

Lower Back Pain

Introduction

Back pain is the number one problem facing the workforce in the United States today. To illustrate just how big a problem low back pain is, consider these facts:

- Low back pain is the second most common cause of missed work days
- Low back pain is the leading cause of disability between the ages of 19-45
- Low back pain is the number one leading impairment in occupational injuries

It is estimated that over 80 billion dollars is spent because of back pain each year, and the cost is growing. Eight out of ten people will have a problem with back pain at some time during their lives. Back pain is more likely to occur during the ages of 30 to 50, the most productive period of most people's lives. Most episodes of low back pain are self limited, meaning that they will resolve no matter what the treatment is. But, in some people these episodes of back pain can become chronic, meaning that they do not go away. The back pain continues and causes problems indefinitely. Low back pain is a common problem for all types of people, no matter what their job is. There is no quick fix or total cure for most back problems. The good news is that chronic back problems can be treated effectively to limit the impact on your day to day life. How your back pain affects you on a daily basis is very much up to you - how you view your back pain, how well you understand your back problem and what you do to protect your back.

Most people with low back pain do not simply injure their back suddenly. Over many years your back is subjected to repeated stress which may not result in pain at the time the injury to the parts of the spine actually occurs. These repeated injuries add up, and can slowly cause degeneration of the parts of the spine and low back pain. Most episodes of low back pain are at least partially the result of degenerative changes that have occurred in the back over many years. There may be an acute injury that causes your back to begin to hurt, but the overall condition of the lumbar spine is also very important. The overall condition of the spine usually determines how fast you will recover and the risk of the condition becoming chronic.

The goal of any treatment program should be to improve your back pain symptoms and to slow the progression of the degenerative process occurring in the spine. The physician's role in the treatment of low back pain should be aimed at identifying dangerous problems that require immediate attention, and attempting to prevent chronic back problems by giving you the tools to help prevent further injury.

The goal of this presentation is to help you understand more about your back problem so that you can better make decisions and help yourself.

Anatomy

The Lumbar Spine is made up of the last five vertebra of the spine. To better understand how the parts of the spine affect each other, we sometimes focus on a spinal segment. A spinal segment is composed of:

- two vertebrae
- the intervertebral disk between the two vertebra
- the two nerve roots that leave the spinal cord, one from each side

The vertebrae are the bones of the spine. Their function is to provide support and protection to the spinal cord. Each vertebrae is composed of a large round piece of bone called the body, which is attached to a bony ring. When the vertebra are stacked one on top of the other, they form a sort of column on the front and a bony tube in the back. The tube formed by the rings in the back is where the spinal cord and nerves run. The facet joints allow the vertebrae to be linked like a chain. They provide mobile connections between each vertebra, that shift and slide as we bend and twist our backs. Like other joints in the body, the facet joints can be affected by degenerative arthritis. An intervertebral disk sits between each individual vertebra. The disk is actually a large, round ligament that connects the vertebrae together.

Understanding the anatomy of the vertebra and the spinal segment in cross section is helpful as well. If we look at the disk in cross section, we see that it is made up of two parts. The annulus is the outer ring. It is the strongest part and is responsible for connecting the vertebrae. The nucleus pulposus is the soft, inner portion. The nucleus pulposus material that is about the consistency of fresh chewing gum and is responsible for the shock absorption properties of the spine. The nerve roots of the spine carry information between the lower extremities and the brain. The nerve roots are sometimes the cause of low back pain as well. Pain in the low back and one or both legs may occur when the nerve roots are irritated or pinched by the disk or bone spurs.



Many of the problems that cause back pain are the result of injury and degeneration of the intervertebral disk. Degeneration is a process where wear and tear causes deterioration (like when your favorite jeans get old and begin to fray). The degenerated disc has the consistency of crab meat. The disk is subjected to different types of stress as we use our backs each day. The disk generally acts like a shock absorber. Bending over results in compression of the disk, and may also cause the disk to bulge backwards towards the spinal canal and nerves. The facet joints must also shift to allow the bending to occur. Twisting and bending together is perhaps the greatest stress on the parts of the spine - especially the disk.

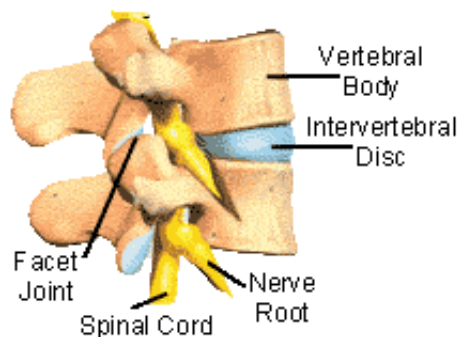
Probably, the earliest of changes that occur in the disk are tears in the annulus portion of the intervertebral disk and is like a gasket. Remember that the annulus is a large round ligament.

These tears in the annulus heal the same way tears in other ligaments do - by scar formation. Scar tissue is not as strong as normal tissue. The repeated cycle of many annular tears healing by scar tissue leads to a disk that finally begins to degenerate.

What happens when the disk begins to degenerate?

As the degeneration of the disk progresses the nucleus pulposus loses some of its water content. It becomes stiff and loses the ability to act as a shock absorber. The process may continue until the disk is collapsed. Bone spurs may form as the body's response to this degeneration. (It's somewhat unclear why the body seems to develop bone spurs.) These spurs are thought to be the result of excess motion at the spinal segment. Eventually, bone spurs form around the nerves of the spine as well.

Looking at our cross section of the spinal segment, we can watch the process of degeneration.



One of the most dramatic injuries to the lumbar spine is the Herniated Disk. In this injury, a tear in the annular ligament allows the nucleus pulposus to squeeze into the spinal canal. If the nerve root is compressed by the disk material, there is pain, numbness, and weakness in the areas supplied by the nerve. There is a considerable amount of evidence to suggest that its not only the pressure that plays a part in the symptoms from a herniated disk. The nucleus material that is squeezed out against the nerve seems to set up an inflammatory response in the nerves causing pain.

Where does the pain come from in degenerative disk disease?

It is not entirely clear where the pain comes from due to degenerative disk disease. In fact, the pain probably comes from more than one part of the lumbar spine. Many physicians feel that at least part of the problem is caused by a condition called segmental instability. Remember our earlier description of a spinal segment? Segmental instability is a term used to describe the shift of one vertebra on another in a spinal segment. This movement can result in pinching and irritation of the nerve root as it exits through the foramen. The excess motion at the spinal segment can also inflame the facet joints and cause mechanical pain from arthritis of the joints. Muscle spasms may occur in the muscles that support the spine. These muscles begin to spasm (meaning that they tighten up uncontrollably) in an attempt to stop the painful spinal segment from moving. Just like a cramp in your calf, if it goes on for long it can become quite painful. Finally, the degenerating disk itself can become inflamed and may cause mechanical pain.

In the late stages of spinal degeneration, bony spurs from the degenerative process can cause a condition known as spinal stenosis. In this condition, the spinal canal becomes too small and

presses on the nerve roots causing pain and nerve dysfunction in the legs . This usually occurs after years of wear and tear on the spine and is much more common in elderly people. Spinal stenosis is usually a term that is used to describe narrowing of the whole spinal canal in the lumbar spine. Technically, anything that causes the bony tube that the spinal nerves run in to become too small can be termed spinal stenosis. You may hear the term segmental spinal stenosis used to describe the combination of bone spurs arising from the facet joints and a bulging disk at the same spinal segment causing a narrowing of the spinal canal.

Symptoms

How you perceive spine problems Now let's use the information from the anatomy section to help understand the symptoms of low back pain. Low back pain can be divided into two main types:

Mechanical Type pain Compressive Type Pain: Mechanical type back pain results from inflammation caused by irritation or injury to the disk, the facet joints, the ligaments, or the muscles of the back. A common cause of mechanical pain is disk degeneration. A typical muscle strain, or lumbar strain, can also be the cause of mechanical type symptoms. Mechanical type back pain usually starts near the lower spine. Mechanical type pain may also spread to include the buttock and thigh areas. It rarely extends below the knee.

Compressive or neurogenic (meaning nerve related) type pain occurs when the nerve roots that leave the spine are irritated or pinched. A common cause of compressive pain is a herniated disk. The nerves that leave the lower lumbar spine join to form the sciatic nerve. This nerve provides sensation and controls the muscles of the lower leg. Pressure, or irritation on the nerve roots of the lumbar spine that come together to form the sciatic nerve can interfere with the normal function of the sciatic nerve. One of the earliest signs of pressure on a nerve root is numbness in the area supplied by the nerve. There is commonly pain in the same area, usually extending below the knee to the foot. In cases where there is pressure on a nerve root as it comes out of the spine, it is not unusual for the back itself to be painless. This can be confusing at times since there is no back pain - but the problem is located in the lumbar spine! Finally, the muscles that the nerve controls may become weak and the reflexes disappear. This is because the pressure on the nerve roots interferes with the signals from the brain to the muscles. There is no signal going from the brain to the muscle to tell it to contract.

Spinal stenosis can also cause compressive type pain. In some people, degeneration of the spine can result in a narrowing of the spinal canal - the bony tube where the spinal nerves are located. This causes all of the nerves within the spinal canal to become inflamed, and fail to work properly. One problem that occurs when the tube is too small is that the nerves cannot get enough blood supply to work properly. The nerves may be OK when you are at rest, but if you become active, the nerves need more blood flow to get more oxygen. Because the tube is too tight, the blood supply cannot increase. One of the symptoms this may cause is numbness which can involve both of the legs. The numbness may become worse with activities, such as walking. The pain can involve both of the lower extremities. The pain becomes worse with activities such as walking, and gets better after short periods of rest. Weakness of the muscles of both legs may also occur, and again, this may get worse when activity increases.

The Cauda Equina Syndrome **WARNING!**

In a very few cases, a disk herniation can be so big that it fills the entire spinal canal. The immediate pressure on the nerves in the spine may cause paralysis of the muscles that control the bowels and bladder. If you lose control over your bowels or bladder, you should contact your physician immediately.

THIS IS AN EMERGENCY!

Diagnosis

The first thing that must be done is to provide your doctor with a complete history of your back pain. After a history has been provided, your doctor will conduct a thorough physical examination.

X-rays of your lower back may also be ordered at the initial office visit if your back pain has been going on for more than 4-6 weeks. X-rays are sometimes ordered if there are specific reasons to suspect a fracture, infection, or possibly a malignant tumor of the spine. X-rays show the bones of the lumbar spine. Most of the soft tissue structures of the spine do not show up. Still, much can be learned from the X-rays in certain instances. Here we see X-rays taken of the same patient 20 years apart, showing the degree of degeneration in the spinal segments during that time. If your physician feels that other special radiological tests to look at the spine will be needed, X-rays are usually a first step in looking into any back problem and will help in deciding which other tests, if any, will be required.

There are many tests available to try and find out what is causing your low back pain.

The MRI (Magnetic Resonance Imaging) scan is the most common test used to look at the spine. The MRI scanner uses magnetic waves instead of radiation. Imagine if you could slice through the spine layer by layer and take pictures of each slice. That's exactly what the MRI scanner allows us to do. Multiple pictures of the spine are taken by the MRI scanner. This allows us to view not only the bones of the spine, but also the nerves and disks.

Slices can also be taken across the spine, giving a cross sectional view. The MRI scanner allows us to see the nerves and disk quite clearly. No special dyes or needles are necessary. Here we see a MRI cross section showing a fairly typical herniated disk side view and cross section view.

The MRI scan is, perhaps, too good at showing the anatomic details of the spine. There is a growing body of evidence that suggests that not all abnormalities that show up on the MRI scan are really the cause of the individual patient's problem. Abnormalities, such as bulging disks, show up frequently in normal volunteers undergoing MRI scans - folks who have never had any problem with their back. The bottom line is this - an MRI scan is a great test to show the lumbar spine anatomy, but it must be correlated carefully with your symptoms so that the findings aren't blown out of proportion.

The CAT Scan (Computer Assisted Tomography) is an X-ray test that is very similar to the MRI scan. X-ray slices can be taken across the spine, giving a cross sectional view. The CAT scan shows the bones of the spine much better than the MRI scan, and is useful when conditions that affect the bones of the spine are suspected. The CAT scan is commonly combined with a myelogram to give a better picture of the spinal nerves and help determine if there is pressure from spinal stenosis or a herniated disk.

A Myelogram is a test that involves placing dye into the spinal sac that shows up on X-ray. Any abnormal indentation on the spinal sac may indicate that there is pressure on the nerves of the spine, such as that caused by a herniated disk. This test has been replaced in most cases by the MRI scan - but it is still used sometimes when the MRI scan is confusing.

The Discogram is a special test where dye is injected directly into the disk in the area of the nucleus pulposus. If the injection causes you to experience the same low back pain you have been complaining of, this suggests that the disk being tested is causing your pain. Plain X-rays and a CAT scan can also be used to look at the disk, and may show whether or not the disk is ruptured.

An Electromyogram(EMG) is a test that looks at the function of the nerve roots leaving the spine. The test is done by inserting tiny electrodes into the muscles of the lower extremity. By looking for abnormal electrical signals in the muscles, the EMG can show if a nerve is being irritated, or pinched as it leaves the spine. Think of how you test the wiring on a lamp. If you place a working bulb into the lamp, and the bulb lights up, you assume that the wiring is OK. But what if the bulb doesn't light up? You can safely assume that something is probably wrong with the wiring. Like the lamp is unplugged. Or a short circuit has occurred. By using the leg muscles like the light bulb in the lamp, the EMG is able to determine the condition of the nerves that supply those muscles, like the wiring on the lamp. If the EMG machine finds that the muscles (the light bulb) are not working properly, we can assume that the nerves (the wiring) must be getting pinched somewhere.

A bone scan is used to help locate the affected area of the spine. In order to perform a bone scan, a radioactive chemical is injected into the bloodstream. The radioactive chemical attaches itself to areas of bone that are undergoing rapid changes for any reason. Areas of the skeleton that are undergoing rapid changes appear as dark areas on the film. Once the affected area is identified, other tests, such as the MRI scan are done to look more closely at the specific area.

There are many possible causes of low back pain. Some of these causes are not related to degeneration of the spine. Blood tests to look for infection, or arthritis may be necessary. Problems originating in areas other than the spine may also cause back pain. These can include: aortic aneurysm, kidney problems, and stomach ulcers. These problems are just a few of the possibilities. Specific tests to rule out these possibilities may be suggested if your doctor feels that they are necessary.

Treatment

The treatment of back pain ranges from simple reassurance that nothing is wrong to extremely delicate surgery. Each case is different and treatment must be individualized to meet the circumstances. Treatment falls into two major categories:

- Conservative treatment --- which includes exercise, medications, physical therapy, and other non-operative therapy.
- Surgical treatment --- which includes endoscopic discectomy, laminectomy, diskectomy, and spinal fusion in selected conditions.

Treatment for any back condition should involve two goals:

- To relieve the immediate problem

- To reduce the risk of re-injury

Exercise plays an important role in achieving both of these goals. Many studies have shown that people who exercise regularly have far fewer problems with back pain. Exercise stimulates the body's natural pain controlling hormones and actually decreases pain perception. A physical therapist may be contacted to help you with your exercise program. The physical therapist will also teach you about ways to prevent further back injury.

Managing low back pain effectively requires a good education - so we have created a whole document on Understanding Spinal Rehabilitation that you should review.

Medications should be used wisely!

SOME MEDICATIONS ARE HIGHLY ADDICTIVE!

PAIN MEDICATION USED FOR PROLONGED PERIODS HAS THE POTENTIAL OF LEADING TO ADDICTION.

No medication will cure back pain of degenerative origin. Medications are used to control: pain, inflammation, muscle spasm, and sleep disturbance. Many physicians feel that narcotic medications should not be used on a continuous basis to treat chronic low back pain. There are certain circumstances where pain management specialists are finding that chronic narcotics will actually benefit certain groups of patients with chronic low back pain - but the majority of low back pain will not require this approach.

If simple measures fail to control your back pain an Epidural Steroid Injection (ESI) may be suggested. Many different problems can cause inflammation of the nerves in the lumbar spine. The epidural steroid injection involves placing a small amount of cortisone into the bony spinal canal. Cortisone is a very powerful anti-inflammatory drug that may bring the inflammation surrounding the nerves under control and ease your pain. The epidural steroid injection is not always successful. Most centers report a 40%-50% success rate. These injections are reserved for cases where all other conservative measures have failed, or as a last attempt to postpone surgery.

Surgery is only necessary in a small number of patients. There is no one surgical procedure that is appropriate for all spine problems. If surgery is suggested for your problem, the best operation for your specific problem will be suggested. While back surgery may seem to be common, this misconception is probably due to the fact that so many people have back problems at some time in their lives that there are substantial number of back operations done - especially in the United States. The vast majority of people with back problems never have back surgery and function quite well with a minimal effect on their daily lives. The following is meant to be an overview of the general types of back surgery that are sometimes necessary.

One of the most common surgical procedures is an endoscopic discectomy which is done with local anesthesia without removing any bone by sliding between the vertebra through the intervertebral foramen to accomplish the removal of a herniated disk to relieve pressure on a nerve root. The Selective Endoscopic Discectomy (SED) procedure does not create scar tissue in the spinal canal and is the least invasive procedure to remove damaged disc tissue. However, when the conditions are not ideal then a microlumbar laminectomy may be necessary and the first

step is to remove a portion of the lamina of the vertebra. The lamina is the portion of the vertebra that forms the roof over the spinal nerves. Removing a portion of the lamina creates a window into the spine. The nerves are then pulled to the side so that the herniated disk can be seen. Small instruments are then used to remove the herniated disk material. Most of the nucleus pulposus is removed to prevent the disk from herniating again. Once the disk material is removed, the nerves are free of pressure and irritation. The lamina and the area of the disk that is removed fill with scar tissue very rapidly.

When the major problem appears to be spinal stenosis the spinal canal needs to be made larger. This is usually done by performing a complete laminectomy. Remember, the lamina is the back portion of the spine and forms the roof of the spinal canal. The term laminectomy means to remove the lamina. Removing the lamina allows more room for the nerves, and enables the surgeon to remove bone spurs around the nerves. This allows more room for the nerves of the spine and reduces the irritation and inflammation on the spinal nerves. The bone does not grow back. Instead, scar tissue replaces the lamina and protects the spinal nerves.

If your back problem is the result of segmental instability, a spinal fusion may be suggested. A spinal fusion involves placing a bone graft between two or more vertebrae, causing the vertebrae to grow together, or fuse. The bone graft is usually taken from the bones of the pelvis at the time of surgery. There are two general types of spinal fusions:

- Posterior fusion using pedicle screws or facet screws
- Interbody fusion using a TLIF or XLIF procedure

In the posterior fusion, the bone graft is placed on the back side of the vertebrae. During the healing process the vertebrae then fuse, or grow together. This creates a solid block of bone between the vertebrae, and the vertebra that are fused together act like one bone. The interbody fusion differs by placing the bone graft between the vertebrae, where the disk has been removed. Once again, the healing process causes the vertebrae to fuse, creating a solid block of bone between the fused vertebrae. Both fusions accomplish the same thing. The vertebrae grow together, or fuse into one bone. The goal of a spinal fusion is to stop the motion between two vertebra that comes from segmental instability. Fusing the vertebra together reduces the mechanical back pain and impingement on the nerve root that comes from too much motion between the vertebra.