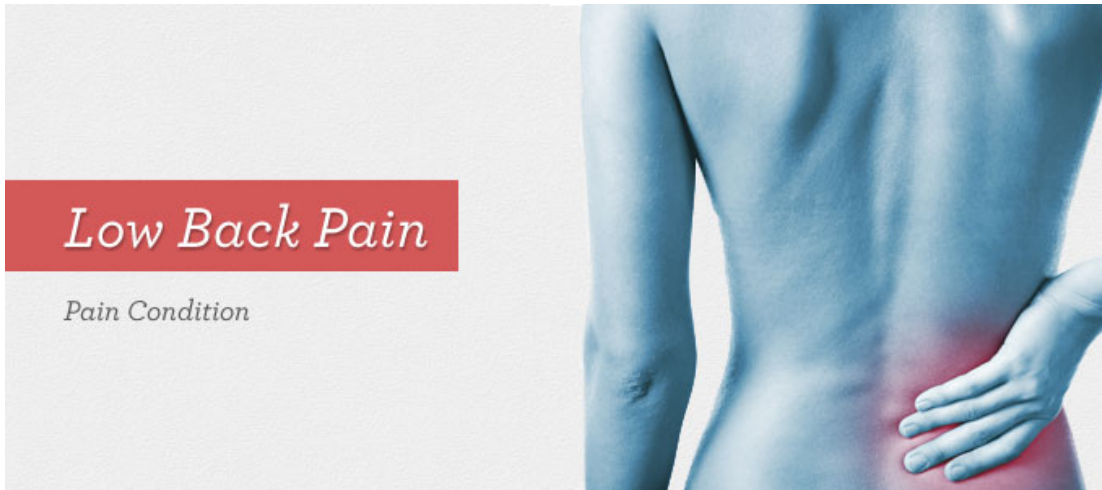


# LOW BACK PAIN MODULE



Complements of *painHEALTH* website

## Learning objectives

By the end of this module participants should be able to:

- Understand that low back pain (LBP) is the most common cause of pain and disability in the world.
- Understand the classification of LBP and how this relates to diagnosis and management.
- Screen for 'red flags' (serious medical conditions) (mnemonic 'TINT') and 'yellow flags' (psychosocial issues) (mnemonic 'CHAMPS') associated with LBP.
- Understand the causes, assessment and management of *radicular* leg pain.
- Demonstrate how to perform a *straight leg raise test* and a *slump test*.
- Demonstrate how to test power, reflexes and dermatomes related to L4, L5 and S1 spinal nerves.
- Provide patients with therapeutic information about LBP, focusing on realistic expectations, reducing catastrophic thinking and encouraging active coping and self-management.
- Understand that psychosocial factors ('yellow flags'), particularly catastrophic thinking and stress-loading, are the best predictors for developing chronic low back pain.
- Understand that opioid analgesia should be avoided for the treatment of chronic non-specific LBP, particularly in younger patients.
- Understand that a multimodal and multidisciplinary approach should be applied to the management of LBP.
- Apply the 'PainChecker'™ approach to the assessment and management of LBP.

**Essential pre-module reading:** Maher CG, et al. Managing low back pain in primary care. *Aust Prescr* [Internet]. 2011 [cited 2015 May 31]; 34:128–132. Available from: <http://www.australianprescriber.com/magazine/34/5/article/1216.pdf>

# Low Back Pain (LBP)



Figure 1: Anatomical boundaries for low back pain..

[https://firsthealthassociates.chiromatrixbase.com/clients/4688/images/core\\_strength\\_18.jpg](https://firsthealthassociates.chiromatrixbase.com/clients/4688/images/core_strength_18.jpg)

**Fast fact:** The 'old-fashioned' term for LBP was *lumbago*.

## How is LBP classified?

- *Timing* (acute or chronic?).
- *Cause* (if a cause can be found?).
- *Leg pain* (present or not?).

## Timing

- **Acute** (<3M).
- **Chronic** (persistent) (≥3M).

## Cause

- **Non-specific low back pain (NSLBP).**
  - No cause** can be identified in **80%** of cases of LBP!
- **Specific low back pain (SLBP).**
  - A specific cause ('pain generator') is identified in **20%** of cases.

## Leg pain (20% of cases)

- **Referred** leg pain ('referred' from musculoskeletal structures) (**90%** of cases).
- **Radicular** leg pain (so-called 'sciatica') (due to nerve root irritation) (**10%** of cases).

## Who gets LBP?

- LBP is so common it's considered 'a *normal part of being human*'.
- LBP is most common in middle age.
- LBP is rare in childhood.
- Childhood back pain should always be investigated as a 'red flag' (see below).
- Incidence: 80% over a lifetime.
- Prevalence: 10% of the population at any one time.
- That's 2.2 million Australians right now.
- Up to 75% will experience a repeat episode of LBP within one year.
- 20% will develop chronic low back pain (CLBP) after an acute back pain episode.

### **What are the impacts of LBP on society?**

- LBP is the most common chronic pain condition worldwide.
- LBP is the leading cause of *disability*.
- Accounts for 5-10% of all GP visits.
- Major cause of healthcare, workers' compensation and disability claims.
- Australians spend \$5 billion a year on LBP treatments.

**Reference:** Hoy D, March L, Brooks P, et al. The global burden of low back pain: estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis* [Internet]. 2014 [cited 2015 May 31]; 73: 968–974. Available from:

<http://ard.bmj.com/content/73/6/968.full.pdf+html>

### **What usually triggers an episode of acute LBP?**

- Work.
- Sports.
- Vigorous physical activity or exercise.
- Lifting, twisting, straining.
- Repetitive use of lower back.
- Pregnancy.
- '**Red flags**' (TINT) (see below).
- Other pathology (pelvic, visceral or renal disease, aortic aneurysm, shingles) (<5%).

### **What are risk factors for developing LBP?**

- Work injury.
- Sports.

- Psychosocial stress.
- Spinal surgery.
- Family history.
- High BMI.
- Smoking.
- Lack of physical fitness.

**Reference:** Parreira P, Maher CG, Latimer J, Steffens D, Blyth F, Li Q, Ferreira ML. Can patients identify what triggers their back pain? Secondary analysis of a case-crossover study. *Pain*. 2015 Jun 1. [Epub ahead of print] PMID: 26039901

**Module exercise:** *List five strategies that could reduce the risk of someone developing LBP?*

### What are some of the specific causes of LBP (*pain generators*)?

- Anatomical structures that cause LBP are called '*pain generators*'.
- Because there are many structures in the back, *in most cases (80%)* it is difficult to pinpoint a *specific* cause of LBP.
- That's why most LBP is classified as '*non-specific*' (NSLBP).
- The most common LBP generators are musculoskeletal structures, including;
- Intervertebral discs (40%), facet joints (10-20%), sacro-iliac joints (10-20%), cluneal nerves (10-20%), myofascial tissues (trigger points).
- Pin-pointing a *specific* pain generator usually involves:
  - **Imaging** (x-rays or MRI scans).
  - **A diagnostic local anaesthetic block** of the pain generator, such as facet joint.

### **Specific back pain generators**

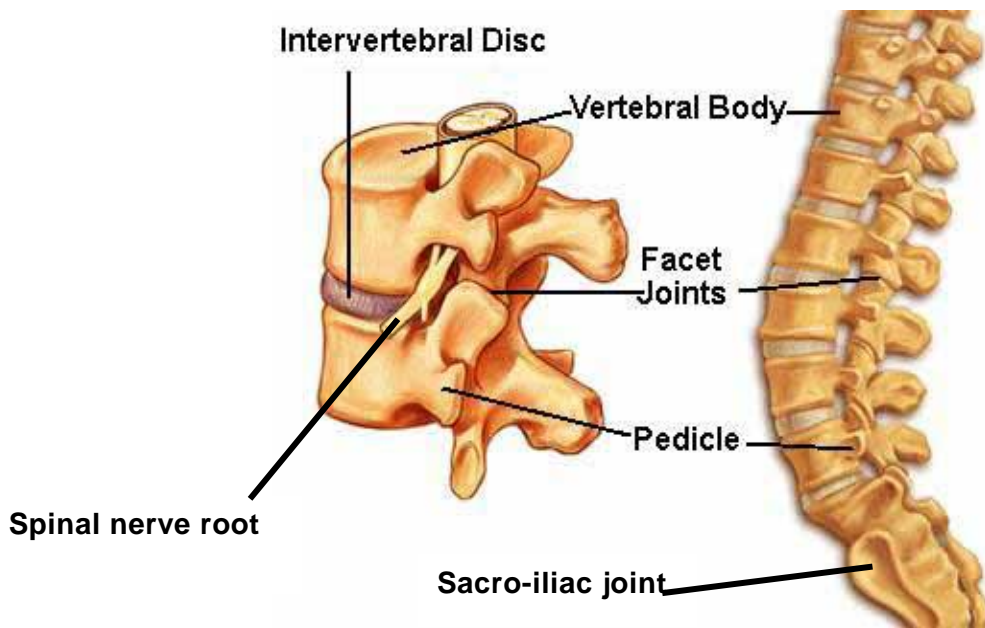


Figure 2: Diagram of the spine: structures in-and-around the lower spine which may cause back pain.  
[http://www.chiro.org/LINKS/Anatomy\\_101.shtml](http://www.chiro.org/LINKS/Anatomy_101.shtml)

### Intervertebral discs (40%)

- The most common LBP generators (40%).
- Discs develop small tears or 'fissures' (like cracks in a car tyre) which irritate nerve fibres in the **annulus fibrosus**, causing pain (see Fig. 3).
- This is called **Internal Disc Disruption (IDD)**.
- Despite IDD being the most common cause of back pain, there is no procedure, drug or operation (eg. discectomy or spinal fusion) that reliably treats this condition.

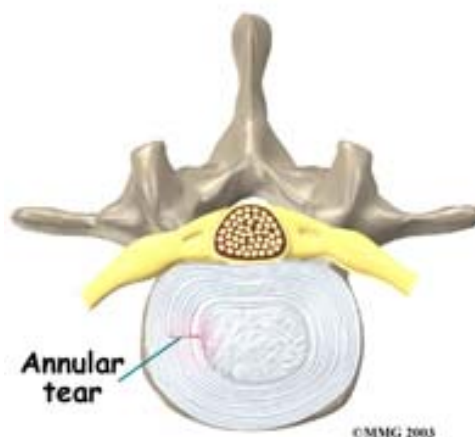


Figure 3: Intervertebral disc, axial view. Annular tears causing internal disc disruption are the most common pain generators in LBP.

[http://www.backcarebootcamp.com/images/program/bcbc\\_6\\_annular\\_tear.jpg](http://www.backcarebootcamp.com/images/program/bcbc_6_annular_tear.jpg)

### Modic vertebral end-plate changes

- Diagnosed on an MRI scan, these are *inflammatory changes in the bone marrow* of the vertebral end plates, which can be associated with back pain in some cases (see Fig. 4).

- **Fast fact:** Scandinavian scientists recently proposed that Modic inflammation in vertebral end plates was caused by a low-grade acne bacteria infection which means LBP could be treated with antibiotics!

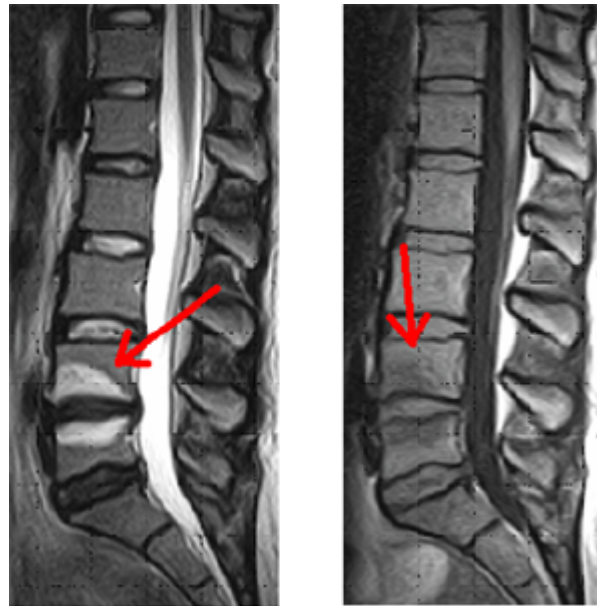


Figure 4. Modic changes in lumbar vertebral body end-plates on MRI.

<http://images.yuku.com.s3.amazonaws.com/image/gif/c05256543996f34ace8fa92b35f9069d4a95eff.gif>

### Facet (zygapophysal or 'Z') joints (10-40%)

- Small joints on the outside of the lumbar spine (look like 'fins') (see Fig. 2).
- They can develop osteoarthritis which in turn may cause spinal pain.
- Facet joint pain is most common in over 60s and rare in younger persons.
- The only way to diagnose facet joint pain is to perform a **diagnostic local anaesthetic block** of the joint.

### Sacroiliac joints (SIJs) (10-20%)

- Are the largest joints in the body.
- SIJ pain is felt (one-sided predominantly) in the low back, buttock and posterior thigh.
- SIJ pain is common in **inflammatory (seronegative) arthritis** eg. *ankylosing spondylitis*.



## Leg pain (associated with LBP) (20%)

- Leg pain is associated with back pain in **20%** of cases.
- **Referred leg pain:** is most common (90%) and caused by discs, facet joints or SIJs and
- **Radicular leg pain:** (sometimes called 'sciatica') is much less common (10%) and is caused by compression or inflammation of lumbar spinal nerve roots.

## Radiculopathy and radicular leg pain

- **Radicular:** means 'spinal nerve root.'
- **Radiculopathy:** means 'pathology' of a spinal nerve root
- **Radiculitis:** means an 'inflamed' nerve root.

### Radicular leg pain is caused by:

- *Compression* of a lumbar spinal nerve root by a *disc prolapse* (hernia).
- *Compression* of a nerve root in an *intervertebral foramen* or in the *central spinal canal*—*this is called spinal stenosis.*
- *Inflammation* of a nerve root and/or the **dorsal root ganglion.**
- An *annular tear* can 'spill' disc contents (*nucleus pulposus*) on to a nearby nerve root, causing inflammation (*radiculitis*) and radiculopathy (see Fig 7).

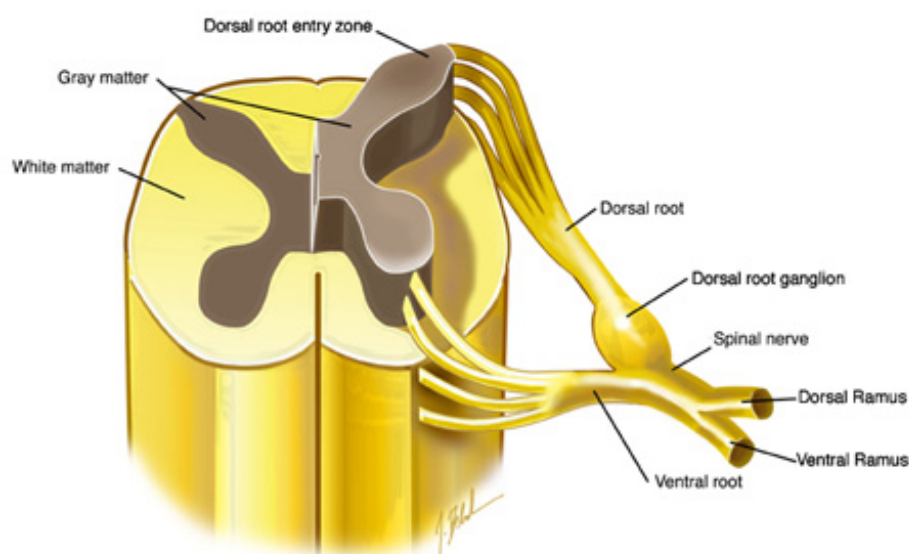


Figure 5. Typical anatomy of a spinal nerve root.

[http://www.daviddarling.info/encyclopedia/N/nerve\\_root.html](http://www.daviddarling.info/encyclopedia/N/nerve_root.html)

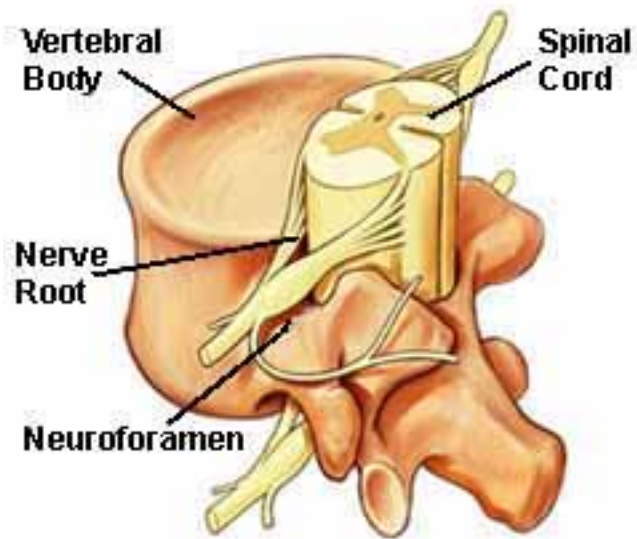


Figure 6. Lumbar nerve root related to a vertebra.

[http://www.chiro.org/LINKS/Anatomy\\_101.shtml](http://www.chiro.org/LINKS/Anatomy_101.shtml)

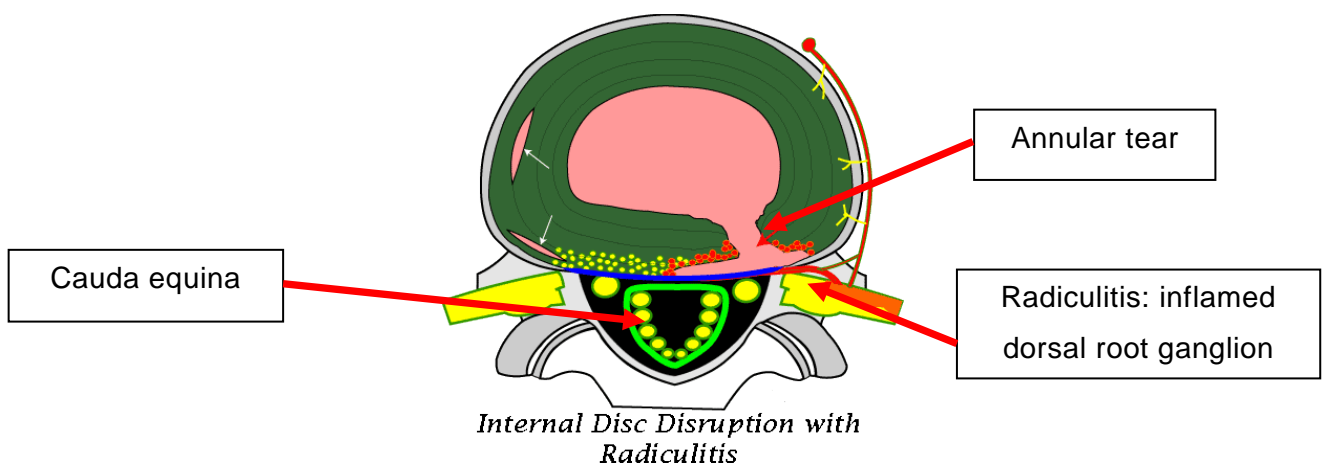


Figure 7. Internal disc disruption (IDD) with chemical inflammation of the nerve root and dorsal root ganglion (radiculitis).

[http://www.southcoastspine.com.au/images/Causes\\_of\\_Back\\_and\\_Neck\\_Pain/anatomy-normal-disc.png](http://www.southcoastspine.com.au/images/Causes_of_Back_and_Neck_Pain/anatomy-normal-disc.png)



## Radiculopathy

- **Radicular pain** is a form of *neuropathic* (nerve) pain.
- Pain described as 'electrical': *burning, aching, shooting, stabbing, electric shocks*.
- Look for *sensory signs and symptoms* in the leg (allodynia, paresthesiae, numbness).
- Look for *motor signs and symptoms* in the leg (weakness, reduced ankle or knee reflexes).

## Diagnosis of radicular leg pain

- **90%** of radicular leg pain involves the L5 or S1 spinal nerve roots.

## Applied neuro-anatomy

- A lumbar disc protrusion compresses the spinal nerve root **below** it.
  - L4/5 disc protrusion = L5 nerve root compression.
  - L5/S1 disc protrusion = S1 nerve root compression.
- NB: in the **cervical spine** a disc protrusion compresses the spinal nerve root **above** it.

## To diagnose radicular leg pain you need '3 Ps'

- **Pain** (leg).
- **Physical** examination findings.
- **Picture**: MRI or CT scan.

## Pain

- Pain with neuropathic qualities.
- Typical pattern of radiation (see Fig. 11b below).

## Physical examination

- Power (see Fig. 11b)
- Reflexes
- *Straight leg raise test* (see Fig. 9)
- *Slump test* (see Fig. 10)
- Sensation (numbness, allodynia) (see Fig. 11b).

## Clinical presentation of L5 or S1 radiculopathy

- Identify patterns of leg pain, numbness, motor & reflex changes seen in Figure 11b.
- *Scan (MRI or CT) of the lumbar spine* demonstrates a nerve root compression corresponding with the clinical presentation.

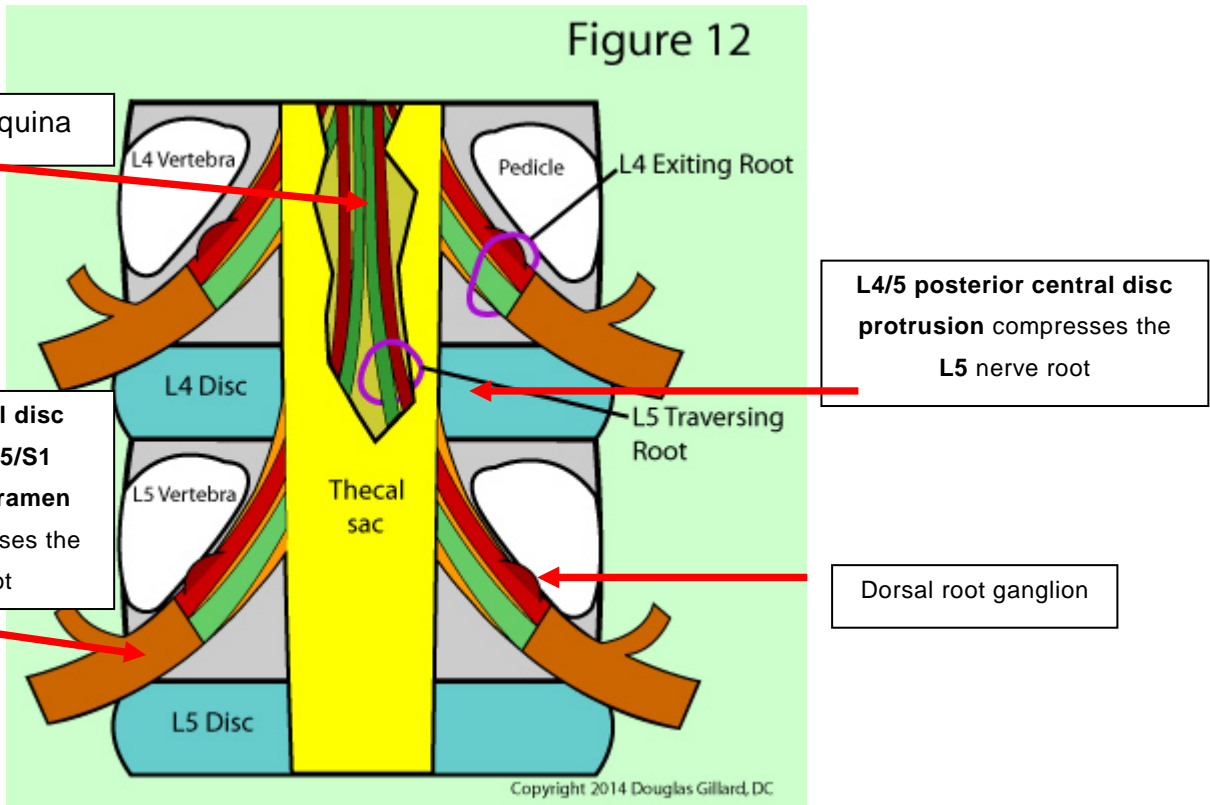


Figure 8. Sagittal view of lumbar spine showing where disc protrusions & nerve roots may intersect, causing radiculopathy. <http://www.chirogeek.com/Anatomy%20Page/Images/Anatomy%20PG/traver-exit-roots.jpg>

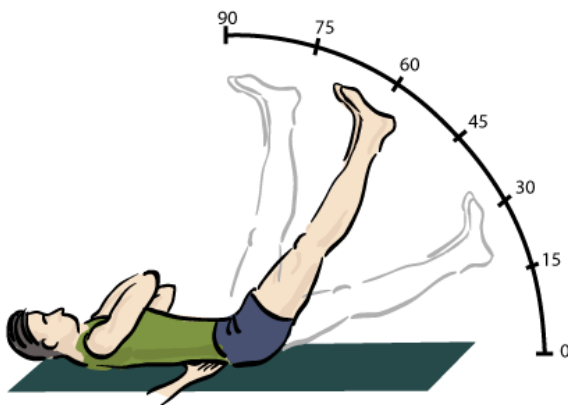


Figure 9. Straight leg raise test for radicular leg pain. [http://en.wikipedia.org/wiki/Straight\\_leg\\_raise#/media/File:Straight-leg-test.gif](http://en.wikipedia.org/wiki/Straight_leg_raise#/media/File:Straight-leg-test.gif)



Figure 10. Slump test for radicular leg pain.  
<https://lumbarspineassessment.files.wordpress.com/2012/10/slump1.jpg?w=900>.



Figure 11a. Saggital MRI of lumbar spine demonstrating an L5/S1 disc protrusion.

Figure 1: Testing for lumbar nerve root impingement







Nerve root	L4	L5	S1
Pain			
Numbness			
Motor weakness	Extension of quadriceps	Dorsiflexion of great toe and foot	Plantar flexion of great toe and foot
Screening exam	Squat and rise	Heel walking	Walking on toes
Reflexes	Knee jerk	None reliable	Ankle jerk

Figure 11b. Patterns of motor weakness, reflex changes, pain and numbness for L4, L5 & S1 radiculopathy.

Bigos S, Bowyer O, Braen G, et al. Acute low back pain problems in adults: Clinical Practice Guideline, Quick Reference Guide Number. 14. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research. AHCPR Pub. No. 95-0643. December 1994. Available from: <http://www.chirobase.org/07Strategy/AHCPR/clinicians.pdf>

**Spinal stenosis (lumbar)** is a pain syndrome consisting of:

1. Low back pain.
  2. Radicular leg pain (usually bilateral).
  3. **Claudication** (leg pain & numbness that worsens after walking a set distance).
  4. A spinal MRI or CT scan showing narrowing (stenosis) of lumbar central spinal canal.
- Spinal stenosis may be due to: disc protrusion, facet joint enlargement (osteophytes), or 'slippage' of vertebral bodies (*spondylolisthesis*) (see below).
  - Spinal stenosis usually affects the elderly (over 70s).
  - Back pain and aching legs (claudication) develops after walking a set distance (especially climbing stairs).
  - Claudication is relieved by rest or leaning over a shopping trolley whilst walking in the supermarket!



Figure 12. Sagittal MRI of lumbar spine demonstrating an L4/5 disc protrusion causing a central spinal stenosis. Note obliteration of the (white) CSF signal (cauda equina compression).  
<http://spinedisease.com/el-kadi/wp-content/uploads/mri-lumbar-stenosis.png>



Figure 13. Axial MRI of lumbar spine demonstrating a disc protrusion causing a central spinal stenosis. Note obliteration of the (white) CSF signal (cauda equina compression).  
[http://www.srs.org/patient\\_and\\_family/the\\_aging\\_spine/graphics/closed\\_spinal\\_canal\\_MRI.jpg](http://www.srs.org/patient_and_family/the_aging_spine/graphics/closed_spinal_canal_MRI.jpg)



Figure 14. Leaning over a shopping trolley whilst walking decompresses the cauda equina in the lower back and reduces leg pain in patients with spinal stenosis.  
[http://www.longstreetclinic.com/images/stenosis\\_cart.jpg](http://www.longstreetclinic.com/images/stenosis_cart.jpg)

### Module question

Q. Why do you think claudication *worsens* when someone with spinal stenosis climbs a flight of stairs, and why does walking leaning over a shopping trolley help?

A. The diameter of the lumbar central spinal canal is increased by flexing the spine, taking pressure off the nerves of the cauda equina and thus reducing leg pain.

### Pars fractures

- About 10% of the population are born with an increased risk of developing small fractures in the pedicles of the spinal arch.
- These are called *pars (stress) fractures* and are more common in younger people with low back pain, and in fast bowlers.
- L5 pedicles are most commonly affected.
- Pars fractures (bilateral) can lead to 'slippage' of adjacent vertebrae (spondylolisthesis) and central spinal canal stenosis (see Fig. 16).
- It's not really clear if they cause low back pain.

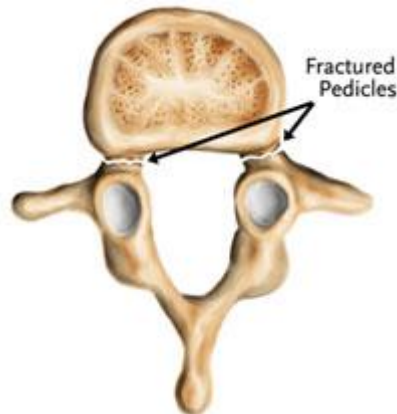


Figure 15. Pars fractures of lumbar vertebral pedicles.  
<http://drbrettaylor.com/wp-content/uploads/2011/09/spondy5.jpg>

### Back pain terminology

- **Spondyl:** means 'spine'.
- **Spondylosis:** means 'degeneration' of the spine eg. osteoarthritis, disc degeneration.
- **Spondylitis:** means 'inflammation' of the spine, such as ankylosing spondylitis.
- **Spondylolisthesis:** is slippage ('listhesis') of the spine, where one vertebral body moves relative to its neighbour.
  - Associated with pars fractures or degenerative facet changes (elderly).
  - Spondylolisthesis can cause nerve root compression.



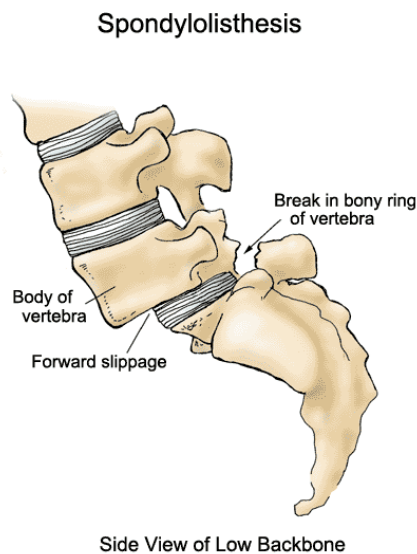


Figure 16. L5 on S1 "listhesis" (slippage) due to bilateral L5 pars fractures.  
<http://perfectformphysio.com.au/wp-content/uploads/2013/04/spondylolisthesis1.gif>

### Cluneal neuralgia 10-20%

- *Cluneal neuralgia* (due to cluneal nerve compression in thoraco-lumbar fascia) is an often-forgotten cause of unilateral low back, buttock and thigh pain.
- The 3 branches of the *superior cluneal nerve* descend from T12, L1 and tunnel through the *thoraco-lumbar fascia at the top of the iliac crest* where they may be compressed; somewhat like a carpal tunnel syndrome of the back! (see Fig. 17).
- Cluneal nerves may also be damaged by iliac bone graft harvesting during spinal surgery.

### Clinical presentation

- Usually history of *twisting or rotational injury* to lower back, or iliac bone graft harvest.
- Low back, buttock and thigh pain: usually unilateral, 'aching' & neuropathic pain qualities.
- Altered sensation (increased or decreased) of skin over the buttock.

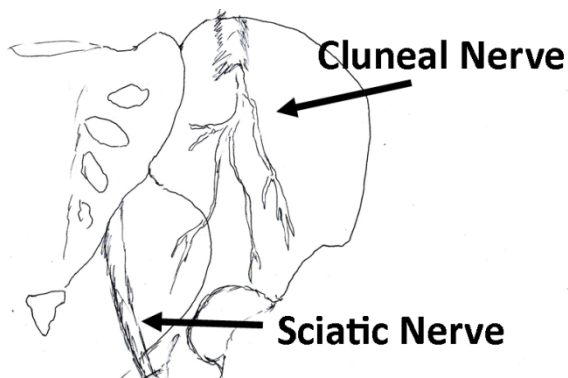


Figure 17: Cluneal nerve passing through tunnel of thoraco-lumbar fascia-tunnel compression.  
<http://www.bing.com/images/search?q=cluneal+nerve&view=detailv2&&id=9AD204B3203B884F9F3468B17D27B77EF0ACB9B4&selectedIndex=37&ccid=6VOixkxh&simid=608003216089677995&thid=JN.Qvv8SjWMA%2fkPAZUGjLkbcw&ajaxhist=0>

### Cluneal nerve tests (*perform these on every back pain patient*).

- Get a toothpick, start over the mid back (about T7) in line with top of iliac crest and go down one side; altered sensation over the buttock suggests cluneal neuralgia.
- Press over the top of the iliac crest (in 11-1 o'clock position) with one finger—if tender and reproduces the pain, suggests cluneal neuralgia.

### Myofascial structures in the low back.

- Back muscles attached to the spine act like 'scaffolding' to support and stabilise it (referred to as **spinal core stability**).
- These muscles may develop 'knots' ('trigger points') which cause pain.
- Specific muscles in the buttock, such as the *piriformis* and the *gluteals* may also cause low back pain, often radiating from the buttock, down the back of the leg (similar to 'sciatica').

### Risk factors for LBP: The 'flags' concept

- 'Flags' remind us of things-not-to-miss when assessing anyone with musculoskeletal pain.
- 'Flags' should be checked **every time** you see a patient with musculoskeletal pain.
- **Red flags** are biomedical conditions that should not be missed, such as a fracture or cancer (The good news is that red flags cause less than 5% of low back pain).
- **Yellow flags** are psychosocial factors that predict increased risk of developing chronic low back pain and disability.

### Red flags

Remember the mnemonic **TINT**

Tumour, Infection or Inflammation, Neurological (*cauda equina*), Trauma.

- **Red flags** include vertebral fractures (osteoporosis), infections of discs and bones, tumours (eg. breast or prostate cancer), inflammatory arthritis, or nerve, cauda equina or spinal cord compression.

### Important **red flags** when taking a history are:

- Cancer history.
- Steroid use.
- Trauma (falls in the elderly) (vertebral or pelvic fractures).

- Intravenous drug use (discitis or osteomyelitis of the spine).
- Extremes of age (< 20 or > 70).
- Night pain and sweats.

## Cauda equina syndrome

Do NOT miss this **red flag** presenting with:

- Leg weakness.
- Change in bladder or bowel function.
- Numbness in the saddle region.

**Cauda equina syndrome is a neurosurgical emergency, requiring urgent referral.**

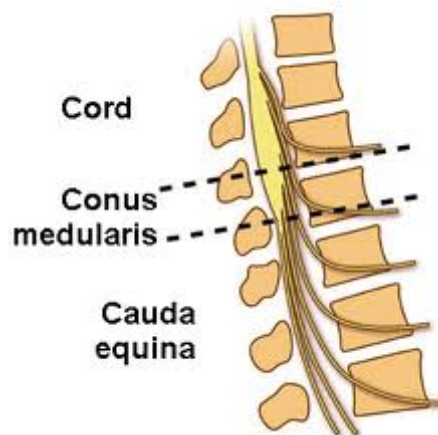


Figure 18. the Cauda Equina in lumbar spine.

<http://www.resus.com.au/wp-content/uploads/2012/03/images3.jpeg>

## Discitis

- Discitis is like the labour pain of the back
- If LBP is severe, the patient is distressed and there is a risk of systemic infection IVDU, diabetes, endocarditis, it is discitis until proven otherwise

## Yellow flags

Remember the mnemonic **CHAMPS**

**C**atastrophic-thinking, **H**ypervigilance, **A**nxiety, **M**edically-focused, **P**assive-coping, **S**tress or **S**ubstance over-use.

- 20% of patients with acute back pain develop chronic low back pain within 12M.
- Yellow flags are the best predictors of developing chronic low back pain and disability after an injury.
- Yellow flags are more predictive than an MRI scan!

## What are the best predictors of chronic back pain and disability?

- Yellow flags.
- Severe acute back pain.
- Psychosocial stress.
- Unhappiness at work (I hate my boss and my job).
- Maladaptive coping behaviours (passive rather than active).
- Functional impairments.
- Poor general health and fitness.
- Depression, anxiety.
- Substance or medication overuse.

**Fast fact:** A study at the Boeing aircraft factory in the 1960s found the best predictor of developing chronic pain and disability after a back injury was how much you disliked your boss.

## Malingering

- Malingering is deliberately acting sick for secondary gain, such as financial compensation.
- Malingering is not a psychological disorder—it is acting and deceit.
- Despite folklore to the contrary, malingering is uncommon (less than 5% of patients chronic LBP and disability)
- Insurers often confuse malingering and yellow flags when investigating patients reporting low back pain—especially using video surveillance.

## 10 key messages

1. LBP is the world's leading cause of chronic pain and disability.
2. LBP is classified according to *timing, cause* and presence-or-absence of *leg pain*.
3. LBP is triggered by vigorous physical activity, lifting, twisting or straining, most often at work.
4. Most back pain is classified as 'non-specific' (NSLBP) because it is difficult to pinpoint a specific pain generator.
5. Intervertebral disc disruption (40%), facet joint arthropathy (20-40%), sacroiliac joint arthropathy (10-20%) and cluneal neuropathy (10%) are the most common low back pain generators.
6. Radicular leg pain ('sciatica') occurs in less than 10% of cases.
7. **Every time** you see someone with musculoskeletal pain, check for 'flags'.
8. TINT (red flags)
9. CHAMPS (yellow flags): predictors of chronic pain and disability after injury.
10. Do NOT miss cauda equina syndrome (weak legs, bladder/bowel, saddle-numbness).

## Management of low back pain

### Essential pre reading

- Australian prescriber 2011  
[pdfhttp://www.australianprescriber.com/magazine/34/5/128/32](http://www.australianprescriber.com/magazine/34/5/128/32)
- NPS Back pain 2013  
<http://www.nps.org.au/conditions/nervous-system-problems/pain/for-individuals/pain-conditions/low-back-pain/back-pain-acute-low/back-pain-choices>

## Management of *acute* low back pain

### Brief summary

#### Key messages

- Keep it simple (KISS).
- Watchful waiting.
- Reassure and educate.
- Site, cause & leg pain?
- Identify flags
- Simple analgesia (paracetamol, NSAIDs, tramadol, tapentadol)
- Comfort measures (heat packs).
- Keep moving and keep working.