PROMISE series: ST tumours

James F Griffith
MRI RIGHT KNEE

FINDINGS:
There is a large joint effusion
The anterior cruciate ligament is completely torn 😶
No cartilage injury 👍
The remainder of the knee joint is normal 😊
General Principles

Soft tissue tumours are common

Superficial : Deep = 20:1

Superficial: Benign : Malignant = 100 : 1

Reassurance is usually what is required
General Principles

Superficial – any size
Deep & Small

Deep & Large

Ultrasound

MRI
Reaching a diagnosis

- HISTORY
- LOCATION
- SPECIFIC IMAGING FINDINGS
- CONSIDER MIMICS
- IS BIOPSY NECESSARY?
- FOLLOW-UP, WHEN AND HOW
History

- Duration of lesion
- Rapidity of growth
- Episode of trauma (be careful)
- Change with exercise
- Dependency or diurnal
- Skin Changes
- Pain (shock-like)
Large subcutaneous lipoma
Vascular Malformation (high flow)

- Classify as ‘low flow’ or ‘high flow’
- Capillary-venous or venous (low flow)
- Arteriovenous (high flow)
Epidermoid Cyst

- Well-defined
- Slightly echogenic, avascular, acoustic enhancement
- Hypoechoic ovoid or tubular ‘clefts’
- Short thick echogenic lines (due to ketatin)
Nerve Sheath Tumour
Nerve Sheath Tumour

Schwann cell tumour : Schwannoma

Connective tissue tumour : neurofibroma

Not good at distinguishing schwannoma from neurofibroma
Vascular Leiomyoma

- Majority occur in foot and ankle region
- Occur along neurovascular bundle
- Similar to nerve sheath tumour but no neural tail
Pilomatixoma

- More common in children, > upper limb,
- Hypoechoic, calcified (75%), hypoechoic rim (50%)
- Mild to moderate vascularity (variable)
Ultrasound

- Lipoma / angiolipoma
- Ganglion
- Nerve sheath tumour
- Epidermoid
- Lymph node
- Vascular malformation / haemangioma
- Vascular leiomyoma
- Pilomatrixoma

- Allow specific diagnosis in majority (>80%) cases
- Best sign of malignancy = suspicious features and does not look like any of benign tumours
Malignant Fibrous Histiocytoma
Dermatofibrosarcoma protruberans
Deep tumour: move quickly to MRI

- Move quickly to MRI
- Don’t be concerned re establishing extent with US
- Check hyperaemia, LNs and finish
Check regional lymph nodes

Malignant

Reactive
Radiography

Should be seen in all cases
Calcification (osteoid, chondroid, dystrophic)
- Calcification (scattered, peripheral or central, mature)
- Fat
- Bone scalloping
- Articular rather than juxtaarticular
Radiography
Then & Now
MR protocol

Axial imaging as primary imaging plane
- Add on T1 weighted sequence (fat)
- 1 or 2 longitudinal scans
- GE imaging if haemosiderin considered
- T1-FS prior to contrast
- Do not always have to give contrast
- Additional small FOV imaging
Always ask question – will contrast help?
Often does help

- Better demarcation
MR evaluation

Location, location, location
- SC or subfascial, intermuscular or extramuscular, fascial or NVB
- Tissue characteristics
- Fat
- Flow voids
- Spread
- Enhancement
- Adenopathy
Soft Tissue Sarcoma

- Centrifugal growth
- Pseudocapsule compresses rather than invades
- Lymph node mets 5%
  (clear cell sarcoma, angiosarcoma, ASPS, synovial sarcoma and rhabdomyosarcoma)
- Recurrence
Tissue characterization by MRI

Is helpful but limited
MRI will never replace biopsy even with DWI, MRS etc
Even with histology, difficulty with tumour type
Typical Case
Nodular fasciitis

- Benign proliferative fibroblastic lesion
- Upper limbs, shoulder
- Along fascia (investing, intermuscular)
- ± myxoid (‘target sign’)
- Linear extension along fascia (‘fascial tail’)


Definitive dx 30% of deep soft tissue masses

Only call something benign when you can definitely put a label on it. Otherwise either follow-up or biopsy
Neurovascular bundle invasion

Low grade fibromyxosarcoma

Malignant Fibrous Histiocytoma
Neurovascular bundle invasion

Fibrosarcoma

Synovial sarcoma
Optimise imaging to surgically relevant features
Same day – Same coil

One thigh

Probably not involved
Same day – Surface coil

Definitely not involved
Same tumour – same day – same scanner

? NVB involvement

No NVB involvement
Malignant fibrous histicytoma

? NVB involvement

No NVB involvement
Very few (0.25%) superficial masses = sarcoma

? sc or subfascial

Subcutaneous MFH
Bony change: assume cortical infiltration
Non-neoplastic mimicking neoplasia

- Myositis ossificans
- Elastofibroma dorsi
- Calcific tendinitis
- Muscle tears
- Infection
- Haematoma
- Tumoural calcinosis
- Haemophiliac pseudotumour
Expanding haematoma
Comparable MR images

T1

T2FS

T1FS +C

T2FFE

Manaster BJ AJR 2013
Healing muscle tear
Sarcoma vs Mimic

T1SE

? gluteal STS

T2-FFE

Gluteal haematoma
Elbow mass ? Sarcoma
Elbow mass ? Sarcoma
Tumoral calcinosis
Accessory popliteus muscle
Healing tear / contusion
Chronic tear vasta lateralis
Chronic haematoma
Minic

SUV = 4.4

? Muscle sarcoma

Eventual diagnosis = healing muscle tear
Left thigh mass ? Sarcoma
Left thigh mass ? Sarcoma

Hypertrophy tensor fascia lata muscle
27-year old female/ left hip pain
Follow-up MRI 6 months later
31-year old lateral thigh swelling ? sarcoma
31-year old lateral thigh swelling ? sarcoma
Morel-Lavellee lesion (shear injury)
Subcutaneous tumour
Subcutaneous tumour
Two years later
Two years later
Pleomorphic Hyalinizing Angiectatic Tumor

- rare mesenchymal tumor
- Locally aggressive
- considered low malignant potential
- subcutaneous / extremities
- extension along fascial planes
- treatment of choice wide local excision
Neoplastic mimicking non-neoplastic

- Myxoid liposarcoma
- Haemorrhagic tumour
- Myxofibrosarcoma
Hemorrhagic tumour

Thought to be vascular malformation
Biopsy consistent with expanding haematoma
Hemorrhagic tumour

? Expanding haematoma with underlying vascular malformation

Excision → angiomatoid malignant fibrous histiocytoma
79-yr-old female with #NOF

Undifferentiated pleomorphic sarcoma
Reaching a diagnosis

- HISTORY
- LOCATION
- SPECIFIC IMAGING FINDINGS.
- Does it require biopsy?
- BIOPSY (most vascular area, most suspicious part)
Biopsy ST tumour margins and hyperaemic areas
Biopsy ST tumour margins
Mesenchymal Origin (WHO STS 2002)

- Fibrous
- Fatty
- Smooth muscle
- Fibrohistiocytic
- Chondro-osseous
- Vascular
- Skeletal muscle
- Uncertain differentiation
Liposarcoma

- Well-differentiated
- Myxoid (thigh, <25% fat, high metastatic potential)
- Round cell (high grade)
- Pleomorphic (high grade, elderly, periphery)
- Dedifferentiated (high grade, > in recurrence)
Lipoma vs liposarcoma

- > 10cm
- thick (>2mm) septa
- Nodular non-fatty areas
- > 25% non-fatty component
- Foci of T2-hyperintensity
- Enhancing areas

Peterson JJ Skel Radiol 2003
Radiologists correctly call nearly all liposarcomas
Over-call many atypical lipoma as liposarcoma
(fat necrosis, calcification, myxoid tissue within lipoma)

Relevant since biopsy often uncertain

Lee YM et al JCAT 2011
Desmoid tumour / Aggressive fibromatosis
Desmoplastic fibroma

- Locally aggressive
- Usually infiltrative
- Scar tissue, aponeurotic tissue, rectus abdominus
Desmoid tumour / Aggressive fibromatosis
Desmoplastic fibroma
Desmoid tumour / Aggressive fibromatosis
Desmoplastic fibroma
Desmoid tumour / Aggressive fibromatosis
Desmoplastic fibroma
Chemotherapy response fibromatosis

For most tumours:

↓ Size is the only criterion of response
MRS, DWI, DCEMRI not necessary

For fibromatosis:

↓ Size
↓ T2-hyperintensity
↓ Enhancement

….are all markers of response
Fibromatosis: ↓ size

Pre-Rx

Post-Rx

Rxd with methotrexate/vinblastine.
Fibromatosis ↓ T2-hyperintensity

T2 pre-Rx

T2 post-Rx

Tumour size unchanged
Collagen maturity
Fibromatosis ↓ enhancement

Pre-Rx

Post-Rx

Tumour size unchanged
Nerve sheath tumour
Nerve sheath tumour
Well-defined multiloculated cystic mass with enhancing wall and septum in the left hemipelvis. Retroperitoneal mass may represent a serous cystadenoma or serous cystadenocarcinoma.
39-year-old female with abdo pain

TAS/TVS – left hypoechoic cyst with fluid interface ?dermoid followed by laparoscopy
39-year-old female with ant knee swelling for years and recent fall
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Plexiform neurofibroma
Malignant peripheral NST

- 50% have NF Type 1
- Growth
- Size > 5cm
- Peritumoral oedema
- Necrosis with peripheral enhancement
- Locally aggressive
266 soft tissue tumours referred to MRI

LOCATION
- 97 superficial: 27 (28%) malignant
- 169 deep: 75 (44%) malignant

SIZE
- 125 <5cm: 31 (25%) malignant
- 141 >5cm: 71 (50%) malignant

Chung WJ et al BJR 2012
Location Size and Signal

- 266 soft tissue tumours referred to MRI

**T2 HETEROGENEITY (>30% heterogeneous signal)**

- 86 homogeneous : 13 (15%) malignant
- 108 heterogeneous: 89 (82%) malignant

Using SI, Size and Depth

- Sensitivity 64%, Specificity 85%, Accuracy 77%
Thank you