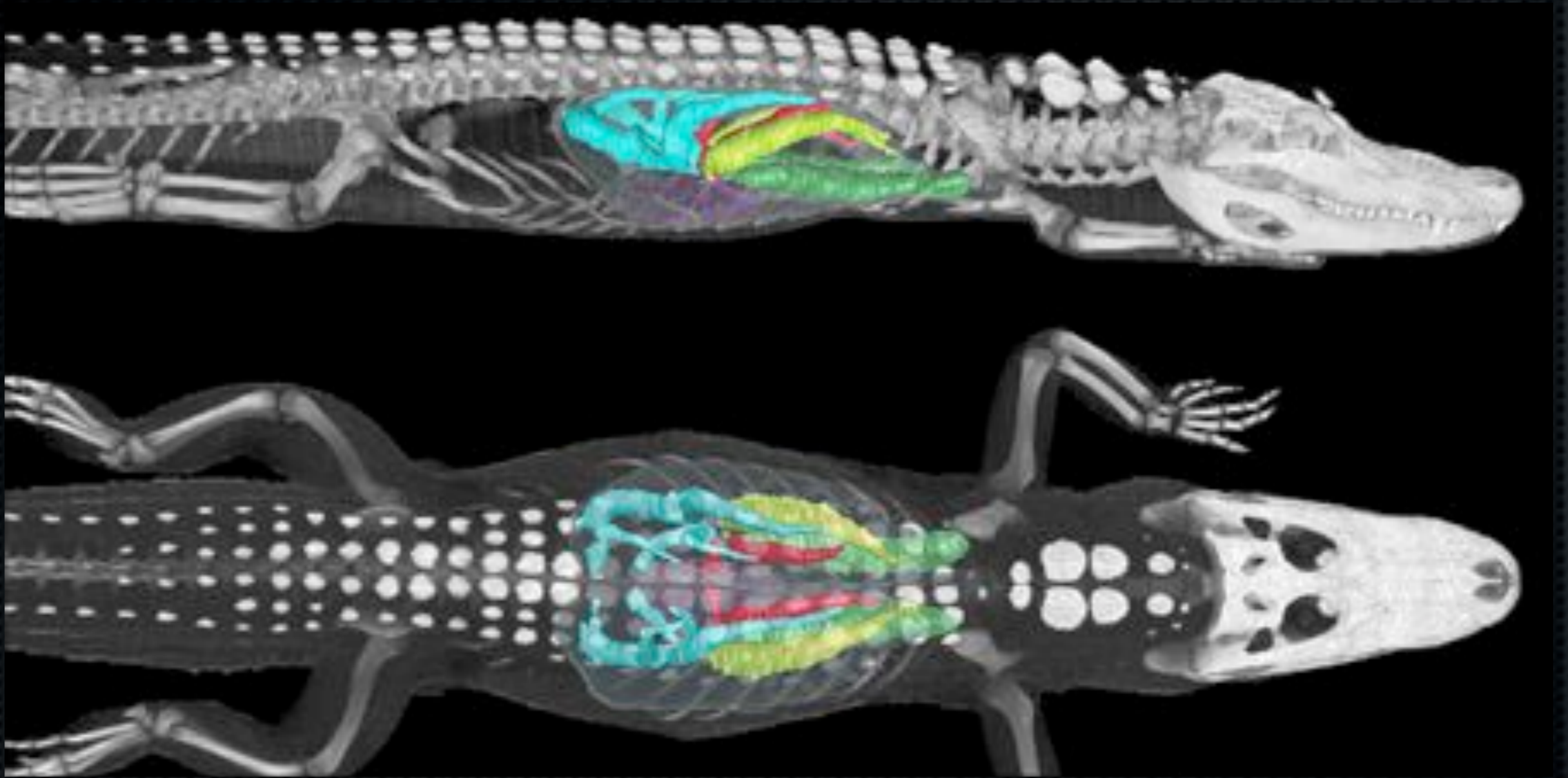
CT scanning of the musculoskeletal system

- Excellent anatomic detail
- Complex intra-articular fractures
- Bone graft/ fracture healing
- Will detect almost all pathology related to cortical bone
- Soft tissue calcification
- Tumours

Complex injuries

Very helpful for 3D reconstructive surgery planning





Multislice CT

You can scan pretty much anything

Disadvantages of CT

- Expensive (x-ray \$100, CT \$1000)
- Radiation
- Less effective imaging of soft tissue
- Need for iodinated contrast to show this, and vascularity
- Barriers to access - prior approvals

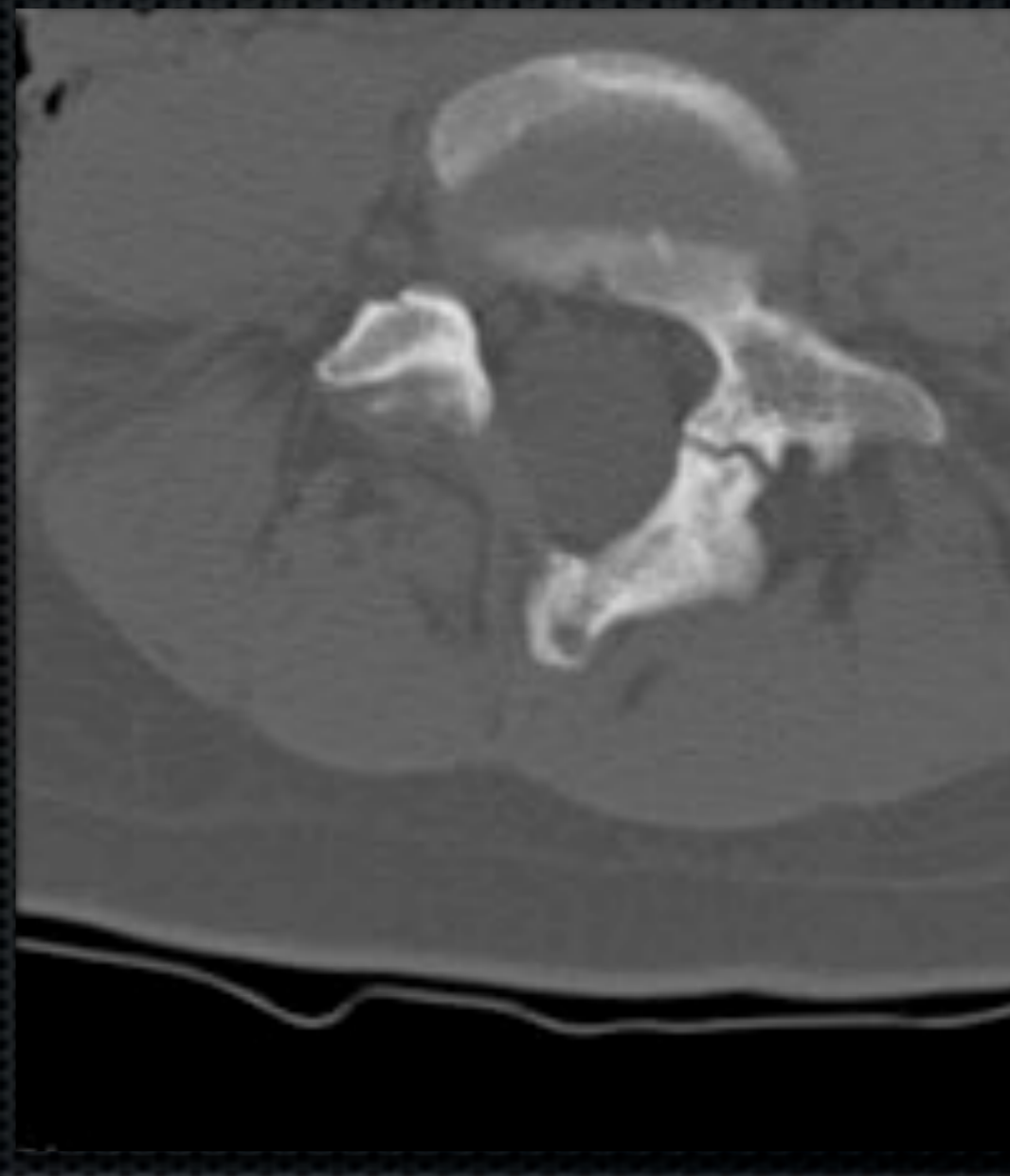
Volume imaging

- ✦ Elegant surface shaded display
- ✦ Useful for complex anatomy
- ✦ Useful for patient explanation



CT volume

- ✦ The real information is still in the selected slice data
- ✦ Volumes are for show, slices are for dough



MRI scanner

Long bore 3T

Open 1T



MRI Pros & Cons

- Reproducible
- Accurate
- Full visualisation
- Arthrography option
- Muscle
- Bone
- Measurement
- Interpreter variation
- Non dynamic
- Expensive
- Claustrophobia
- Metallic devices
- Availability
- Less sensitive to tendon calcium
- Partial tear vs tendonopathy



NON FAT SAT PD
KNEE

MRI shows water (fluid)
behind the patella



CORTEX

IF THERE ARE NO PROTONS THEN NO SIGNAL

- AIR
- BONE
- TENDON



KNEE

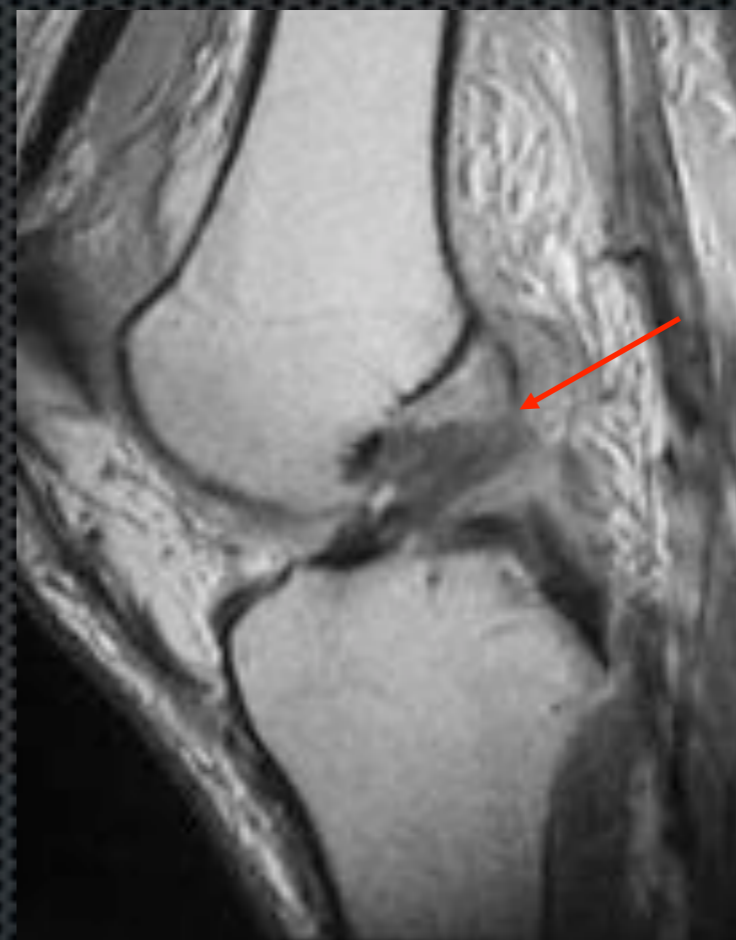
MRI of a normal posterior cruciate ligament



MRI – Internal Derangement

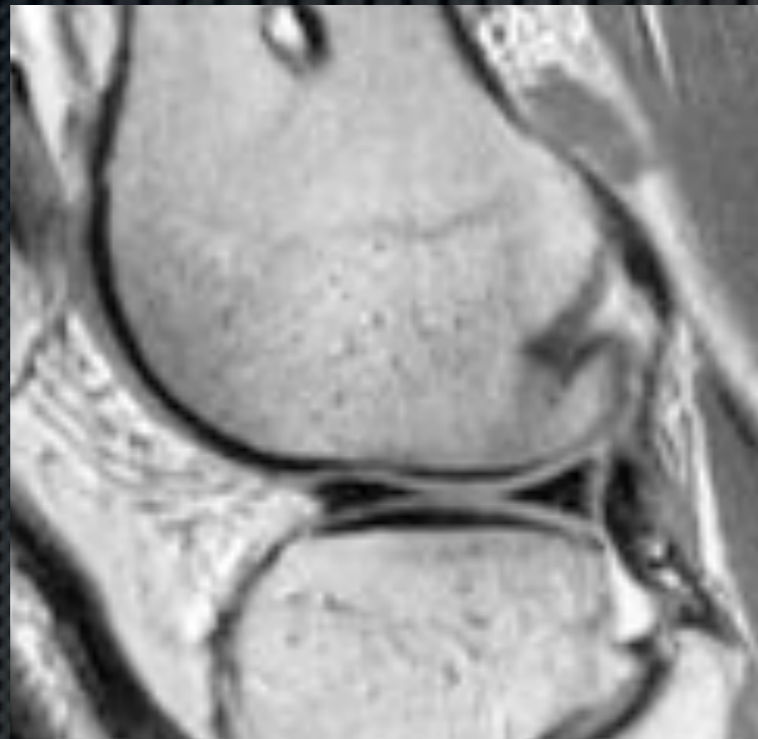


Sagittal – Intact
ACL



Torn
ACL

MRI – Internal Derangement

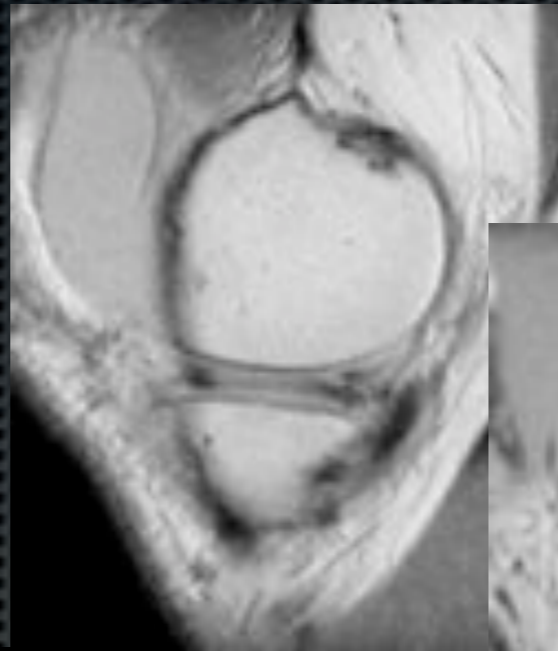


Sagittal, Meniscus NL

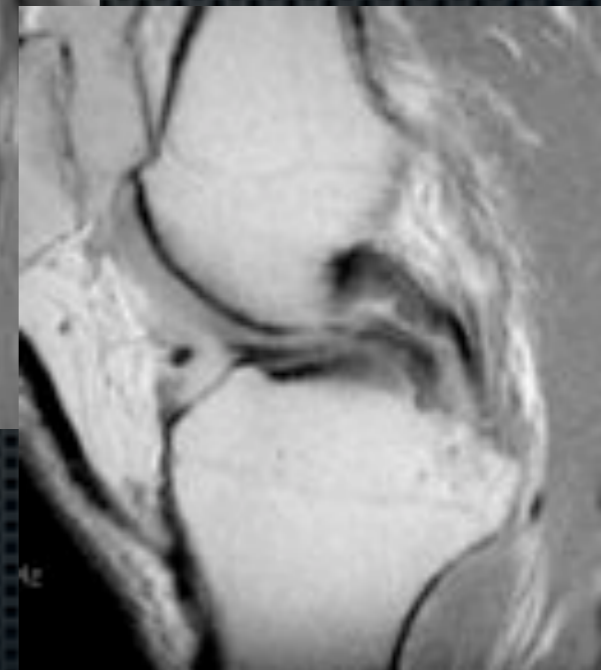


Posterior Horn Tear

MRI – Internal Derangement



Bucket handle meniscal tear





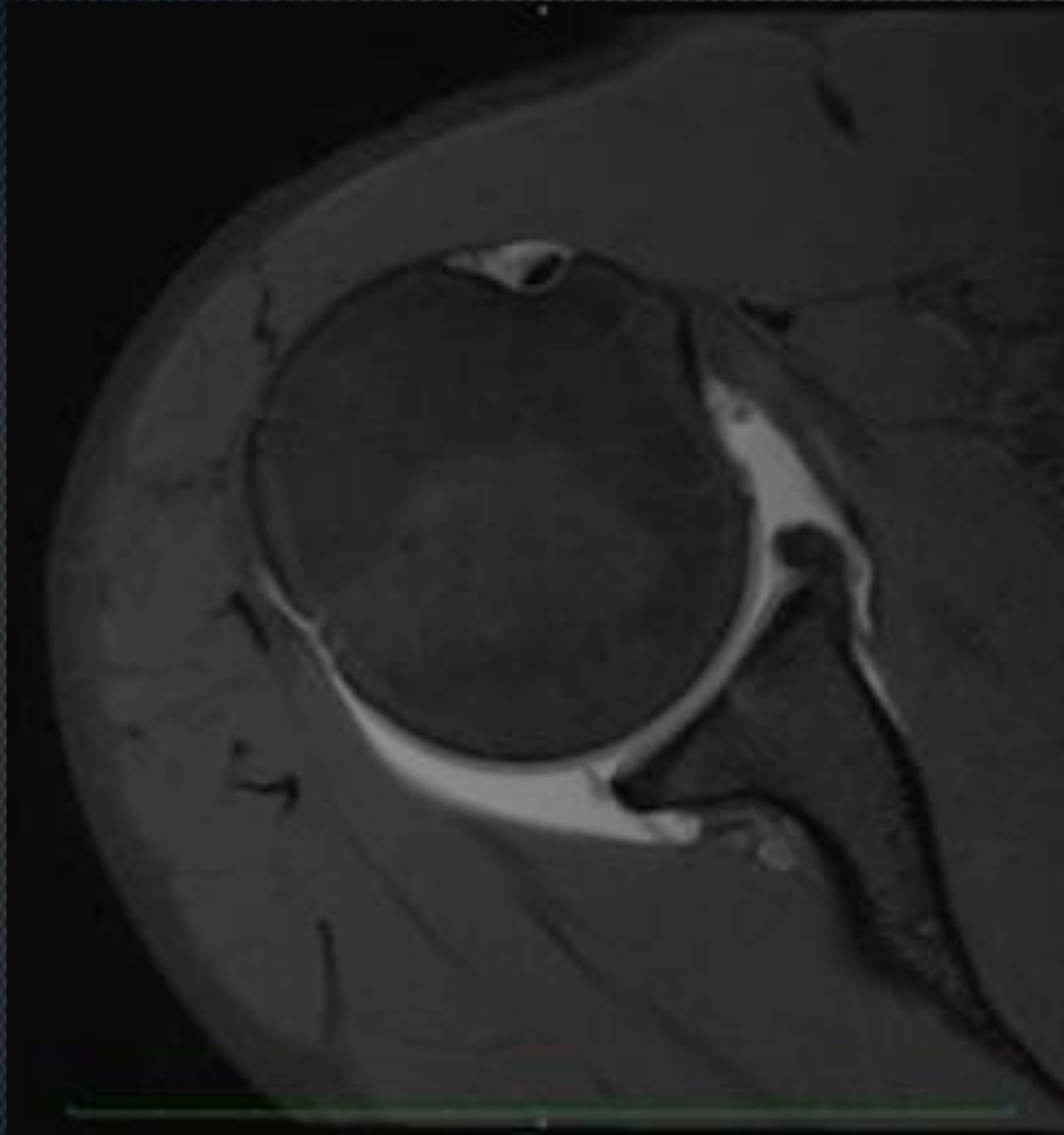
MR KNEE

BUCKET HANDLE TEAR

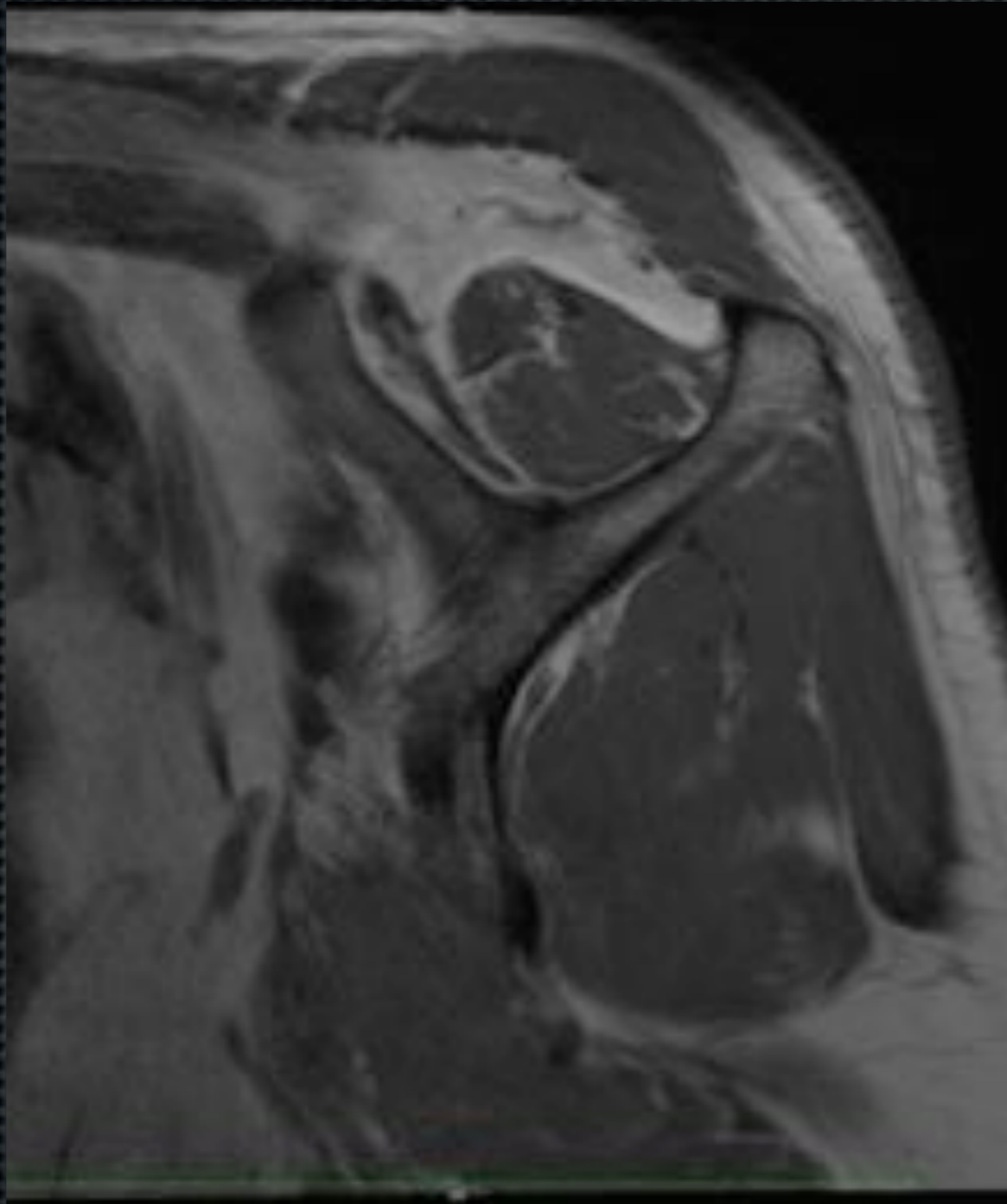


MR KNEE

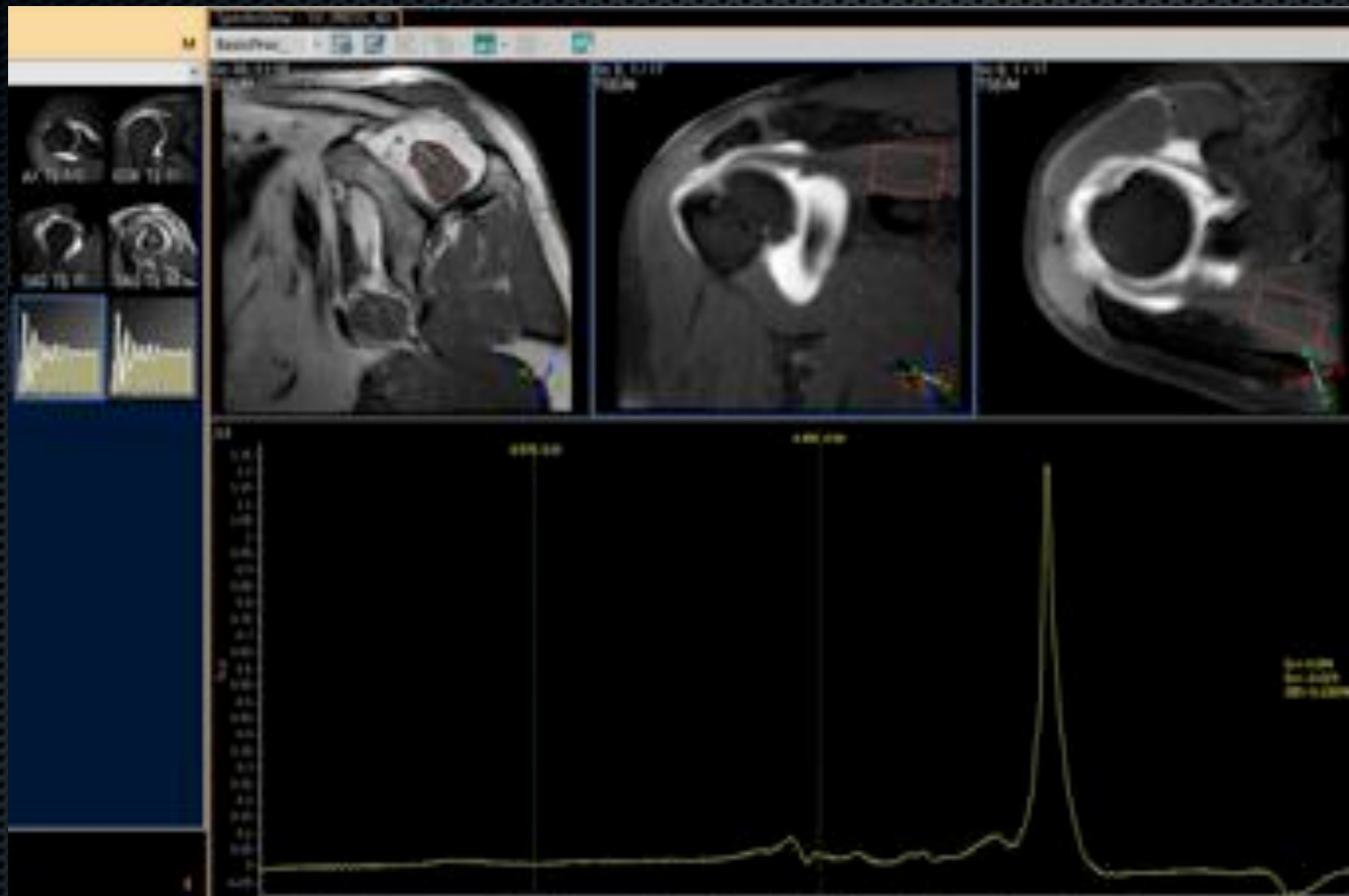
MR 3T DETAIL



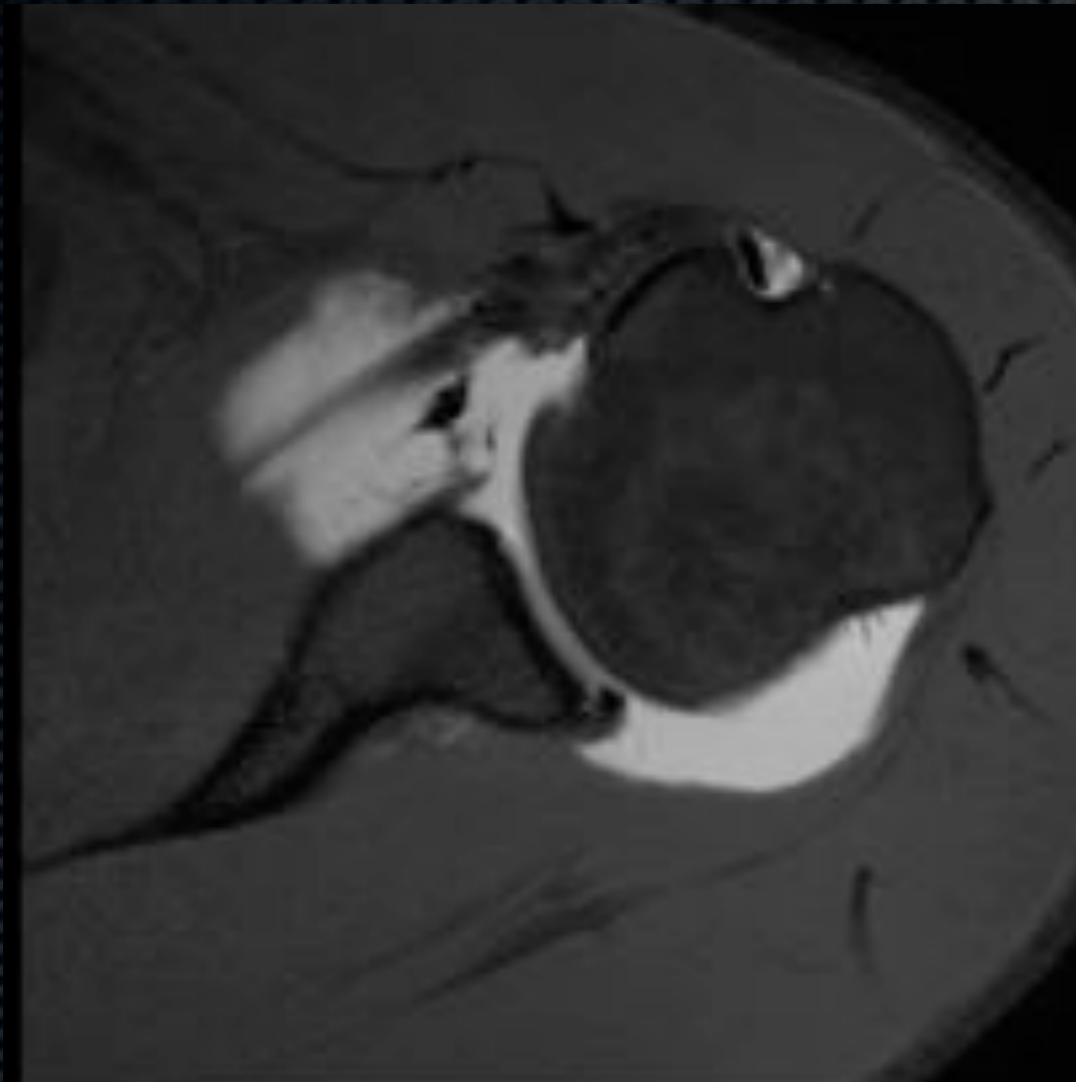
MR ATROPHY



MR SPECTROSCOPY

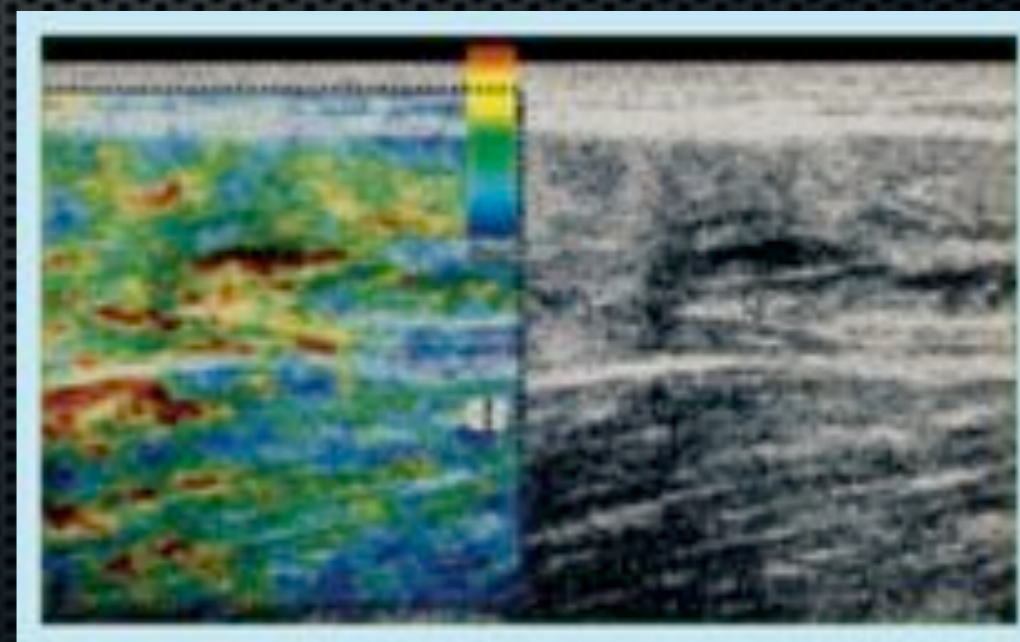


GLENOID INSTABILITY



MARCH OF TECHNOLOGY

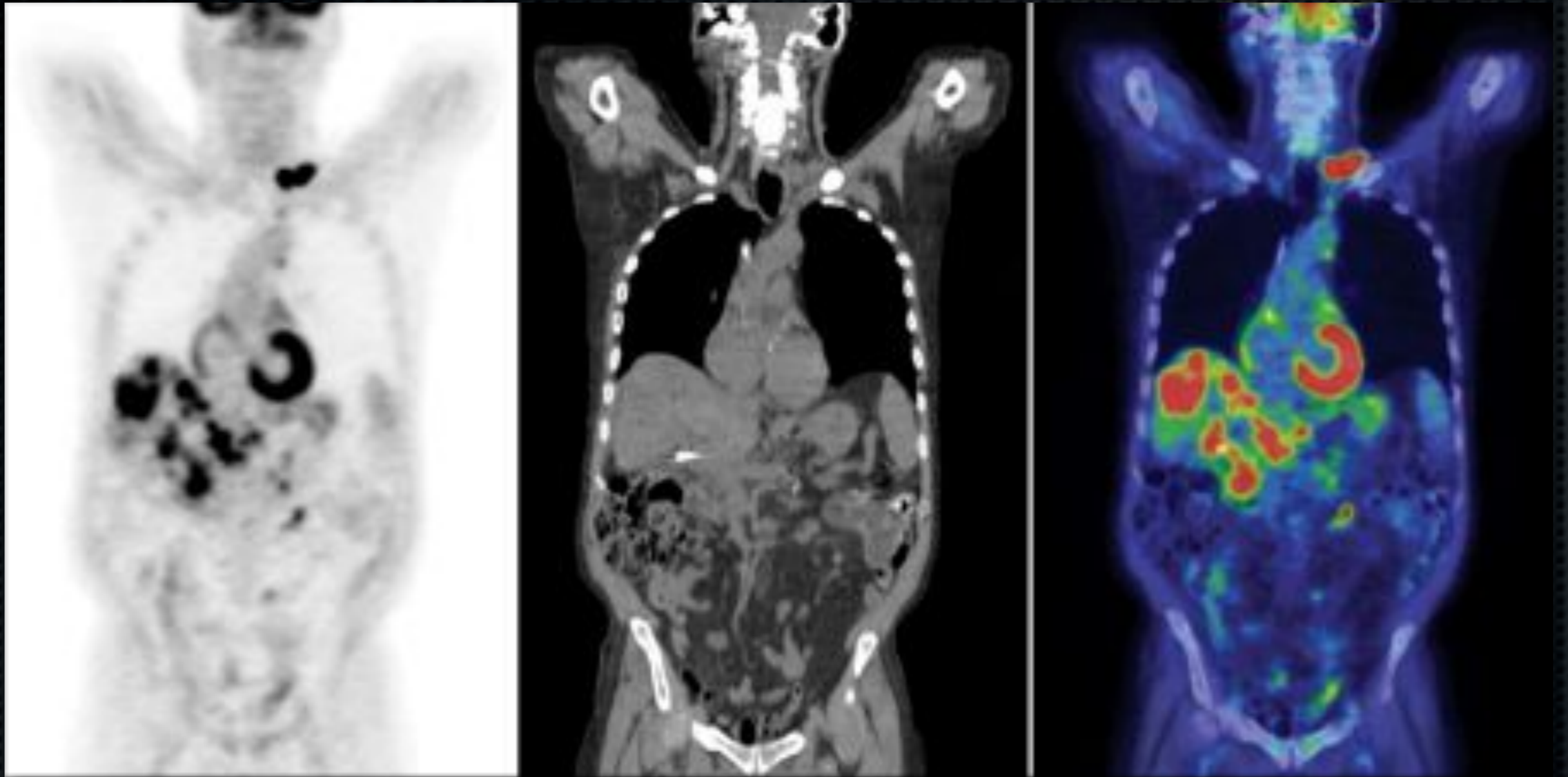
- For cuff tear both MR and USS return high sensitivity and specificity
- No dedicated large series of USS at 7.5 to 17MHz
- No dedicated large series of shoulder imaging at 3T
- The goalposts are always in motion, papers usually reflect previous generation technology
- Elastography....7T MR



CT PET

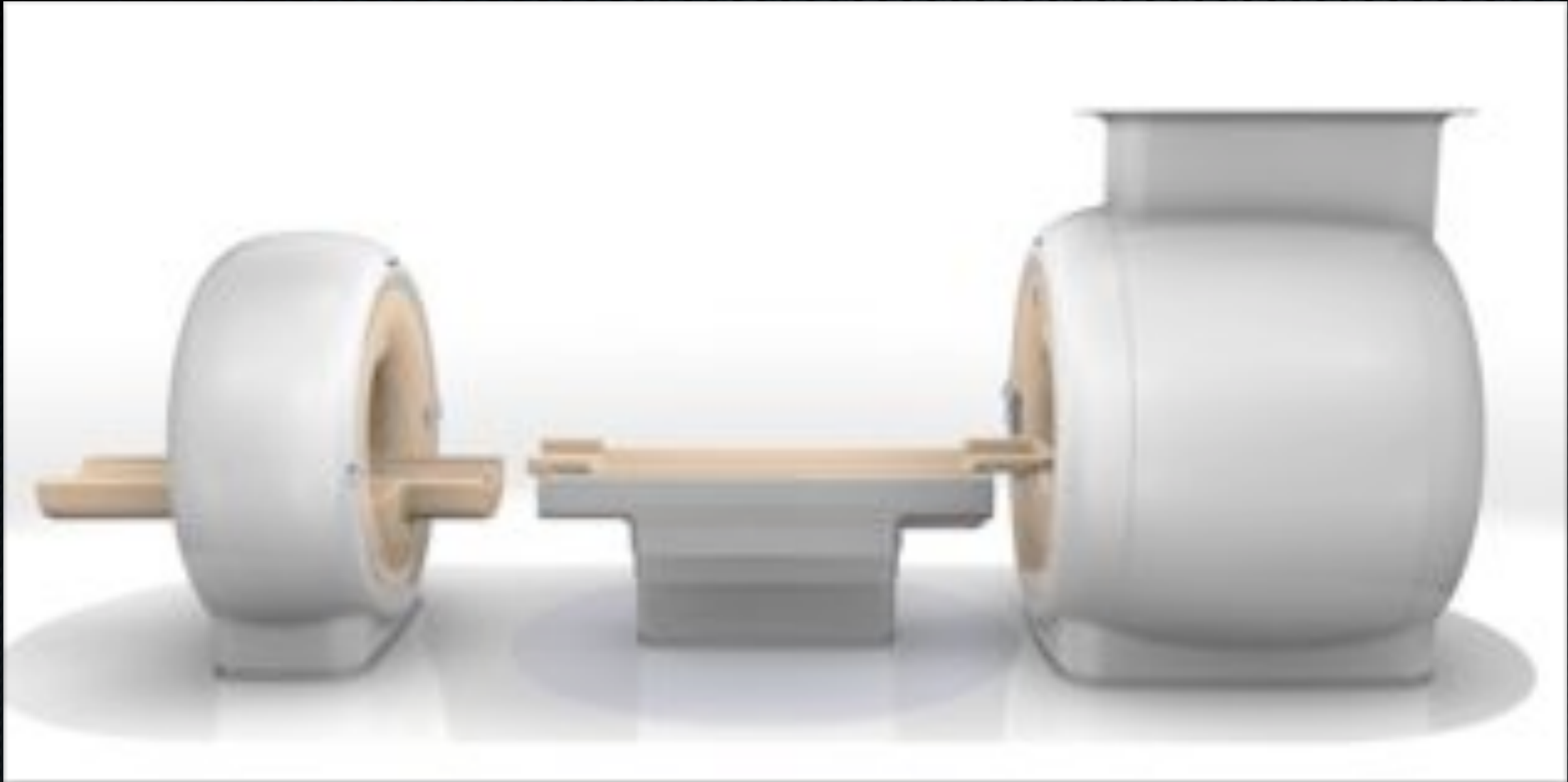
Integrated multislice
CT imaging and
positron emission
tomography





CT PET

Adding anatomic precision to scintigraphy, and tissue process sensitivity to CT anatomy



MR PET

Two for the price of two

MR PET

Precise alignment of functionally abnormal tissue with soft tissue imaging





PET TIGER

No explanation needed - there is still too much money in America

NOW FOR SOME SOUND!

Primary care imaging

- Plain films easy
- Ultrasound - by other providers, but technology has enabled bedside point of primary contact imaging
- Nucs, CT, MR and more exotic imaging will be more accessible particularly along agreed pathways
- However there will always be constraints

NOW FOR SOME SOUND!

Primary care imaging

- MSK is good place to start
- Common in primary practice 35%
- Often good palpable landmarks and familiarity
- Procedure guidance eg steroids
- Can correlate with other findings eg clinical
- Start with simple structures before complex eg shoulder
- Simple set up fewer probes for msk (10 - 15Mhz)

To scan or not to scan

- Isolated/rural practice
- Developed MSK or other special interest eg O & G
- Adjunct to clinical evaluation
- Guidance of needles
- Steroid, local, blood patches, aspirations etc

Ultrasound Machines

- Start with an entry level platform
- Size investment to fit practice - you can invest more later
- Don't get conned into too many probes & extras
- Local service and applications support
- On line servicing/ support vital if rural

TRAINING - learn to use the bloody thing properly!

- ✦ Ultrasound is a practical skill set
- ✦ Know the patient
- ✦ Know the anatomy
- ✦ Know the physics - artefacts abound
- ✦ Know the machine
- ✦ **KNOW WHEN YOU DON'T KNOW**

TRAINING

- ✦ Participate in a formal course
- ✦ Scan something with known anatomy/pathology
- ✦ Guide a procedure you do by palpation
- ✦ Save and label your images
- ✦ Compare them with others and teaching examples
- ✦ Make friends - radiologists, sonographers, applications specialists - anyone you can learn from

RESOURCES & COURSES

University of Otago (Department of General Practice, Dunedin School of Medicine)	E: raelene.abernethy@otago.ac.nz P: (64 3) 4667971
Course	CCPU Units
Post Graduate Certificate in Clinician Performed Ultrasound	FAST AAA Early Pregnancy DVT Renal

- **Postgraduate Certificate in Clinician-Performed Ultrasound (PGCertCPU)**

- http://dnmeds.otago.ac.nz/departments/gp/teaching/rural_cert.html

RESOURCES & COURSES

LEARNING AT A DISTANCE



RESOURCES & COURSES

LEARNING AT THE COALFACE

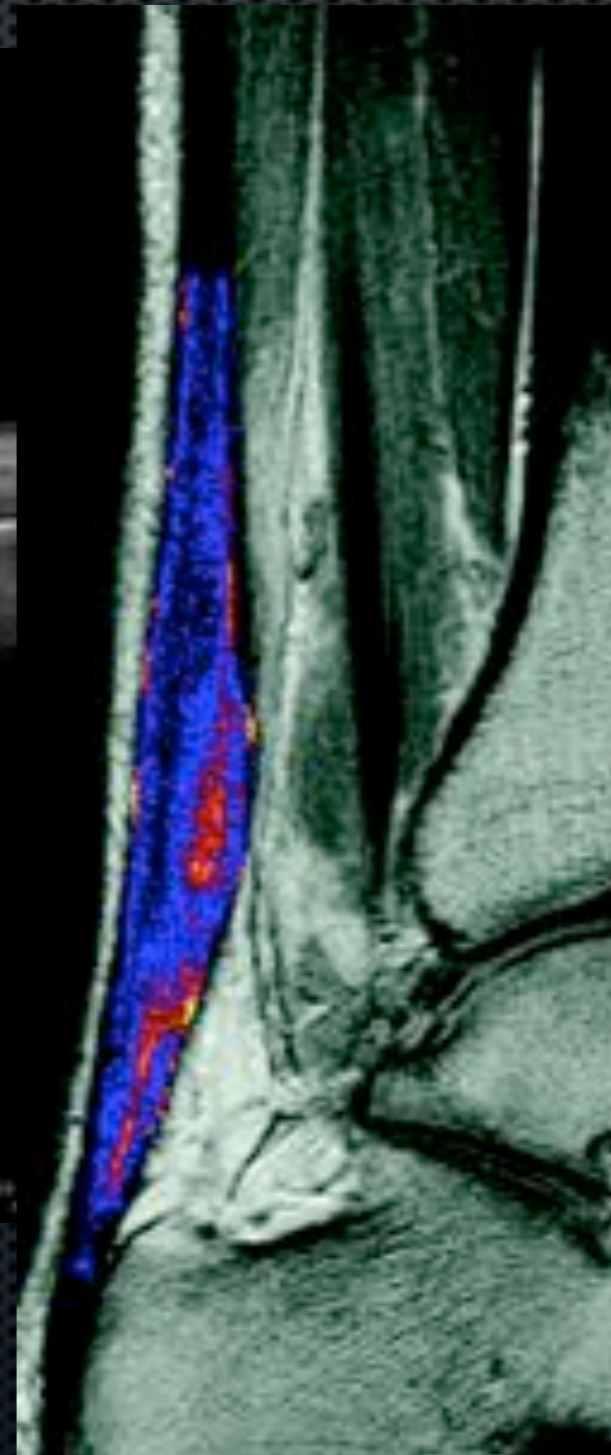


Tendonosis - grades

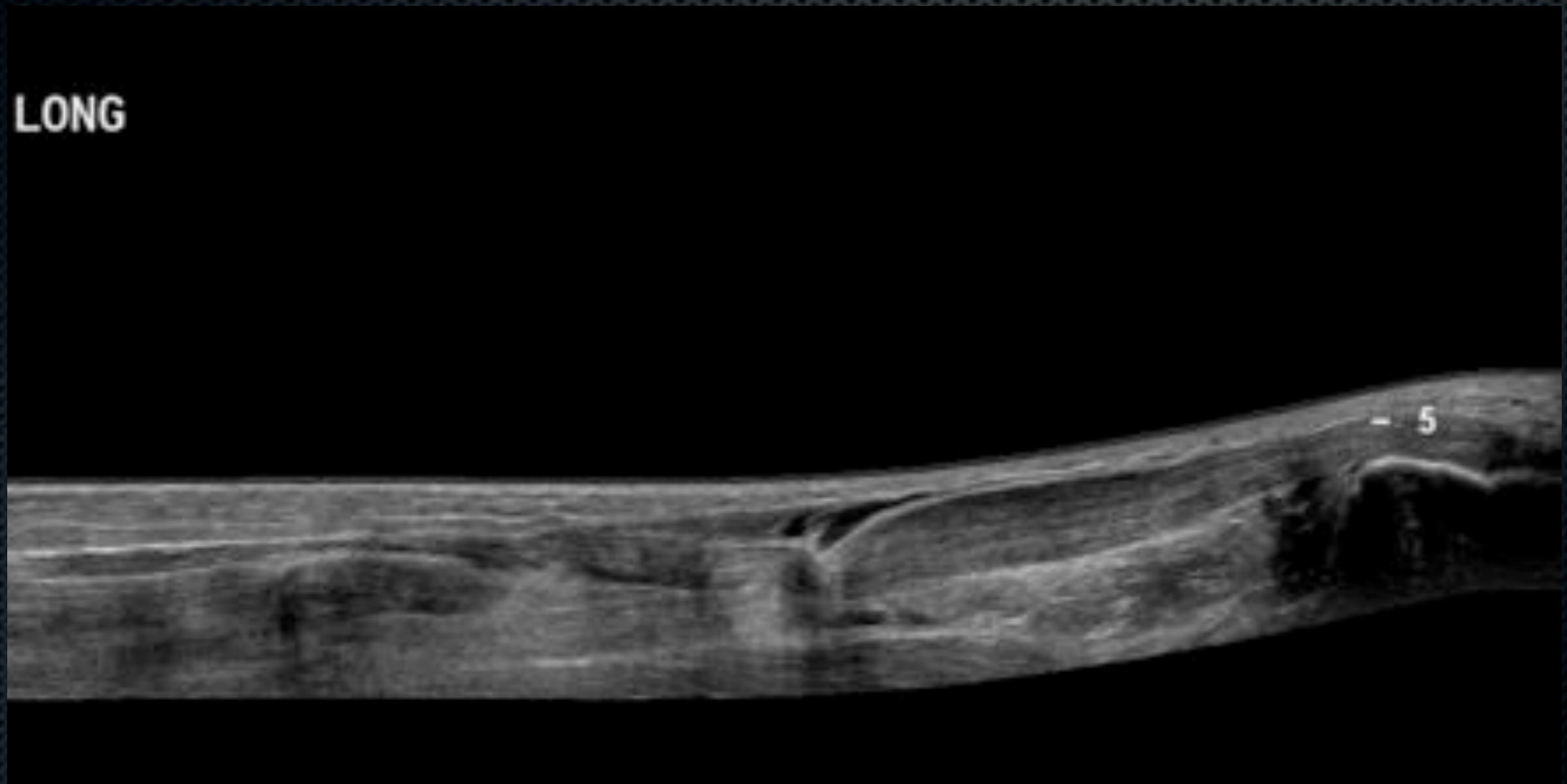
- Grade 1 is fat
- Grade 2 is thin
- Grade 3 is gone



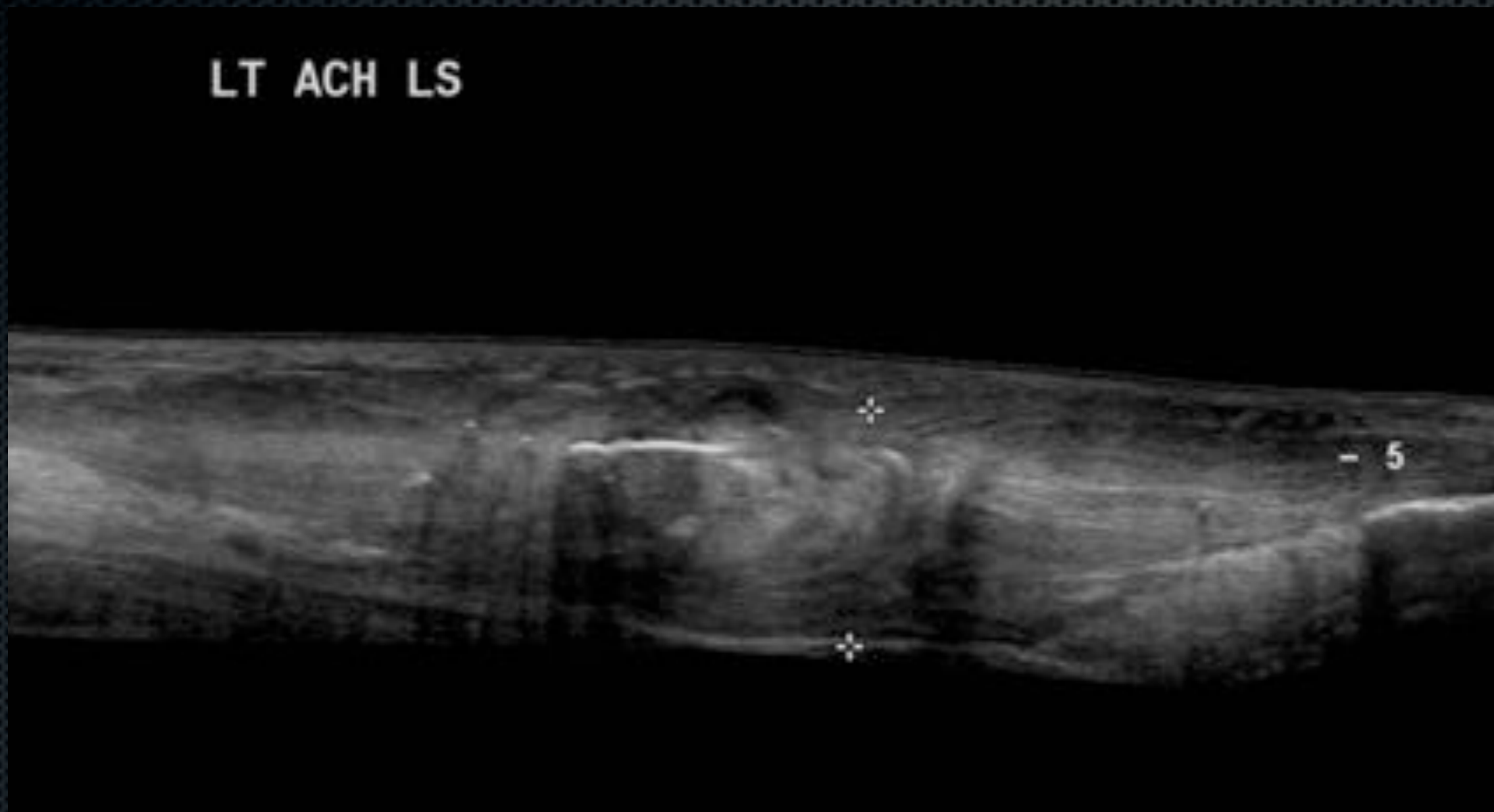
Achilles tendonosis - fat



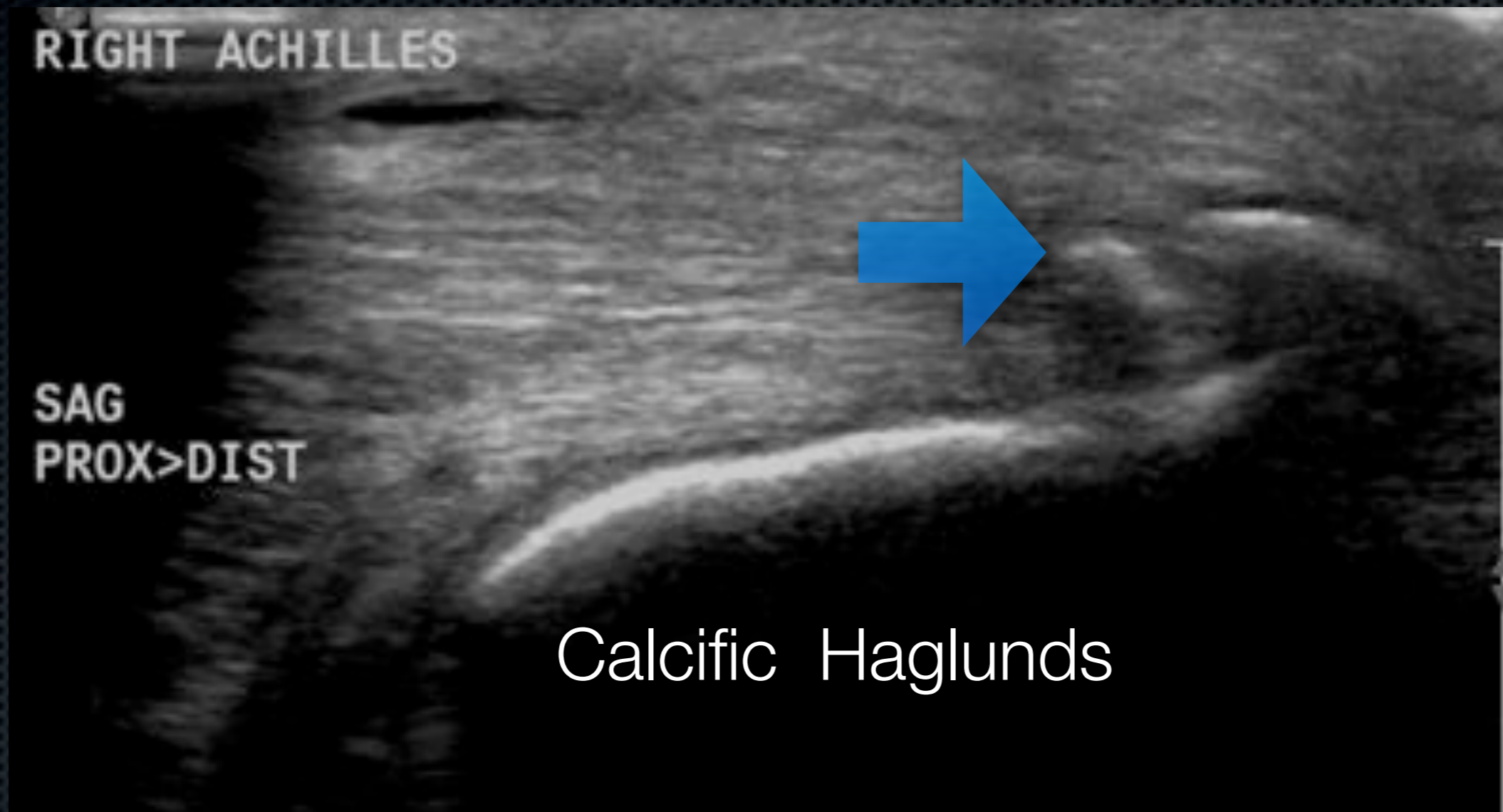
Achilles tendon acutely thin



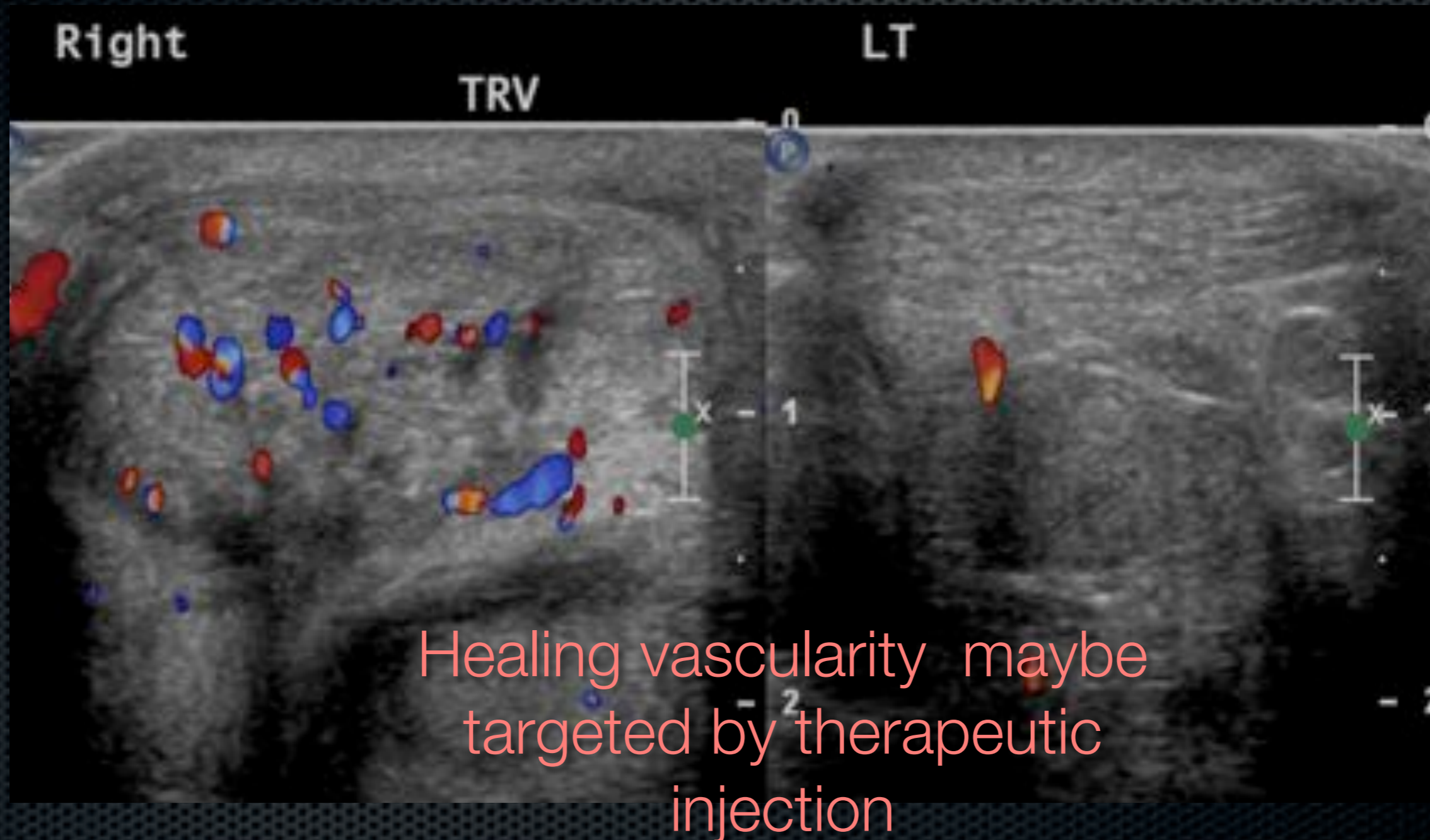
Achilles tendon - repair



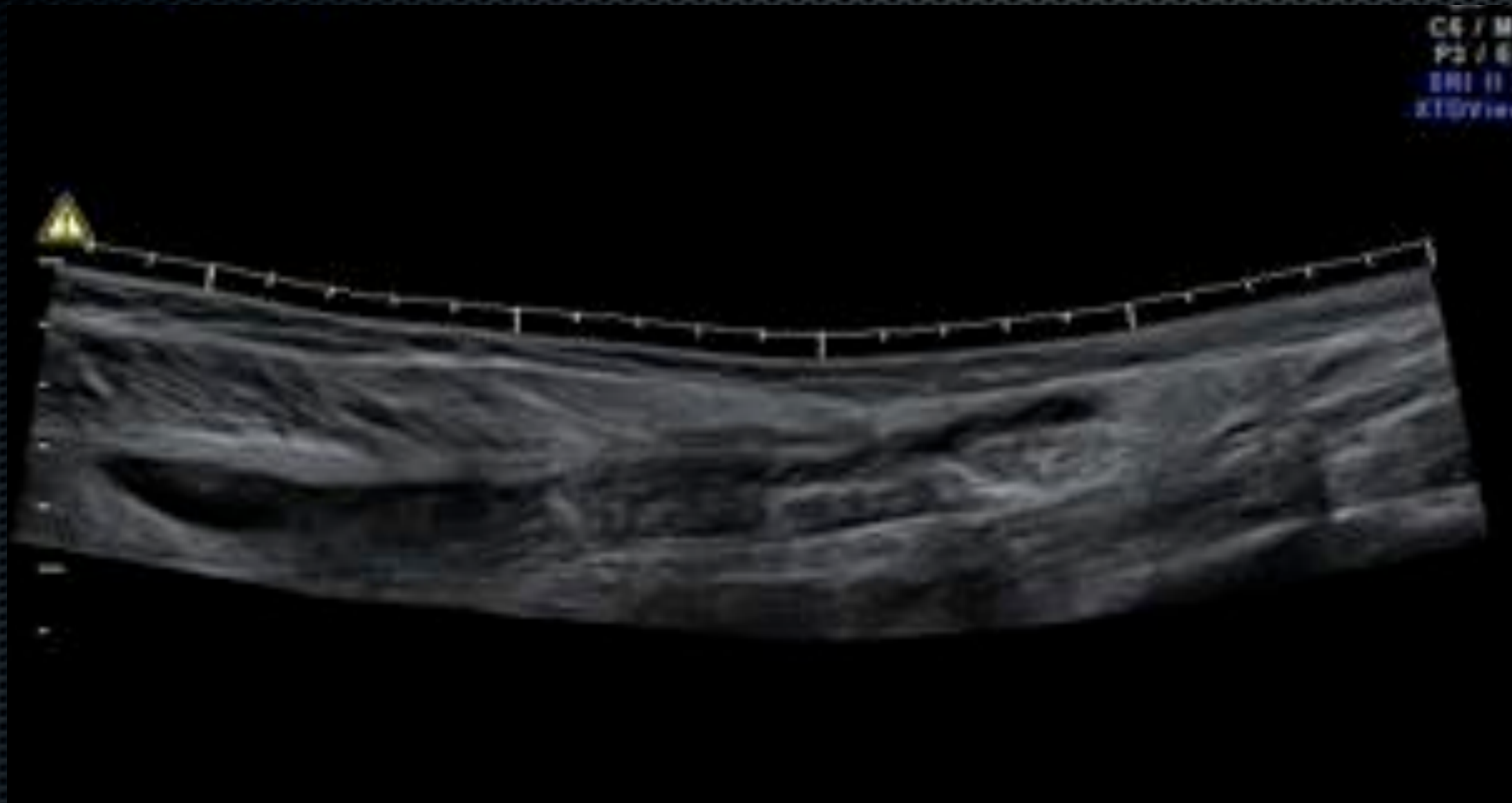
Achilles tendon - chronic



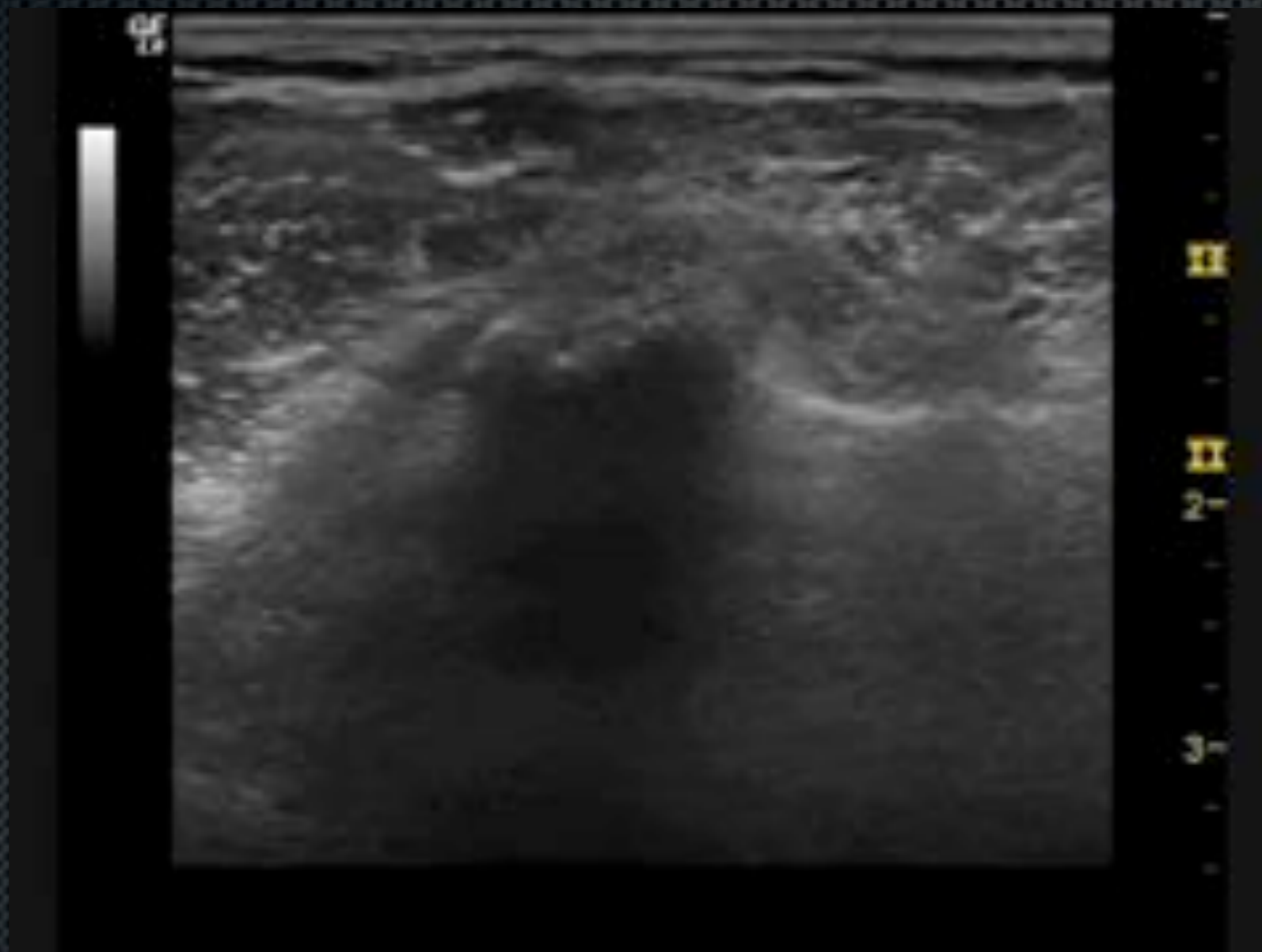
Achilles tendon - healing



Plantaris tear



Needle precision



KNOW WHEN TO QUIT - and don't feel bad about it!

- ✦ Some people are just not very good at ultrasound
- ✦ Every programme kicks out students who just don't get it
- ✦ This means doctors as well
- ✦ Just because you went to medical school you won't be brilliant at everything.....
- ✦ Someone else in your practice might be better

GIVE IT A GO !

- ✦ Be clear about your aims
- ✦ Work to a sensible budget
- ✦ Get formal training - pretend its your golf swing
- ✦ Keep a log book and analyse your progress and outcomes
- ✦ A radiologist not only makes mistakes, but takes pictures of them and shows them to other people!
- ✦ Welcome to the most humbling branch of medicine



THE END

