Spondylosis, Facet Joint Arthropathy and Pain

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Do ‘Age Related’ Changes in the Spinal Column Cause or Contribute to Chronic Pain?
And why enquire about this?

- Major insurance agencies worldwide covering work and other accident related injury often use the presence of ‘spondylosis’ and ‘facet joint arthropathy’, as seen on imaging, to decline further cover for a particular incident.

- This often occurs without warning in a setting in which the patient felt an inherent security in the system or process that was expected to provide for his medical rehabilitation, and protection of income while injured.

- Question: Is this a justifiable stance? Yes or No?
Questions requiring answers...

- What is the true prevalence of spinal spondylosis and altered zygapophysial (facet joint) morphology?
- What is its relation to increasing age?
- How much do these changes contribute to spinal pain syndromes?
Spondylosis - Definitions

‘Spondylosis is a process whereby the morphology of the vertebral bodies change, with the production of marginal osteophytes at the superior and inferior bodies’

‘One cardinal feature of spondylosis is said to be the development of vertebral body osteophytes’

Bogduk, 1997 (1)
Spondylosis - Definition

‘Spondylosis is a term referring to degenerative osteoarthritis of the joints between the centra of the spinal vertebrae and or neural foraminae. In this condition the interfacetal joints are not involved’

(Wikipedia – the online encyclopaedia)
Age Changes in the Spinal Column

The ‘Wear and Tear’ of Life
Intervertebral Discs
The Ageing Disc

- Reduced proteoglycan synthesis (65% by dry weight > 30% as early adulthood > age 60)
- Reduction in proteoglycan size
- Ratio of chondroitin/keratin drops
- This decreases water binding capacity
- Number of viable chondrocytes decreases with increasing evidence of necrosis
The end result is that with increasing age the discs become drier with an increase in collagen density and become more fibrous and less resilient.
MRI Imaging

Normal Sagittal T2
MRI
Sagittal
T2
Loss of Disc Signal and Height
Anulus fibrosis

- As the nucleus dries more load is borne by the anulus
- The lamellae of the anulus become thickened and fibrillated
- Cracks cavities and fissures may develop in the anulus
- Intervertebral disc height and diameter tend to increase with age
Vertebral Body

- Bone density decreases with age
- There is a relative loss of horizontal trabeculae
- This reduces the load bearing capacity of the vertical trabeculae and, greater load is borne by the cortical bone of the vertebra
- Cortical bone is more prone to failing under deformation than trabecular bone so that the vertebral body is more liable to deformation
- Osteophytes occur at the bony margins
Vertebral Body
Zygapophysial ('z' 'facet') joints
‘Z’ Joint Arthropathy

- The subchondral bone gradually increase in thickness with age
- Cartilage fibrillation occurs from repeated stresses of daily living with erosion and focal thinning of the cartilage
- Osteophytes develop at the attachment sites of the joint capsule and the ligamentum flavum hypertrophies
- There may be excess intra-articular fluid
MRI Imaging

Normal Axial
MRI Imaging

Facet Joint Fluid
So What Are the Real Causes of Spinal Pain?
What Does Cause Spinal Pain?

- Any tissue in the spinal column, with the exception of an intact nucleus pulposus may cause pain.

- These tissues include:
  - Intervertebral discs – nucleus and anulus
  - Facet joints
  - Vertebreal bodies
  - Muscle, ligament and tendon
  - Nerves and dorsal root ganglia
3 main sources are . . .

- Discs up to 40%  \textit{Schwarzer, 1995} \textsuperscript{(2)}
- Facet joints 15 – 40%  \textit{Schwarzer, 1994} \textsuperscript{(3)}
- In a study of 438 patients with presumed facet joint pain:
  - \textit{Cervical} – 39%
  - \textit{Thoracic} – 34%
  - \textit{Lumbar} – 27%  \textit{Manchukonda, 2007} \textsuperscript{(4)}
- Lumbar facets 33 – 42%  \textit{Manchikanti, 2008} \textsuperscript{(5)}
- And for low back, the SIJ (15%)  \textit{Schwarzer 1995} \textsuperscript{(6)}
Discogenic Pain

- Spondylosis per se is not a cause
- The pathogenesis of discogenic pain is internal disc disruption
- This is a process that is first initiated by microfracture of the endplates
Vertebral end-plates

- Each end-plate is a layer of cartilage 1 mm thick. In infancy the vertebral end-plate is part of the growth plate of the vertebral body.
- By age 20 the end-plate is gradually sealed off from the vertebral body.
- With age the end-plate becomes thinner with increasing cell death.
Facet Joint Pain

- When facet joints are injured (MVA) the non radiological pathology includes:
  - Joint capsule stretching and tearing
  - Gouging, tears, splits and partial loss of the articular cartilage
  - Damage to the surface layers of the underlying subchondral bone – infraction
  - Small undisplaced fractures of facet tips
Joint Haemarthrosis
Cartilage Damage
Bone Bruising
Fracture
Facet Joint
Tip
However . . .

- Whilst these tissues are frequently the cause of spinal pain, there is no reason to suspect that there is any particular relationship to spondylosis and altered facet joint anatomy changes that occur with age

- For example, in patients with whiplash, particularly in younger patients, imaging commonly shows no abnormality
Prevalence of Spondylosis
## Prevalence of Spondylosis By Age

<table>
<thead>
<tr>
<th>Age Range</th>
<th>20 -39</th>
<th>40 - 49</th>
<th>50 –59</th>
<th>60 – 69</th>
<th>70 +</th>
<th>80 +</th>
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<td>24%</td>
<td>45%</td>
<td>74%</td>
<td>90%</td>
<td>70%</td>
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<tr>
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<td>45%</td>
<td>73%</td>
<td>75%</td>
<td>85%</td>
<td>90%</td>
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<tr>
<td>34%</td>
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</tr>
</tbody>
</table>

- Kalichman, 2008<sup>10</sup>  
  N = 188 patients

- Yoshimura, 2009<sup>11</sup>  
  N = 3,040

- Boden, 1996<sup>12</sup>
## By Level

<table>
<thead>
<tr>
<th>L2 - 3</th>
<th>L3 - 4</th>
<th>L4 - 5</th>
<th>L5 – S1</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>30%</td>
<td>45%</td>
<td>40%</td>
<td>Kalichman 2008 10</td>
</tr>
</tbody>
</table>

GPCME South 2010 - Spondylitis and Pain
And, as we get older . . .

- Two hundred twenty-three subjects who underwent MRI 10 years ago, underwent another MRI, neurologic examination, and questionnaire survey regarding symptoms related to cervical spine and life style. Progression of degeneration of cervical spine on MRI was frequently observed during 10-year period. No factor related to progression of degeneration of cervical spine was identified except for age.

So Does Spondylosis and Arthropathy cause Spinal Pain?

The Medical Literature

For the Affirmative
Class IV evidence . . .

- ‘Low back pain is responsive to therapies that are effective for osteoarthritis in other locations. Osteoarthritis of the lumbar spine does cause low back pain’. Patients who do not have osteoarthritis of the facet joints on magnetic resonance scan do not have back pain’ (Borenstein 2004)

- ‘When mechanical factors are prominent, the condition is often referred to as “cervical spondylosis,” although the term is often applied to all non-specific neck pain. Mechanical and degenerative factors are more likely to be present in chronic neck pain.’ (Binder 2007)
For the Negative
For the Negative . . .

- Studies have highlighted the fact that a simple relationship of structural abnormalities to low back pain is impossible because similar alterations can be found in symptomatic as well as in asymptomatic individuals (Boos, 1998).
Since the 1960’s . . .

- The relationship between degenerative changes seen on imaging and back pain has been questioned . . .
  - Lawrence 1966 (15)
  - Biering-Sorensen, 1985 (16)
  - Frymoyer 1984 (17)
As for imaging . . .

- With normal X-ray the documented reliability of reporting for facet joint disease is poor, with kappa scores ranging from 0.2 to 0.3 (Coste 1991)

- Although some diagnoses related to low back pain were quite consistently evaluated, the substantial disagreement on many findings should alert clinicians and radiologists against overestimating the validity and usefulness of the examinations (Espeland 1998)
There is a weak correlation between back pain and spondylosis on plain films. The data have poor sensitivity, poor specificity, and only generate likelihood ratios (LR) of a little over 1 (Bogduk 2002).

Plain X-ray lacks validity, and with some exception, generates Likelihood Ratios seldom better than 1.5 (Bogduk 2002).

- Degeneration, defined by the presence of disc space narrowing, osteophytes, and sclerosis, turned out to be associated with nonspecific low back pain with odds ratios ranging from 1.2 to 3.3.

- There is no firm evidence for the presence or absence of a causal relationship between radiographic findings and nonspecific low back pain.
MRI . . .

- Two decades following their description, the significance of Modic vertebral endplate and marrow changes remains a matter of debate. These changes are closely related to the normal degenerative process affecting the lumbar spine, and their prevalence increases with age. *(Rahme, 2008)*

- MRI has been recognized as a modality of choice in the evaluation of the spine. Morphological abnormalities demonstrated by MR imaging do not always reflect low back pain *(Fukuda, 2001)*.
Low back pain is a common but poorly understood entity. Features of degeneration depend on which component of the motion segment is predominantly affected, and include disk space narrowing, vacuum phenomenon, disk desiccation, vertebral osteophyte formation, disk herniation, and facet arthrosis, but these features do not necessarily have any relationship to symptoms  

(Miller, 2004)
Degenerative changes of the spinal column have long been and continue to be confused with the presence of spinal distress and pain (Anderton 1998). Degenerative disorders in the spine are normal, age-related phenomena and largely asymptomatic in most cases (Roh, 2005).
Degenerative spinal pathology is often implicated as the primary reason for chronic low back pain in older adults. Despite evidence that spinal pathology may be ubiquitous in older adults regardless of pain status, radiography continues to be heavily used in the diagnostic process (Hicks 2004). Radiographic severity of disc and facet disease was not associated with pain severity among those with chronic low back pain (Hicks 2004).
Influence of occupation

- An MRI study was performed in female subjects aged 45 to 62 years with persistent LBP and in age-matched controls. Subjects (n = 109) were selected from nursing and administrative professions.

- These findings give evidence that in subjects performing non-heavy work, patterns of lumbar disc degeneration are not associated with the job type and characteristic physical loadings. (Schenk et al, Spine, 2006)
Imaging Reporting

- ‘Radiologists must take some responsibility for the way their reports are used and interpreted. At present reports of plain radiographs are relayed in a manner that is unintentionally damaging to patients because they promote beliefs and patterns of behaviour that contravene current guidelines on the management of back pain.

- Radiologists should use epidemiological information to convey precise and useful information, to reduce potential harm, and to educate their users’
And should spondylosis be reported at all?

- The labeling of disease can be beneficial in terms of defining appropriate treatment such as in coronary artery disease. However, sometimes it may be detrimental such as when x-rays are used to diagnose lumbar spondylosis

(Bedson 2004)
Illustrative Case 1

Mrs G
Age 79
Mrs G’s History . . .

- Mrs G tripped over a kerb, whilst running to catch a plane in the airport in the semi darkness
- She fell heavily striking her head and breaking a rib
- The rib healed, but six weeks later she still had significant left sub-occipital neck pain and headache VAS 70-90/100 with marked restriction of movement
Loss of Disc Space

CT Imaging

C1-2 Facet Arthropathy
CT Imaging
Facet Arthropathy
Figure 5  The frequency with which patients with pain stemming from C1–2 reported pain in various grid areas.
Left C1-2 Facet Injection
Illustrative Case 2

Mr ‘C’

Age 39
Mr C’s History...

- 39 year old truck driver
- Helping to lift 200kg sheet of metal
- Slipped, twisted and developed ALBP
- Previously fit and healthy, an active sportsman, 9 months later he cannot work or play sport
- Was assessed by an orthopaedic specialist on behalf of ACC who organised an MRI scan
Summary
Traditionally certain changes in the intervertebral discs and zygapophysial joints have been described as features of a disease.

With respect to the intervertebral discs, the term used is ‘spondylosis’.

With respect to the zygapophysial (or facet) joints the terms used are ‘osteoarthritis’, or ‘degenerative joint disease’.
Spondylosis and spinal osteoarthrosis are irregularly, if ever, in themselves associated with symptoms and disability.

Osteoarthrosis or altered morphology of the zygapophysial joints is not a disease, but an expression of the morphological changes resulting as a natural consequence of the stresses applied to the zygapophysial joints during life.
Conclusion

- Patients with spondylosis and osteoarthrosis may present with pain, but there are a greater number of others of the same age with spondylosis who do not have pain, and many with pain who have no changes at all.

- The presence of these findings on imaging should be interpreted with great caution, and should never be relied upon to establish a tissue-specific diagnosis for spinal pain.
References


