

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



Sudan University for Science and Technology



College Graduate Studies

Study Of Lower Back Pain Using MRI

دراسة الالم أسفل الظهر بالرنين المغنطيسي

A thesis submitted for partial fulfillment for requirement of M.SC degree
in Diagnostic radiological technology

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الآية

بسم الله الرحمن الرحيم

قال تعالى:

﴿وقل رب أدخلني مدخل صدق وأخرجني مخرج صدق وأجعل لي من لدنك سلطاناً

نصيراً﴾

صدق الله العظيم

سوره الاسراء (80)

Dedication

Dedicated this research to my parents and my brothers , my friend

To all teachers who taught me

And to everyone help me to complete this research

Acknowledgement

First and always thank Allah for everything Secondly a great thank to Dr. Caroline Edward my teacher and my supervisor thirdly a big thanks to all members

of MRI centers where my work took place. Finally I continue to be extremely grating full to all those colleagues' family members who have supported me both professionally and personally and who continue to encourage me. Thank you without you this moment and all this would never be possible.

Abstract

This is descriptive study was conducted during period from 2016-2017 at Modern Medical Center and Ribat Hospital University by using two magnetic resonance imaging (MRI) , close MRI machine 1.5 tesla ,and open MRI machine 0.3 tesla. This study carried a sample of 100 patients (56 males and 44 females) was used and routine lumber spine MRI protocol was performed.

The purpose of this study , the study lower back pain by using MRI and correlated to age , gender, weight, height .

The main result of this study were that the men and standard deviation for age, weight , height , and time duration .Was $\pm 47.7100SD16.00397$ (years), $\pm 74.8600SD15.21$ (kg), $167.210SD15.422$ (cm), $\pm .1100SD .31447$ (years) .

The study found that disc bulge was the most common causes 21%, Spondylolisthesis 12%, Spondylitic arthritis 11% , Disc degeneration 18% , Disc prolapsed 14%, Disc protusion 13%, Others 11% .

The study showed that no correlation between the subject's age weight , just height and time pain duration .

Finally the researcher conclude that imaging studies (MRI) are helpful in cases of lower back pain but are not the only factor to determine lower back etiology ,for that proper history and clinical examination are very necessary to determine which type of imaging is need , and it will also allowed the technologist to focus the effort of the examination at proper disc level.

ملخص الدراسة

هذه الدراسة الوصفية قد أجريت هذه الدراسة في الفترة ما بين 2016-2017 في المركز الطبي الحديث و مستشفى الرباط الجامعي . باستخدام جهازين رنين مغنطيسي ، جهاز رنين مغنطيسي مغلق بقوة 1.5 تسلا ، و جهاز رنين مغنطيسي مفتوح بقوة 3 تسلا . أجريت هذه الدراسة علي عينه من 100 مريض (56 ذكورا" و 44 اناثا") و بتطبيق الفحص العادي للسلسلة الفقرية.

الهدف من هذه الدراسة هو دراسة الالم أسفل الظهر باستخدام تقنية الرنين المغنطيسي و ربطها بالعمر والنوع و الوزن و الطول مع فتره الالم.

أهم نتائج هذه الدراسة أن المتوسط و الانحراف المعياري للعمر و الوزن و الطول و فتره الالم هو 47.7100 الانحراف المعياري 3.1447 (سنة)، 74.8600 الانحراف المعياري 15.21 (كغم) ، 176.210 و الانحراف المعياري 15.422 (سم) ، 0.1100 الانحراف المعياري 0.31447 (سنة).

وجد في هذه الدراسة أن اكثر الحالات شيوعا" 21% من الالم أسفل الظهر يرجع الي النتوء و الانفتاق و 12% من ضيق النخاع الشوكي و 11% من التهاب النخاع الشوكي و 18% من النتوء و التغير الانحلالي و 14% من انزلاق الفقرات و 13% من و 11% لديهم مسببات اخرى.

كما وجد انه ليس هنالك علاقه بين العمر و الوزن مع الالم اسفل الظهر ، فقط الطول مع فتره الالم .

وختاما" فأن الباحث قد وجد أن التصوير بالرنين المغنطيسي يساعد في تحديد اسباب الالم اسفل الظهر ، لكن يجب ان يسبقها شرحا" للحالة من و الفحص السريري للمساعدة في تحديد نوعيه الفحص و كذلك اختيار طريقه صحيحه لعمله.

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List of abbreviation

DDD	Degenerative disc disease
DLSD	Degenerative lumbar spine disease
FSC	Fast spine echo
GRE	Gradient echo
LBP	Low back pain
L1	First lumbar disc level
L2	Second lumbar disc level
L3	Third lumbar disc level
L4	Fourth lumbar disc level
L5	Fifth lumbar disc level
MRI	Magnetic resonance imaging
SE	Spine echo
T1	Longitudinal Relaxation Time
T2	Transverse Relaxation Time
TR	Repetition Time
TE	Echo Time

Chapter one

Chapter one

1.1.Introduction:

Lower back pain can best described in terms of specific accompanying features .(Levin, 2010)

Lower back pain can be caused by a variety of problems with any parts of the complex, interconnected network of spinal muscles, nerves, bones, discs or tendons in the lumbar spine.(Ullrich, 2015)

The lumbar (or lower back) region is made up of five vertebrae (L1-L5), sometimes including the sacrum. In between these vertebrae are fibro cartilaginous discs, which act as cushions, preventing the vertebrae from rubbing together while at the same time protecting the spinal cord. Nerves come from and go to the spinal cord through specific openings between the vertebrae, providing the skin with sensations and messages to muscles. Stability of the spine is provided by the ligaments and muscles of the back and abdomen. Small joints called facet joints limit and direct the motion of the spine .(Wikipedia)

Magnetic resonance imaging (MRI) is the preferred investigation for most spinal diseases and is increasingly requested for people with low back pain (LBP). However, determining the cause of back pain is complicated as it is often multifactorial and anatomical abnormalities are common in the spine and may not necessarily translate into clinical symptoms.(Ann Rheum Dis 2010/ard.2009)

MR images of the spine are clear and more detailed than with other imaging method. This detail makes MRI an invaluable tool in early diagnosis and evaluation of many spinal condition including tumors. (RSANA, 2011)

1.2 Problem:

The usual causes and sources of the lower back pain is degeneration of the spine or disc herniation. These can also factors in lower back pain. MRI can provide information and determining the sources of the pain can help guided diagnoses

1.3 Objective:

1.3.1 General Objective:

The aim of Study to lower back pain using MRI

1.3.2 Specific Objectives:

To identify and diagnose the causes of lower back pain.

To evaluate anatomic detail in lumbar spine

To detect the most common of level of the lumber spine affected by lower back pain

To determine the relationship between the age ,gender , weight and height of the lower back pain

To compared between males and females in lower back pain

1.4 Importance of study:

The role of this study provide diagnose and investigation for most spinal disease and lower back pain by using MRI

Diagnosis lower back pain and disease

1.5 Overview of study:

This study will consist of five chapters chapter one deal with the introduction chapter two include literatures review chapter three detailed the materials and methods then chapter four presents the results and chapter five presents the discussion conclusion and recommendations.

Chapter Two
Literature Review

Chapter two

Literature Review

2.2.1 Anatomy of spine:

The human vertebral column is the back bone or spine, consisting of twenty four articulating vertebrae, and nine fused vertebrae in the sacrum and the coccyx. The vertebrae in the column are separated from each other by intervertebral discs. It houses and protects the spinal cord in its spinal canal. There are normally thirty-three vertebrae; the upper twenty-four are articulating and separated from each other by intervertebral discs, and the lower nine are fused, five in the sacrum and four in the coccyx or tailbone. The articulating vertebrae are named according to their region of the spine. There are seven cervical vertebrae, twelve thoracic vertebrae and five lumbar vertebrae. The number of vertebrae in a region can vary but overall the number remains the same. The number of those in the cervical region however is only rarely changed. (Gray, 1979)

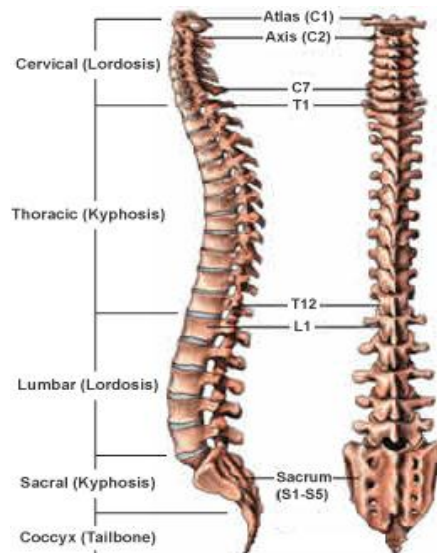


Figure 2:1 Anatomy of spine

(© 2016 NeuroSpine Institute)

2.2.2 Anatomy of lumbar spine

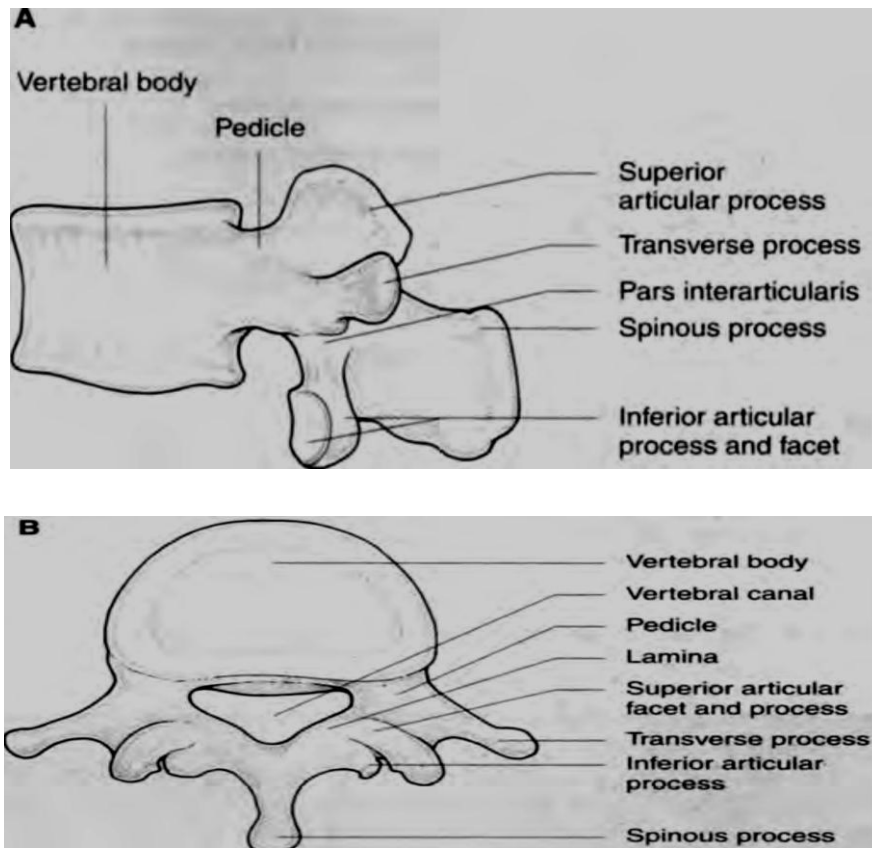


Fig2:2 Typical lumbar vertebra: (a) lateral view; (b) superior view

Elsevire, 2011)

2.2.2.1 Bones and Joints

The human spine is made up of 24 spinal bones, called vertebrae. Vertebrae are stacked on top of one another to form the spinal column. The spinal column is the body's main upright support.

From the side, the spine forms three curves. The neck, called the cervical spine curves slightly inward.

(<http://.medicalmultimedigroup.com>)

The middle back, or thoracic spine curves outward. The outward curve of the thoracic spine is called kyphosis. The low back, also called the lumbar spine curves slightly inward. An inward curve of the spine is called lordosis. (<http://.medicalmultimedigroup.com>)

The lumbar spine is made up of the lower five vertebrae. Doctors often refer to these vertebrae as L1 to L5. The lowest vertebra of the lumbar spine, L5, connects to the top of the sacrum, a triangular bone at the base of the spine that fits between the two pelvic bones. Some people have an extra, or sixth, lumbar vertebra. This condition doesn't usually cause any particular problems. ([http:// medicalmultimedialogroup.com](http://medicalmultimedialogroup.com))

Each vertebra is formed by a round block of bone, called a vertebral body. The lumbar vertebral bodies are taller and bulkier compared to the rest of the spine. This is partly because the low back has to withstand pressure from body weight and from movements such as lifting, carrying, and twisting. Also, large and powerful muscles attaching on or near the lumbar spine place extra force on the lumbar vertebral bodies. (<http://.medicalmultimedialogroup.com>)

A bony ring attaches to the back of each vertebral body. This ring has two parts. Two pedicle bones connect directly to the back of the vertebral body. Two lamina bones join the pedicles to complete the ring. The lamina bones form the outer rim of the bony ring. When the vertebrae are stacked on top of each other, the bony rings form a hollow tube that surrounds the spinal cord and nerves. The laminae provide a protective roof over these nerve tissues. (<http://.medicalmultimedialogroup.com>)

A bony knob projects out at the point where the two lamina bones join together at the back of the spine. These projections, called spinous processes, can be felt as you rub your fingers up and down the back of your spine. Each vertebra also has two bony knobs that point out to the side, one on the left and one on the right. These bony projections are called transverse processes. The projections in the low back are broader

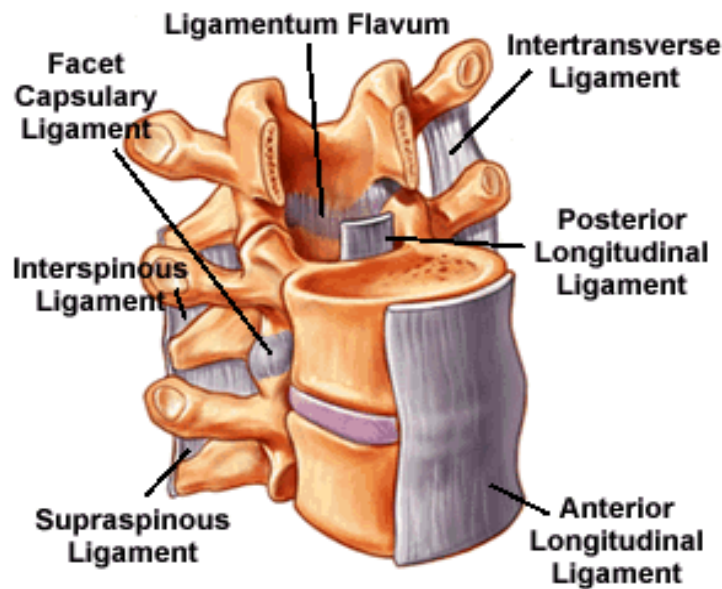
than in other areas of the spine because many large back muscles attach and impart powerful forces on them. (<http://medicalmultimedialogroup.com>)

Between the vertebrae of each spinal segment are two facet joints. The facet joints are located on the back of the spinal column. There are two facet joints between each pair of vertebrae, one on each side of the spine. A facet joint is made of small, bony knobs that line up along the back of the spine. Where these knobs meet, they form a joint that connects the two vertebrae. The alignment of the facet joints of the lumbar spine allows freedom of movement as you bend forward and back. (<http://.medicalmultimedialogroup.com>)

The surfaces of the facet joints are covered by articular cartilage. Articular cartilage is a smooth, rubbery material that covers the ends of most joints. It allows the ends of bones to move against each other smoothly, without friction. (<http://.medicalmultimedialogroup.com>)

On the left and right side of each vertebra is a small tunnel called a neural foramen. (Foramina is the plural term.) The two nerves that leave the spine at each vertebra go through the foramina, one on the left and one on the right. The intervertebral disc (described later) sits directly in front of the opening. A bulged or herniated disc can narrow the opening and put pressure on the nerve. A facet joint sits in back of the foramen. Bone spurs that form on the facet joint can project into the tunnel, narrowing the hole and pinching the nerve. (<http://.medicalmultimedialogroup.com>)

2.2.2.2 Nerves



The hollow tube formed by the bony rings on the back of the spinal column surrounds the spinal cord. The spinal cord is like a long wire made up of millions of nerve fibers. Just as the skull protects the brain, the bones of the spinal column protect the spinal cord.

The spinal cord extends down to the L2 vertebra. Below this level, the spinal canal encloses a bundle of nerves that goes to the lower limbs and pelvic organs. The Latin term for this bundle of nerves is cauda equina meaning horse's tail.

Between vertebrae, two large nerves branch off the spinal cord, one on the left and one on the right. The nerves pass through the neural foramina of each vertebra. These spinal nerves group together to form the main nerves that go to the organs and limbs. The nerves of the lumbar spine (cauda equina) go to the pelvic organs and lower limbs. (<http://.medicalmultimedialogroup.com>)

2.2.2.3 connective tissue

Ligaments and tendons are fibrous bands of connective tissue that attach to bone. Ligaments connect two or more bones together and help stabilize

joints. Tendons attach muscle to bone. Tendons vary in size and are somewhat elastic and attach bones to muscles. (J.W Wilson 2005)

2.2.2.3.1 A Ligaments

The system of ligaments in the vertebral column, combined with the tendons and muscles, provides a natural brace to help protect the spine from injury. Ligaments aid in joint stability during rest and movement and help prevent injury from hyperextension and hyper flexion (excessive movements). (J.W Wilson 2005)

Figure 2:3 shows the vertebral ligament (Gray's 2005)

Table (1-1) shows the description of the ligament

Ligament Name	Description
Anterior Longitudinal Ligament (ALL) A primary spine Stabilizer	About one-inch wide, the ALL runs the entire length of the spine from the base of the skull to the sacrum. It connects the front (anterior) of the vertebral body to the front of the annulus fibrosis.
Posterior Longitudinal Ligament (PLL) A primary spine Stabilizer	About one-inch wide, the PLL runs the entire length of the spine from the base of the skull to sacrum. It connects the back (posterior) of the vertebral body to the back of the annulus fibrosis.
Supraspinous Ligament	This ligament attaches the tip of each spinous process to the other.
Interspinous Ligament	This thin ligament attaches to another ligament called the ligamentum flavum that runs deep into the spinal column.

Ligamentum Flavum The strongest	This yellow ligament is the strongest. It runs from the base of the skull to the pelvis, in front of and between the lamina, and protects the spinal cord and nerves. The ligamentum flavum also runs in front of the facet joint capsules.
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2.2.2.5 Tendons and Muscles

Tendons are similar to ligaments, except these tension-withstanding fibrous tissues attach muscle to bone. Tendons consist of densely packed collagen fibers. Muscles, either individually or in groups, are supported by fascia. Fascia is strong sheath-like connective tissue. The tendon that attaches muscle to bone is part of the fascia. The vertebral column surrounds the spinal cord. It travels within the spinal canal, a central hole within each vertebra. The spinal cord is part of the central nervous system that supplies nerves and receives information from the peripheral nervous system within the body. (Wilson 2005)

The spinal cord consists of grey matter and white matter and a central cavity. Adjacent to each vertebra emerge spinal nerves. The spinal nervous provide sympathetic nervous supply to the body, with nerves emerging forming the sympathetic trunk and the splanchnic nerves .The spinal canal follows the different curves of the column; it is large and triangular in those parts of the column which enjoy the greatest freedom of movement, such as the cervical and lumbar regions; and is small and rounded in the thoracic region, where motion is more limited. The spinal cord terminates in the conus medullaris and cauda equine(Wilson 2005)

2.2.2.6 Blood supply

The anterior and posterior spinal arteries descend in the pia from the intracranial part of the vertebral artery. They are reinforced serially by branches from the ascending cervical, the cervical part of the vertebral, the intercostal and the lumbar arteries.(Richard H. Daffner 2014)

2.3 Physiology :-

Lumbar spine is designed to protect the spinal cord, support the body and facilitate movement (<http://neurospineinstitute.org/>).

Specific function of the lumbar spine :

2.3.1 Vertebrae

The vertebrae support the majority of the weight imposed on the spine. The body of each vertebra is attached to a bony ring consisting of several parts. A bony projection on either side of the vertebral body called the pedicle supports the arch that protects the spinal canal. The laminae are the parts of the vertebrae that form the back of the bony arch that surrounds and covers the spinal canal. There is a transverse process on either side of the arch where some of the muscles of the spinal column attach to the vertebrae. The spinous process is the bony portion of the vertebral body that can be felt as a series of bumps in the center of a person's neck and back (<http://neurospineinstitute.org/>)

2.3.2 Intervertebral Disc

Between the spinal vertebrae are discs, which function as shock absorbers and joints. They are designed to absorb the stresses carried by the spine while allowing the vertebral bodies to move with respect to each other. Each disc consists of a strong outer ring of fibers called the annulus

fibrosis, and a soft center called the nucleus pulposus. The outer layer (annulus) helps keep the disc's inner core (nucleus) intact. The annulus is made up of very strong fibers that connect each vertebra together. The nucleus of the disc has a very high water content, which helps maintain its flexibility and shock-absorbing properties

(<http://neurospineinstitute.org/>) .

2.3.3 Facet Joint

The facet joints connect the bony arches of each of the vertebral bodies. There are two facet joints between each pair of vertebrae, one on each side. Facet joints connect each vertebra with those directly above and below it, and are designed to allow the vertebral bodies to rotate with respect to each other (<http://neurospineinstitute.org/>) .

2.3.4 Neural Foramen

The neural foramen is the opening through which the nerve roots exit the spine and travel to the rest of the body. There are two neural foramen located between each pair of vertebrae, one on each side. The foramen creates a protective passageway for the nerves that carry signals between the spinal cord and the rest of the body (<http://neurospineinstitute.org/>) .

2.3.5 Spinal cord and nerves

The vertebral column surrounds the spinal cord. It travels within the spinal canal, a central hole within each vertebra. The spinal cord is part of the central nervous system that supplies nerves and receives information from the peripheral nervous system within the body. The spinal cord consists of grey matter and white matter and a central cavity. Adjacent to each vertebra emerge spinal nerves. The spinal nervous provide sympathetic nervous supply to the body, with nerves emerging forming

the sympathetic trunk and the splanchnic nerves .The spinal canal follows the different curves of the column; it is large and triangular in those parts of the column which enjoy the greatest freedom of movement, such as the cervical and lumbar regions; and is small and rounded in the thoracic region, where motion is more limited. The spinal cord terminates in the conus medullaris and cauda equine(Wilson 2005) .

2.3.6 Spinal Muscles

Many muscle groups that move the trunk and the limbs also attach to the spinal column. The muscles that closely surround the bones of the spine are important for maintaining posture and helping the spine to carry the loads created during normal activity, work and play. Strengthening these muscles can be an important part of physical therapy and rehabilitation.

(<http://neurospineinstitute.org/>) .

2.3.7 Nervous System

All of the elements of the spinal column and vertebrae serve the purpose of protecting the spinal cord, which provides communication to the brain, mobility and sensation in the body through the complex interaction of bones, ligaments and muscle structures of the back and the nerves that surround it. The true spinal cord ends at approximately the L1 level, where it divides into the many different nerve roots that travel to the lower body and legs. This collection of nerve roots is called the cauda equina, which means “horse’s tail,” and describes the continuation of the nerve roots at the end of the spinal cord (<http://neurospineinstitute.org/>) .

2.4 pathology

There are several common potential sources and causes of back pain : these include spinal disc herniation and degenerative disc disease or isthmic Spondylolisthesis ,osteoarthritis (degenerative joint disease) and lumbar spinal stenosis , trauma, cancer, infection , fracture and inflammatory disease.(Stewart G Eielson, 1999- 2011)

2.4.1 Developmental Abnormalities

Developmental abnormalities are not uncommon, occurring in an estimated 1 in 1,000 live births. These anomalies may range from nothing more serious than an unfused spinous process to a severe form of spinal dysraphism, usually with multiple associated abnormalities.

Other anomalies include hemivertebrae, congenital fusions, both of which often result in scoliosis, and cervical ribs. Among the plethora of associated findings are neurologic abnormalities such as hydrocephalus and urinary tract problems. Because of advancements in medical, surgical, and rehabilitation therapy, patients with severe spinal abnormalities can survive into adulthood and lead productive lives.

More common are segmentation anomalies occurring in the lumbar region and producing.

Either lumbarization of S1 or sacralization of L5 .This terminology can be a source of confusion and some have recommended the use of the term transitional lumbosacral vertebra. If surgery or radiation therapy is to be performed, it is important for the correct level to be identified. Therefore, it is imperative that radiographs be obtained to accompany all vertebral CT and MR studies.(Richard H. Daffner.2014)

Large defects are associated with spinal cord abnormalities and may lead to a variety of muscular abnormalities and lack of bladder or bowel control. In many cases a slight dimpling of the skin or a tuft of hair over the vertebral defect indicates the site of the lesion. Large defects in the lumbar or cervical spine may be accompanied by herniation of the meninges (meningocele), or of the meninges and a portion of the spinal cord or nerve roots (myelomeningocele). A patient with a meningocele may be asymptomatic. Other malformations associated with a meningocele are clubfoot, gait disturbances, and bladder incontinence. The myelomeningocele has associated neurologic deficits at and below the site of protrusion.(Ronald L. Eisenberg 2012)

2.4.2. Lumbar Spinal Stenosis

Lumbar spinal stenosis (LSS) is any narrowing in the lumbar spinal canal or lateral recess. It can be developmental, congenital, or acquired. This article discusses acquired degenerative lumbar spinal stenosis. Lumbar spondylosis refers to degenerative changes of the lumbar spine. Facet joint hypertrophy, thickening and bulging of the ligamentum flavum , outward bulging of the intervertebral disc, and disc degeneration, or degenerative Spondylolisthesis, are all manifestations of lumbar spondylosis. These degenerative changes may cause a reduction in the sagittal diameter of the spinal canal, commonly referred to as (central canal stenosis). The normal horseshoe-shaped spinal canal becomes a flattened triangular shape . Lateral recess stenosis also is a result of hypertrophy of the facet joints, loss of disc space height, posterolateral bulging of the disc, or degenerative Spondylolisthesis. There can be central canal stenosis in the absence of lateral recess stenosis (Gunzburg & Szpalski, 2003).

Spine extension (bending backward) causes posterior disc bulging and bulging of the ligamentum flava, which Results in further narrowing of the central and lateral canals. To compensate, a forward-flexed posture alleviates some of the narrowing caused by the hypertrophied ligamentum flavum and facets.(J Neurosci Nurs. 2005)

2.4.3 degenerative disc disease

As a normal sequel of aging, disc degeneration begins early in life due to loss of hydration resulting in disc height loss and diffuse bulging.

Degenerative lumbar spine disease (DLSD) includes spondylotic (arthritic) and degenerative disc disease of the lumbar spine with or without neuronal compression or spinal instability. DLSD is common. Patients with DLSD often present with range of symptoms such as, lumbar back pain ,sciatica and claudication . In symptomatic patients, a significant proportion of symptoms are due to bony, discal or ligamentous compression of neural elements at the spinal canal or nerve root exit foramina. Cauda equina syndrome due to compression of the cauda equina by a herniated central lumbar disc is a specific condition requiring emergency neurosurgical attention .In terms of aetiology, in most patients DLSD is the result of "normal" wear and tear associated with the aging process or overuse. Other causes include a congenitally narrowed spinal canal, genetic predisposition to early disc disease, trauma, infection, inflammation and rarer conditions such as ossification of the posterior longitudinal ligament.

2.4.3. DLSD due to normal aging process can be divided into:

Spondylitic degenerative change:

2.4.3.1 Spondylolysis

In spondylolysis, a crack or stress fracture develops through the pars interarticularis, which is a small, thin portion of the vertebra that connects the upper and lower facet joints. Most commonly, this fracture occurs in the fifth vertebra of the lumbar (lower) spine, although it sometimes occurs in the fourth lumbar vertebra. Fracture can occur on one side or both sides of the bone.

The pars interarticularis is the weakest portion of the vertebra. For this reason, it is the area most vulnerable to injury from the repetitive stress and overuse that characterize many sports. Spondylolysis can occur in people of all ages but, because their spines are still developing, children and adolescents are most susceptible. (American Academy of Orthopaedic Surgeons. AAOS.1997-2017)

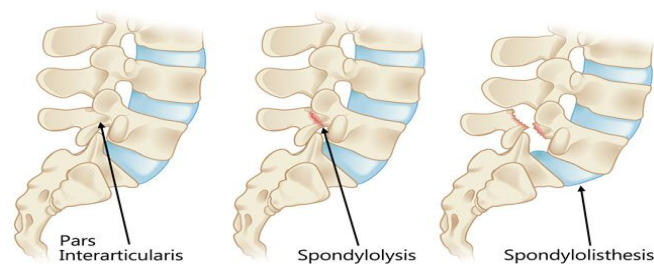
2.4.3.2. Spondylolisthesis

spondylolysis can weaken the vertebra so much that it is unable to maintain its proper position in the spine. This condition is called Spondylolisthesis.

In Spondylolisthesis, the fractured pars interarticularis separates, allowing the injured vertebra to shift or slip forward on the vertebra directly below it. In children and adolescents, this slippage most often occurs during periods of rapid growth—such as an adolescent growth spurt.

Doctors commonly describe Spondylolisthesis as either low grade or high grade, depending upon the amount of slippage. A high-grade slip occurs when more than 50 percent of the width of the fractured vertebra slips.

forward on the vertebra below it. Patients with high-grade slips are more likely to experience significant pain and nerve injury and to need surgery to relieve their symptoms. (American Academy of Orthopaedic Surgeons.AAOS.1997-2017)



2.4.4. Bulging Disc

A Bulging Disc occurs when the tough outer fibers of the spinal disc weaken and stretch allowing the "jelly center" of the disc to "bulge" outward . A Disc bulge is generally considered the first step toward a more serious problem called a Herniated Disc . A Herniated Disc is similar to a Disc Bulge except that the outer layers of the disc actually weaken to the point of tearing . (Irvine Family Health Center Spinal Decompression , 2006- 2010)

The majority of symptoms caused by a Bulging Disc are related to irritation of spinal nerves . These nerves exit the spine through small holes called foramen . The spinal disc are located next to these nerve passageways . The bulging of the disc material caused by a Bulging Disc can "pinch" these nerves creating a variety of uncomfortable and

sometimes debilitating symptoms. (Irvine Family Health Center Spinal Decompression , 2006- 2010)

A disc bulge in the low back can causes low back pain or numbness, Tingling, burning pain or weakness in the legs or feet .Sharp pain along the back of the legs is often referred to as sciatica . (Irvine Family Health Center Spinal Decompression 2006- 2010)

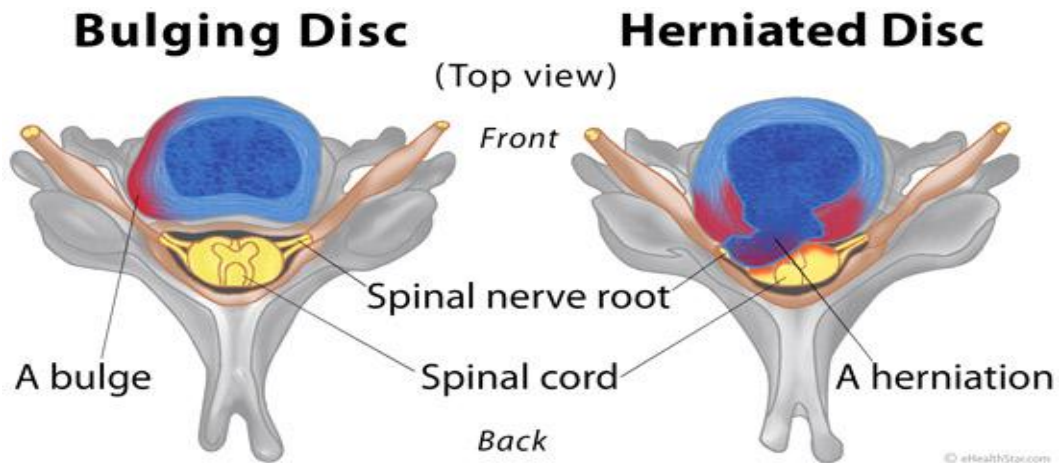


Figure 2:5 (© 2017 eHealthStar)

2.4.5. Herniated Disc

Spinal disc herniation, also known as a slipped disc, is a medical condition affecting the spine in which a tear in the outer, fibrous ring of an intervertebral disc allows the soft, central portion to bulge out beyond the damaged outer rings. Disc herniation is usually due to age-related degeneration of the outer ring, known as the annulus fibrosus, although trauma, lifting injuries, or straining have been implicated as well. Tears are almost always postero-lateral (on the back of the sides) owing to the presence of the posterior longitudinal ligament in the spinal canal.

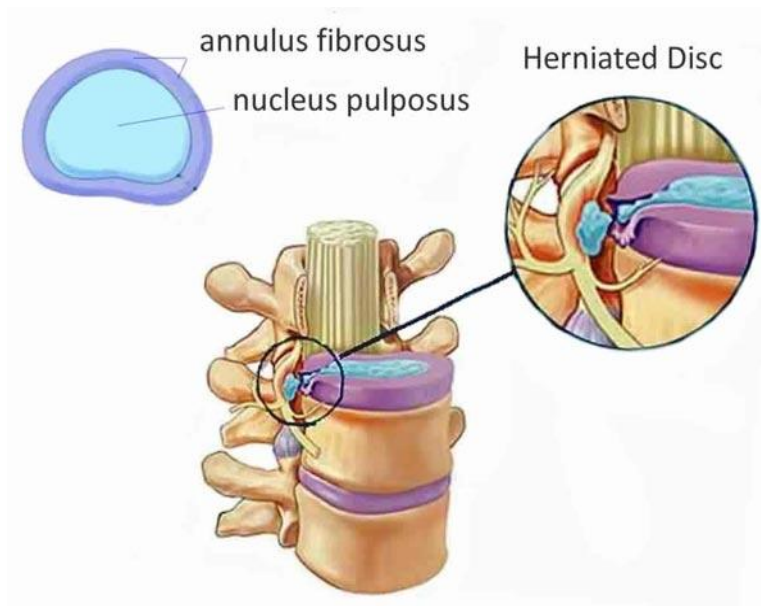


Figure 2:6 (© 1999-2017 Vertical Health, LLC)

This tear in the disc ring may result in the release of chemicals causing inflammation, which may directly cause severe pain even in the absence of nerve root compression.

Disc herniations are normally a further development of a previously existing disc protrusion, a condition in which the outermost layers of the annulus fibrosus are still intact, but can bulge when the disc is under pressure. In contrast to a herniation, none of the central portion escapes beyond the outer layers. Most minor herniations heal within several weeks. Anti-inflammatory treatments for pain associated with disc herniation, protrusion, bulge, or disc tear are generally effective. Severe herniations may not heal of their own accord and may require surgery. The condition is widely referred to as a (slipped disc), but this term is not medically accurate as the spinal discs are firmly attached between the vertebrae and cannot "slip" out of place. (Gerald L. Burke. 2013)



Figure 2: 7(©Mjorter at Dutch Wikipedia . 2007)

2.4.6. Infectious spine diseases

2.4.6.1. Arthritis

The word “arthritis” translates to “inflammation of a joint.” So, spinal arthritis, literally means inflammation of the facet or spinal joints.

Spinal arthritis is one of the common causes of back pain. Spinal arthritis is the mechanical breakdown of the cartilage between the aligning facet joints in the back portion (posterior) of the spine that quite often leads to mechanically induced pain. The facet joints (also called vertebral joints or zygapophyseal joints) become inflamed and progressive joint degeneration creates more frictional pain. Back motion and flexibility decrease in proportion to the progression of back pain induced while standing, sitting and even walking.(Centered Health and Wellness 2016)

Over time, bone spurs (small irregular growths on the bone also called osteophytes) typically form on the facet joints and even around the spinal vertebrae. These bone spurs are a response to joint instability and are

nature's attempt to help return stability to the joint. The enlargement of the normal bony structure indicates degeneration of the spine. Bone spurs are also seen as a normal part of aging and do not directly cause pain, but may become so large as to cause irritation or entrapment of nerves passing through spinal structures, and may result in diminished room for the nerves to pass (spinal stenosis). (Centered Health and Wellness 2016)



Figure 2:9 (© 2016 Centered Health and Wellnes)

2.4.6.2. Tuberculous Osteomyelitis

Tuberculous osteomyelitis (which is rare today) most commonly involves the thoracic and lumbar spine. Pott's disease (tuberculosis of the spine) occurs in the midthoracic spine and thoracolumbar region. Irregular, poorly marginated bone destruction within the vertebral body is often associated with a characteristic paravertebral abscess, an accumulation of purulent material that produces

a fusiform soft tissue mass about the vertebra The spread of tuberculous osteomyelitis causes narrowing of the adjacent intervertebral disk and the extension of infection and bone destruction across the disk to involve the adjacent vertebral body. Unlike bacterial infection, tuberculous

osteomyelitis is rarely associated with periosteal reaction or bone sclerosis (Mosby2012).



**Fig: 2:10 Sagittal STIR image shows loss of disc height
(Richard H. Daffner 2016)**

2.4.7 Spinal injury :

The spinal cord contains the nerves that carry messages between your brain and body. The cord passes through your neck and back. A spinal cord injury is very serious because it can cause loss of movement (paralysis) below the site of the injury spinal cord injury may be caused by Bullet , stab wound Traumatic injury to the face, neck, head, chest, or back (for example, a car accident),Diving accident. Electric shock Extreme twisting of the middle of the body, Landing on the head during a sports injury ,Fall from a great height. (American Collage of Surgons , 1997)

2.4.8. Trauma to the spinal column

Fractures occur when internal or external forces on the vertebrae exceed their structural strength. Common causes are vehicle accidents, sports, violence, and falls. Fractures can be further classified into two more groups: minor and major. When a posterior column element, such as the facet joint, is fractured it is "minor" because that structure is not vital to the stability of the spine. On the other hand, if the vertebral body is fractured (middle or anterior column), it is "major" because the stability of the spine may be at risk or damage to the spinal cord may occur. Vertebral body fractures may be further termed as stable or unstable. If a fracture is unstable, the bone fragments can damage the spinal cord and immediate intervention is necessary (Gray. Henry ,1977).

2.4.8.1. A Compression fractures

As the name implies, compression fractures occur from excessive axial forces disrupting the continuity of the anterior column of the vertebral body. Osteoporosis is a leading precursor to compression fractures because of the vertebrae's lower ability to support a load. A missed step or even a cough can result in a compression fracture. People often accept back pain as a normal part of aging. Repeated compression fractures can result in the loss of six inches or more in height. Another common cause of compression fracture is trauma, such as a fall. Click on the button below to witness a sudden vertical impact to the vertebral column. Often, vertebral compression fractures eventually heal on their own. Aspirin and other nonsteroidal anti-inflammatory drugs (NSAIDs) can be taken to relieve pain. More aggressive techniques include vertebroplasty, the injection of bone cement into the vertebra to stabilize it. Kyphoplasty is

similar, but the vertebra is first expanded to near normal height and then stabilized with cement or mechanical devices. (Gray's 2005).

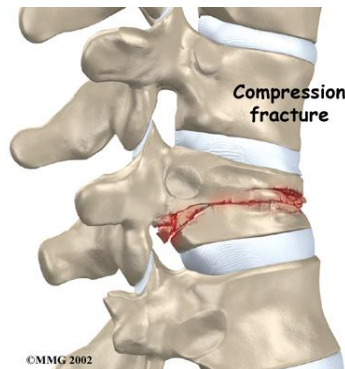


Figure 2:11 (©MMG2002)

2.4.8.2. Burst fractures

Burst fractures usually occur from severe trauma such as a vehicle accident or a fall. Burst Fxs are more dangerous than compression Fxs for two reasons. The anterior and middle columns of the vertebral body are broken into several fragments, which are more likely to cause spinal cord injury. Since the vertebral body has lost its structural integrity, the spinal column is less stable. If the burst Fx does not impinge on the spinal cord, it may be treated non-surgically. However, if there are loose fragments or nerve injury, surgery is usually performed. The spine can be accessed anteriorly, posteriorly, or both. Loose fragments may be moved into a better position or removed. The spine may be reduced (elongated) for alignment. The fragments may be stabilized with screws and other mechanical means. In severe cases, the entire Fx vertebral body is removed and the adjacent vertebrae fixed in place with rods and screws. A bone-conductive reinforcement structure replaces the vertebra. (Gray's 2005).

2.4.8.3. Flexion-distraction fracture

This type of fracture is sometimes called a "Chance" fracture. It was often caused by lap seat belts without shoulder restraints in cars. The initial collision can cause extreme flexion of the vertebral column, soon followed by the distraction of the rebound. In this fracture, all three columns of the vertebral body can fail and there may be injury to bone, ligaments and discs as well as other internal injuries. Chance fractures are inherently unstable and require immediate intervention. These fracture types represent about 10% of lumbar spine fractures. The posterior column may be damaged by rupture of the spinus process or posterior longitudinal ligament, or both (Gray's 2005).

2.4.8.4. Stable versus unstable fractures

If only the anterior column is damaged, as in the case of most wedge and compression fractures, the fracture is considered stable. When both the anterior and middle columns are involved, the fracture may be considered more unstable. When all three columns are involved, the fracture is by definition considered unstable, because of the loss of the integrity of the vertebra and posterior stabilizing ligaments.

Stable fractures do not pose a threat to the spinal cord. Unstable fractures endanger the spinal column and, depending on circumstances, may require immediate surgical intervention. (Gray's 2005).

2.4.9. Hyperlordosis of the spine

Lordosis describes the natural curvature of the lumbar spine, but Hyperlordosis is a pathologically exaggerated lumbar curvature,

commonly called "swayback". Hyperlordosis is usually accompanied by the pelvis tilting abnormally forward, often causing an exaggerated protrusion of the buttocks. Symptoms may include pain and numbness if the nerve trunks are compromised. . (Gray's 2005).

Typically, the condition is attributed to weak back muscles or a habitual hyperextension, such as in pregnant women, men with excessive visceral fat, and some dance postures. Hyperlordosis is also correlated with puberty. Treatment for hyperlordosis isn't required unless it may progress, causes pain, or compromises nerves. Initially analgesics and anti-inflammatory medication are administered. . (Gray's 2005).

Physical therapy to build strength, flexibility, and increase range of motion is common. The reduction to ideal body mass index is recommended. In adolescents, bracing may be applied to control progression. In severe cases with neurological involvement, surgery should be considered. This typically involves a fusion of L4-L5 and L5-S1. This is a younger person's disease, often associated with overtraining in active sports. There is also a hereditary correlation to weakness in the pars region, suggesting a genetic component. (Gray's 2005).

2.4.10. Tumors of the spine

here are three common types of spinal tumors that can cause back pain: vertebral column tumors, intradural - extramedullary tumors, and intramedullary tumors.



Figure 2:12 (Website <http://clinicalgate.com> 2015)

Fig:2:12 Sagittal T2WI demonstrates heterogeneous marrow signal with areas of high and low signal that both correspond to metastatic deposit

Primary tumors: These tumors occur in the vertebral column, and grow either from the bone or disc elements of the spine. They typically occur in younger adults. Osteogenic sarcoma (osteosarcoma) is the most common malignant bone tumor. Most primary spinal tumors are quite rare and usually grow slowly.

Metastatic tumors: Most often, spinal tumors metastasize (spread) from cancer in another area of the body. These tumors usually produce pain that does not get better with rest, may be worse at night, and is often accompanied by other signs of serious illness (such as weight loss, fever/chills/shakes, nausea or vomiting).

In women, spinal tumors most frequently spread from cancer that originates in the breast or lung.

In men, spinal tumors most frequently spread from cancer that originates in the prostate or lung. (Mosby 2012)

2.4.10.1. Intradural-Extramedullary Tumors

Intradural-Extramedullary (inside the dura) tumors grow within the spinal canal (under the membrane that covers the spinal cord) but outside of the nerves. Usually these tumors are benign and slow growing. However, they can cause symptoms of pain and weakness.

Most of these spinal tumors are:

Meningiomas that occur in the membranes surrounding the spinal cord and are usually benign but may be malignant. These tumors are more common in middle age and elderly women.

Nerve sheath tumors (schwannomas and neurofibromas) that arise from the nerve roots that come off the spinal cord. Again, this type of tumor is usually benign and slow growing, and it may be years before any neurological problems occur.

2.4.10.2. Intramedullary Tumors

Intramedullary tumors grow from inside the spinal cord or inside the individual nerves and often arise from the cells that provide physical support and insulation for the nervous system (glial cells). These tumors occur most often in the cervical spine (neck). They tend to be benign, but surgery to remove the tumor may be difficult. (Mosby, Inc., an affiliate of Elsevier Inc.,2012)

The two most common types of intramedullary tumors are astrocytomas and ependymomas.

2.4.11. Paget's Disease

Paget's disease (osteitis deformans) is one of the most common chronic metabolic diseases of the skeleton. Destruction of bone, followed by a reparative process, results in weakened, deformed, and thickened bony structures that tend to fracture easily. The disease, seen most commonly during middle life, affects men twice as often as women and has been reported to occur in about 3% of all persons older than 40 years. Although the destructive phase often predominates initially, there is more frequently a combination of destruction and repair in the pelvis and weight-bearing bones of the lower extremities. The reparative process may begin early and may be the prominent feature, often involving multiple bones. Paget's disease affects particularly the pelvis, femurs, skull, tibiae, vertebrae, clavicles, and ribs (Mosby, Inc., an affiliate of Elsevier Inc.,2012) .



(A)



(B)

Fig:2: 13 (A) T1 signal and enlargement of the L3 posterior elements low

Fig:2:14 (B) Heterogenous low T2 signal within L3 vertebral body

Website (<https://www.mypacs.net/cases2011>)

2.4.12. Lower back pain:

Low and lower back pain can vary from dull pain that develops gradually to sudden, sharp or persistent pain felt below the waist. Unfortunately, almost everyone, at some point during life will experience low back pain that may travel downward into the buttocks and sometimes into one or both lower extremities. The most common cause is muscle strain often related to heavy physical labor, lifting or forceful movement, bending or twisting into awkward positions, or standing in one position too long. (<https://www.spineuniverse.com>)

2.4.12.1. The following factors are linked to a higher risk of developing low back pain:

A mentally stressful job ,Pregnancy - pregnant women are much more likely to get back pain ,a sedentary lifestyle , age - older adults are more susceptible than young adults or children ,anxiety ,Depression , gender - back pain is more common among females than males , obesity/overweight ,smoking ,strenuous physical exercise (especially if not done properly),strenuous physical work. (<http://www.medicalnewstoday.com>)

2.4.12.2 Signs and symptoms of back pain:

1. Weight loss
2. Elevated body temperature (fever)
3. Inflammation (swelling) on the back
4. Persistent back pain - lying down or resting does not help
5. Pain down the legs
6. Pain reaches below the knees

7. A recent injury, blow or trauma to your back
8. Urinary incontinence - you pee unintentionally (even small amounts)
9. Difficulty urinating - passing urine is hard
10. Fecal incontinence - you lose your bowel control (you poo unintentionally)
11. Numbness around the genitals
12. Numbness around the anus
13. Numbness around the buttock
(<http://www.medicalnewstoday.com>)

2.4.12.3. Causes of back pain:

2.4.12.3.1 Strain - the most common causes of back pain are:

1. Strained muscles
2. Strained ligaments
3. Lifting something improperly
4. Lifting something that is too heavy
5. The result of an abrupt and awkward movement
6. A muscle spasm. (<http://www.medicalnewstoday.com>)

2.4.12.3.2. Structural problems - the following structural problems may also result in back pain:

2.4.12.3.3. Ruptured disks - each vertebra in our spine is cushioned by disks. If the disk ruptures there will be more pressure on a nerve, resulting in back pain.

2.4.12.3.4. Bulging disks - in much the same way as ruptured disks, a bulging disk can result in more pressure on a nerve.

2.4.12.3.5.Sciatica - a sharp and shooting pain that travels through the buttock and down the back of the leg, caused by a bulging or herniated disk pressing on a nerve.

2.4.12.3.6.Arthritis - patients with osteoarthritis commonly experience problems with the joints in the hips, lower back, knees and hands. In some cases spinal stenosis can develop - the space around the spinal cord narrows.

2.4.12.3.7.Abnormal curvature of the spine - if the spine curves in an unusual way the patient is more likely to experience back pain. An example is scoliosis, when the spine curves to the side.

2.4.12.3.8.Osteoporosis - bones, including the vertebrae of the spine, become brittle and porous, making compression fractures more likely. (<http://www.medicalnewstoday.com>)

2.4.12.4.Below are some other causes of back pain:

2.4.12.4.1. Caudaequina syndrome - the cauda equine is a bundle of spinal nerve roots that arise from the lower end of the spinal cord. People with cauda equine syndrome feel a dull pain in the lower back and upper buttocks, as well as analgesia (lack of feeling) in the buttocks, genitalia and thigh. There are sometimes bowel and bladder function disturbances.

2.4.12.4.2.Cancer of the spine - a tumor located on the spine may press against a nerve, resulting in back pain.

2.4.12.4.3. Infection of the spine - if the patient has an elevated body temperature (fever) as well as a tender warm area on the back, it could be caused by an infection of the spine.

2.4.12.4.4. Other infections - pelvic inflammatory disease (females), bladder or kidney infections.

2.4.12.4.5. Sleep disorders - individuals with sleep disorders are more likely to experience back pain, compared to others.

2.4.12.4.6. Shingles - an infection that can affect the nerves.

2.4.12.4.7. Bad mattress - if a mattress does not support specific parts of the body and keep the spine straight, there is a greater risk of developing back pain.(<http://www.medicalnewstoday.com>)

2.4.12. Back pain can also be the result of some everyday activity or poor posture. Examples include:

2. Bending awkwardly
3. Pushing something
4. Pulling something
5. Carrying something
6. Lifting something
7. Standing for long periods
8. Bending down for long periods
9. Twisting
10. Coughing
11. Sneezing
12. Muscle tension
13. Over-stretching
14. Sitting in a hunched position for long periods (e.g. when driving)

15. Long driving sessions without a break (even when not hunched). (<http://www.medicalnewstoday.com>)

2.4.12.5 Diagnosing back pain

1. **X-rays** can show the alignment of the bones and whether the patient has arthritis or broken bones. They are not ideal for detecting problems with muscles, the spinal cord, nerves or disks.
2. **MRI or CT scans** - these are good for revealing herniated disks or problems with tissue, tendons, nerves, ligaments, blood vessels, muscles and bones.
3. **Bone scan** - a bone scan may be used for detecting bone tumors or compression fractures caused by brittle bones (osteoporosis). The patient receives an injection of a tracer (a radioactive substance) into a vein. The tracer collects in the bones and helps the doctor detect bone problems with the aid of a special camera.
4. **Electromyography or EMG** - the electrical impulses produced by nerves in response to muscles is measured. This study can confirm nerve compression which may occur with a herniated disk or spinal stenosis (narrowing of the spinal canal). (<http://www.medicalnewstoday.com>)

2.12.5.6 Treatments for back pain:

Usually back pain is categorized into two types:

Acute - back pain comes on suddenly and persists for a maximum of three months.

Chronic - the pain gradually develops over a longer period, lasts for over three months, and causes long-term problems.

A considerable percentage of patients with back pain experience both occasional bouts of more intense pain as well as more-or-less continuous mild back pain, making it harder for the doctor to determine whether they have acute or chronic back pain. (<http://www.medicalnewstoday.com>)

Injecting cells to regenerate spine discs - scientists from Duke University, North Carolina, developed new biomaterials that can deliver a booster shot of reparative cells to the nucleus pulposus, effectively eliminating pain caused by degenerative disc disease. (<http://www.medicalnewstoday.com>)

If home treatments do not give the desired results, a doctor may recommend the following:

Medication - back pain that does not respond well to OTC painkillers may require a prescription NSAID (nonsteroidal anti-inflammatory drug). Codeine or hydrocodone - narcotics - may also be prescribed for short periods; they require close monitoring by the doctor.

Some tricyclic antidepressants, such as amitriptyline, have been shown to alleviate the symptoms of back pain, regardless of whether or not the patient has depression.

Physical Therapy :the application of heat, ice, ultrasound and electrical stimulation, as well as some muscle-release techniques to the back muscles and soft tissues may help alleviate pain. As the pain subsides the physical therapist may introduce some flexibility and strength exercises

for the back and abdominal muscles. Techniques on improving posture may also help. The patient will be encouraged to practice the techniques regularly, even after the pain has gone, to prevent back pain recurrence.

Cortisone injections - if the above-mentioned therapies are not effective enough, or if the pain reaches down to the patient's legs, cortisone may be injected into the epidural space (space around the spinal cord). Cortisone is an anti-inflammatory drug; it helps reduce inflammation around the nerve roots. According to The Mayo Clinic, the pain-relief effect will wear off after less than six weeks.

Injections may also be used to numb areas thought to be causing the pain. Botox (botulism toxin), according to some early studies, are thought to reduce pain by paralyzing sprained muscles in spasm. These injections are effective for about three to four months.

Surgery - surgery for back pain is very rare. If a patient has a herniated disk surgery may be an option, especially if there is persistent pain and nerve compression which can lead to muscle weakness. Examples of surgical procedures include:

Fusion - two vertebrae are joined together, with a bone graft inserted between them. The vertebrae are splinted together with metal plates, screws or cages. There is a significantly greater risk for arthritis to subsequently develop in the adjoining vertebrae.

Artificial disk - an artificial disk is inserted; it replaces the cushion between two vertebrae.

Discectomy (partially removing a disk) - a portion of a disk may be removed if it is irritating or pressing against a nerve.

Partially removing a vertebra - a small section of a vertebra may be removed if it is pinching the spinal cord or nerves.

CBT (Cognitive Behavioral Therapy) - according to some studies, CBT can help patients manage chronic back pain. The therapy is based on the principle that the way a person feels is, in part, dependent on the way they think about things. People who can be taught to train themselves to react in a different way to pain may experience less perceived pain. CBT may use relaxation techniques as well as strategies to maintain a positive attitude. Studies have found that patients with CBT tend to become more active and do exercise, resulting in a lower risk of back pain recurrence. (<http://www.medicalnewstoday.com>)

Complementary therapies

A large number of patients opt for complementary therapies, as well as conventional treatments; some opt just for complementary therapies. According to the National Health Service (NHS), UK, chiropractic, osteopathy, shiatsu and acupuncture may help relieve back pain, as well as encouraging the patient to feel relaxed.

An osteopath specializes in treating the skeleton and muscles.

A chiropractor treats joint, muscle and bone problems - the main focus being the spine.

Shiatsu, also known as finger pressure therapy, is a type of massage where pressure is applied along energy lines in the body.

The shiatsu therapist applies pressure with his/her fingers, thumbs and elbows.

Acupuncture, which originates from China, consists of inserting fine needles and specific points in the body. Acupuncture can help the body release its natural painkillers - endorphins - as well as stimulating nerve and muscle tissue.

Studies on complementary therapies are have given mixed results. Some people have experienced significant benefit, while others have not. It is important, when considering alternative therapies, to use a well-qualified and registered therapist. (<http://www.medicalnewstoday.com>)

TENS (transcutaneous electrical nerve stimulation) - a popular therapy for patients with chronic (long-term) back pain. The TENS machine delivers small electric pulses into the body through electrodes that are place on the skin. Experts believe TENS encourages the body to produce endorphins, and may possibly block pain signals returning to the brain. Studies on TENS have provided mixed results; some revealed no benefits, while others indicated that it could be helpful for some patients. (<http://www.medicalnewstoday.com>)

A TENS machine should be used under the direction of a doctor or health care professional.

Pregnant women, people with epilepsy, people with a pacemaker, and patients with a history of heart disease should not use a TENS machine.

2-5 Preventing back pain:

Steps to lower the risk of developing back pain consist mainly of addressing some of the risk factors.

Exercise - regular exercise helps build strength as well as keeping your body weight down. Experts say that low-impact aerobic activities are best; activities that do not strain or jerk the back. Before starting any exercise program, talk to a health care professional.

Core-strengthening exercises; exercises that work the abdominal and back muscles, help strengthen muscles which protect your back.

Flexibility - exercises aimed at improving flexibility in your hips and upper legs may help too.

Smoking - a significantly higher percentage of smokers have back pain incidences compared to non-smokers of the same age, height and weight.

Body weight - the fatter you are the greater your risk of developing back pain. The difference in back pain risk between obese and normal-weight individuals is considerable.

Posture when standing - make sure you have a neutral pelvic position. Stand upright, head facing forward, back straight, and balance your weight evenly on both feet - keep your legs straight.
(<http://www.medicalnewstoday.com>)

Previous Study:

Chou (2011) conducted a systematic review of studies to evaluate the role of routine MRI in the clinical management of patients with chronic low back pain . These review focused on studies addressing the relationship between degenerative changes detect through MRI , and chronic low back pain, and that compared surgical and nonsurgical treatment of these degenerative changes . The authors identified five cross sectional studies , four of which showed statistically significant association between the presence of disc degenerative and chronic low back pain (odds ratio , 1.8-2.8) . The authors considered the overall strength of evidence to be insufficient to establish an association between degenerative changes detected by MRI and the presence of chronic low back pain . Based on these results the authors recommend against routine use of MRI for chronic low back pain evaluation . In addition , regarding efficacy of surgical treatment of degenerative changes detected through MRI , the authors recommend strongly against the surgical treatment of chronic low back pain based solely on MRI- detected degenerative changes.

Endean (2011) , in a systemic review and meta-analysis , examined the potential value of MRI abnormalities in refining case definition for mechanical low back pain epidemiological research . These researchers asked : to what degree can low back pain (LBP)be attributed confidently to abnormalities detected on magnetic resonance imaging (MRI) ? the authors found that base on MRI findings of disc protrusion , nerve root displacement or compression , disc degeneration , and high intensity zone are all associated with low back pain , but individually , none of these abnormalities provides a strong suggestion that low back pain(LBP) is the result of underlying disease . The limits their value in refining

epidemiological case definitions for low back pain based on MRI findings .(Endean A,,2011)

Sahar (2012) (Assessment of Severe Lower Back Pain Disorders using MRI) . This study was to assess the severe lower back pain disorders using MRI . The study was found that disc bulge was the most common causes 46% ,disc bulge & disc herniation 6% ,disc bulge generative 10% ,disc bulge ,degenerative & stenosis 2%, disc bulge ,degenerative & spondylolisthesis 2%, disc bulge ,degenerative & other 8%, disc bulge, disc herniation, degenerative , other 4%, disc bulge & spondylolisthesis 2% ,disc bulge & other 2% ,disc herniation 6%,normal 8%and others 4% . The incidence of LBP is equal between the men and female. Most patients affected by diseases their age range between 40-69 yrs. The L4/L5 was the most level of spine affected by diseases. MRI has become promising modality for diagnosis the causes of low back pain

Wasiema (2013) (Evaluation of Lower Back Pain Using Magnetic Resonance Imaging) . This study showed that the correlation between the subject's age, weight and height and lower backache duration shows a linear relationship between the sample age, weight, height and lower back pain duration. The results show that 31 cases with disc bulge, 10-disc degeneration and 7 disc prolapsed on MRI. Finally the researcher conclude that imaging studies (MRI) are helpful in cases of lower back pain but they aren't the only factor to determine low back etiology, for that proper history and clinical examination are very necessary to determine which type of imaging is need, and it will also allow the technologist to focus the effort of the examination at the proper disc level

Chapter Three

Materials and Method

Chapter three

Materials and Methods

3.1. Materials:

- **3.1.1. Study Design**

Observation study –hospital based study

- **3.1.2. Area of study**

Sudanese population

- **3.1.3 Place of study**

1- police hospital center.

2-khartoum modern center.

- **3.1.4. Duration of study**

From September 2016 to February 2017

- **3.1.5 Inclusion criteria:**

Patients with disease of lumbar spine

- **3.1.6 Exclusion criteria:**

Normal patients

- **3.1.7 MRI scan used:**

In the present study, MRI machines were used:

- **3.1.7.1 For police hospital center:**

1. Machine :Open MRI machine New soft

2. Power :0.3 tesla
 1. Coil :Posterior spinal coil
 2. Magnet : superconductive with helium cooling
- **3.1.7.2 For Modern medical center and analyses medical center**
 1. Machine : Close MRI machine general electric system
 2. power:1.5 Tesla
 3. Coil :Posterior spinal coil
 4. Magnet : superconductive with helium cooling

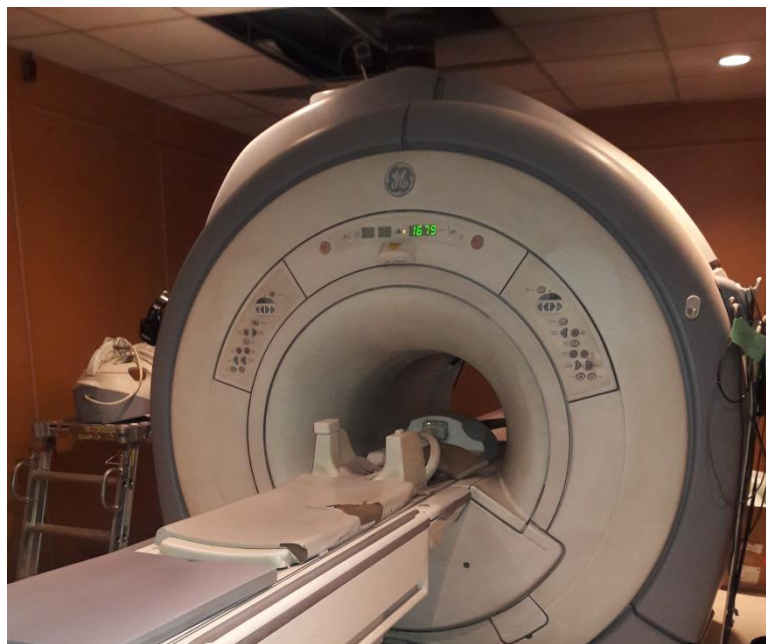


Figure 3:1 GE 1.5 Tesla in Modern medical center and analyses medical center

3.2:Methodes:

3.2.1 MRI Protocol

The protocol that used that was used in the examination the subject under study

Sagittal/coronal SE/FSE T1 or coherent GRE T2*

Sagittal SE/FSE T1

Sagittal SE/FSE T2 or coherent GRE T2*

Axial/oblique SE/FSE T1/T2 or coherent GRE T2*

3.2.2.Data collection sheet

Data collection sheet used include demographic information (age ,gender, weight , height), level of lumber spine ,MRI finding , symptoms related to age proses and other finding.

3.2.3. Data analysis:-

The data collected from the cases of patient and entered to Microsoft office Excel

3.2.4.Evaluation and image interpretations:

Cases were evaluated by different consultant radiologist with different experiences and practice.

Chapter four

Results

Chapter four

Results

The following tables and figures present data collection from 100 patients including (46 males and 44 females), the ages were classified in to classes and correlation between the age and causes of lower back pain duration where studied .

Table 4.1: The sample classification according to gender.

Gender	Frequency	Percentage %
Male	56	56%
Female	44	44%
Total	100	100%

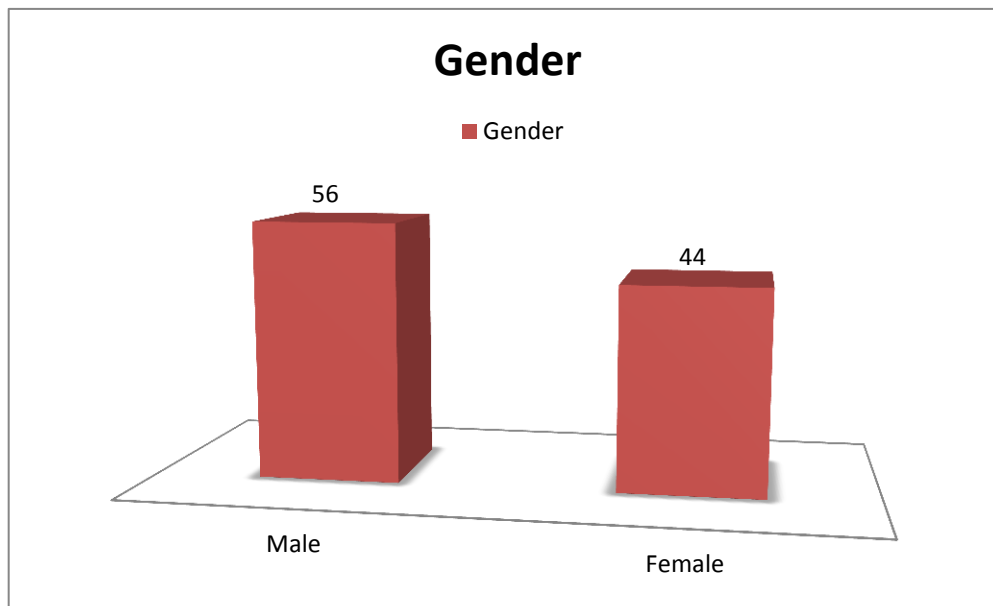


Figure 4.1: The sample classification according to gender.

Table 4.2: The distribution of sample according to gender.

Age class	Frequency	Percentage
10-20	6	6%
21-30	12	12%
31-40	17	17%
41-50	18	18%
51-60	23	23%
61-70	20	20%
71-80	4	4%
Total	100	100%

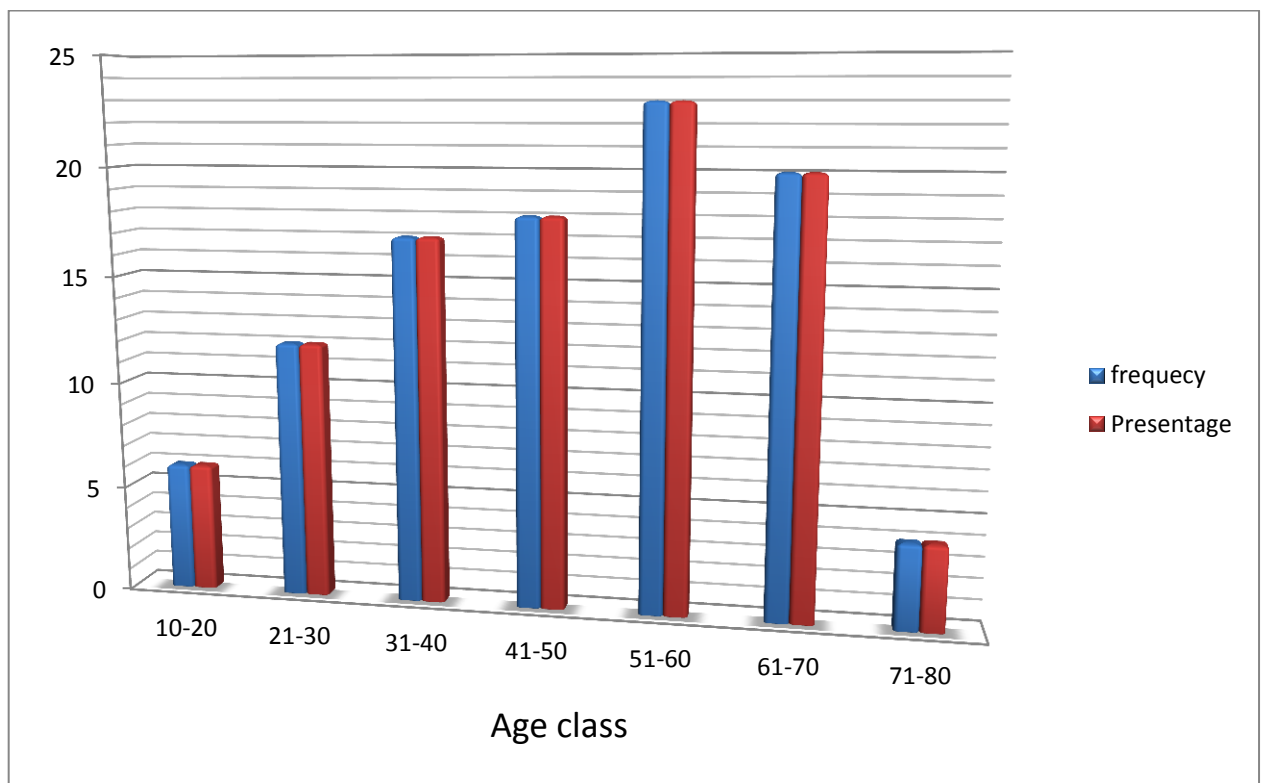


Figure 4:2 : The distribution of sample according to gender.

Table 4:3 The distribution of sample according to weight

Wight	Frequency	Percentage
40-50	6	6%
51-60	10	10%
61-70	24	24%
71-80	26	26%
81-90	19	19%
>91	15	15%
Total	100	100%

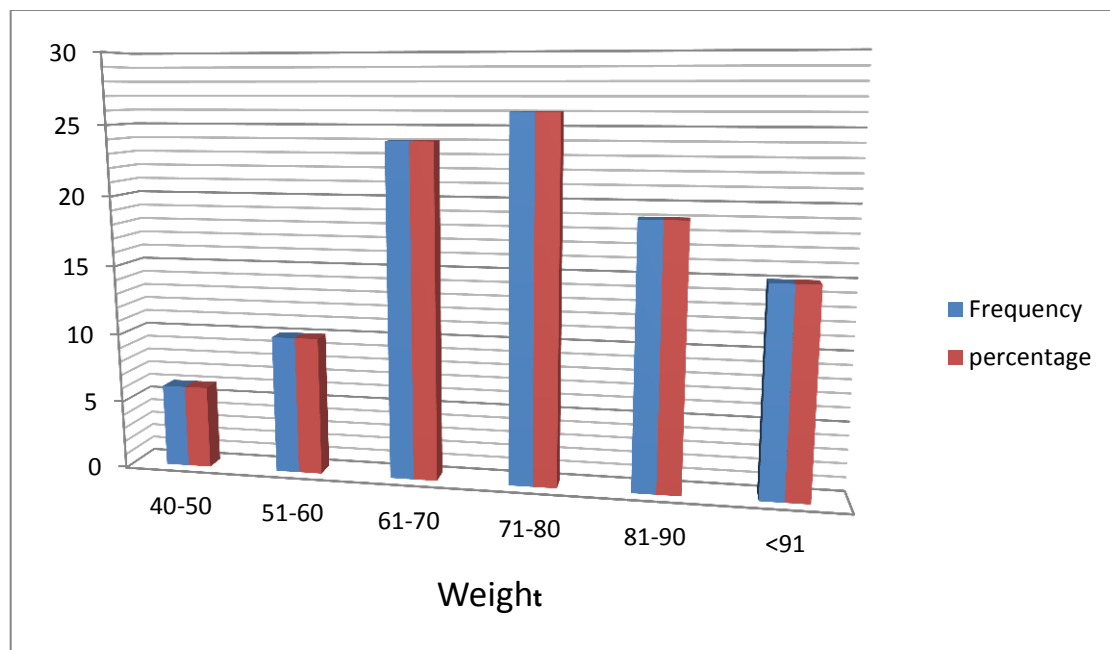


Figure 4:3 The distribution of sample according to weight

Table 4:4 The distribution of sample according to height

Height	Frequency	Percentage
145-155	12	12%
156-165	29	29%
166-175	34	34%
176-185	23	23%
186-195	9	9%
>195	2	2%

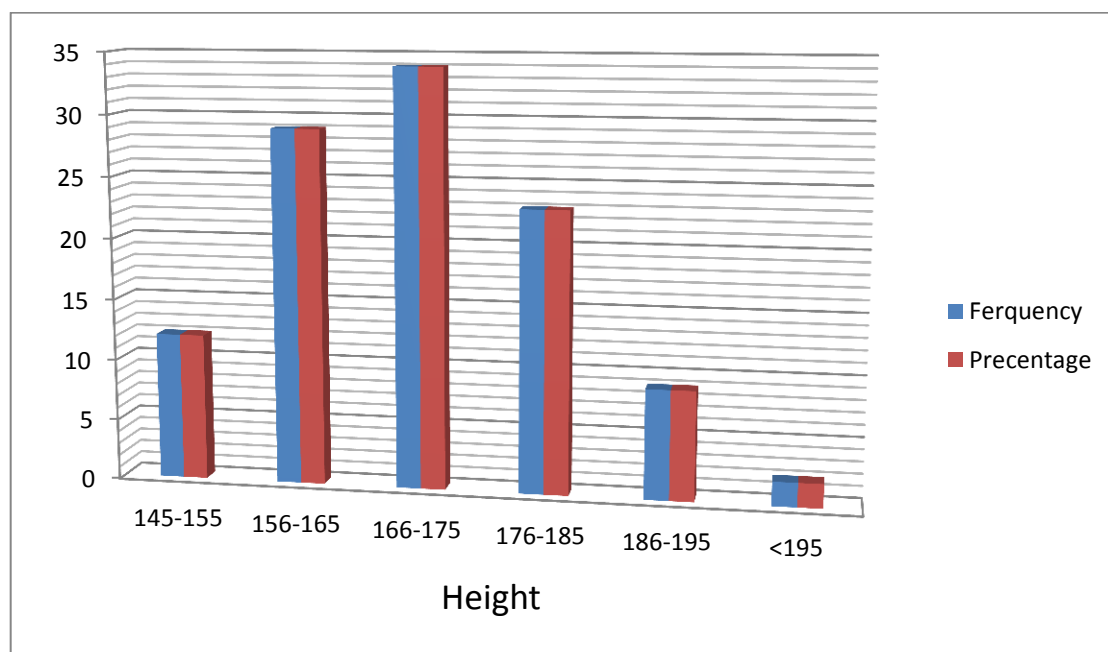


Figure 4:4 The distribution of sample according to height

Table 4:5 Show distribution of incidental findings according age range

Age Class	Disc Bulge	Spondylolisthesis	Spondylitic arthritis	Disc degeneration	Disc prolapsed	Disc protrusion	Others	Total
	10-20	2	0	0	1	0	1	2
21-30	2	0	2	4	3	1	2	14
31-40	3	2	1	4	4	2	1	17
41-50	5	4	3	2	2	3	0	19
51-60	4	3	2	3	3	2	1	18
61-70	3	2	3	4	2	3	4	21
71-80	2	1	0	0	0	1	1	5
Total	21	12	11	18	14	13	11	100

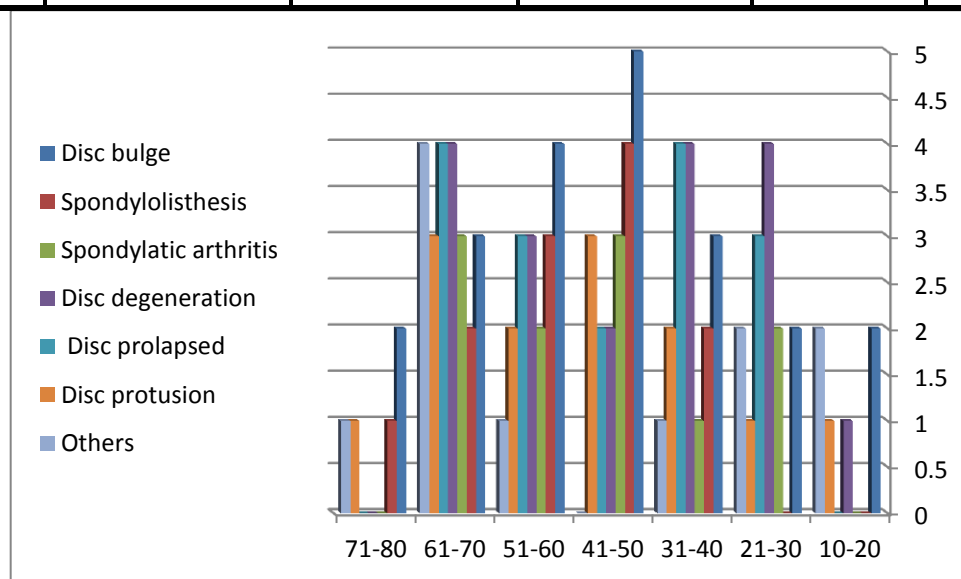


Figure 4: 5 Show distribution of incidental findings according age range

Table 4:6 Show distribution of incidental findings and lumber spine level

Level of spine	Disc bulge	Spondylolisthesis	Spondylitic arthritis	Disc degeneration	Disc prolapsed	Disc protusion	Others
L1-L2	0	0	1	1	1	0	1
L2-L3	3	2	0	3	2	3	0
L3-L4	16	0	4	19	5	1	3
L4-L5	29	3	8	17	3	1	4
L5-S1	23	1	0	9	1	4	5

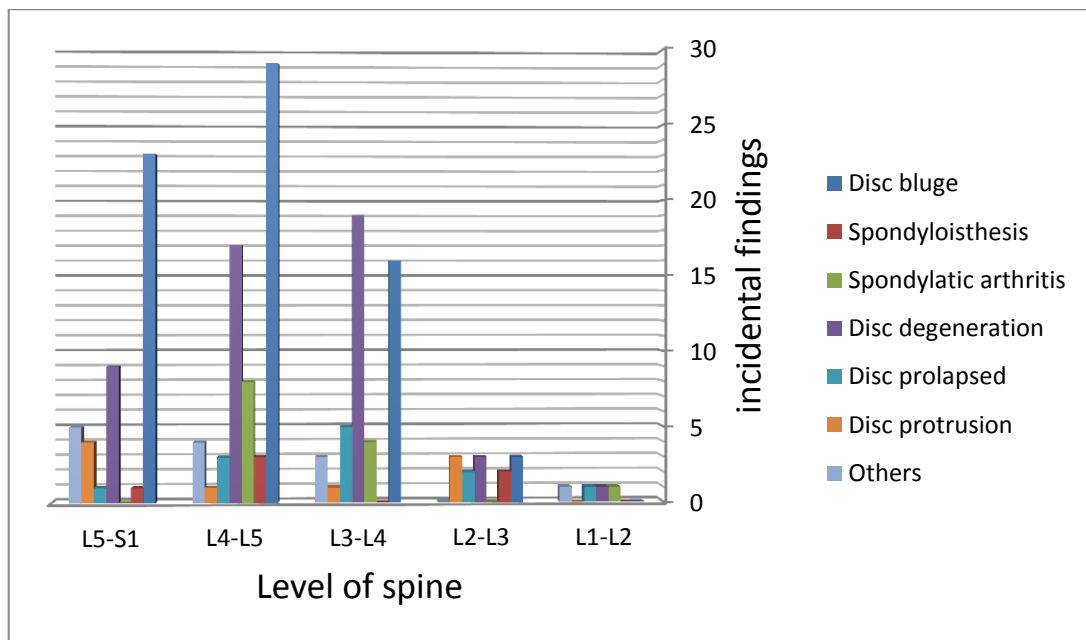


Figure 4:6 Show distribution of incidental findings and lumber spine level

Table: 4:7 correlation between age , weight , height, time duration

		Disc bulge	Spondylolisthesis	Spondylitic arthritis	Disc degeneration	Disc prolapsed	Disc protusion	Other
Age	Pearson Correlation	- .065-	.136	.006	-.088-	-.065-	-.065-	.006
	Sig. (2-tailed)	.523	.178	.950	.384	.523	.523	.950
	N	100	100	100	100	100	100	100
Weight	Pearson Correlation	.029	-.040-	-.069-	.097	.029	.029	-.069-
	Sig. (2-tailed)	.772	.695	.498	.336	.772	.772	.498
	N	100	100	100	100	100	100	100
Height	Pearson Correlation	.005	.004	.029	.202 [*]	.005	.005	.029
	Sig. (2-tailed)	.964	.965	.778	.044	.964	.964	.778
	N	100	100	100	100	100	100	100

Chapter five

(Discussion, Conclusion, Recommendation)

Chapter five

5.1 Discussion:

In this study, MRI findings in patients with pain limited to their lower back were analyzed . The pathology of anatomical structures that may causes lower back pain include the bones , muscles , fascia , ligaments, disc(exterior annulus fibrosus and posterior disc regions) , and nerve roots , and exclude the nucleus pulposus a and the ligament flavum .

In this study the researcher evaluated the lower back pain by MRI . From the result of images , tables , and data collected from reports and patients the researcher find that :

Table and graph (4:1) Most cases of lower back pain are males 46%.

Table and graph (4:2) Show the range of patient age and number of patient show that range was 51-60 , 23%.

Table and graph (4:3) Show the range of patient weight and number of patient show that the weight range was 71-80, 26%.

Table and graph (4:4) Show the range of patient height and number of patient show that the height range was 166-175 , 34%.

Table and graph (4:5) Show the distribution of incidental findings according age range ,show that range between 61-70yrs were that most age class affected by disease (disc bulge 21% , Spondylolisthesis 12%, Spondylitic arthritis 11% , Disc degeneration 18% , Disc prolapsed 14%, Disc protrusion 13%, Others 11% , 21 patients of population of this study, as previously observed (Sahar Omer 2012) found 40-69yrs 18% of the population of study.

Table and graph (4:6) Show the distribution of incidental findings and the lumbar spine level L4-L5 was the most level of spine affected by disease. as previously observed (Sahar Omer 2012) The incidence assessment of sever lower back pain disorders by using MRI was most frequent at level L4-L5. In this study disc bulge which present 51 of cases (33.3%) at level L4-L5 , Spondylolisthesis was present of cases 6 (3,9%) at level L4-L5, Spondylitic arthritis was present of cases 13 (8.4%) at level L4-L5 , Disc degeneration also most causes 49(32%) at level L4-L5 , Disc prolapsed was present 12 (7.8%) at L4-L5 , Disc protrusion was present of cases 9(5.8%) , and Others was present of cases 13(8.4%) at level L4-L5.

The study showed that the correlation between the subject`s age, weight , height , time duration and incidental findings Mean , Standard Deviation

Table (4:7) Correlation between age, weight , height, time duration show no correlation between age, weight, just height in disc degeneration and time duration

5:2. Conclusion

1. Lower back pain have become common among the adults and older people . Obviously , they have relation with age, weight , height and lower back pain duration .
2. The analysis of abnormal MRI finding in this study showed that Disc bulge , spondylolisthies, Spondylitic arthritis, disc degeneration ,disc prolapsed and disc protusion.
3. Disc bulge is common causes of lower back pain 21% of the study cases.
4. The common level of lumbar spine affected by disease is L4/L5

5. MRI have big role in diagnosis of lumbar spine pathologies and has ability to differentiate between them.

5-3. Recommendations:

The study recommend the following:

1. Before doing MRI complete history is necessary to determine the site, position and necessity factor for radiological examination.
2. More research should be done using a large sample of patients for further assessment .
3. Researcher suggests that doing the same studies for all patients complaining of lower back pain to exclude major causes of lower back pain .

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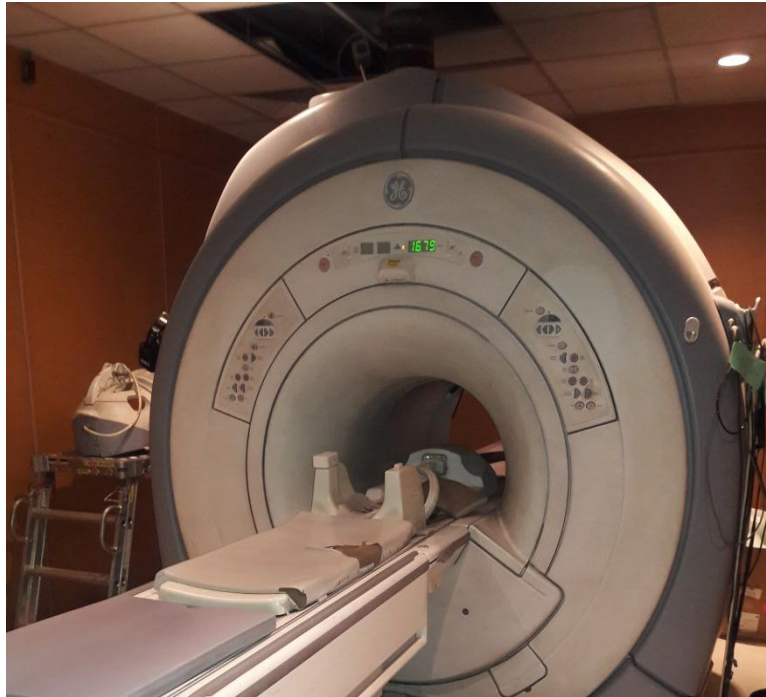
Irvine Family Health Center Spinal Decompression , 2006- 2010

kathleen J.W Wilson ,Annewaugh, Anatomy and physiology in health and illness edition 8 1997

Appendices

Appendices

Appendix (A)



GE 1.5 Tesla in Modern medical center and analyses medical center

Appendix (B)

Chart of data collection

Sudan University of Sciences and Technology

Collage of Graduate Studies

M.Sc. in Diagnostic Radiology

Title: Evaluation of patients with Lower back pain using Magnetic Resonance Imaging (MRI)

Data Collection Sheet

No	Gen der	Age	W ei ght	Hei ght	Time durat ion	Leve l of spine	Findings						
							Dis c Bul ge	Spon dy lolisthie s	Spon dy latic arthritis	disc degenera tion	disc prolap sed	disc protus ion	Othe r

Other:-

- Hemangioma
- Stenosis
- Pot's disease
- Compression fracture(osteoporosis)
- Spondylosis
- Abscess

Appendix (C)

MRI Images

(A) Patient No(1)



Image C1 : Male 60 year(L/S MRI) Showed Sagittal FSE T2 L5-S1 spondylosis

Patient No(2)



C2 (A) Showed Sagittal T2

Image C2 (B) Showed T2 Axial

Image A&B2. Male 75 year(L/S MRI) showed partial bone destruction L1-L2 paravertebral fluid, collection psoas muscle (Abscess)

Patient No(3)

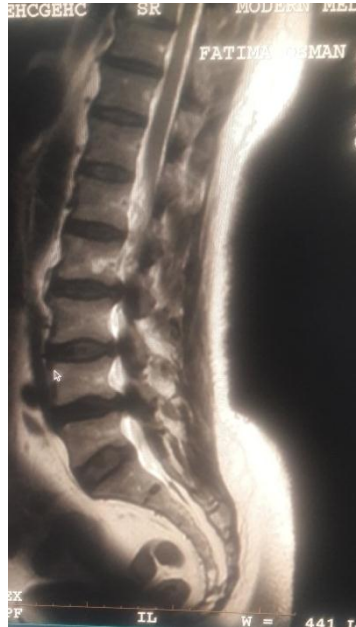


Image C3:Female 45 year (L/S MRI) showed T2 spondylosis, stenosisL4-L5 and disc protrusion L2-L5

Patient No(4)



Image C4: Male 50 year(L/S MRI) showed sagittal T2 showed disc prolapsed L5-S1, disc bulge L4-L5, spondylosis, disc protrusion L3-L4