

# Broadcast Summary

## **MRI Interpretation**

# With Mr Alexander Montgomery MRCS (Orth) First broadcast on 6<sup>th</sup> November 2014

#### How MRIs Work (in a nutshell)

- Magnetic field is attracted to body's H atoms
- H atoms are generally in a disorganised state, but magnetic field causes them to align
- When they return to normal they emit radio waves, which are • detected by the scanner, generating an image
- Image depends on material generating the signal
- No harmful radiation
- T1 shows fat as bright signal
- T2 shows water as bright signal

Degenerate disc will show a different water component to a healthy disc



- Normal disc is largely water hence bright signal (on T2 weighted image)
- Degenerative disc has less water, hence less bright

#### Lumbar Stenosis

- Symptoms less pain on FB, more on extension
- Less LEX pain walking uphill, due to FB posture
- More pain in LEX walking downhill

Arrow indicates complete narrowing of spinal canal - no white, indicating CSF

- Black area at arrow is hypertrophied ligamentum flavum
- Other side is bulging disc pressure at both sides

In spinal decompression, most of the work is removal of ligamentum flavum



### **BASIC LUMBAR MRI**





#### Lumbar Stenosis – Axial View

• View is from feet to head (inferior to superior), therefore anatomical right side is on left

- On left white = CSF surrounding nerves
- Paravertebral muscles below

• On right image – severe stenosis. CSF = white line with triangular protrusion

• Because facets and lig flavum have hypertrophied and grown into the canal

• When conservative measures fail, surgery can often quickly facilitate standing straight

Note: Sagittal provides overall view, axial gives detail

#### **Degenerative Cervical Spine**

- Left image is normal, discs in black
- On right at arrow, bulging disc cord is pinched
- Cannot tell if bulge goes laterally needs axial view
- Need to assess for signs of myelopathy:

• "long track signs" – brisk reflexes, plantar reflexes, Hoffman's sign, inverted radial sign,

- Tests: Romberg's, heel-toe for balance
- If these are normal look for radicular signs/weakness

#### In more detail:

• Note white signal in spinal cord at arrow, usually indicative of oedema in acute trauma or in chronic condition, irreversible ischaemia

- Posteriorly note hypertrophied lig flavum
- Not showing, but facets also hypertrophied
- Pinching on one side may allow cord to move
- Pinching on both sides, as here, gives myelopathy
- In this case, pt has weakness in both UEX and LEX
- Cause: 20mph whiplash

• In a degenerate spine, a hyperextension injury like this is often called central cord syndrome



### **DEGENERATIVE SPINE**



## CERVICAL MYELOPATHY



## LUMBAR STENOSIS

### **CERVICAL AXIAL**

Note kidney-shaped spinal cord on right, compared to normal oval on left – this is due to central spinal cord compression

If the patient had radicular symptoms, the prolapse would probably be more lateral





Even here, surgery is not indicated unless the clinical picture dictates

Note that even minor impact (whiplash eg) could have significant effect on spinal cord – manipulation of neck in this case could be dangerous

#### Another patient with spinal cord compression

• Assuming conservative measures have failed, MRI very useful in determining whether to approach from anterior or posterior. Xray and CT scan don't show what's needed.

• Here there's evidence of facet and lig flavum hypertrophy.

• No concrete rule, but if 3 or more levels involved anterior approach is difficult.

- In this instance, both approaches necessary!
- Options include:
  - disc replacement (younger patients)
  - fusion with cage or autograft from hip
  - posteriorly facet removal needed here
- Success rate:
  - Pt with myelopathy: aim is prevent deterioration (paralysis/wheelchair). Pts may not be in pain
  - Reversing symptoms dependent on chronicity, but no better than 50:50
- -
- Post surgery, there will be pain
  - posterior approach worst
  - anteriorly, skin is loose, less muscle (usually need to cut just platysma, sometimes omohyoid)

## CERVICAL CORD COMPRESSION WHICH APPROACH ?



#### <u>Trauma</u>



Normal Xray

CT Scan shows Fractured Spinous Process

MRI shows high signal (at arrow) -this is blood

- Fractured SP not usually too worrying, but indicates that damage has occurred
- In this instance, fracture hidden by shoulders
- If there's an abnormality on CT scan after trauma, MRI is worthwhile
- CT shows bones better than MRI (in trauma CT is preferred as Xray misses too much)
- MRI shows ruptured disc, with torn ant long lig bleeding into it
- Fracture at back combined with torn ligament at front means instability
  - In trauma, one is looking not just for fractures but for haematomas and sot tissue changes



Here, minor fracture shown in both images at the arrows, but neither looks serious



At yellow arrow, bright signal within cord indicates oedema

Bright disc above arrow indicates blood from either ligament or disc

Right hand image shows later deterioration – more oedema

• Chronicity largely indicated by history, but older damage often looks more plaque-like (as opposed to the flared signal in the image above (at the yellow arrow))

#### Trauma – To Operate or Not?





Xray showing wedged compression fracture

MRI shows blood between spinous processes (white area) – spinous process and lamina are fractured

#### Can Acute Cord Oedema be Treated?

• Difficult - high dose steroids advocated in N American study, but in UK/Europe not done due to high complication rate and doubts over methodology and statistics in study

• A lot of high level research is being conducted into medication that can stop the changes – not just about oedema, but also free radicals which go across the nerve (calcium, oxygen...)

• Right now in UK, don't intervene other than to keep them well perfused – keep BP above 90 systolic (mean arterial pressure)

• One danger is the drop in blood pressure caused by anaesthetics – can cause serious damage through hypoperfusion

#### Infection

• East London has the highest rate of TB in the spine of the Western World (largely due to high immigrant population, mainly Bangladeshi), second only to Hong Kong in first world countries

• Therefore in London, ask screening questions of any back pain sufferer from south Asian community: weight loss, excessive night sweats etc

#### **Case History**



- Xray of young Bangladeshi man

- Seen by GP and physio many times
- Told his back pain was postural
- Eventually referred to spine centre due to weight loss



MRI of same patient L5 shows as chronic, granulomatous TB This will go into paravertebral tissues: disc, psoas, epidural space

- Good news about TB can be treated with medications (quadruple therapy), bones scar up very well
- TB is unlikely in Caucasian community unless immune-compromised

#### **Different Patient**

Presented with minor discomfort – pain on flexing hips, some back pain, but with weight loss and night sweats MRI shows TB in psoas



#### **Tumours:**

- Patient presented with mild leg pain. GP Xrayed NAD, so referred to physio, but no improvement
- Referred to spine centre Schwannoma evident on MRI (these are uncommon)



Normal Xray

Tumour evident on MRI

• Benign tumours of nerve roots are uncommon (Schwannomas, neurofibromas, meningiomas or (very rarely) primary cancers of the spinal cord).

• Schwannomas slightly more common – likely to see one or two in clinic over lifetime, usually presenting as normal leg pain. Often no symptoms and therefore not treated, but will not respond to injections or physical therapy so, if there's pain, refer for surgery.

#### **Syrinx**

- A water-filled sac in the spinal cord
- Can be the result of trauma, subsequent to tumour or simply genetic
- Can only be diagnosed from MRI
- Normally vague neurological symptoms (Parasthesiae or numbness not corresponding to anything specific)
- Surgery only required in the presence of symptoms
- Often associated with Chiari malformation cerebellar tonsil dips down into spinal cord



• Syrinx and chiari are NOT contraindications to manipulation in the absence of other abnormalities such as disc prolapse

#### **Scoliosis**

- Inherent thoracic stiffness
- Postural patterns follow from scoliosis handbag on same shoulder, leaning on lower side when sitting
- Lower facets become overloaded, ribs become rotated if chronic
- More likely to get other spinal cord abnormalities such as syrinx.



• Rarely can get tethered cord – manipulation or surgery to treat scoliosis can cause neurological damage at the tether.

• Incidence of syrinx or tether ten times greater in scoliotic patient



#### How is all this helpful?

• Good evidence that if MRI is explained to the patient, back and neck pain can improve without intervention

• To this end, it is useful to attend regular seminars to understand MRIs – especially axial views

• For example on the images to the right, the lower part clearly shows the disc (in black) encroaching towards the cord (the bright white is CSF)

• On image left (patient's right) black circle is nerve. This is not visible on image right, due to disc impingement.



#### **Trend in MRIs**

- Competition is greater, therefore costs have reduced
- Public demand for MRIs potentially clogs up the system, but plenty of space privately
- Open MRIs are available for the claustrophobic
- Upright MRIs not as good in quality as supine

#### Outcomes

- 97% success if operating on prolapsed disc within 6 weeks of presentation (pain relief)
- 85-90% at 6 months
- 75% after one year

#### Summary

- Explaining the MRI: very important for patient's outcome
- Interpreting MRI and correlating

• Remember it's supine! Nerve foramina reduce in diameter by up to 25% when standing, so MRI can still miss the problem. Don't dismiss clear radicular signs just because MRI is clear. These "dynamic compressions" are good candidates for nerve root injections.

• Remember that uncommon things still happen!