

18. Back problems (chronic)

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Summary

Many people are afflicted one or more times in their life by back problems that remain for an extended period of time. A large majority of all prolonged or chronic back problems are non-specific. This means that the cause of the problems cannot be determined, not even with advanced magnetic resonance imaging (MR) technology. The physical inactivity often resulting from chronic back problems has not been shown to improve pain or back function. On the contrary, inactivity has been shown to have harmful physical and psychological effects. There are growing indications that the best way in which to alleviate pain and improve function if there is no definitive cause of the chronic back problems that can be diagnosed with traditional methods is to return to as normal physical activity as possible despite the problems. Attempting to normalise physical activity is also sufficient for the majority of specific back problems. An increase in physical activity may involve a return to daily activities such as walking and domestic chores and have the objective of mitigating a “fear of movement”. Normalisation can then be followed by gradually intensifying strength and aerobic fitness training.

Definition

Diagnosis – based on symptom duration

Lumbar spine problems can be defined in many different ways. Based on the duration of the symptoms, back problems are described as acute, subacute or chronic (1, 2). Since “chronic” suggests an incurable condition, which is seldom the case with back problems, the term is directly misleading and tends to stigmatize the patient (3). The boundary between acute, subacute and chronic problems has to-date been considered to be around 3 months (1). However, there are growing indications that the term “chronic” can and should be applied considerably earlier. One reason for this is that the changes that were previously considered to constitute, and respectively define, the transition to chronic back

problems can be observed earlier than previously expected. Major population studies carried out in recent years have shown that back and neck problems are characterised by frequent relapses (4–7). It appears to be increasingly clear that back and neck problems often tend to become chronic. Most people have mild to moderate symptoms and a typical progression appears to involve symptoms that fluctuate between periods of few symptoms and periodic deterioration where pronounced problems are relatively rare (4).

Diagnosis – based on symptoms

Regardless of duration, problems in the lumbar region can be divided into three symptom groups. The various symptoms may occur separately or in combination (2, 8, 9). The three main symptoms are:

1. **Lumbago.** Symptoms are called lumbago when back pain is located somewhere between the lower ribs and gluteal folds on the back of the thighs. The symptoms are still called lumbago even in the somewhat common case that the pain radiates down along the back of the thigh, as far down as the knee joint.
2. **Sciatica.** Symptoms are called sciatica when the pain extends along the innervation area of the sciatic nerve, i.e. the area served by the sciatic nerve. Sciatica pain is often accompanied by an impact on both sensitivity and motor functions. By definition, sciatica means that one or more of the L5, S1 and/or sometimes S2 nerve roots signal(s) symptoms along its or their distribution area.
3. **Neurogenic claudication.** Symptoms of neurogenic claudication include pain and motor and/or sensory effects, which typically present themselves with a certain physical activity, usually walking a certain distance or assuming a certain body position (10). Symptoms most often occur along the distribution area of the sciatic or femoral nerve. The pain typically subsides when the individual rests or changes body position.

All three symptoms may occur with both acute and chronic back problems.

Diagnosis – based on causes

When the cause of back problems can be determined, such as by means of a clinical examination and/or radiographs or magnetic resonance imaging, the problems are classified as *specific*, regardless of the type of symptoms. Consequently, back problems without a diagnosable cause are called *non-specific* (2, 9, 11, 12).

Of acute back problems, 90–95 per cent are considered to be non-specific. The percentage of specific back problems increases with the duration of the problems. After around three months, one third of all back problems are estimated to be specific. The existence of specific problems is considered to have a negative effect on the prognosis for improvement on the short term. It is also relatively typical that the onset of non-specific symptoms is most often more acute, such as the onset of lumbago, than specific symptoms, where a more prolonged onset is considered to be more common.

Regardless of whether symptoms are specific or non-specific by nature, they can be the same, i.e. lumbago, sciatica or claudication (9). However, symptoms of sciatica or claudication occur significantly more often in specific back problems. It can generally be said that a specific treatment most often exists for specific symptoms, which is not the case with non-specific symptoms.

Causes of specific chronic back problems

There are a number of causes of specific back problems. The most common causes of specific chronic back problems are:

1. **Disc hernia.** A lumbar disc hernia arises when tissue from the disc's core (nucleus pulposus) protrudes between or through the peripheral part of the disc (annulus fibrosus) and causes pressure on one or more of the nerve roots in the spinal cavity. The pressure on the nerve root leads to pain along the compressed nerve root and also usually in the lumbar region, i.e. lumbago. The occurrence of symptom-inducing disc hernia is difficult to determine. It has also been shown that nearly 2/3 of the normal adult population have asymptomatic disc hernias that are visible with magnetic resonance imaging (13). The prevalence of sciatica, most likely caused by a disc hernia, varies between 3 to 5 per cent (1).
2. **Spinal stenosis** and disc hernia are the most common causes of specific problems in the lumbar region. Classic symptoms include neurogenic claudication, i.e. activity or position-induced pain along the sciatic nerve. Spinal stenosis is caused by a "narrowing" of the spinal canal or the so-called spinal nerve root canals. The narrowing of the actual spinal canal is called central spinal stenosis while the narrowing of the nerve root canals is called lateral spinal stenosis. Typical symptoms arise in connection with e.g. walking or special body positions, usually those that lead to an extension of the lumbar region, and in connection with activities or positions that aggravate the compression of the nerves in the spinal canal. The narrowing or compression of the cauda equina is in turn caused by a degeneration of the tissues that make up the joint systems between adjacent vertebrae (10). These degenerative changes usually develop gradually over several years and can eventually lead to a compression of the nerve roots in the cauda equina (14). When walking, for example, the pressure rises and characteristic symptoms, neurogenic claudication, appear. Symptoms of compression become apparent when the nerve roots in cauda equina have less space than 0.75 cm² (15).
3. **Spondylolisthesis.** Also referred to as isthmic spondylolisthesis, i.e. a defect usually found in the fifth vertebral arch of the lumbar vertebra. Spondylolisthesis is a forward slippage of a vertebral column usually above the most proximal end-plate of the sacral vertebra. The slippage is considered to be of clinical relevance, meaning that it causes symptoms, only when it amounts to at least 25 per cent of the subadjacent vertebral end-plate. Characteristic symptoms include pain in the lower lumbar region, which often radiates along the back of the thighs down towards the knees, affecting the walking pattern (16, 17).

4. **Pronounced instability.** Often characterised by a pronounced degeneration of the relevant intervertebral joint. The term intervertebral joint refers to the joints between two vertebrae comprised of the disc and the two facet joints. A marked degeneration leads to a lower disc height and usually pronounced changes in the form of facet joint osteoarthritis. This can cause an abnormal forward or backward slippage between adjacent vertebrae. Pronounced instability is usually suspected if distinct pain is induced by movements of the back, at certain positions or a sudden movement (18). This diagnosis is still controversial and, consequently, so is its correlation to back problems. In what is presumed to be pronounced instability, examinations with special technology have not been able to show any increased flexibility, but rather back muscle activity that has been interpreted as a defensive response by a painful intervertebral joint that is more indicative of a segmental disorder rather than instability (19, 20).
5. **Inflammatory back disorders.** Back problems can be caused by various types of inflammatory diseases such as Mb Bechterew. Pain is most often felt in and along the entire spine. In typical cases, pain arises both under strain and at rest, such as at night time.
6. **Osteoporotic fractures.** Osteoporotic fractures occur in the spine in the form of vertebral compressions. Osteoporotic fractures are usually found between the thoracic spine and lumbar spine, i.e. in vertebrae Th12 and L1. To-date, the progression has been considered to be benign, i.e. a good prognosis in terms of subsiding pain and improvement in back function. However, recent studies of the natural progression of fractures appear to contradict this anticipated good progression. A very large proportion of patients with a fresh vertebral compression have proven to continue to have pronounced pain, poor back function and, as a result, a greatly reduced quality of life for at least 12 months after the fracture (21).

It is important to remember that specific changes may occur without giving rise to symptoms. As previously mentioned, this is particularly true of herniated discs (13). The spinal changes must correspond with the symptoms for the symptoms to be described as specific.

A large number of changes visible on radiographs or deviations from the “norm” have long been considered to possibly be the cause of both acute and chronic back problems. Most of these changes and abnormalities have been able to be dismissed as clinically insignificant, meaning that they have no correlation to the occurrence of back problems (22, 23).

Back pain

Pain, particularly chronic pain, is often very complicated and remains a reaction that is difficult to explain, in which emotional and psychosocial factors play a role, creating large differences both within each individual and between individuals (11, 24).

In order for the pain of lumbago to arise, peripheral nerve endings or nociceptors must be activated by mechanical, chemical, thermal or inflammatory stimulation or what is otherwise referred to as nociceptive stimuli. Nociceptors normally have a high stimulation threshold, which means that they are not triggered to signal pain by normal stimuli,

such as light pressure from touch, etc. Nociceptors are found in essentially every tissue that surrounds or forms the human spine (25). In terms of the actual disc, nociceptors have been observed in the peripheral parts of annulus fibrosus. The core parts of the disc constitute an exception where no nociceptors have been found. Although still subject to debate, it has been reported that nerve endings, and thereby the possibility of nociception or pain signal transduction, can be developed in a degenerated, aged disc. Nerve endings have been detected in severely degenerated discs (26). These nerve endings have been assumed to have “entered” the disc in connection with the formation of scar/connective tissue as a result of degeneration (27, 28). This “immigration” may come from the vertebral body end-plates and underlying spongy (porous) bone which are both full of nociceptors (29). Nerve endings are also found in blood vessel walls, as well as all of the muscles surrounding the spinal column.

Experimental studies have shown that there is feedback from the pain transduction neuron to the motor nerves, i.e. that a nociceptive stimuli in the annulus fibrosus triggers a contraction of the the back muscles (30, 31). This would very likely explain the active contraction of back muscles so often observed with acute back problems. It is not unlikely that essentially the same mechanism would also explain the prolonged back muscle contractions seen in individuals with chronic back problems (20). However, recent experiments have also shown that a damaged annulus fibrosus has a segmental muscle influence that implies a reflex inactivation of, for example, the multifidus muscles (31).

A prolonged muscle contraction could be facilitated by fear, not least the fear of more pain as a consequence of moving. Consequently, the contraction itself could be the main cause of the back pain, even long after the initial pain-inducing nociceptive stimulation has healed (usually within 2–3 days) (4, 7).

In addition to mechanisms that promote the transmission of pain impulses, there are also dampening or inhibiting mechanisms in the spinal cord and brain stem (32). Among the latter are endogenous opiates or endorphins, as well as transmission substances such as noradrenalin and serotonin. It is via the endorphins, among others, that a positive correlation has been presumed to exist between physical activity and its influence on pain, such as in chronic back problems.

Because all tissue components are equipped with nociceptors, with the exception of the disc’s core, all of them at least have the prerequisites to signal pain, either separately or collectively. Hypothetically, non-specific back problems can thereby conceivably be caused by nociceptive stimuli (pain due to damaged or irritated tissue) generated by all of the tissue components of the back, i.e. the tissue of bones, ligaments, tendons, discs, muscles, vessels and/or nerves in and around the vertebral column. Accordingly, conceivable damage or mechanisms that can generate a nociceptive stimuli could, for example, be:

1. Internal tears or ruptures in the annulus fibrosus with penetration of the nucleus material into the annulus (33).
2. Microfractures in vertebral end-plates and/or surrounding spongy bone with inflammation/oedema in the spongy bone (34–36).
3. Tears or ruptures of vertebral column tendons (37).

4. Tears or ruptures of facet joint capsules.
5. Inflammatory reactions in facet joints and synovial membranes.
6. Tears and other changes in the spinal muscles.

Common to all of these conceivable changes or damage as causes of back problems is that they cannot be diagnosed using the methods and technology available at the present time (2).

Disc degeneration

Disc degeneration is the name for the degenerative changes that occur in the disc with increasing age. The first signs of degenerative changes in the disc appear as early as adolescence (38). The degree of degeneration varies greatly from individual to individual (39–41). Early signs of disc degeneration are a loss of water in the tissue and tears of the annulus fibrosus (29). Over time, pronounced degenerative disc changes will lead to a decreased disc height. These changes affect the mechanical characteristics of the disc.

In a review of evidence on the correlation between physical load and degree of disc degeneration, several extensive post-mortem studies confirmed that between 72 and 90 per cent of all 70-year-olds have degenerative changes, but that those in women are less pronounced (42). Another clinical radiology study involving more than 15,000 patients confirmed that men have degenerative changes more frequently than women and that the men's changes were also more pronounced. However, no correlation was found between heavy physical work and the occurrence of these degenerative changes (8). Another radiology study confirmed that a reduction in disc height was not correlated with occupational category or the occurrence of lifting in the work or professional exposure to full-body vibrations (22). In two Finnish studies, there was an increased prevalence of disc degeneration among elite athletes who were exposed to extreme physical loads. However, the studies also report that, in spite of being subjected to an extreme load for more than 20 years, sometimes with injuries, only 10 per cent of the degeneration could be explained by the extreme physical load. In contrast, a 5-year follow-up study using magnetic resonance imaging showed that low physical activity was one of the risk factors for accelerated development of disc degeneration (39). In another Finnish study of identical twins, no statistically significant correlation could be established between the degree of occupational physical exposure and the prevalence of disc degeneration (41, 43, 44). Heredity was by far the most important factor that could explain the degree of degeneration in these identical twins.

Effects of chronic back problems

Chronic back problems and the physical inactivity that they cause not only negatively affect the back itself, but also the entire body. Early on, it was possible to use measurements of bone mineral density in the vertebral column to show that the bone mineral content in the vertebrae was lower, the longer the back problems had been present (45–47). Because bone mineral content is without comparison the factor that means the most to the

strength of a vertebra, a lower bone mineral content means weaker vertebrae. Besides the actual bone, a low bone mineral content in the spine has also been shown to reflect weaker tendons, ligaments and other soft tissues of the back (37, 48).

Chronic back problems also have a negative effect on the back muscles. This has been shown in repeated studies of the back muscles. Using computed tomography or magnetic resonance imaging, it has been possible to identify spinal muscular atrophy in individuals with chronic back problems (49–53). Experimental studies have found back muscles to be negatively affected only a few days after minor damage to e.g. the annulus fibrosus (31). The muscle changes observed suggest that reflex inhibition may be one of several conceivable causes of the inactivity changes resulting from back problems. Worse functional characteristics of the muscles have also been indirectly found in the form of reduced strength, endurance, etc. (54, 55).

Besides the direct negative effects on the various tissues of the spine, chronic back problems have been shown to have general effects in the form of reduced fitness, overweight, etc. (54) In this context, it deserves mentioning that although the negative physical effects of chronic back problems are considerable, the negative psychosocial effects, which often cause e.g. a lack of self-confidence, social isolation and exclusion, are usually at least just as serious (1, 56–59).

Effects of physical activity

Several randomised controlled studies have shown that the advice to patients with acute or chronic back problems to “be as normally physically active as possible” despite the problems is a treatment that improves pain, functional ability and, where relevant, the capacity to work as well (60–63).

When the scientific evidence for or against the effect of back and/or aerobic fitness training was evaluated a few years ago in the SBU report “Back pain, neck pain”, it was confirmed that there was strong evidence that back training has a positive effect on chronic back problems (1). The most commonly studied back training methods are flexion and extension exercises, and the training of back, neck and abdominal muscles. The muscle training methods have commonly been dynamic, static or focused on increasing endurance (64–66).

For most people, walking or jogging with varying intensity is the most common and most readily available way of improving their aerobic fitness on their own (67). For others, swimming or cycling might be preferable or even a requirement to be able to exercise at all. The latter may, for example, apply to people with spinal stenosis or other specific back problems, where the space in the spinal canal is restricted, such as in spondylolisthesis. Cycling, which usually involves bending forward, is often a symptom-free exercise for people with spinal canal compression. Preparation studies have shown that the space in the spinal canal increases by around 40 cm² when the lumbar spine is moved from maximum backward to maximum forward position, which would probably explain the positive effects of cycling (68).

The direct effects of aerobic training on back problems have not been completely established. One conceivable pain-inhibiting effect may be through the effect of exercise on the body's endorphin production. The movement of the spine when walking or jogging may also contribute to the essential metabolic transport into and out of the relatively avascular middle vertebral plates (discs) (69). Metabolites that could affect the induction of pain in the periphery of the disc could thereby be transported away (33). A generally positive effect on both pain and function of physical activity compared to inactivity has been confirmed in many studies of chronic back problems (70, 71).

By drilling a metal pin into the spinous process and then attaching an accelerometer on test subjects and asking them to walk or run in place, it was confirmed that there is very little effect on the lumbar spine from the impact generated by walking or running (72). The conclusion from these studies is that the load on the lumbar spine when jogging at a moderate pace is only marginally elevated compared with standing still or walking. Consequently, walking or jogging at a moderate pace should not cause any harmfully elevated load on the spinal column.

Perhaps the most important effect of various training methods and exercises is probably the activating effect that they have on contracted and probably painful back muscles, as well as counteracting or breaking down the fear of movement that individuals with chronic back problems have (20, 60).

The old expression "everything in moderation" may also be applicable to back problems since there appears to be an elevated risk of back problems among those who are very physically active, at least among young people.

Indications

Non-specific and most specific chronic back problems.

Prevention

The vast majority of people suffer from back pain at some point in their lives. The degree of discomfort can vary from slight discomfort to distinctly severe pain. One or more episodes of slight or moderate back problems are usually forgotten before long. Consequently, determining whether a preventive measure should be classified as primary or secondary is often both impossible and not very meaningful. There are few studies that clearly show a preventive effect from various physical activities and a reduced incidence of back problems (50, 73). At least the number of studies that have not been able to indicate any preventive effect or even a negative, aggravating effect are not fewer in number than those with a positive effect (74, 75).

Prescription

The principal advice to most patients regardless of whether the problems are acute or chronic is to be “as normally physically active as possible” despite the problems. The severity of the symptoms should determine the pace that the normalisation of the physical activity should and can have. If the symptoms are of a non-specific nature, there are, by definition, no tissue-related changes that would constitute a contraindication of a rapid normalisation of physical activities. In such cases, the only limitation may possibly be the hypotrophy or atrophy caused by the inactivity. Strongly emphasizing the fact that no tissue damage could be located and that, consequently, no “dangerous” injury or change exists can be a strong motivating factor for the individual to achieve a normalisation of his or her level of physical activity. In the event of a pronounced fear of movement, a gradual normalisation of physical activity can be tried, possibly with well-defined intermediate objectives.

In case of specific problems such as spinal stenosis or symptom-inducing disc hernia, the activity level must be adapted to the presence of symptoms, especially nerve root damage. In many cases, perhaps especially with spinal stenosis where normal walking is more difficult or impossible, cycling may be a good alternative in order to maintain a certain level of physical activity.

Examples of suitable early activities to return to normal physical activity include light household work, walking, cycling, etc. For most people that do not have an extremely physically challenging job, early occupational training or a partial return to work is a very important step towards a normalisation of physical and, perhaps just as important, social activity. Once symptoms have subsided, individual training advice is particularly important for those who have not previously trained e.g. their back and abdominal muscles.

Contraindications

Absolute contraindications include certain specific types of chronic back problems, such as those caused by a tumour, metastasis or fracture and where the stability of the spine is endangered by a normal load.

Relative contraindications may exist with certain types of specific chronic back problems, such as spinal stenosis, a herniated disc or spondylolisthesis. Intensifying nerve root effects in the form of pain or another nerve effect radiating down the leg indicates that the pressure on the nerve root(s) is increasing and that there may be a risk of more pronounced nerve damage.

Risks

See above.

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