

*Ministry of Defence*

## **Synopsis of Causation**

### **Low Back Pain**

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## **Disclaimer**

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This synopsis has been completed by medical practitioners. It is based on a literature search at the standard of a textbook of medicine and generalist review articles. It is not intended to be a meta-analysis of the literature on the condition specified.

Every effort has been taken to ensure that the information contained in the synopsis is accurate and consistent with current knowledge and practice and to do this the synopsis has been subject to an external validation process by consultants in a relevant specialty nominated by the Royal Society of Medicine.

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# 1. Definition

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- 1.1. Low back pain is a poorly defined term but represents the symptom of pain or discomfort felt in the back or buttocks.
- 1.2. It may be the presenting complaint for a number of different disorders.
- 1.3. Low back pain sufferers can be divided into acute and chronic groups. Definitions vary, but where symptoms persist for more than 12 weeks the condition is generally considered to be chronic back pain. This distinction aids treatment and prognosis.
- 1.4. Back pain is a common problem and was recently thought to affect 17.3 million people in the UK.<sup>1</sup>
- 1.5. Three quarters of people will have low back pain at some point in their lives. Up to one third of people experience back pain in the course of a year. At any one time up to one fifth of the population will have back pain. Up to 10% of sufferers have chronic back pain.<sup>2,3</sup>
- 1.6. One third are referred to orthopaedic surgeons; one fifth can be given a precise causal diagnosis; 3% are admitted to hospital for assessment and treatment and only 0.5% will undergo surgical treatment.

## 2. Clinical Features

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- 2.1. The reported features of back pain will be determined by the underlying condition. It should be emphasised again, that in only 1 in 5 patients can a definite pathological process be identified as causing the symptoms.
- 2.2. Pain can be felt not only in the lower back but also buttocks, hips, sacrum and thighs. The pain may be made worse by activity or inactivity, bending, lifting or stretching. Often riding a bicycle does not cause pain.<sup>4</sup> The quality of the pain can vary widely.
- 2.3. Back pain should be distinguished from nerve root pain. Back pain referred from a specific process is often felt 5-10cm below the site of the problem and is vague. It can include the low back, buttocks and thighs.<sup>5</sup> Nerve root pain follows a recognised anatomical pattern stretching down the leg. Back pain can occur before nerve root symptoms develop.<sup>6</sup>
- 2.4. The timing of symptoms is varied. The reported onset of back pain following a causative injury can be delayed. A delay of 2 weeks is not unusual.<sup>6</sup> This may be prolonged further if the injury was associated with a head injury or time spent in bed.
- 2.5. Three patterns of back pain are recognised. Acute back pain lasts up to one month; this represents the majority of patients. Sub-acute back pain lasts 1 to 3 months. Chronic back pain is defined when symptoms have been present for more than 3 months. Only a small proportion of this last group recover. Overall, chronic back pain sufferers represent about 10% of all patients with back pain.<sup>7</sup>
- 2.6. Pain severity is difficult to assess. Activities affected by back pain include the everyday tasks of daily living, work, leisure and the use of aids. Formal scales such as the Oswestry index are often recorded but are best considered in context.<sup>8,9</sup>
- 2.7. Severe night pain is a feature of tumour or infection.
- 2.8. Radiographs and MRI or CT scans are often obtained. Abnormalities are frequently found in such imaging. This is often unrelated to symptoms and should be interpreted in the context of the clinical picture. For example, during the investigation of a patient with back pain in whom lumbar disc prolapse is suspected, an MRI scan might be carried out. In order to confirm the diagnosis this might be followed by a provocative test where fluid is injected into the disc itself, using x-ray control. Only then could the surgeon be confident that the disc is the source of back pain. This is also the case for facet joint degeneration – confirmatory tests are used to evaluate suspected sources of pain rather than simply assuming that a radiological abnormality must be the cause of the pain.

### 3. Aetiology

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- 3.1. A prospective survey in Manchester of 2715 adults with no previous back pain, found that approximately one third of people had an episode of back pain in the following year.<sup>10</sup> It can, therefore, be hard to attribute the onset of pain to a specific event.
- 3.2. Causes of back pain include:<sup>11</sup>
  - 3.2.1. Unknown, often labelled mechanical back pain 70%.
  - 3.2.2. Degenerative discs and facet joints 10%.
  - 3.2.3. Prolapsed discs giving nerve root pain 4%.
  - 3.2.4. Spinal stenosis 3%.
  - 3.2.5. Others, including referred pain, psychogenic pain and miscellaneous causes.
- 3.3. Spondylolisthesis: The presence of this abnormality radiographically is not uncommon. Unless symptomatic during the teenage years, it is not considered by spinal surgeons to cause back pain. The subject is considered in more detail in the Synopsis *Spondylolisthesis*.
- 3.4. Generally, compared to someone without a past history of low back pain, an individual is more than 2-3 times more likely to develop further back pain if there is a history of previous episodes.<sup>12</sup> Other factors thought to be important in causing back pain include smoking, being overweight, exercise and height, although there is no clear evidence to support these in the literature.<sup>10,12</sup>
- 3.5. If it is thought that an event precipitated the onset of back pain, then the mechanism of injury should be considered with an estimate of the amount of force involved. For example one should establish whether a normal or abnormal working practice was involved, if a fall was involved which part of the body hit the ground first, and what training had been given in lifting and handling techniques.<sup>6</sup>
- 3.6. Service personnel will be at risk from the same problems as the general population. They may be considered to be at increased risk due to certain occupational exposures, such as physical workload (repeated heavy lifting, trekking with back-packs) or recurrent minor 'soft-tissue' type injuries, insignificant when sustained but claimed to result in degeneration later in life. However, a recent literature review from Canada summarises the change in emphasis in recent years regarding occupational exposure and lumbar degeneration.<sup>13</sup>
- 3.7. Videman's group in Alberta, Canada, have written extensively on the subject of occupational exposure and lumbar degeneration, both original work and reviews. Their most recent summary clearly states that "physical loading specific to occupation and sport has a relatively minor role" in lumbar degeneration. Instead genetic factors are felt to have a "dominant" role. They consider that genetic influences explain 74% of variance in adult populations and note the identification of several gene forms associated with degeneration.<sup>13</sup>
- 3.8. This represents strong evidence to reject claims of occupation being a dominant cause of back pain. There is also no evidence specifically linking minor injuries with subsequent degeneration.

3.9. **Mechanical Back Pain.** This is a term referring to pain arising and experienced in the back or buttocks. There may be no obvious cause or it may be due to a number of processes, some of which are discrete problems in themselves.

3.9.1. The unifying features are an absence of nerve root pain, pain usually worse on waking partly due to stiffness, pain worse on activity and towards the end of the day, but not precluding sleep.

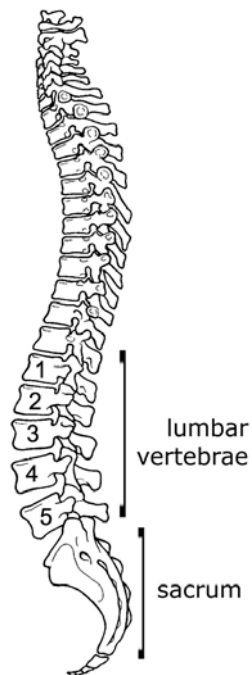


Figure 1: Lumbar and Sacral vertebrae

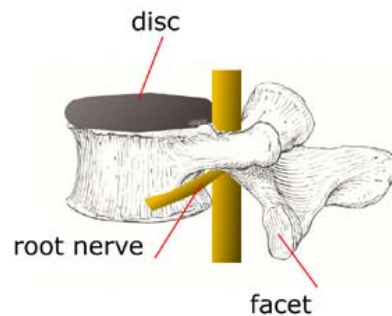


Figure 2: Vertebra from the side

3.9.2. The main cause is probably spinal degeneration. This can arise from the normal ageing process of the intervertebral disc in which the fluid content is lost. This in turn reduces its function and increases forces through other parts of the spine leading to progressive facet (intervertebral joint) disease. This can be painful and may additionally cause spinal stenosis or nerve root pain due to impingement.

3.9.3. **Sacroiliitis** usually presents with pain at the base of the spine between the buttocks with no nerve root findings.

3.9.4. **Myofascial pain** presents with pain and tenderness over specific areas (trigger points) as well as stiff muscles. Pain often improves with stretching. **Fibromyalgia** presents with pain and tenderness over trigger points also. One of these is the lower back. Generalised stiffness, muscle pain and lethargy are also present.

3.9.5. Serious causes of back pain include **osteomyelitis**. This results from infection within the vertebral bodies.

3.9.6. **Malignant tumours** of the spine will also present with pain, typically at night.

- 3.10. **Referred back pain.** This is pain felt in the back but not arising from the back. The pain is referred from other areas, for example aortic aneurysm, bowel disease, urinary tract infections and hip arthritis.
- 3.11. **Psychogenic back pain** is a diagnosis which should only be made by exclusion. It is pain in the absence of any physical causes. Waddell's inappropriate signs are often present.<sup>14</sup> These are a series of manoeuvres and observations that appear to the patient to provoke spinal symptoms but in fact indicate that a non-organic or psychological component is present. If more than 3 of the 8 signs are found the clinician should assess the case comprehensively. Waddell's inappropriate signs include non-specific pain over the whole back, extreme behaviour and the loss of a positive straight leg raising test when the patient is distracted.
- 3.12. **Discogenic back pain.** Pain arising from the intervertebral discs can contribute to mechanical back pain or it may be a discrete problem itself. Symptoms are more pronounced when the disc is prolapsed. A direct link to a causal event may be hard to establish but pain is likely to commence soon after the event.
- 3.12.1. The pain arises from the intervertebral disc itself and tends to be felt in the middle of the back. It is worse when bending and lifting, or when arching the back. The most common locations for prolapse are the structures in the lower part of the spine, L4-S1 (Figures 1 & 2).
- 3.12.2. There is no evidence for how probable a disc prolapse is following injury. Prolapsed discs are found at post-mortem examination in one third of adults older than 20 years. Only 3 in 100 are thought to cause symptoms. Their presence is therefore neither uncommon nor necessarily a cause for back pain.
- 3.13. **Nerve root pain.** This may be caused by disc prolapse, spinal degeneration or spinal stenosis. The pain may extend to the buttock and leg and tends to be sharp and well localised, and there may also be tingling or numbness. There is often a positive straight leg raise pain made worse by lifting a straight leg on the affected side.
- 3.14. **Spinal stenosis.** This is a narrowing of the lumbar or cervical spinal canal, which causes compression of the nerve roots. The condition may occur due to degeneration of the joints between vertebrae or due to loss of height of the discs with age. The loss of disc height will usually be seen on x-rays of the lumbar spine. Patients frequently experience leg pain, often in both legs and made worse by walking. In this setting, even minor trauma may provoke nerve root pain.
- 3.15. There are some exposures that are specific to military personnel.
- 3.15.1. **G-Forces.** Studies regarding military personnel and their occupational exposure to risk factors generally involve small numbers of subjects. The studies tend to be observational or case-controlled in nature. The evidence provided as such is of a lower quality than that, for example, from randomised-controlled trials. Valid points are however raised.
- 3.15.2. Hämäläinen has raised concerns about the effect of high G-forces on lumbar spine symptoms in a questionnaire survey.<sup>15</sup> This work could have been strengthened with further objective assessments. The expressed aim of the study was to determine whether high G-force exposure caused work-related thoraco-lumbar spine pain in fighter pilots. The study surveyed 320 fighter pilots and 283 non-flying controls matched for age and sex, using a questionnaire assessing back pain. The conclusion was that pilots were between 1.5 and 3.5 times

more likely to experience thoraco-lumbar pain than non-pilots of similar age and sex. This risk increased with increasing G flight hours.

- 3.15.3. Petren-Mallmin and Linder sought to establish the reason for this in a case-control study.<sup>16</sup> A survey of MRI scans of the cervical spine led to the conclusion that military high performance aircraft pilots seem to be at increased risk of premature development of degenerative lesions of the same type as are seen in an aging population.
- 3.15.4. **Vibration.** De Oliveira et al. found a lack of evidence linking low back pain in helicopter pilots to poor posture in-flight and whole-body vibration.<sup>17</sup> In a small observational study of 10 pilots, only one pilot showed significant correlation between vibration and spinal muscle response. Generally, muscle contraction was low during most of the flight.
- 3.15.5. Battie et al. compared driving exposure in 45 identical twins from the Finnish Twin Cohort in an observational study, where one had been exposed to an occupation involving driving and one had not.<sup>18</sup> There was no difference in the amount of disc degeneration between those twins that drove as an occupation and their brothers.
- 3.15.6. **Impact.** Bar-Dayyan et al examined the presence and amount of degenerative changes in the lumbar spine of 74 parachutists.<sup>19</sup> The degenerative changes correlated both with the parachutists' age and the number of jumps undertaken . It was therefore not clear whether the jumps were causal.

## 4. Treatment

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- 4.1. Guidelines for the Arthritis and Musculoskeletal Alliance have recently been published following a systematic evaluation of the evidence for treatment of back pain.<sup>20,21</sup> Non-operative treatment outside of hospitals by a number of professionals with complementary skills is emphasised.
- 4.2. In acute back pain:<sup>22</sup>
  - 4.3.1. Activity, anti-inflammatory and muscle relaxant drugs are beneficial.
  - 4.3.2. Painkillers are likely to be beneficial.
  - 4.3.3. Specific exercises are unlikely to be beneficial.
  - 4.3.4. Bed rest is considered unhelpful or harmful.
- 4.3. In chronic back pain:<sup>22</sup>
  - 4.3.1. Exercise and behavioural therapy and a multi-disciplinary approach are beneficial.
  - 4.3.2. Painkillers, anti-inflammatory drugs, occupational therapy and massage are likely to be beneficial.
  - 4.3.3. Bed rest is unlikely to be beneficial.
  - 4.3.4. Facet joint injections and traction are considered unhelpful or harmful.
- 4.4. A recent randomised trial has questioned the use of spinal fusion in the treatment of chronic back pain.<sup>23</sup> No clear evidence was found that primary fusion of the lumbar spine was better than an intensive rehabilitation programme in chronic back pain sufferers who were considered suitable for spinal fusion.
- 4.5. A number of recent publications have focussed on both combinations of non-operative treatments and comparing non-operative treatments with surgery.<sup>23,24,25</sup>
- 4.6. No clear evidence was found that primary fusion of the lumbar spine was better than an intensive rehabilitation programme in chronic back pain sufferers who were considered suitable for spinal fusion.
- 4.7. Manipulation followed by exercise reduced disability by a moderate amount at 3 months, but by less at a year. The improvements were significantly better than manipulation or exercise alone, which were better than standard treatment. The interventions were felt to be cost effective.
- 4.8. Further definition of subgroups of back pain sufferers and targeted treatment for them is called for.<sup>26</sup>

## 5. Prognosis

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- 5.1. Prognosis is quite good for most patients presenting with mechanical back pain. Overall, 60-70% of individuals will recover by 6 weeks and 80-90% by 12 weeks. These 10% showing no recovery at 12 weeks represent the chronic back pain group for whom treatment and outcome become more uncertain.<sup>3,7</sup>
- 5.2. Of patients diagnosed with 'back pain', 60% are better within 10 days.
- 5.3. Of patients labelled as having 'sciatica', 40% are better in 10 days.
- 5.4. Recurrence is common and occurs in 40% of patients within 6 months.
- 5.5. Return to work can be expected within 3.6 months for an injury occurring away from work and 14.9 months for an injury occurring at work.
- 5.6. Psychosocial issues may affect prognosis. A fairly selective study of people claiming workmen's compensation<sup>27</sup> showed that recovery was delayed (benefits were claimed for longer) in older people, those where there was a delay between injury and treatment, those where pain radiated into the leg and where the findings included more than 3 of Waddell's signs.
- 5.7. Recovery was quicker (less time claiming benefits) where pain was intermittent. Unlike in other studies a previous episode of back pain was also associated with a faster recovery.

## 6. Summary

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- 6.1. Low back pain is a poorly defined term but represents the symptom of pain or discomfort felt in the back or buttocks. An important distinction exists between acute and chronic back pain.
- 6.2. Three quarters of people will have low back pain at some point in their lives. Over a quarter of people experience back pain in the course of a year. At any one time up to one fifth of the population will have back pain. Up to 10% of sufferers have chronic back pain.
- 6.3. Causes of back pain include mechanical back pain, degenerative discs and facet joints, prolapsed discs, spinal stenosis, referred pain, psychogenic pain and miscellaneous causes.
- 6.4. Occupation is not considered to have a dominant role in the causation of lumbar degeneration.
- 6.5. Prognosis is generally good; it is worse mainly for the 10% of sufferers with chronic back pain.

## **7. Related Synopses**

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Neck Pain

Spondylosis

Spondylolisthesis

Prolapsed Intervertebral Disc

## 8. Glossary

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degeneration	Wear and tear changes related to the intervertebral disc or facet joints. Usually associated with pain.
facet joint disease	Facet joints are found at the back of the spine and allow motion between vertebrae in conjunction with the intervertebral discs. These wear out in a similar way to any osteoarthritic process.
impingement	Pressure on a nerve root within the spine causing leg pain.
intervertebral disc	Soft structure between vertebrae which can wear or prolapse.
lumbosacral spine	Pertaining to the lumbar and sacral parts of the spine.
mechanical back pain	Pain experienced in the back/buttocks. Usually with no obvious cause or may be due to a number of processes, some of which are discrete problems in themselves. Usually there is an absence of nerve root pain; pain is usually worse on waking (partly due to stiffness), and is worse on activity and towards the end of the day, but does not prevent sleep.
Oswestry index	A universally used scoring system in back pain assessment. The index is scored from the response to 10 questions and gives a percentage disability. 0% to 20% represents minimal disability while 40% to 70% represents a degree of disability which limits the activities of daily living and may preclude work. Above 80% is considered to represent psychological distress in addition to any physical problems.
prolapsed disc	Protrusion of a degenerate intervertebral disc. The disc material may compress a nerve root causing sciatica.
psychosocial factors	Factors relating to psychological and/or social causes.

sciatica	Pain in the buttock and down the leg, often into the foot.
spinal stenosis	A narrowing of the lumbar or cervical spinal canal, which causes compression of the nerve roots.
straight leg raise test	The patient lies on his back and the leg (with the knee straight) is raised by the examiner. In a positive test the manoeuvre aggravates leg pain.

## 9. References

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1. Maniadakis N, Gray A. The economic burden of back pain in the UK. *Pain* 2000;84:95-103.
2. Carey TS, Garrett JM, Jackman AM. Beyond the good prognosis. Examination of an inception cohort of patients with chronic low back pain. *Spine* 2000;25(1):115-20.
3. Andersson GB. Epidemiological features of chronic low-back pain. *Lancet* 1999 Aug;354(9178):581-5.
4. Dong G, Porter RW. Walking and cycling tests in neurogenic and intermittent claudication. *Spine* 1989;14:965-9.
5. Kellgren J. The anatomical source of back pain. *Rheumatol Rehabil* 1977;16:3-12.
6. Fairbank J. The thoracic and lumbar spine. *Medicolegal reporting in orthopaedic trauma*. London: Churchill Livingstone; 2002.
7. Frank JW, Brooker AS, DeMaio SE, Kerr MS, Maetzel A, Shannon HS et al. Disability resulting from occupational low back pain. Part II: What do we know about secondary prevention? A review of the scientific evidence on prevention after disability begins. *Spine* 1996;21(24):2918-29.
8. Fairbank J, Pynsent P. The Oswestry Disability Index. *Spine* 2000;25:2940-2953.
9. Lancourt J, Ketteelhut M. Predicting return to work for lower back pain patients receiving worker's compensation. *Spine* 1992;17:629-640.
10. Croft PR, Papageorgiou AC, Thomas E, Macfarlane GJ, Silman AJ. Short-term physical risk factors for new episodes of low back pain. Prospective evidence from the South Manchester Back Pain Study. *Spine* 1999 Aug;24(15):1556-61.
11. Deyo RA, Weinstein JN. Low back pain. *N Engl J Med* 2001;344(5):363-70.
12. Muller CF, Monrad T, Biering-Sorensen F, Darre E, Deis A, Kryger P. The influence of previous low back trouble, general health, and working conditions on future sick-listing because of low back trouble. A 15-year follow-up study of risk indicators for self-reported sick-listing caused by low back trouble. *Spine* 1999 Aug;24(15):1562-70.
13. Battie MC, Videman T, Parent E. Lumbar disc degeneration. Epidemiology and genetic influences. *Spine* 2004;29(23):2679-90.
14. Waddell G, McCulloch JA, Kummel E, Venner RM. Nonorganic physical signs in low-back pain. *Spine* 1980;5:117-25.
15. Hämäläinen O. Thoracolumbar pain among fighter pilots. *Mil Med* 1999 Aug;164(8):595-6.

16. Petren-Mallmin M, Linder J. Cervical spine degeneration in fighter pilots and controls: a 5-yr follow-up study. *Aviat Space Environ Med* 2001;72(5):443-6.
17. de Oliveira CG, Simpson DM, Nadal J. Lumbar back muscle activity of helicopter pilots and whole-body vibration. *J Biomech* 2001 Oct;34(10):1309-15.
18. Battie MC, Videman T, Gibbons LE, Manninen H, Gill K, Pope M, Kaprio J. 2002 Occupational driving and lumbar disc degeneration: a case-control study. *Lancet* 2002;360(9343):1369-74.
19. Bar-Dayan Y, Weisbort M, Bar-Dayan Y, Velan GJ, Ravid M, Hendel D, Shemer J. Degenerative disease in lumbar spine of military parachuting instructors. *J R Army Med Corps* 2003;149(4):260-4.
20. van Tulder MW, Koes BW, Bombardier C. Low back pain. *Best Pract Res Clin Rheumatol* 2002;16(5):761-75.
21. Guzman J, Esmail R, Karjalainen K, Malmivaara A, Irvin E, Bombardier C. Multidisciplinary bio-psycho-social rehabilitation for chronic low back pain. *Cochrane Database Syst Rev* 2002;(1):CD000963.
22. Arthritis and Musculoskeletal Alliance. Standards of care for people with back pain. London: Arthritis and Musculoskeletal Alliance; 2004.
23. Fairbank J, Frost H, Wilson-MacDonald J, Yu LM, Barker K, Collins R; Spine Stabilisation Trial Group. Randomised controlled trial to compare surgical stabilisation of the lumbar spine with an intensive rehabilitation programme for patients with chronic low back pain: the MRC spine stabilisation trial. *Br Med J* 2005;330(7502):1233. Erratum in: *Br Med J* 2005 Jun 25;330(7506):1485.
24. UK BEAM Trial Team. 2004 United Kingdom back pain exercise and manipulation (UK BEAM) randomised trial: effectiveness of physical treatments for back pain in primary care. *Br Med J* 329(7479):1377.
25. UK BEAM Trial Team 2004 United Kingdom back pain exercise and manipulation (UK BEAM) randomised trial: cost effectiveness of physical treatments for back pain in primary care. *Br Med J* 329(7479):1381.
26. Harvey N, Cooper C. Physiotherapy for neck and back pain. *Br Med J* 2005;330:53-4.
27. McIntosh G, Frank J, Hogg-Johnson S, Bombardier C, Hall H. Prognostic factors for time receiving workers' compensation benefits in a cohort of patients with low back pain. *Spine* 2000;25(2):147-57.