Precision Diagnosis and Management of Low Back Pain and Lower Limb Radicular Pain

Dr Sanjeeva Gupta
MD; DNB; FRCA; FIPP; FFPMRCA
Consultant in Pain Management and Anaesthesia
Bradford Teaching Hospitals NHS Trust
Low Back Pain

• Acute low back pain often responds to physical therapy, activity modification & time

• 80 - 90% resolve in 6 weeks
  – Manchikanthi L. Pain Physician 200-; 3: 167-92

• 5-10% develop persistent LBP

• Prevalence of persistent LBP is 15% in adults and 27% in the elderly with a point prevalence of 30%

• LBP with Red Flags - Urgent referral
Management of Chronic Pain

- Pharmacological approach
- Physiotherapy, TENS, etc
- Peripheral and central neural blockade
- Targeted therapy & endoscopy
- Spinal Cord Stimulator
- Restorative treatment - Vertebroplasty
- Psychological approach
Classification of pain

- **Nociceptive Pain:** Pain due to tissue damage and inflammation
- **Neuropathic Pain:** Pain initiated or caused by a primary lesion or dysfunction in the CNS or PNS
- **Visceral**
- **Mixed**
Pharmacotherapy of Pain

- Conventional analgesics
  - Paracetamol
  - NSAID - Cox 2 inhibitors
  - Opioids, Tramadol

- Nonconventional analgesics
  - Antidepressants
  - Anticonvulsants
  - Antiarrhythmics (lignocaine, mexiletine)
  - Anxiolytics, Baclofen
  - Topical agents – Capsaicin, lignocaine
Location Location Location

Diagnosis
Diagnosis
Diagnosis
Diagnosis
Current diagnostic methods

1. History
2. Physical examination
3. Imaging
4. Blood tests
5. Nerve conduction studies
“80% of patients are undiagnosable”
Precision Spinal Pain Diagnosis

- Low Back Pain
- Lower Limb Radicular Pain
Precision diagnostic methods

**Principle:**

1. Innervated
2. Stimulation - pain
3. Blockade – relief
4. Precision needle techniques - Analogous to palpation
Where does back pain come from?

1. Disc
2. Facet joints
3. Sacroiliac joint
4. Nerve root / dura
5. Vertebral Body
6. Ligaments
7. Muscles
Neuroanatomy of the Spine

- Facet joints supplied by Median Branches of Dorsal Rami

- Outer third of Annulus Fibrosis richly innervated
  - Branches of the Sinuvertebral Nerves
  - The Grey Rami Communicantes
  - Lumbar Ventral Rami

Yoshizawa H. J Pathology 1980;132:95-04

- Inner 1/3rd - Not innervated
- Middle 1/3rd - May or may not be innervated
Where does back pain come from?

Facet Joint Pain

21% - 40% in general population

16% in post lumbar surgery patients (FBSS)

Prevalence of FJP

- 15% in younger aged, injured workers
- 40% in older, rheumatology patients
  (Schwarzer et al 1994)

- L5/S1 joint commonest
- L4-5 joint common
- L3-4 joint least common
Diagnosis of Facet Joint Pain

- Clinically
  - Back pain
  - Non radicular referred pain in the postero-lateral aspect of thigh rarely below knee
  - Pain increases as the day progresses
  - Pain over the paraspinal muscles

- Radiology – Not helpful
  - Plain X-ray, Bone Scan
  - CT scan, MRI scan
Facet Joint Pain - Evaluation

- Facet Joint Injections
- Medial Branch Block
- False positive rate -30%

High on the “eye” of the “Scotty dog”
Laminae
Pedicles
Vertebral End Plates
Vertebral body
Par intraarticularies
Spinous process
SAP
IAP
Transverse process
Cephalic or Caudal tilt to view endplates

Oblique view of the lumbar spine creates the “Scotty!”
For L4-5 Facet Joint Block The L3 and L4 Median Branches at L4 and L5 are Blocked
Facet Joint Denervation - Evidence

• Shealy Technique – largely discredited
  – 12 months follow up
  – 60% patients had 80% pain relief
  – 80% patients had 60% pain relief
  – Significant sustained improvement in physical function

• Nath et al. Spine 2008; 33(12):1291-7
  – Percutaneous lumbar Facet Joint Neurotomy using radiofrequency current, in the management of chronic low back pain: a randomized double-blind trial
Where does back pain come from? 
SI joint pain

Prevalence: 10 to 38%

Manchikanthi et al. Pain Physician 2001; 4:308-16
Schwarzer N et al Spine 1995

Chronic low back below the level of L5

Clinical suspicion during physical examination

Reduction of usual pain following SI-joint injection with 3-5 ml bupivacaine 0.5%
RF-sacro-iliac joint

• False Positive Rate between 20 and 54%
  – Manchikanthi et al. Pain Physician 2001; 4:308-16

• Indication:
  – At least 80% reduction of pain on ADL following SI-joint injection with LA on two different occasions
  – Or diagnostic nerve block of dorsal rami of L5 and lateral branch blocks of S1-S3 (?)

• Retrospective Study
• 14 patients in the study
• Two test block done in all
• 64% had >50% pain relief for 6 months
• 36% had complete pain relief at 6 months


Cooled RF
RF with Simplicity III
Where does back pain come from?

**Disc stimulation:**

Discogenic low back pain 39% (29 - 49%)


Manchikanthi L, et al. *Pain Physician* 2001; 4: 308-16 (26%)
Low Back Pain

• Young Patients – 20 to 50 years – Discogenic – Annular Tear
Discogenic Pain: Mechanism

- Nucleus pulpouses contains PLA2, PG, Nitric oxide, Metalloproteinase enzymes capable of sensitising nociceptors
- IDD - Migration of sensitising chemicals into outer annulus can cause DP
- IDD - Nociceptor penetration into inner annulus + chemical sensitization
Grading IDD – CT Discography

<table>
<thead>
<tr>
<th>Grade 0 – Contrast within the NP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade I – Radial fissure - Contrast in Inner 1/3rd of AF</td>
</tr>
<tr>
<td>Grade II – Contrast in Middle 1/3rd of AF</td>
</tr>
<tr>
<td>Grade III – Contrast in Outer 1/3rd of AF</td>
</tr>
<tr>
<td>Grade IV – Grade 3 + circumferential exten.</td>
</tr>
</tbody>
</table>

High Intensity Zone

- **28% prevalence in LBP**

- **45.5% of patients and not related to symptoms**

  Rankie JJ et al. Spine 1999; 24:1918-19
Discogenic Pain

• If conservative measures fail and persistent pain
  – Investigate – MRI
  – Provocation Discography
  – Analgesic discography
False positive response of 9.3%
Wolfer L, et al. pain Physician 2008; 11; 513-38
Discogenic Low Back Pain

- Conservative management – Diagnosed by discography and no further investigations
- Caudal Epidural Steroid Injections
- Lumbar Sympathetic Block
- Lumbar Sympathetic RF Denervation
- Intradiscal Thermal Annuloplasty (IDET)
  – NICE – investigational procedure
- Percutaneous Disc Neucleoplasty
- Discectomy
- Disc Replacement
- Fusion
Caudal Epidural for Discogenic LBP

Table 14. Results of randomized and observational studies of effectiveness of caudal epidural steroid injections in managing discogenic pain.

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Characteristics</th>
<th>Methodological Quality Scoring</th>
<th>Participants</th>
<th>Pain Relief</th>
<th>Results</th>
<th>Long-term relief</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 mos.</td>
<td>6 mos.</td>
<td>12 mos.</td>
</tr>
<tr>
<td>Manchikantiet al 2008 (780)</td>
<td>RA, DB</td>
<td>72</td>
<td>64</td>
<td>78%</td>
<td>75% to 81%</td>
<td>72%</td>
</tr>
<tr>
<td>Manchikantiet al 2001 (782)*</td>
<td>O</td>
<td>76</td>
<td>70</td>
<td>95%</td>
<td>85%</td>
<td>61% to 73%</td>
</tr>
<tr>
<td>Manchikantiet al 2002 (781)*</td>
<td>O</td>
<td>73</td>
<td>62</td>
<td>86%</td>
<td>60%</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Indicates use of fluoroscopy
Advantages of precision diagnosis

• No longer treating blind - Diagnosis!
• Avoidance of continuing futile attempts at diagnosis
• Avoidance of major spinal surgery, or else surgery can be carried out in the presence of a firm diagnosis
• Reduction of the FBSS (up to 50\%) (Follet & Dirkes 1993)
**Totals:**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal disc disruption</td>
<td>39% (29 - 49%)</td>
</tr>
<tr>
<td>Discogenic LBP</td>
<td>39% (29 - 49%)</td>
</tr>
<tr>
<td>Zygapophysial joint</td>
<td>15% (10 - 20%)</td>
</tr>
<tr>
<td>Sacroiliac joint</td>
<td>15% (7 - 23%)</td>
</tr>
<tr>
<td>Total</td>
<td>69% (46 - 92%)</td>
</tr>
</tbody>
</table>
Radicular Pain - Aetiology

- Disc Prolapse
- Annular Tear – Leaking Nucleous Pulposus
- Foramenal Stenosis
- Bony Osteophytes
- Fibrosis – Failed Back Surgery Syndrome
Natural History

• Most lower limb radicular pain will settle with conservative management

• About 10% are likely to remain seriously disabled & will need further interventions

NOT RADICULAR PAIN
RADICULAR PAIN

Presentation can alter if treated

lancinating, shooting, or “electric” pain; traveling down the limb in a narrow band.

Mechanism - INFLAMMATION


RADICULAR PAIN

INFLAMMATION

- NO
- PLA_2
- PLE_2
- TNFα
- interleukins 8, 12
- leukotriene B4
- thrombaxane
- interferon γ
- metalloproteinases
- Ig M, Ig G

- dorsal root
- ganglion
- spinal nerve
- macrophages
- lymphocytes
- fibroblasts
RADICULAR PAIN

INFLAMMATION

- metalloproteinases
- Ig M, Ig G
- PLA$_2$
- PLE$_2$
- TNF$\alpha$
- interleukins 8, 12
- leukotriene B4
- thromboxane
- interferon $\gamma$

Dorsal root ganglion

- spinal nerve
- macrophages
- lymphocytes
- fibroblasts
RADICULAR PAIN

INFLAMMATION

metalloproteinases
Ig M, Ig G
interleukins 8, 12
tumor necrosis factor (TNF-α)
leukotriene B4
thromboxane
interferon γ

macrophages
lymphocytes
fibroblasts

steroids

PLA₂
PLE₂

spinal nerve
dorsal root
ganglion
Radicular Pain

- Epidurals – Caudal, Interlaminar
- DRG or Transforaminal epidural
- Catheter Neuroplasty
- Spinal endoscopy
- Sympathetic block
- Spinal cord stimulator
# Caudal Epidural Steroid Injection

Table 11. Results of randomized trials of effectiveness of caudal epidural steroid injections in managing pain of lumbar disc herniation/radiculitis.

<table>
<thead>
<tr>
<th>Study</th>
<th>Methodological Quality Scoring</th>
<th>Participants</th>
<th>Pain Relief</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manchikanti et al 2008 (769)*</td>
<td>RA, DB</td>
<td>72</td>
<td>84</td>
<td>81% 86% 79% to 81%</td>
</tr>
<tr>
<td>Dashfield et al 2005 (770)*</td>
<td>RA, DB</td>
<td>50 Caudal = 30 Endoscopy = 30</td>
<td>SI SI NA</td>
<td>P NA</td>
</tr>
<tr>
<td>Bush and Hillier 1991 (768)</td>
<td>RA, DB</td>
<td>55</td>
<td>23</td>
<td>SI NSI NSI</td>
</tr>
<tr>
<td>Mathews et al 1987 (771)</td>
<td>RA, DB</td>
<td>62 C = 34 T = 23</td>
<td>SI SI SI</td>
<td>N P</td>
</tr>
<tr>
<td>Hesla and Breivik 1979 (773)</td>
<td>RA, DB</td>
<td>58 69 patients: crossover design</td>
<td>77% vs 29% 59% vs 25% 59% vs 25%</td>
<td>P P</td>
</tr>
<tr>
<td>Breivik et al 1976 (772)</td>
<td>RA, DB</td>
<td>68 C = 19 T = 16</td>
<td>20% vs 50% 20% vs 50% NA</td>
<td>P NA</td>
</tr>
</tbody>
</table>

*Indicates use of fluoroscopy

**Radicular pain due to disc herniation**
**Post surgery syndrome**
**Spinal stenosis**
Lumbar Interlaminar Epidural

• Three Systematic Reviews

• 15 RCT on Interlaminar ESI
  – 8 reported ESI was more effective than placebo
  – 7 reported no better or worse outcome

• Of the best 11 studies
  – 6 positive and 5 negative outcome

• Conclusions
  – Benefits of ESI if any is for short duration only
    • Between 6 weeks and 3 months
Flaws in the design of most studies

- Small sample size – lack of statistical power
- No standard controls
- Blinding of study groups
- No fluoroscopic guidance
  - Needle in the epidural space – up to 52% not in ES depending on physician experience
  

- Steroid reaching the target site – Adhesions
- Steroid reaching the anterior epidural space
Lumbar Transforamenal Epidural
Transforaminal Epidural
Prospective RC Double Blind Trial

- 55 patients referred to the spine surgeon for LRP
- All patients requested operative treatment and were operative candidates by the treating surgeon

Follow-up from 1 to 2 years

Randomised into two groups

- TFI of Bupivacaine alone – Fluoroscopy and contrast
- TFI of Bupivacaine and betamethasone
Riew D, et al: The main outcome measure was avoidance of surgery

<table>
<thead>
<tr>
<th></th>
<th>Bupivacaine and Betamethasone</th>
<th>Bupivacaine only</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Patients</strong></td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td><strong>Patients not having surgery</strong></td>
<td>20 (71%)</td>
<td>9 (33%)</td>
</tr>
</tbody>
</table>

\[ P < 0.0004 \]

Normally all would have been treated operatively.
Treatment algorithm now includes 3 to 4 TFESI before considering surgery.

• A prospective randomised controlled study
• 50 patients with radicular pain due to HNP
• Group 1: 25 pts, 9 mg betamethasone +LA
• Group 2: 23 pts, TP inj with 3 ml N/S
<table>
<thead>
<tr>
<th></th>
<th>TFESI</th>
<th>Trigger Pain Injections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Patients</td>
<td>25</td>
<td>23</td>
</tr>
<tr>
<td>Patients not needing surgery:</td>
<td>21 (84%)</td>
<td>11 (43%)</td>
</tr>
<tr>
<td>Pain relief &gt;50%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NNT of 3 for 50% pain relief = NNT for Drug therapy for NP

- Randomised, Double-Blind Trial
- 160 patients, unilateral symptom for 1-6 months
- 80 patients MP +LA: 80 patients Saline
Karppinen J, et al. Spine 2001; 23: 2587-95

- Cost effectiveness of TFESI for sciatica
- For contained herniations
  - Steroid better for leg pain, disability, SLR in the short term
  - By 1 year steroid prevented operations costing $12,666 less per responder
- For extrusions
  - Steroid seemed to increase the op. rate and was more expensive
Summary – Lumbar ESI

• **Interlaminar Lumbar Epidural studies**
  – 15 RCT’s: 8 positive and 7 negative
    – Radicular pain relief between 6 wks & 3 mths
      • No fluoroscopy
      • In the posterior epidural space
      • ?Adhesions

• **Lumbar TFESI**
  – 3 RCT’s - Fluoroscopy and contrast agents used
    • 2 showed significant decrease in the need for surgery
    • 1 did not show any difference
    • 1 Showed Significant cost savings when TFESI used in contained herniated discs
Percutaneous Disc Nucleoplasty

- Day case minimally Invasive technique
- Bipolar radiofrequency technology for soft tissue ablation via molecular disintegration

*Before molecular disintegration: typical large organic molecule (protein).*

*After molecular disintegration: elementary molecules and low weight molecular gases.*
Percutaneous Disc Nucleoplasty

- Contained herniated disc with or without nerve root compression
- Bulging disc
- Positive discography
Nucleoplasty - Evidence

• 60-70% patients get good pain relief for 12 months
• Prospective trial, 49 pts with back and leg pain, follow-up 3, 6, 9 and 12 months → 79% success rate (2 point reduction on VAS)\(^1\)
• Assessment of 67 pts up to 1 year → 80% significant pain relief and 60% significant improvement in sitting, standing and walking at 12 months \(^2\)
• Follow-up of 30 pts for 12 months → VAS = 3.14, 69% resolution of leg pain, reduction in narcotic use. \(^3\)

1. Sharps, Pain Phys, 2002
2. Singh et al. Pain Phys, 2002
3. Cheng ISIS 10th annual meeting, 2002
Spinal endoscopy
Spinal endoscopy

ANATOMY & PATHOLOGY

- Inflamed tissue
- Adhesion
- Epidural fat
- Nerve root
Spinal endoscopy

Adhesiolysis: mechanically & hydrostatically

• improved CSF flow
• improved blood supply
• reduced intraneural oedema
• improved NGF delivery
• reduced nerve fibre abnormalities eg demyelination
Neuromodulation
Vertebroplasty / Kyphoplasty

- To provide relief from a pathologic vertebral compression fracture from Osteoporosis or Neoplasm
- 70 – 80% of patients experience dramatic or complete relief of pain within 72 hours
How Does Vertebroplasty Alleviate Pain?

- Stabilization of fracture
- Prevents further collapse of the treated vertebral body
Procedure: Needle Insertion

• Advance bone needle to desired position within the vertebral body using imaging guidance
Procedure: Needle Insertion
Procedure: Needle Insertion
Bone Cement Injection
Vertebroplasty

- Palliative procedure and does not correct the underlying cause of the vertebral fracture

- Medical management of osteoporosis or malignancy must therefore be initiated and continued
Conclusions

• Causes of Low Back Pain
• Precision Diagnosis and Management of LBP
• Mechanisms of Lower Limb Radicular Pain
• Management of Radicular Pain
• Neuromodulation of Radicular Pain
• Vertebroplasty for Vertebral Body Pain
Thank You for Your Attention