"EVALUATION OF LOW BACKACHE IN YOUNG ADULTS WITH MRI"

By

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In partial fulfillment of the requirements for the degree of

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IN

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Date-

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LIST OF ABBREVIATIONS

MSK	**-**	**Musculo-skeletal system**
MRI	**-**	**Magnetic Resonance Imaging**
LBP	**-**	**Low back pain**
CT	**-**	**Computed Tomography**
NMR	**–**	**Nuclear Magnetic Resonance**
CNS	**-**	**Central nervous system**
ALL	**-**	**Anterior Longitudinal Ligament**
PLL	**-**	**Posterior Longitudinal Ligament**
C	**-**	**Cervical**
T	**-**	**Thoracic**
L	**-**	**Lumbar**
S	**-**	**Sacral**
CSF	**-**	**Cerebrospinal fluid**
FSE	**-**	**Fast Spin Echo**
STIR	**-**	**Short Time Inversion Recovery**
DS	**-**	**Degenerative spondylolisthesis**
TB	**-**	**Tuberculous**

ABSTRACT

Background & Objectives

Low back pain is a commonly reported musculoskeletal condition in day to day life. The direct and indirect effects of low back pain are enormous in terms of quality of life, productivity and employee absenteeism making a common complaint as a cause of musculoskeletal system (MSK) related disability. [1]

Thus, in the absence of more objective diagnostic criteria, most epidemiological studies of low back pain have defined cases simply on the basis of reported symptoms. With this approach, various risk factors have been established, including physical activities that stress the spine. [2]

Magnetic resonance imaging (MRI) has opened up new possibilities for refined diagnostic classification of low back pain in epidemiological research. Various abnormalities can be identified on spinal MRI, including disc herniation, nerve root impingement, disc degeneration and annular tear. However, before any of these abnormalities is used in case definition, evidence is needed that it can be measured repeatably and that it is importantly related to the pathogenesis of symptoms and not simply an incidental finding. [2]

However the available literature has shown a widespread inconsistency over the physical, pathological and psychological aspects of low back pain. Hence this study was taken up to determine the sensitivity and probability of MRI in patients with low back pain, as the investigation would also evaluate spinal canal without contrast, multiplanar capabilities, non-invasiveness and high sensitivity with or without enhancement.

AIMS & OBJECTIVES OF THE STUDY:

To study the prevalence and MR imaging findings in non-traumatic young adults (24- 40 years) with low back pain.

SOURCE OF DATA:

Patients visiting the department of radio-diagnosis of Shri B M Patil Medical College for MRI with chronic back pain.

METHOD OF COLLECTION OF DATA:

The study is based on number of patients, who are visiting Department of Radio Diagnosis for magnetic resonance imaging from the period of November 2013 to July 2015. Consent will be taken for each case.

RESULT: Out of 85 patient studied 43 (50.6%) were males and 42 (49.6%) were females. The age range was from 24-40 years. Low backache with radicular pain was the commonest clinical presentation. In our study the frequency of MRI changes in the spine in the symptomatic patients appears to be higher when compared to other reports in the literature and these changes were more frequent in the 24 to 30 years age group. The commonest cause of low back ache was degenerative disc disease, most common level being L4-L5

INTERPRETATION: In this study we present our experience in the utilization of MRI as a diagnostic tool in the evaluation of low back pain in the young adults and its correlation with clinical scenarios.

KEY WORDS: MRI, Low backache, young adult

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INTRODUCTION

Low backache is a remarkably common disability. Hirsch stated that 65% of population is affected by low back pain at some time during their working lives. [3]

Low backache is defined as pain occurring between costal margins and gluteal folds. [4]

The etiology of low backache is multifactorial and can be broadly classified as spondylogenic, neurogenic, vascular and psychogenic. [5]

In spondylogenic it can be subclassified as due to congenital, inflammatory, infectious, traumatic and neoplastic causes [6]. Spondylogenic back pain is defined as pain derived from spinal column and its associated structures. The pain may be derived from the lesions involving the bony components of spinal column, changes in the sacroiliac joints or most commonly changes occurring in the soft tissue.

Since these lesions contribute to the most common cause of low back pain seen in clinical practice, the lumbar spine is evaluated in detail. [5]

While current diagnostic imaging technology enables a remarkably detailed anatomic assessment, there is also a potential for identification of incidental findings. These incidental findings fall into two main groups: The first is group consisting of morphologically abnormal findings which are not responsible for the symptoms and group consisting of findings that are abnormal and possibly related to symptoms but not relevant to clinical decision making and outcome.

The role of diagnostic imaging in patients with back pain is an important one in today's health care environment. Previous studies have demonstrated a high prevalence of morphologic abnormalities in both symptomatic and asymptomatic individuals. [7]

The importance of these findings, the relevance of their changes over time, and their relationship to symptoms is not fully understood. In view of the frequency and substantial effect of this disorder, we sought to prospectively determine the type of magnetic resonance imaging (MRI) findings in patients with chronic low back pain (LBP) with or without lower limb radiculopathy

Studies have shown that LBP often begins in childhood and during the early teenage years. [8]

The causes of LBP in adolescents and young adults are often not known. Magnetic resonance imaging (MRI) studies are useful sources of information regarding lumbar spinal anatomy. The purpose of the study was to describe the prevalence of certain MRI findings in the lumbar spine and to evaluate any possible associations between LBP/care seeking and the MRI findings. Therefore, a prospective study was designed to evaluate the role of MRI in the evaluation of low back pain in young adults. However, because almost all lumbar structures can elicit pain. [9] It is reasonable to assume that morphologic changes of the lumbar spine also play a role in LBP.

Many imaging modalities are available for the evaluation of chronic low back pain namely Plain radiography, CT, MRI, scintigraphy, discography etc. each of which have their set of advantages and limitations in the identification of the cause of pain.

Radiography: Lumbar radiographs may be sufficient for the initial evaluation of low back pain in the setting of recent significant trauma (at any age), osteoporosis and age more than 70 years [10]

Image of radiograph:

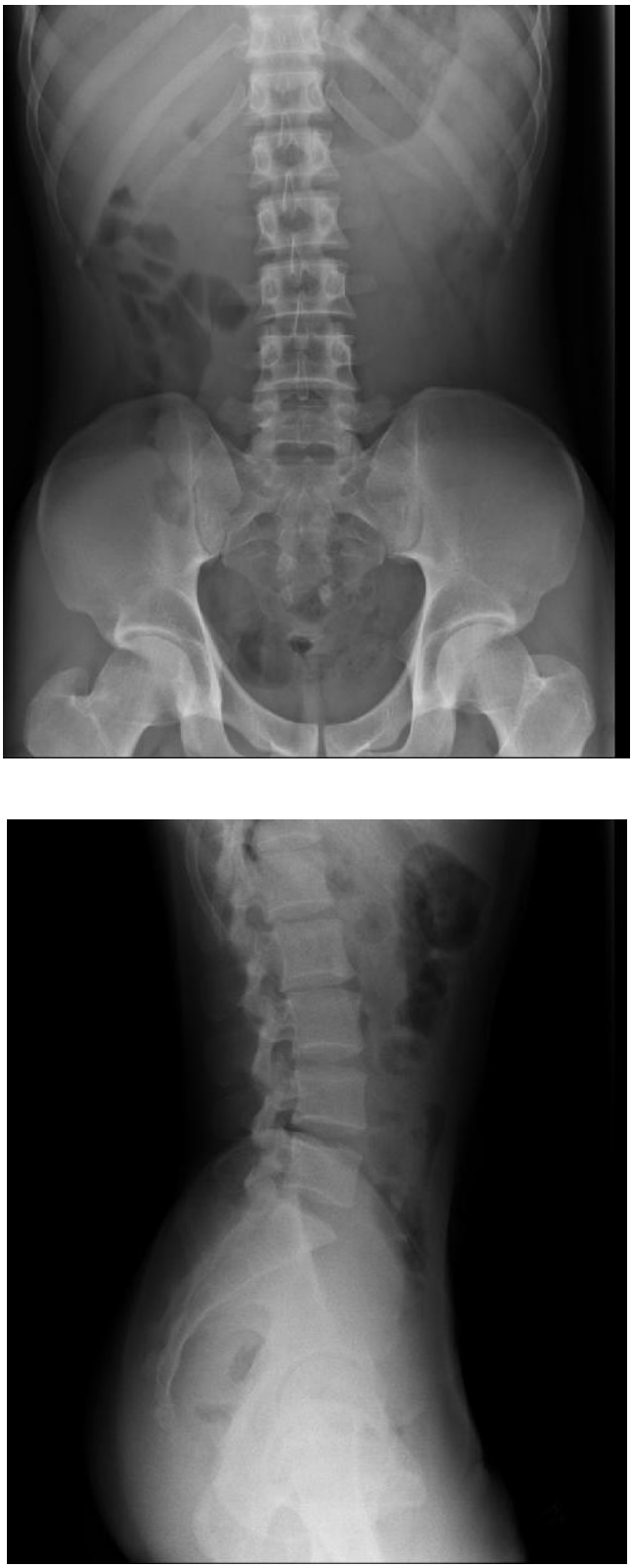


Fig.1: Plain radiograph of the lumbosacral spine. Lateral and Anteroposterior projections.

Isotope bone scans: Bone scan is a moderately sensitive test for detecting the presence of tumor, infection, or occult fractures of the vertebrae but not for specifying the diagnosis. The yield is very low in the presence of normal radiographs and laboratory studies and is highest for patients with known malignancy. The test is contraindicated in pregnancy. [11]

Myelography/CT "Plain" myelography was the mainstay of lumbar herniated disc diagnosis for decades. It is now usually combined with post myelography CT. The combined study is complementary to plain CT or MRI and occasionally more accurate in diagnosing disc herniation, but suffers the disadvantage of requiring lumbar puncture and contrast injection. It may also be useful in surgical planning. [12, 13]

Computed Tomography CT scans provide superior bone detail but are not quite as useful in depicting disc protrusions when compared with multiplanar MRI. With the added value associated with high quality reformatted sagittal and coronal plane images, CT is useful for depiction of spondylolysis, pseudoarthrosis, scoliosis and for postsurgical evaluation of bone graft integrity, surgical fusion and instrumentation. [14]

Magnetic Resonance Imaging of the lumbar spine has become the initial imaging technique of choice in complicated LBP, displacing myelography and CT in recent years. MRI with contrast is useful for suspected infection and neoplasia. [15]

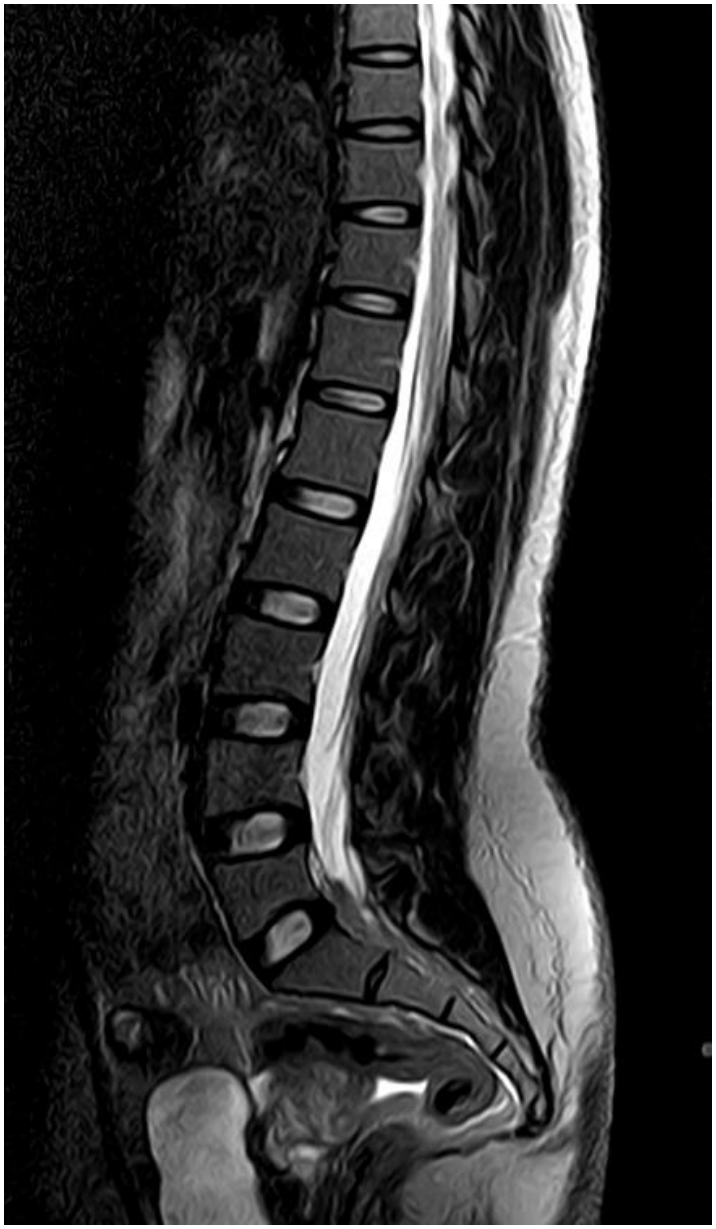


Fig.2: MRI lumbosacral spine

OBJECTIVES

- To study the prevalence and MRI findings in non-traumatic young adults (24-40 years) with low back pain.

REVIEW OF LITERATURE

HISTORICAL VIEW:

It is common to think today that low backache and sciatica is a disease of civilization and a disease of automobile age. Yet earliest accounts of backache are found in the works of Charaka and Sushurata (500 BC). This has been described as 'Katishoola', 'PrushthaShoola' or 'Vat Vedna'.

Intervertebral disc was first described by Vesalias (1555) in his classic monograph "De Humani Corporis Fabrica". Virchow (1857) elaborated on anatomy of disc and Von Lushka (1857) contributed more information on anatomy and embryology. They were the first one to describe herniated discs.

An early description of narrow vertebral canal was given by French anatominst Antoni Portal (1803).

On December 1895, Willhelm Conrad Roentgen presented a paper on new kind of rays; X-rays and thus plain radiography became the first diagnostic modality used in evaluation of a patient with backache. These permitted evaluation of general appearance of bony spine and the disc height.

Dandy's classic description of pneumoencephalogram (1913) gave birth to myelography by Jean Sicard and his pupil Jacques Forestier in 1921. Over the years, myelography became an important radiological tool in detecting posterolateral and central disc herniations.

In 1972 British physicist Godfrey Hounsfield developed and introduced into clinical use Computed Tomography. Hammerscla (1976) and Lee Kazam and Newman (1978) described use of CT in spinal canal. [16]

It was in 1971 that MRI, then called NMR (Nuclear Magnetic Resonance) was proposed for human use with Damadian and co-workers [17] in 1977 publishing the first crude human image.

It was only by 1981 that first high quality image of the human brain was generated at Hammersmith by Young and associates using different pulse sequences and showed superiority of NMR over CT scan. Damadian (1971) working on rats and later Smith et al (1981) published reports indicating the ability of NMR to differentiate malignant from benign tissue. [17]

Initial studies of MRI of the spine were carried out using body coils. Subsequently Modic (1986), MacArdle (1986) and other authors demonstrated the value of surface coils in increasing signal to noise ratios and in providing higher resolution images of the spine. [18]

In a longitudinal study in UK (2011), McNee (2011) et al had found that the initial degeneration of the disc was with increased risk of frequent and disabling LBP was common. No other abnormalities were found between MRI abnormalities and its outcome. They concluded that MRI abnormalities examined in their study are not major predictors of outcome in patients with low back pain. [19]

In a study by Al Saeed et al (2012), 214 young patients were evaluated for low back pain using MRI. [1] A majority of the patients were diagnosed to have evidence of degenerative spinal disease compared to 10% in the control group. About 61% of

the patients were found to have multiple spinal abnormalities, involving lowest 2 disc levels. But obesity correlated with MRI prevalence of abnormalities. They also concluded that MRI prevalence of abnormalities while obesity demonstrated a positive trend. [1]

Back pain resulting from degenerative disease of the lumbar spine is one of the most common causes of disability in adults of working age. The earliest radiographically visible changes of intervertebral disk degeneration are those that occur at the endplate. These are best seen on MRI. The disk bulges diffusely around the posterior (and sometimes lateral) aspects of the end plate. Protruded Disk occurs when some of the inner fibers of the annulus tear but the outer layers remain intact; the nucleus can focally herniate through the inner tear. A disk extrusion occurs when the nucleus pulposus herniates through a complete tear of the annulus fibrosus and is contained only by the posterior longitudinal ligament

The herniated segment, however, remains attached to the parent disk but may extend cephalad or caudad. It can be difficult to differentiate between a disk protrusion and extrusion when the amount of herniated disk is small. When an extruded nucleus breaks free of the parent disk, it is termed a sequestered disk orfree fragment. On long TR or gradient-echo MRI images, sequestered disks may be of higher signal intensity than the disk of origin. [20]

In a study in India by Janardhan et al (2010), 119 clinically diagnosed patients with lumbar disc prolapse were evaluated by using MRI. The clinical level of pain distribution correlated well with the MRI level, but not all disc bulges produced symptoms. Central bulges and disc protrusions with thecal sac compression were mostly asymptomatic, while centrolateral protrusions and extrusions with neural

foramen compromise correlated well with the dermatomal distribution of pain. Root compression observed in MRI did not produce neurological symptoms or deficits in all patients but when deficits were present, they correlated well with the presence of root compression in MRI. Multiple level disc herniations with foramen compromise were strongly associated with the presence of neurological signs. [21]

DEVELOPMENT OF SPINAL COLUMN BONE:

Development of spinal column bone begins in the 4thweek of gestation, when the cells of the sclerotomes surround the spinal canal and notochord. These cells form a mesenchymal column, which retains its segmental origin, and it blocks are separated by areas of less density. [22]

The intervertebral disc is mesenchymal in origin and is derived from the tissue between the cephalic and caudal portions of the original sclerotome. It fills the space between what eventually becomes the precartilaginous vertebral bodies. Although the portions of notochord in the region of the vertebral body regresses, the portion of the intervertebral disc persists and enlarges, with persistent notochord mucoid degeneration and becomes the nucleus pulposus and surrounded by circular fibres of annulus fibrosus. [23]

Development of spinal cord:

Development of spinal cord begins in the 3rd week of fetal life when the ectodermal layer thickens, giving rise to the neural plate. This is followed by neurulution. The neural plate is formed, and the neural folds at the midline from the neural tube. Fusion occurs first in cervical region and then progresses irregularly in the cephalic and caudal direction. [24]

Foetal and postnatal development of spine.

Curvatures of spine:

The thoracic and sacral curvatures are primary and appear before birth. The cervical and lumbar curvatures are classified as secondary curvatures and appear after birth. [25]

Ossification of lumbar vertebra:

A typical vertebra has 3 primary centres of ossification. One centre appear in body and one in each half of neural arch. These centres appear at 9^{th} and 12th weeks of fetal life.

The two neural arches fuse posteriorly during the first year. They unite with centrum between 3^{rd} and 6^{th} years.

Five secondary centres appear in each vertebra after puberty.

They are:

1. One centre at the tip of spinous process.
2. Two centres at the tips of transverse processes
3. Two centres that form ring shaped epiphyses over the upper and lower surface of vertebral body.

Secondary centres fuse with rest of the vertebra at about 25 years. The lumbar vertebras ossify like typical vertebrae but have additional centres for transverse processes. [25]

ANATOMY

OVERVIEW:

The spine is made of 33 individual bones stacked one on top of the other. Ligaments and muscles connect the bones together and keep them aligned. The spinal column provides the main support for your body, allowing you to stand upright, bend, and twist. Protected deep inside the bones, the spinal cord connects your body to the brain, allowing movement of your arms and legs. Strong muscles and bones, flexible tendons and ligaments, and sensitive nerves contribute to a healthy spine. Keeping your spine healthy is vital if you want to live an active life without back pain. [26]

Spinal curves:

When viewed from the side, an adult spine has a natural S-shaped curve. The neck (cervical) and low back (lumbar) regions have a slight concave curve, and the thoracic and sacral regions have a gentle convex curve. The curves work like a coiled spring to absorb shock, maintain balance, and allow range of motion throughout the spinal column. [26]

The muscles and correct posture maintain the natural spinal curves. Good posture involves training your body to stand, walk, sit, and lie so that the least amount of strain is placed on the spine during movement or weight-bearing activities. Excess body weight, weak muscles, and other forces can pull at the spine's alignment. [26]

Vertebrae are the 33 individual bones that interlock with each other to form the spinal column. The vertebrae are numbered and divided into regions: cervical, thoracic, lumbar, sacrum, and coccyx. Only the top 24 bones are moveable; the

vertebrae of the sacrum and coccyx are fused. The vertebrae in each region have unique features that help them perform their main functions. [26]

Lumbar Spine:

The lowest part of the spine is called the lumbar spine. This area has five vertebrae. However, sometimes people are born with a sixth vertebra in the lumbar region. The base of your spine (sacrum) is a fusion of many bones, and when one of them forms as a vertebra rather than part of the sacrum, it is called a transitional (or sixth) vertebra. This occurrence is not dangerous and does not appear to have any serious side effects. [27]

The lumbar spine's shape has what is called a lordotic curve. The lordotic shape is like a backwards "C". If you think of the spine as having an "S"-like shape, the lumbar region would be the bottom of the "S". The vertebrae in the lumbar spine area are the largest of the entire spine, so the lumbar spinal canal is larger than in the cervical or thoracic parts of the spine. Because of its size, the lumbar spine has more space for the nerves to move about.

Low back pain is a very common complaint for a simple reason. Since the lumbar spine is connected to your pelvis, this is where most of your weight bearing and body movement takes place. Typically, this is where people tend to place too much pressure, such as: lifting up a heavy box, twisting to move a heavy load, or carrying a heavy object. Such repetitive injuries can lead to damage to the parts of the lumbar spine. [27]

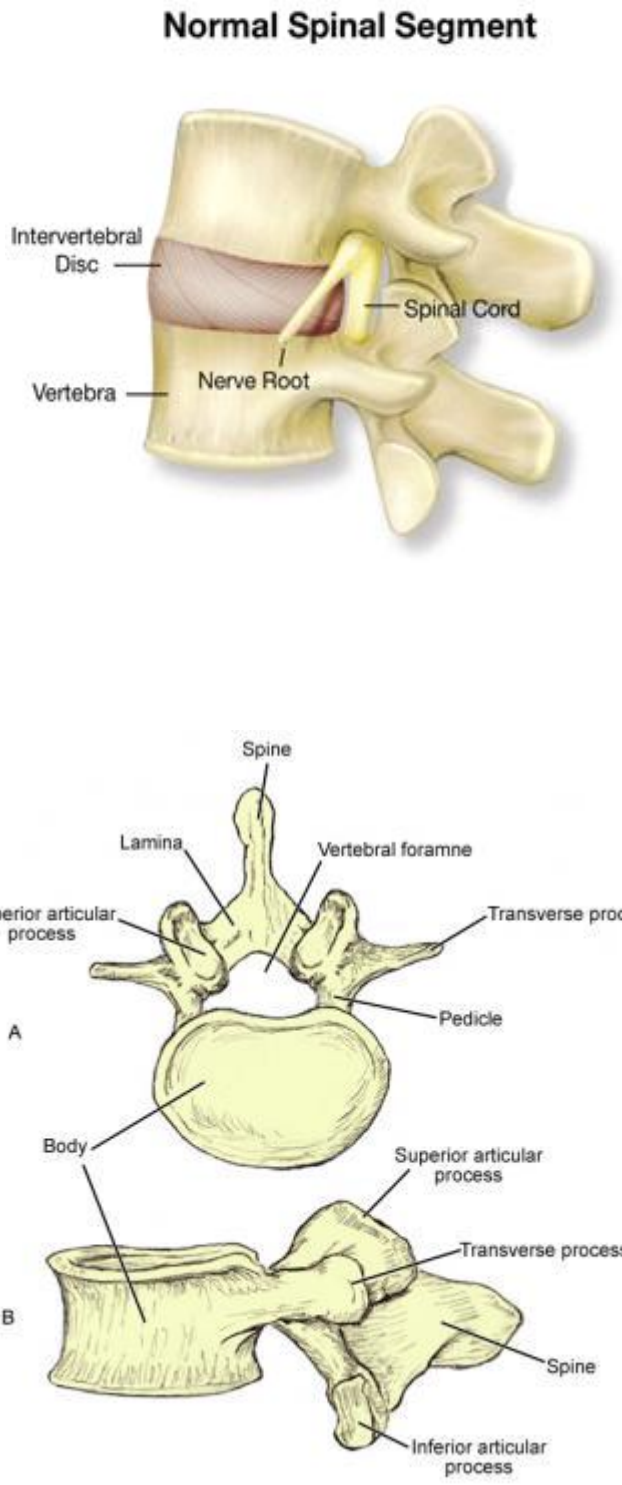


Fig.3: Every vertebra has 3 main parts: body, vertebral arch and processes for muscle attachment.

Intervertebral discs:

Each vertebra in your spine is separated and cushioned by an intervertebral disc, keeping the bones from rubbing together. Discs are designed like a radial car tire. The outer ring, called the annulus, has criss-crossing fibrous bands, much like a tire tread. These bands attach between the bodies of each vertebra. Inside the disc is a gel-filled center called the nucleus, much like a tire tube. [26]

Discs function like coiled springs. The criss-crossing fibers of the annulus pull the vertebral bodies together against the elastic resistance of the gel-filled nucleus. The nucleus acts like a ball-bearing when you move, allowing the vertebral bodies to roll over the incompressible gel. The gel-filled nucleus is composed mostly of fluid. This fluid absorbed during the night as you lie down and is pushed out during the day as you move upright. [26]

With age, our discs increasingly lose the ability to reabsorb fluid and become brittle and flatter; this is why we get shorter as we grow older. Also diseases, such as osteoarthritis and osteoporosis, cause bone spurs (osteophytes) to grow. Injury and strain can cause discs to bulge or herniate, a condition in which the nucleus is pushed out through the annulus to compress the nerve roots causing back. [26]

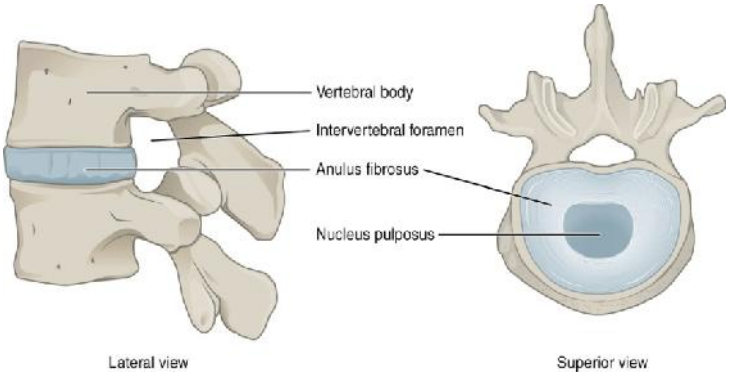


Fig.4: Intervertebral discs are made of a gel-filled center called the nucleus and a tough fibrous outer ring called the annulus. The annulus pulls the vertebral bodies together against the resistance of the gel-filled nucleus

Vertebral arch & spinal canal:

On the back of each vertebra are bony projections that form the vertebral arch. The arch is made of two supporting pedicles and two laminae. The hollow spinal canal contains the spinal cord, fat, ligaments, and blood vessels. Under each pedicle, a pair of spinal nerves exits the spinal cord and pass through the intervertebral foramen to branch out to your body. [26]

Surgeons often remove the lamina of the vertebral arch (laminectomy) to access and decompress the spinal cord and nerves to treat spinal stenosis, tumors, or herniated discs. [26]

Seven processes arise from the vertebral arch: the spinous process, two transverse processes, two superior facets, and two inferior facets. [26]

Facet joints:

The facet joints of the spine allow back motion. Each vertebra has four facet joints, one pair that connects to the vertebra above (superior facets) and one pair that connects to the vertebra below (inferior facets).

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. [26]

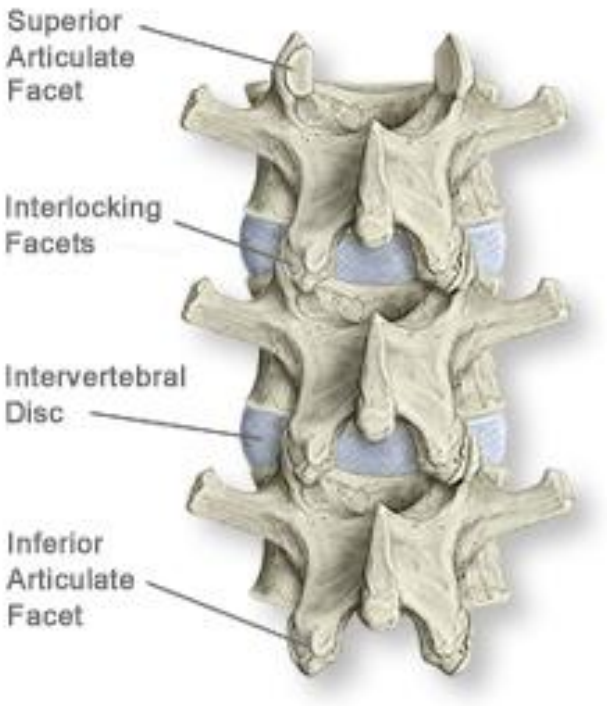


Fig.5: The superior and inferior facets connect each vertebra together. There are four facet joints associated with each vertebra Ligaments

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 hyperflexion (excessive movements). [28]

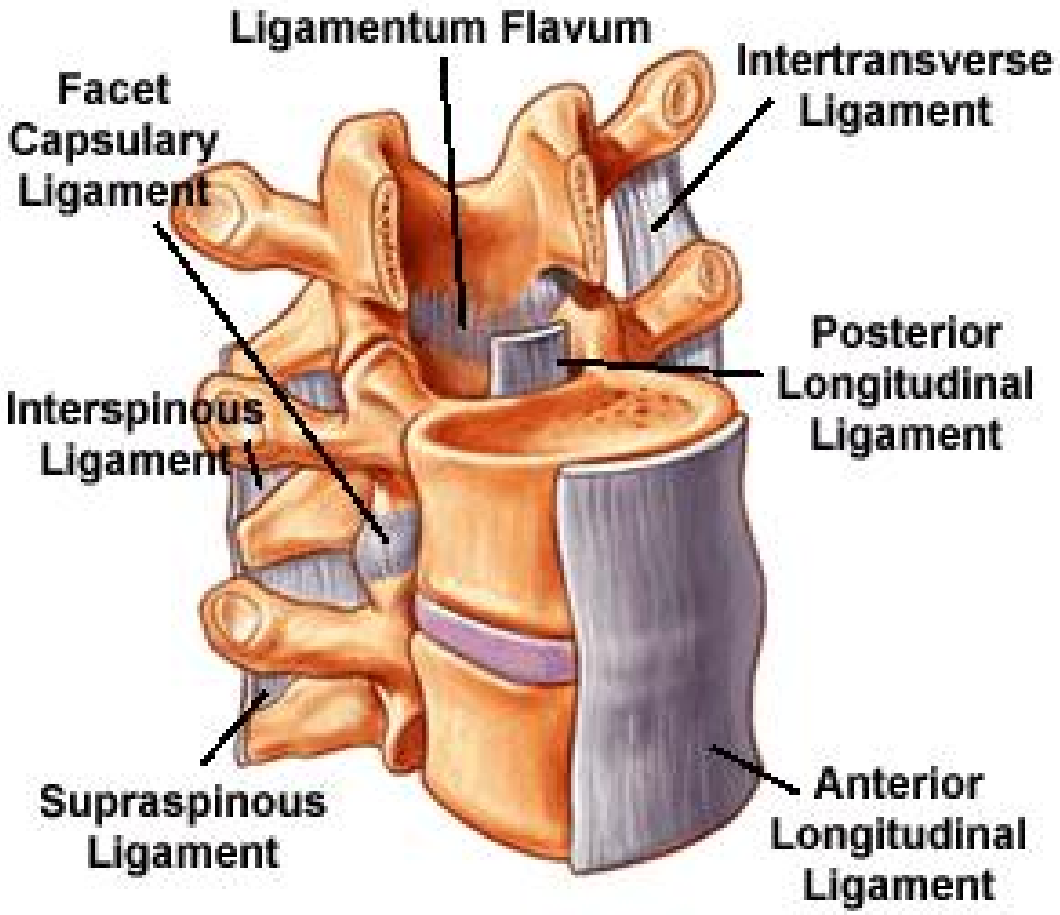


Fig. 6: Ligaments

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 ligament*	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.

Spinal cord:

The spinal cord is the most important structure between the body and the brain. The spinal cord extends from the foramen magnum where it is continuous with the medulla to the level of the first or second lumbar vertebrae. It is a vital link between the brain and the body, and from the body to the brain. The spinal cord is 40 to 50 cm long and 1 cm to 1.5 cm in diameter. Two consecutive rows of nerve roots emerge on each of its sides. These nerve roots join distally to form 31 pairs of ***spinal nerves***. The spinal cord is a cylindrical structure of nervous tissue composed of white and gray matter, is uniformly organized and is divided into four regions: cervical (C), thoracic (T), lumbar (L) and sacral (S), each of which is comprised of several segments. The spinal nerve contains motor and sensory nerve fibers to and from all parts of the body. Each spinal cord segment innervates a dermatome. [29]

General Features:

1) Similar cross-sectional structures at all spinal cord levels.
2) It carries sensory information (sensations) from the body and some from the head to the central nervous system (CNS) via afferent fibers, and it performs the initial processing of this information.
3) Motor neurons in the ventral horn project their axons into the periphery to innervate skeletal and smooth muscles that mediate voluntary and involuntary reflexes.
4) It contains neurons whose descending axons mediate autonomic control for most of the visceral functions.

5) It is of great clinical importance because it is a major site of traumatic injury and the locus for many disease processes. [29]

Although the spinal cord constitutes only about 2% of the central nervous system (CNS), its functions are vital. ***Knowledge of spinal cord functional anatomy makes it possible to diagnose the nature and location of cord damage and many cord diseases.***

Segmental and Longitudinal Organization:

The spinal cord is divided into four different regions: the cervical, thoracic, lumbar and sacral regions. The different cord regions can be visually distinguished from one another. Two enlargements of the spinal cord can be visualized: The cervical enlargement, which extends between C3 to T1; and the lumbar enlargements which extends between L1 to S2. [29]

The cord is segmentally organized. There are 31 segments, defined by 31 pairs of nerves exiting the cord. These nerves are divided into 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal nerve. Dorsal and ventral roots enter and leave the vertebral column respectively through intervertebral foramen at the vertebral segments corresponding to the spinal segment. [29]

The cord is sheathed in the same three meninges as is the brain: the pia, arachnoid and dura. The dura is the tough outer sheath, the arachnoid lies beneath it, and the pia closely adheres to the surface of the cord. The spinal cord is attached to the dura by a series of lateral denticulate ligaments emanating from the pial folds. [29]

During the initial third month of embryonic development, the spinal cord extends the entire length of the vertebral canal and both grow at about the same rate. As development continues, the body and the vertebral column continue to grow at a much greater rate than the spinal cord proper. This results in displacement of the lower parts of the spinal cord with relation to the vertebrae column. The outcome of this uneven growth is that the adult spinal cord extends to the level of the first or second lumbar vertebrae, and the nerves grow to exit through the same intervertebral foramina as they did during embryonic development. This growth of the nerve roots occurring within the vertebral canal, results in the lumbar, sacral, and coccygeal roots extending to their appropriate vertebral levels. [29]

All spinal nerves, except the first, exit below their corresponding vertebrae. In the cervical segments, there are 7 cervical vertebrae and 8 cervical nerves. C1-C7 nerves exit above their vertebrae whereas the C8 nerve exits below the C7 vertebra. It leaves between the C7 vertebra and the first thoracic vertebra. Therefore, each subsequent nerve leaves the cord below the corresponding vertebra. In the thoracic and upper lumbar regions, the difference between the vertebrae and cord level is three segments. Therefore, the root filaments of spinal cord segments have to travel longer distances to reach the corresponding intervertebral foramen from which the spinal nerves emerge. The lumbosacral roots are known as the cauda equina.

Each spinal nerve is composed of nerve fibers that are related to the region of the muscles and skin that develops from one body somite (segment). A spinal segment is defined by dorsal roots entering and ventral roots exiting the cord, (i.e., a spinal cord section that gives rise to one spinal nerve is considered as a segment.). [29]

A dermatome is an area of skin supplied by peripheral nerve fibers originating from a single dorsal root ganglion. If a nerve is cut, one loses sensation from that dermatome. Because each segment of the cord innervates a different region of the body, dermatomes can be precisely mapped on the body surface, and loss of sensation in a dermatome can indicate the exact level of spinal cord damage in clinical assessment of injury. It is important to consider that there is some overlap between neighbouring dermatomes. Because sensory information from the body is relayed to the CNS through the dorsal roots, the axons originating from dorsal root ganglion cells are classified as primary sensory afferents, and the dorsal root's neurons are the first order (1°) sensory neuron. Most axons in the ventral roots arise from motor neurons in the ventral horn of the spinal cord and innervate skeletal muscle. Others arise from the lateral horn and synapse on autonomic ganglia that innervate visceral organs. The ventral root axons join with the peripheral processes of the dorsal root ganglion cells to form mixed afferent and efferent spinal nerves, which merge to form peripheral nerves. Knowledge of the segmental innervation of the cutaneous area and the muscles is essential to diagnose the site of an injury. [29]

Coverings & spaces:

The spinal cord is covered with the same three membranes as the brain, called meninges. The inner membrane is the pia mater, which is intimately attached to the cord. The next membrane is the arachnoid mater. The outer membrane is the tough dura mater. Between these membranes are spaces used in diagnostic and treatment procedures. The space between the pia and arachnoid mater is the wide subarachnoid space, which surrounds the spinal cord and contains cerebrospinal fluid (CSF). This space is most often accessed during a lumbar puncture to sample and test CSF or

during a myelogram to inject contrast dye. The space between the dura mater and the bone is the epidural space. This space is most often accessed to deliver anaesthetic numbing agents, commonly called an epidural, and to inject steroid medication. [26]

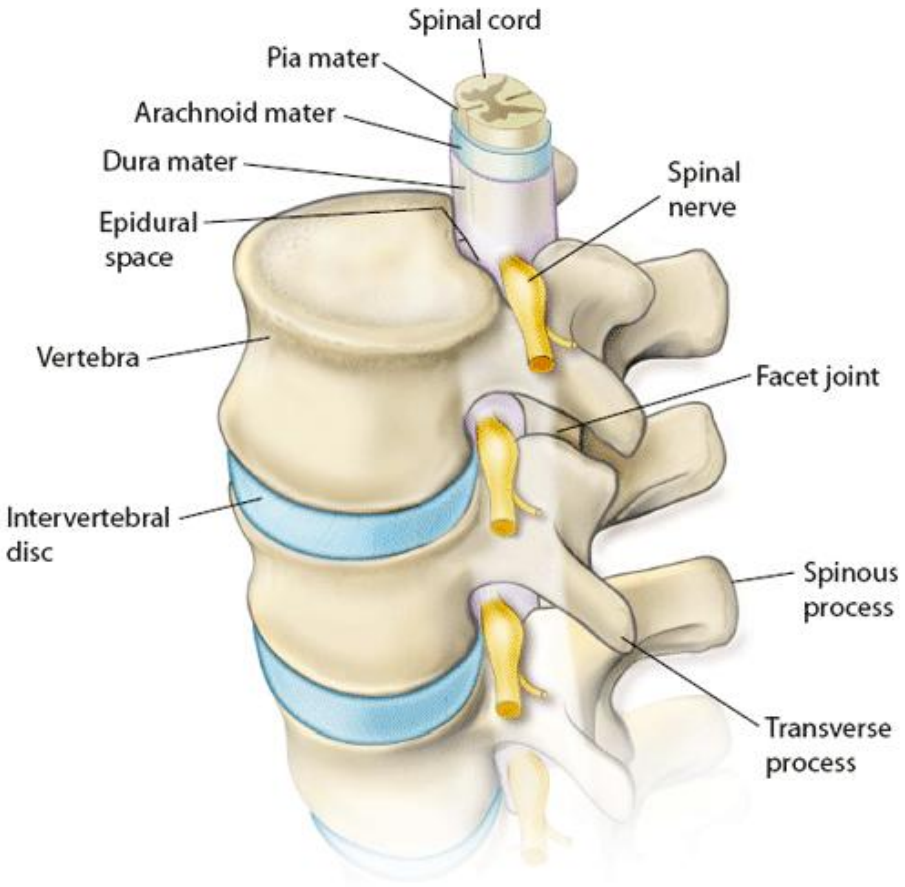


Fig.7: The ventral (motor) and dorsal (sensory) roots join to form the spinal nerve. The spinal cord is covered by three layers of meninges: pia, arachnoid and dura mater

MRI Features of the Spine:

Cortical bone and air both contain scarce water molecules and therefore scarce hydrogen protons. Hence they both present as a very low signal element on the MRI image and therefore appear black in the image produced. The medullary bone has higher intensity in both T1- and T2-weighted images as compared with the cortical bone due to the presence of marrow fat. The fibrous compact tissue of the outer annulus and the Sharpey's fibers have a low signal (dark) on both T1- and T2WI, whereas the nucleus pulposus, composed of fibrocartilaginous tissue with a mucoid matrix, has a high signal intensity on T2WI. In T1WI normal discs appear homogenous and the nucleus and annulus cannot be differentiated. On axial sections, the roots of the filum terminale typically lie in a symmetric, crescent-shaped pattern with the lower sacral roots positioned dorsally and the lumbar roots positioned more anterolaterally. The most laterally positioned roots at each level are those about to exit the dural sac and pass through the intervertebral foramen. On T2- weighted images they look dark against the high-signal CSF, whereas on T1-weighted images they have moderate signal intensity and look gray as compared with the dark CSF. [30] In T2-weighted images of normal discs the nucleus has a much brighter signal and can be easily differentiated from the darker annulus and the darker cortical bone.

The normal sacroiliac joint is well depicted with MRI. T1 weighted images directly demonstrate the cartilage in the synovial compartment as a thin zone of intermediate signal intensity with an adjacent low-signal-intensity cortex and a sharply defined marrow margin. The appearance suggests hyaline cartilage (maximum thickness, 5 mm). This correlates well with histopathologic specimens that demonstrate the sacral articular surface to be covered with hyaline cartilage (up to 4 mm thick), while on the iliac side thinner fibro cartilage (up to 2 mm thick) is present.

Disc degeneration:

Mechanical, traumatic, nutritional, and genetic factors all play a role in the cascade of disc degeneration. With degeneration and aging, type II collagen increases outwardly in the annulus and there is a greater water loss from the nucleus pulposus than from the annulus. This results in a loss of the hydrostatic properties of the disc, with an overall reduction of hydration in both areas to about 70%. In addition to water and collagen, the other important biochemical constituents of the intervertebral disc are the proteoglycans. The individual chemical structures of the proteoglycans are not changed with degeneration, but their relative composition is. The ratio of keratin sulfate to chondroitin sulfate increases, and there is a diminished association with collagen that may reduce the tensile strength of the disc. The decrease in water-binding capacity of the nucleus pulposus is thought to be related to the decreased molecular weight of its nuclear proteoglycans complexes (aggregates). The disc becomes progressively more fibrous and disorganized, with the end stage represented by amorphous fibro cartilage and no clear distinction between nucleus and annulus. [31]

It has been proposed that annular disruption is the critical factor in degeneration and, when a radial tear develops in the annulus, there is shrinkage with disorganization of the fibrous cartilage of the nucleus pulposus and replacement of the disc by dense fibrous tissue with cystic spaces. [31]

Currently most authors believe that annular tears, leading to disc herniation, occur secondary to repetitive stress, especially torsional stress, in a disc that has already undergone degenerative changes. Annular tears initially appear in the outer layers of the annulus pulposus. Because these layers are innervated, it is reasonable to

assume that these tears may elicit axial pain. The tears may progress to involve the whole annular width and subsequently may result in disc herniation. Nucleus pulposus herniation provokes a local inflammatory response, and when it is close to a nerve root, may involve and compress it and bring about radicular pain. Herniation refers to localized displacement of nucleus, cartilage, fragmented apophyseal bone, or fragmented annular tissue beyond the intervertebral disc space. [32]

The Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology have defined herniated disc as a "localized displacement of nucleus, cartilage, fragmented apophyseal bone, or fragmented annular tissue beyond the intervertebral disc space". [33] A bulging disc is not considered a herniated disc and is defined as the presence of disc tissue diffusely (> 50% of the circumference) extending beyond the edges of the ring apophyses. This bulging can be symmetric or asymmetric.

Herniations are subdivided into protrusion and extrusions. As defined by the Combined Task Forces, a "protrusion is present if the greatest distance in any plane between the edges of the disc material beyond the disc space is less than the distance between the edges of the base in the same plane." If in any plane the greatest distance between the edges of the disc goes beyond the distance between the edges of the base, the lesion is called "extrusion". In practical terms, if the herniated disc material has a neck, it is an extrusion. T1- and T2-weighted sagittal and axial MRI images can clearly visualize the vertebral endplates and intervertebral discs. T2-weighted images show good contrast between the outer part of the annulus, which is more fibrous tissue (low signal), and inner part of the annulus and nucleus pulposus, which have more water content (high signal). [33]

Modic et al. described three types of endplate changes. Type 1 is low signal on T1-weighted images and high signal on T2-weighted images and likely represents endplate edema. Type 2 is high signal on T1-weighted images and on T2 fast spin-echo images but is dark on fat-suppressed sequences and likely represents fat. Type 3 is low signal on both T1- and T2-weighted sequences and represents endplate sclerosis. These endplate changes are commonly referred to as "Modic" changes. [34]

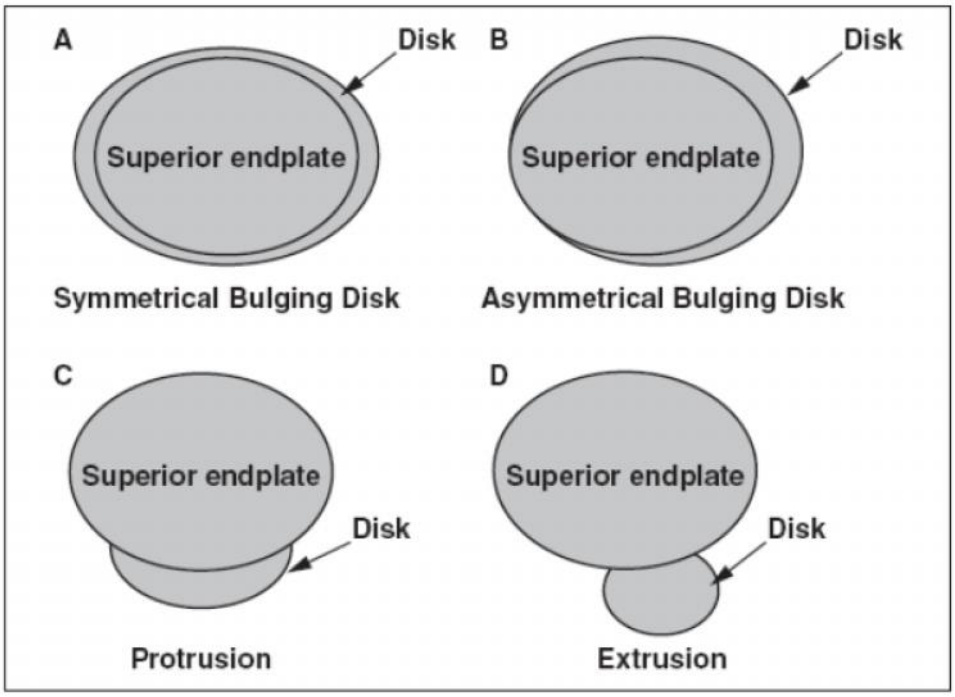


Fig.8: Disc disease classification

MRI is considered to be a safe investigation in the work up of chronic low back pain. It does not involve radiation and is safe for follow up. It is considered safe in second and third trimester of pregnancy. It is widely available. As compared to myelography it is painless. And majority of the spine investigations do not require contrast enhancement. It has a high rate of reproducibility.

PATHOLOGY:

Low back pain that lasts for extended periods may be due to various disorders, including degenerative disc disease, spondylolysis, sacroiliitis, spondylolisthesis, Scheuermann disease, neoplasms, and infections/discitis.

Spondolisthesis/spondylolysis: spondylolysis is defined as a defect in the pars interarticularis, which is the weakest part of the vertebra. [35] When the defect is bilateral, it produces spondylolisthesis of varying degrees. The prevalence of spondylolysis/spondylolisthesis increases with age.

Degenerative disc disease: Theories imply that degeneration and aging are very similar processes, albeit occurring at different rates.[18] It has been proposed that annular disruption is the critical factor in degeneration and, when a radial tear develops in the annulus, there is shrinkage with disorganization of the fibrous cartilage of the nucleus pulposus and replacement of the disc by dense fibrous tissue with cystic spaces.[31] Annular tears, also properly called annular fissures, are separations between annular fibers, avulsion of fibers from their vertebral body insertions, or breaks through fibers that extend radially, transversely, or concentrically and involve one or many layers of the annular lamellae .Scheuermann disease is a disorder that consists of vertebral wedging, end plate irregularities and narrowing of intervertebral disc space. It classically involves the lumbar spine. A common finding of Scheuermann disease is Schmorl's node which has been found in 30% of adolescents and young adults.

Infections: Discitis is associated with a wide spectrum of symptoms and signs and often diagnosis is delayed. Findings commonly found on imaging are reduced

intervertebral disc height, paravertebral soft tissue and erosion of end plate. MRI is considered as diagnostic as scintigraphy in the detection of osteomyelitis. [36]

Sacroiliitis: The symptoms of Sacroiliitis may be indistinguishable from those of mechanical causes of low back pain. Sacroiliitis may be discovered while performing MRI for other causes of low back pain. [20] Causes of Sacroiliitis included ankylosing spondylitis, Reiter syndrome, psoriatic arthritis, and septic arthritis .MRI is a valuable method for evaluating the sacroiliac joint.[37]

Other rare causes: scoliosis, systemic diseases like sickle cell anemia and leukemia.

Tumoral causes:

Tumoral involvement of the sciatic nerve is quite rare and is usually observed with primary tumours of the nerve (schwannoma, neurofibromatosis, neurolymphomatosis and malignant neurofibrosarcoma).

Primary tumours of the sciatic nerve:

Schwannoma is the most common primary tumour of the sciatic nerve. It originates from the Schwann cells forming the sheath of the nerve. It is mostly encountered in head and neck regions and originates from the eighth nerve. Pelvic region schwannomas are quite rare. [38]

The imaging features of a schwannoma overlap those of a solitary neurofibroma (originating from nerve fibres), and often they are indistinguishable. The CT image attenuation of both neurofibromas and schwannomas is similar to that of muscle, and neurofibromas and schwannomas have various degrees of contrast enhancement following intravenous contrast administration. Both lesions are isohypointense on the T1 weighted and hyperintense on the T2 weighted MRI images

when compared with muscle, and a central area of low-intensity signal may be observed (more frequently with neurofibromas), called the target sign. [38]

Despite two-thirds of neurofibroma cases being encountered sporadically, the remaining one-third of cases are associated with neurofibromatosis type 1. These tumours are characteristically multiple and plexiform in appearance, with diffuse involvement of the lumbosacral plexus in patients with neurofibromatosis.

Malignant peripheral nerve sheath tumours occur most often in patients with neurofibromatosis type 1, especially after radiation therapy. [39] The imaging features of malignant neural tumours overlap those of their benign counterparts, making differentiation between the two challenging. Findings that favour a malignant neural tumour include large size, irregular margins and heterogeneity. Clinically, the finding of a progressively enlarging mass in a patient suggests a malignant nerve sheath tumour.

Others:

Intra-abdominal or intrapelvic benign or malignant masses, primary (benign or malign) or secondary tumours originating from neighbouring soft tissues and osseous structures along the course of the sciatic nerve, or lymphomas may affect the sciatic nerve and cause sciatic pain. [38]

The lumbosacral plexus may be affected as a result of compression or invasion by intra-abdominal or intrapelvic masses, with colorectal carcinoma and endometriosis being the most frequently encountered malignant and benign causes, respectively. In addition, the sciatic nerve may be locally invaded by uterine, prostatic and ovarian tumours, or compressed by uterine leiomyoma, adenomyosis or a retroverted uterus.

Despite constituting about 50% of body mass and having a significant blood supply, metastatic tumour involvement of skeletal muscle is quite rare. The frequency of this metastasis is reported to be 0.8–16% in autopsy studies. Lung carcinomas are usually the primary source of metastasis, and the most frequently affected muscles are the diaphragm, rectus abdominis, deltoid, psoas and the intercostal muscles. Rarely, metastatic involvement of muscles neighbouring the sciatic nerve may also be observed. [40]

Intramuscular metastasis is seen as a low-attenuation mass in contrast CT images, often demonstrating peripheral contrast attenuation. On the other hand, intramuscular metastatic lesions are iso to hypointense on the T1 weighted and hyperintense on the T2 weighted MRI images when compared with surrounding muscle tissues. The mass causes expansion of the involved muscle, and accompanying peritumoral oedema may be noticeable. In addition, haemorrhage, necrosis and calcification within the mass may be observable. [41]

Similar to intramuscular metastases, soft-tissue sarcomas are seen as isohypointense T1 weighted and hyperintense T2 weighted MRI lesions. However, necrosis, peritumoral oedema and lobulation are less frequently encountered in soft-tissue sarcomas than in metastatic lesions. [42] Histopathological examination is mandatory for a definitive diagnosis.

The pain of these tumours is similar to that caused by malignant soft-tissue tumours in having an insidious onset, being persistent, progressive, worsening at night and not being relieved by changing position. The characteristics of the pain are usually of utmost importance in the diagnosis of tumour-related sciatica. Most of the osseous tumours causing sciatica are located in the pelvis and proximal femur. [43] In

addition to clearly visualising the lesion, CT and MRI also show in detail its relation to the sciatic nerve

Many benign tumours occur along the course of the lumbosacral plexus and involve or impinge on its various components. Lipomaosteochondroma and ganglion cyst are the most common benign tumours causing sciatica. But a wide range of other benign tumours has been reported in the literature. Although the appearance of many benign processes is non-specific, some offer imaging characteristics that suggest the exact diagnosis.

There are three ways in which lymphomas may affect the sciatic nerve. The most frequent cause of lymphoma-related sciatica is compression of the nerve by the enlarged lymph nodes. Secondly, extranodal involvement of soft tissues such as muscle (e.g. piriformis and gluteus muscles) may affect the sciatic nerve. In such cases, asymmetrical muscle expansion, heterogeneous or low focal density on the CT images, or focal or diffuse low T1 weighted signal intensity or high T2 weighted signal intensity on the MRI images are radiologically observed. A uniform or ring-form contrast attenuation may be seen or the lesion may not attenuate contrast at all. And lastly, although very rare, direct lymphoma invasion of the sciatic nerve has also been reported. [44]

Endoneural metastasis of tumour cells into the sciatic nerve or its primary lymphomatous involvement may cause sciatic pain.

The lumbosacral trunk is anterior to the sacrum and posterior to the iliac vessels, and any aneurysmal or pseudoaneurysmal expansion of the iliac artery (especially the internal iliac artery) and its branches may affect the sciatic nerve. The basic mechanism of aneurysm-related sciatica is compression to the nerve. Although

nerves are fairly resistant to ischaemia and the lumbosacral plexus is rich in vascular supply, ischaemia may play an additional role (secondary to vasa vasorum compression) in the formation of aneurysm-related sciatic pain. [45] In addition, although quite rarely, direct pressure on the sciatic nerve by an arteriovenous malformation or arteriovenous fistula may also cause sciatica.

Bone haemangiomas.

The haemangiomas that occur in bones typically occur in the skull or spine and are most common in people who are 50 to 70 years of age. Capillary and cavernous types are the most common haemangiomas found in bone. They can grow on the surface or deeper into the center canal of a bone. Because they typically do not cause symptoms, these tumors are often found by chance when an x-ray image is taken for other purposes. [46]

MRI of the lumbosacral spine in the sagittal plane showing the normal alignment of the vertebrae, normal signal of the lower spinal cord and conus medullaris. The image shows normal marrow signal and normal intervertebral disc morphology.

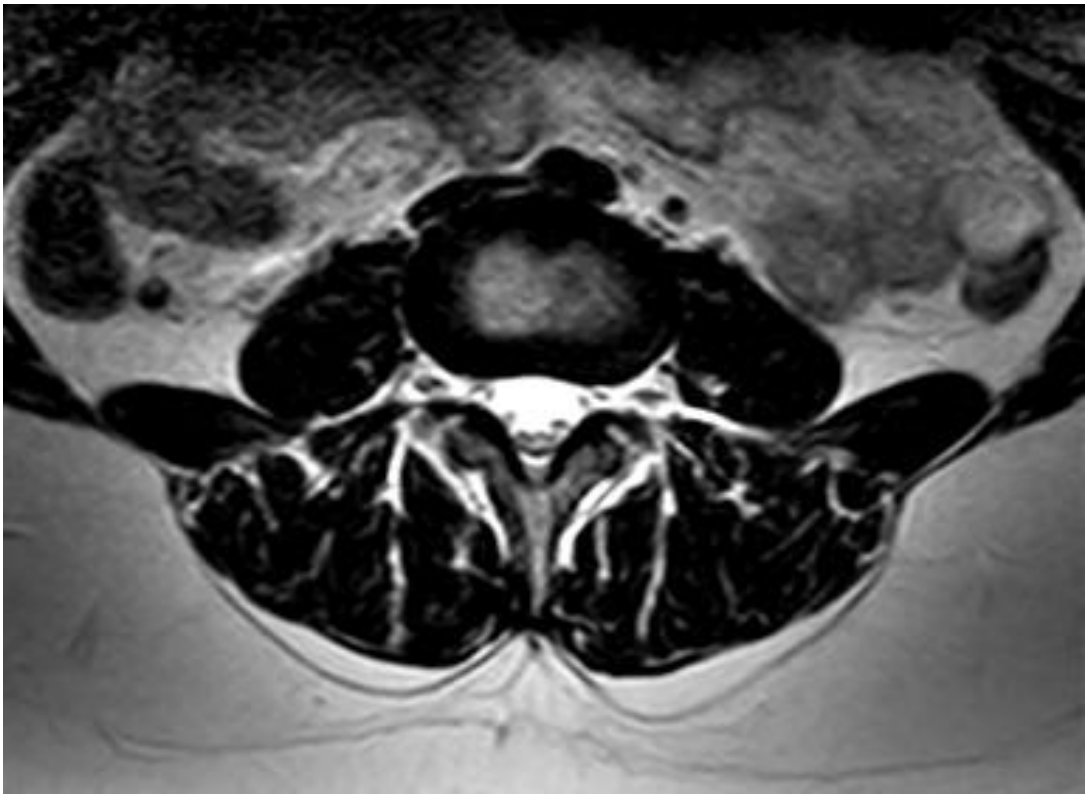


Fig.9: T2W Axial image of the lumbar spine

In this study we present our experience in the utilization of MRI as a diagnostic tool in the evaluation of low back pain in the young adults and its correlation with clinical scenarios.

METHODOLOGY

To study the prevalence and MRI findings in non-traumatic young adults (24-40 years) with low back pain.

SOURCE OF DATA:

Patients visiting the department of radio-diagnosis of Shri B M Patil Medical College for MRI with complaints of chronic back pain to determine the extent of pathological process.

INCLUSION CRITERIA:

- Young patients aged between 24 – 40 years with low back pain

EXCLUSION CRITERIA:

- Trauma cases
- History of recent surgery
- Known case of malignancy

METHOD OF COLLECTION OF DATA:

The study is based number of patients, who are visiting Department of Radio Diagnosis for magnetic resonance imaging from the period of November 2013 to July 2015. Consent will be taken for each case.

Selection of patient will be based on low back pain on clinical presentation and referral to MRI to detect pathology will be chosen for the study.

PHILIPS ACHIEVA 1.5 Tesla compact superconducting active shielded magnet channel with direct digital sampling.

Use of surface coils

Motion suppression technique such as anterior radio frequency saturation bands, gradient moment nulling are critical to reduce motion artefacts.

Technique:

Fast Spin Echo (FSE), T1weighted, T2 weighted, Short Time Inversion Recovery (STIR)

Planes:

Coronal, Axial, Sagittal

RESEARCH HYPOTHESIS:

MRI is better in evaluating the low back pain in young patient than spiral CT and plain radiograph. Because of following reasons:

1. No ionising radiation
2. Exquisite soft tissue details.
3. Multi planar images of good resolution.
4. Visualisation of intrathecal neural elements
5. Extremely sensitive to marrow abnormalities.

SAMPLING:

Study period from: November 2013 to July 2015.

With the prevalence rate of low backache in young adults being 1.5% at 95% confidence interval at ± margin of error, the sample size is 85.

Formula used to calculate the sample size is

$$n = \frac{z^2 \alpha X p X q}{d^2}$$

Hence 85 cases of low back pain in young population will be included in the study.

STATISTICAL ANALYSIS:

- Diagrams
- Percentage

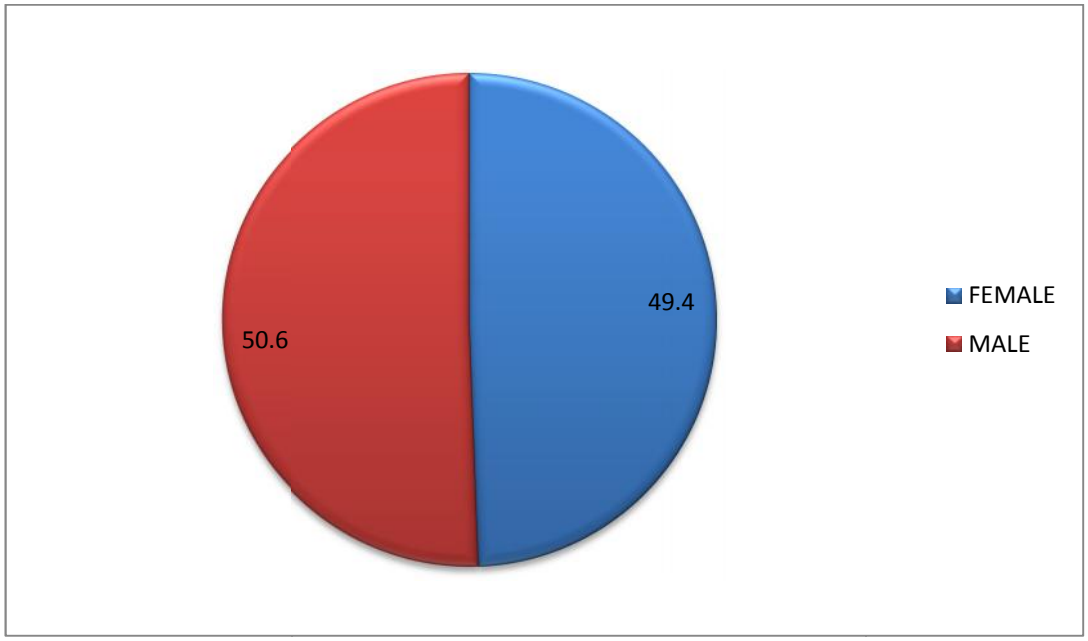
Fig.10: MRI PHILIPS ACHIEVA 1.5 T

Fig.11: SENSE COILS

RESULTS AND OBSERVATIONS

MRI of the lumbosacral spine was performed on 85 patients in the age range of 24-40.There were 43 males and 42 females.

Graph-1: Gender distribution of study population



These patients underwent MRI scans and were given impressions individually and were correlated with the clinical provisional diagnosis and a final diagnosis was made by the referring clinicians. The final diagnosis by the referring clinician is considered ‘Gold Standard’ for this study.

The following are the various abnormalities found in the MRI scans performed in our study.

TABLE 1: VARIOUS MRI ABNORMALITIES

M.R.I CHANGES	No. of Cases
DEGENERATIVE DISC L1-L2	2
DEGENERATIVE DISC L2-L3	7
DEGENERATIVE DISC L3-L4	32
DEGENERATIVE DISC L4-L5	56
DEGENERATIVE DISC L5-S1	47
LUMBAR CANAL STENOSIS	37
SPONDYLOLISTHESIS	18
INFECTION	11
SACROILTIS	10
TUMOR	7
SCHMORL NODE	6
HEMANGIOMA	14
RENAL / GYNAEC CAUSES	7
PERI NEURAL CYST	3
SEQUESTRED DISC	3

Graph-2: Various M.R.I abnormalities

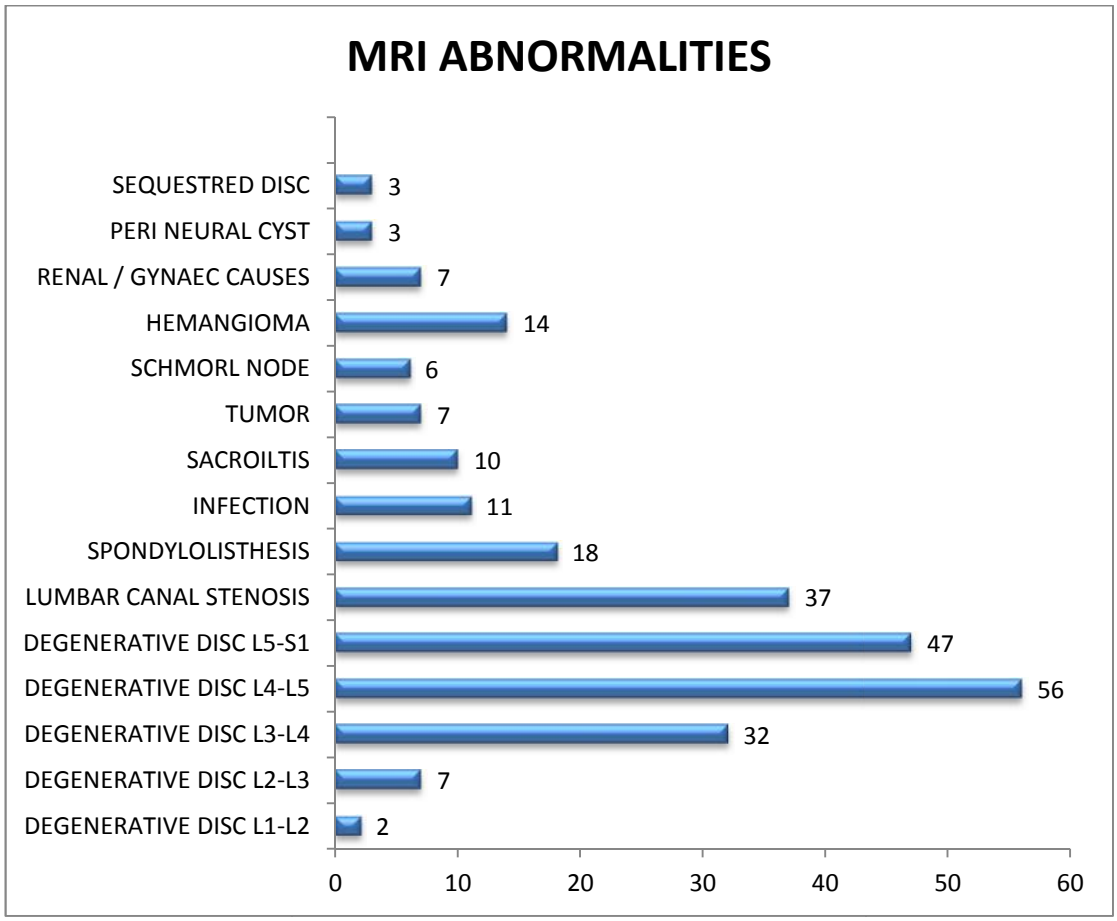


TABLE-2: LEVEL OF DISC LESION

DEGENERATIVE DISC L1-L2	2
DEGENERATIVE DISC L2-L3	7
DEGENERATIVE DISC L3-L4	32
DEGENERATIVE DISC L4-L5	56
DEGENERATIVE DISC L5-S1	47

In our study we have found the majority disc lesions at the level of L4-L5 (65.8%) followed by at the level of L5-S1 (55.3%) least being at the level of L1-L2 (2.35%).

Graph-3: Level of vertebral disc lesion

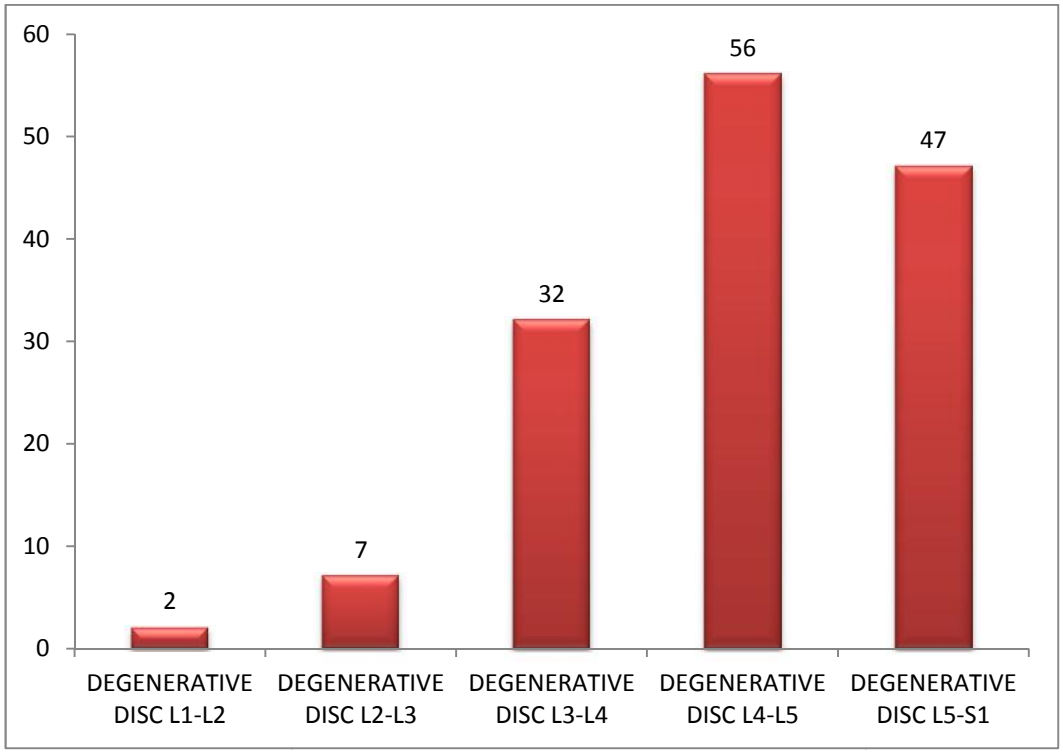


TABLE -3: AGE WISE DISTRIBUTION OF LEVEL OF DISC INVOLVEMENT

Level of disc involved	L1-L2	L2-L3	L3-L4	L4-L5	L5-S1
Age group (years)					
24-30	0	0	12	21	20
31-35	0	4	12	19	13
36-40	2	3	8	16	14
Total	**2**	**7**	**32**	**56**	**47**

Among the age group 24-30 yrs majority of the lesions are present in theL4-L5 (21) level followed by L5-S1 (20) followed L3-L4 (12) and nil at the levels of L1-L2 and L2-L3.Among 31-35 yrs age group majority of the lesions are present in the L4-L5 (19) level followed by L5-S1 (13) followed L3-L4 (8) at the levels of L2-L3(4) and L1-L2 (0). Among 36-40 yrs age group majority of the lesions are present in the L4-L5 (16) level followed by L5-S1 (14) followed L3-L4 (8) at the levels of L2-L3 (3) and L1-L2 (2).

Graph-4: Age wise distribution of level of disc involvement

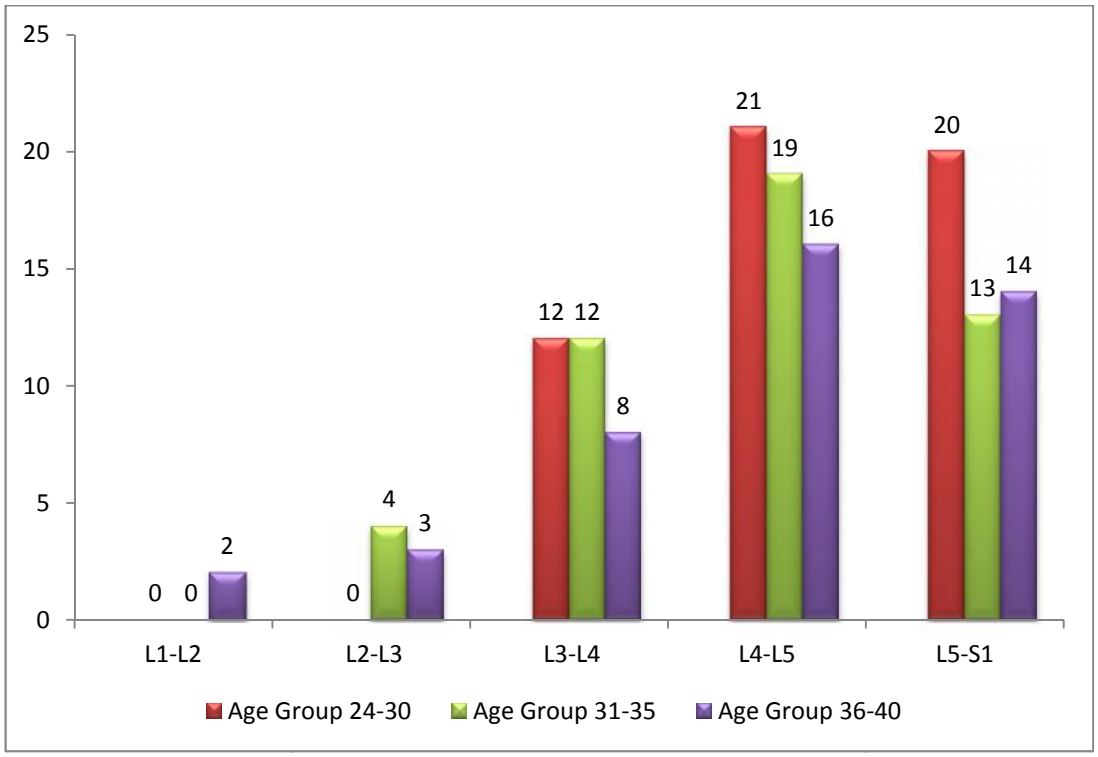


TABLE – 4: GENDER WISE DISTRIBUTION OF LEVEL OF DISC INVOLVEMENT

Age group	Gender	L1-L2	L2-L3	L3-L4	L4-L5	L5-S1
24-30	FEMALE	0	0	6	10	12
	MALE	0	0	6	11	8
31-35	FEMALE	0	0	6	9	5
	MALE	0	4	6	10	8
36-40	FEMALE	1	2	4	7	7
	MALE	1	1	4	9	7

Among the females in the age group 24-30 yrs majority of the lesions are present in the L5-S1 (12) level followed by L4-L5 (10) followed L3-L4 (6) and nil at the levels of L1-L2 and L2-L3, In 31-35 yrs age group majority of the lesions are present in the L4-L5 (9) level followed by L3-L4 (6) followed L5-S1 (5) and nil at the levels of L2-L3 and L1-L2 , In 36-40 yrs age group majority of the lesions are present in the L4-L5 (7) and L5-S1 (7) followed L3-L4 (4) at the levels of L2-L3(2) and L1-L2 (1).

Among the males in the age group 24-30 yrs majority of the lesions are present in the L5-S1 (11) level followed by L4-L5 (8) followed L3-L4 (6) and nil at the levels of L1-L2 and L2-L3, In 31-35 yrs age group majority of the lesions are present in the L4-L5 (10) level followed by L5-S1 (8) followed L3-L4 (6) at the levels of L2-L3(4) and L1-L2 (0), In 36-40 yrs age group majority of the lesions are present in the L4-L5 (9) and L5-S1 (7) followed L3-L4 (4) and equal at the levels of L2-L3(1) and L1-L2 (1).

Graph-5: Gender wise distribution of level of disc involvement

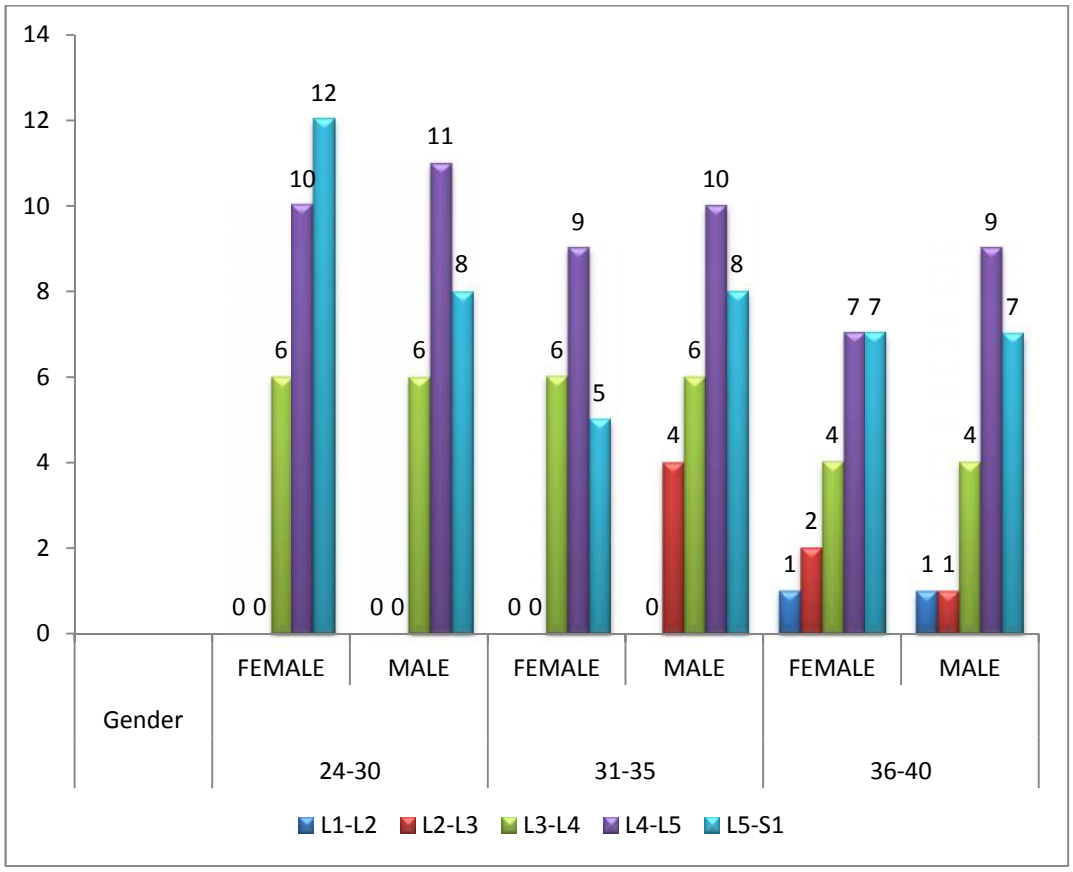


TABLE -5: GENDER WISE DISTRIBUTION OF LUMBAR STENOSIS

Gender	Lumbar canal stenosis		Total
	Absent	Present	
FEMALE	23	19	42
MALE	25	18	43
Total	**48**	**37**	**85**

Among females lumbar stenosis was present among 45.2% and 41.8% among males

Graph-6: Gender wise distribution of lumbar stenosis

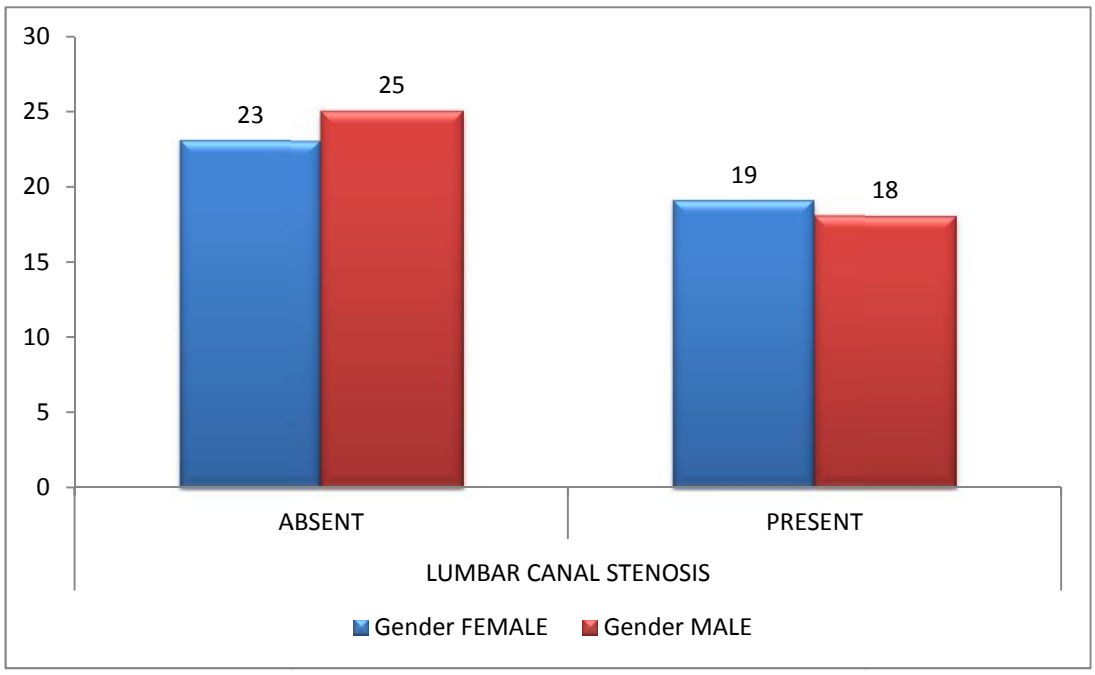
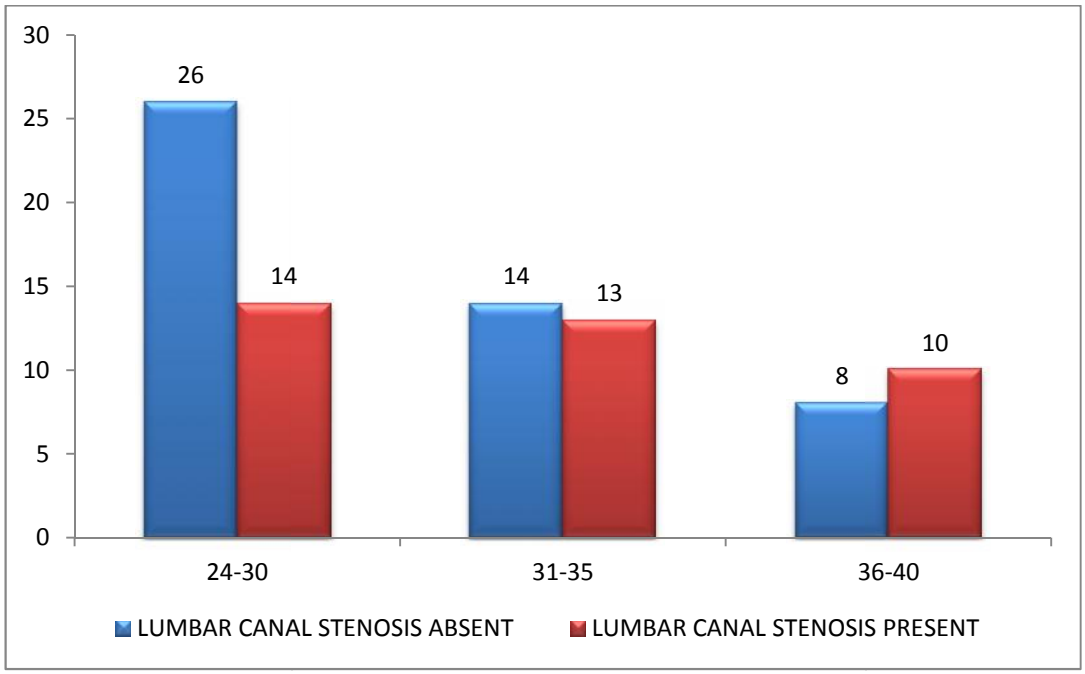


TABLE-6: AGE WISE DISTRIBUTION OF LUMBAR STENOSIS

	Lumbar Canal Stenosis		Total
	Absent	**Present**	
24-30	26	14	40
31-35	14	13	27
36-40	8	10	18
Total	**48**	**37**	**85**

Among the age group of 24-30 Lumbar stenosis was present in 35% of the study population. Among the age group of 31-35 Lumbar stenosis was present in 48.1% of the study population. Among the age group of 36-40 Lumbar stenosis was present in 55.5% of the study population.

Graph-7: Age wise distribution of lumbar stenosis



Graph- 8: Clinical presentation bar chart

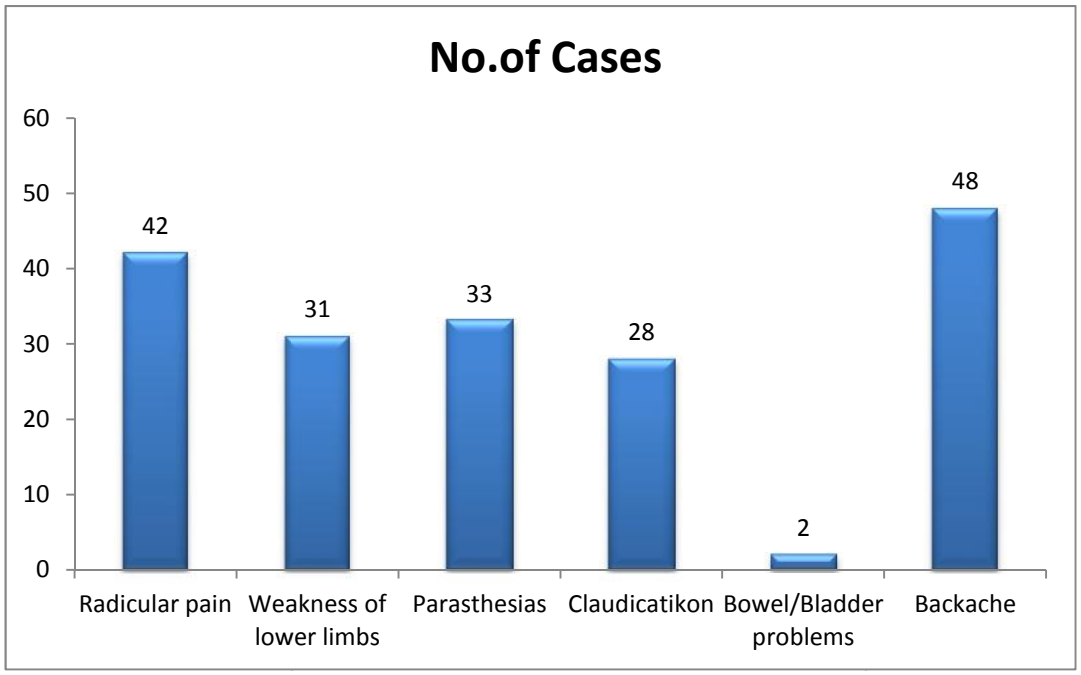
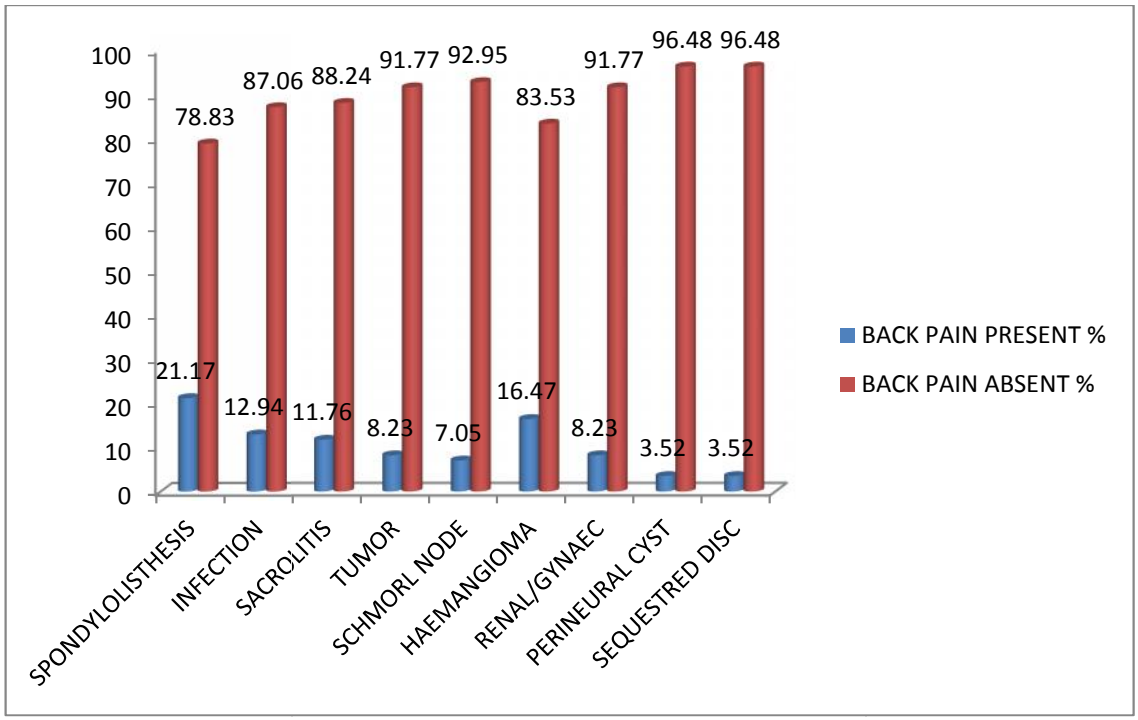


TABLE -7: DISTRIBUTION OF THE STUDY SUBJECTS DEPENDING ON THE CAUSES OF BACK PAIN

CONDITIONS CAUSING BACKPAIN	BACKPAIN PRESENT		BACKPAIN ABSENT		TOTAL	
	n	%	n	%	n	%
SPONDYLOLISTHESIS	18	21.17	67	78.83	85	100
INFECTION	11	12.94	74	87.06	85	100
SACROLITIS	10	11.76	75	88.24	85	100
TUMOR	7	8.23	78	91.77	85	100
SCHMORL NODE	6	7.05	79	92.95	85	100
HAEMANGIOMA	14	16.47	71	83.53	85	100
RENAL/GYNAEC	7	8.23	78	91.77	85	100
PERINEURAL CYST	3	3.52	82	96.48	85	100
SEQUESTERED DISC	3	3.52	82	96.48	85	100

Graph – 9: Distribution of the study subjects depending on the causes of back pain



Among the study subjects, majority complaining of back pain are suffering from spondylolisthesis (21.17%) and a small amount of them are from perineural cyst/sequestered disc (3.52%).

DISCUSSION

All symptomatic patients who came to department of Radiology in the year 2013-2015 were studied. The number of cases studied were 85.

Lumbar disc degeneration is the most common cause of low back pain around the world and the majority is due to disc herniation. Due to development of MRI, non-invasive and excellent imaging of spine is possible.

In our study there were more male (50.5%) patients compared to female (49.4%) patients.

Men are more commonly affected to the disc degeneration than women. It is most likely due to the increased mechanical stress and injury [47]. The findings of our study were consistent with other studies.

Females (40%) had higher prevalence of low back pain compared to males (Schneider et al. 2006 total sample of 5315 persons; Wijnhoven et al. 2006). [48,49] It has been associated with hormonal changes, irregular or prolonged menstrual cycle, different pain perception and recall of symptoms (Wedderkopp et al. 2005; Wijnhoven et al. 2006). [49, 50]

Another study by Resnick Donald, “Degenerative disease of spine” reveals that at most ages, disc degeneration is more common in men and this has been suggested to be due to longer pathways and greater compressive loading. [51]

Degenerative disc disease:

The most common abnormality noted in our study was degenerative disc disease (64.57%). Most cases of disc degeneration was observed in age group of 24-30 years in our study which was comparable with other studies done Cheung KM et al

in 1043 volunteers. [52] Disc desiccation is a common degenerative change of intervertebral discs. It results from the replacement of the glycosaminoglycans within the nucleus pulposus with fibro cartilage which leads to reduced disc height due to reduction in nucleus pulposus volume.[53] Savage et al compared MRI features between 2 age groups (20 to 30 years versus 31 to 59 years). In the 20 to 30 years age group, they found 34% prevalence of disc degeneration on MRI as compared to 59% in the older age group. [54]

In a study by Takatalo et al (2011). Intervertebral disc degeneration was associated with low back symptom severity among young adults, suggesting that the symptoms may have a discogenic origin at this age. [55]

In our study we have found the majority of disc lesions at the level of L4-L5 (65.8%) followed by at the level of L5-S1 (55.3%) least being at the level of L1-L2 (2.35%) which were consistent with findings of other studies. Similar findings were seen in a study conducted by Shafaq Saleem et al (2013) out of 163 patients, disc degeneration was most commonly present at the level of L4/L5 105 (64.4%). Commonest types of disc degeneration were disc herniation 109 (66.9%) and lumbar spinal stenosis 37 (22.7%). [56]

In an another study conducted by Schwarzer et al (1995) the diagnostic criteria for internal disc disruption were fully satisfied in 39% of patients, most commonly at L5-S1 and L4-L5. [57]

Lumbar canal stenosis:

In our study Lumbar canal stenosis was found in 45.2% females and 41.8% males.

In the age group of 24-30years lumbar stenosis was present in 35% of the study population and in the age group of 31-35 years Lumbar stenosis was present in 48.1% of the study population. Among the age group of 36-40 years lumbar stenosis was present in 55.5% of the study population.

Robert Downey Boutin et al showed 70% of the spinal canal stenosis is associated with degenerative changes of the spine. [58]

Spondylolisthesis:

Degenerative spondylolisthesis (DS) is a disorder that causes the slip of one vertebral body over the one below. It differs from spondylolytic spondylolisthesis by the absence of a pars interarticularis defect (spondylolysis), i.e., in DS the whole upper vertebra (vertebral body and posterior part of the vertebra including neural arch and processes) slips relative to the lower vertebra. [59]

In our study 8.07 % patients had spondylolisthesis. Most common level involved was L5-S1 with female predominance (66.6%).

In a study by Remy S Nizard et al (2001) it was found that 60 % of the listhesis were located at L4-L5, 28 % at L5-S1, and 12% at L3-L4. As expected prevalence of listhesis increases with age. [60]

In a prospective study of 60 cases of degenerative diseases of the lumbosacral spine by Md Abul Hossain et al (2008). Spondylolisthesis (8.3%) was most commonly seen at L4-5, where the facets are oriented more sagittally than any other level and are therefore most predisposed to slippage. As the degree of spondylolisthesis is more severe, the spinal canal and /or neural foramina can progressively narrow at that level producing symptoms. [61]

Sacroilitis:

Sacroiliitis is a non-infectious inflammatory process involving the sacroiliac joint, and is a diagnostic criterion for seronegative spondyloarthropathies. Imaging methods are of great value for confirming the diagnosis of this condition. [62] Patients typically have an insidious-onset pain, which is relieved with physical activity and worsens during late night time. Sciatica may be the result of referred pain or the inflammatory changes in the immediate vicinity of the sacroiliac joint directly affecting the nerve. [63] Although the patient's symptoms have a guiding role, CT and MRI findings are pathognomonic. On the other hand, by demonstrating the related acute inflammatory changes, MRI can provide information about the activity of the disease and for making an early diagnosis of sacroiliitis. [64]

10 patients in our study showed evidence of sacroilitis out of which 60% were females.

Shankar et al (2009) showed that MRI abnormality was present in 29 patients (50 joints, bilateral in 21 and unilateral in 8) and in none of the controls. This accounted for a sensitivity of 87.9% and a specificity of 100%.In patients with early sacroiliitis of less than 2 years duration, conventional radiographs did not pick up sacroiliitis; however, both the radionuclide scan and MRI were useful.[65]

In a study conducted by Blum et al (1996). MRI was most sensitive (95%) and superior to quantitative SI scintigraphy (48%) or conventional radiography (19%) for the detection and confirmation of active sacroiliitis.[66]

In a study conducted by Sreedhar et al (2006)., out of 59 MRI proven sacroiliitis, the more frequent findings included; lesions at both SI joints in 29 cases

(49.15%), lesions at iliac aspect of the sacroiliac joint in 29 cases (49.15%), marrow edema in all cases (100%), articular erosions in 24 cases (40.67%) and normal joint space in 52 cases (67.79%). [67]

Sequestered disc:

Disk sequestration can be defined as a herniated disk with perforation of the fibrous ring (or outermost annulus fibrosus) and posterior longitudinal ligament with migration of the disk fragment to the epidural space. [68]

In present study 3 patients had sequestered fragment. The fragment was seen to be hypointense both on T1 and T2 sequences.

While Sarlième et al (2007). reported the first case of an intradural cranial migration of disc material, the patient in their case had undergone previous spinal surgery. [69]

Non degenerative changes:

Tubercular spondylitis:

11 (4.93%) patients had destructive lesions of vertebral bodies with pre and para spinal collections and were diagnosed as tubercular spondylolitis.

Tuberculous (TB) spondylitis can occur in any age. Middle aged adults are the most frequently affected by tuberculous spinal infection.

In a study of 42 cases by Khalequzzaman S1, Hoque HW2 (2012). The peak incidence was found to be in 3rd decade (43.48%) with male predominance, 2.5 times more than female. The mean age was revealed 33.3 years. Highest occurrence was in double vertebrae involvement (42.86%) along with continuous vertebral involvement

(85.71%). Destruction & collapse found in most case (88.10%) with predominance with posterior element involved (54.76%). Spinal deformity was least (11.90%). Para-spinal soft tissue involvement was found in most cases ((80.95%) with no calcification. 21.43% shows cord compression. MRI was found sensitive and accurate modality for diagnosis of TB spondylitis. [70]

Intradural lesions:

7 patients of our study group had neoplastic lesion out of which one had an intradural mass involving the filum terminale, which was diagnosed to be fibrolipoma.

One patient had intramedullary lesion which showed enhancement following contrast suggestive of ependymoma. Three patients had neurofibromas.

Hemangiomas:

Bone hemangiomas are benign, malformed vascular lesions, overall constituting less than 1% of all primary bone neoplasms. They occur most frequently in the vertebral column (30-50%) and skull (20%), whereas involvement of other sites (including the long bones, short tubular bones, and ribs) is extremely rare. [71]

Hemangiomas were seen in 14 patients which were mostly seen in L3 L4 vertebral bodies.

In a study by K.A. Matrawy et al (2013). Atypical hemangioma and malignant lesions of spine: DWI. A total of 24 patients were examined. This study included three groups: group (A) 8 (33%) patients with metastatic bony lesions of spine, group (B) 6 (25%) patients with atypical hemangioma and group (C) 10 (42%) patients with typical hemangioma. [72]

Back pain especially in the middle or lower back, is the most frequent symptom associated with vertebral hemangioma.[73] The pain may be worse at night or on awakening. It may also spread to the hips, legs, feet, or arms as the hemangioma grows. [74]

Others:

Schmorl's nodes have been widely assumed to be the herniation of the nucleus pulposus through the cartilaginous endplate into the body of a vertebra, ever since Schmorl first described them in 1927. [75-77]

Schormls nodes were seen in 6 patients and perineural cyst in 3 patients.

In a study by Pfirrmann and Resnick (2001). Schmorl nodes were found in 58 (58%) of 100 specimens and were multiple in 41 specimens (mean, 3.9 nodes; range, 1–13 nodes). [78]

SUMMARY

- This was a prospective study of 85 patients with chronic low back pain over period of 20 months conducted in the department of Radio diagnosis aimed at analyzing the role of MRI in evaluation of chronic low back pain and MRI as a diagnostic tool.
- Out of 85 patient studied 43 (50.6%) were males and 42 (49.6%) were females.
- The age ranged from 24-40 years.
- Low backache with radicular pain was the most common clinical presentation.
- Degenerative disc disease was the most common cause of low back pain.
- Disc protrusion, nerve root displacement/compression, disc degeneration and high intensity zone can all be assessed repeatably on MRI.
- All of these abnormalities are associated with LBP, but with estimated prevalence rate ratios generally less than two.
- The early dehydration changes were best picked by MRI as loss of signal intensity on T2W images with reduced disc height.
- Disc bulge was seen as loss of posterior concavity of disc, which is diffuse and presence of annulus fibrosus all around.
- L4-5 was the most commonly involved disc 56 (65.8%), followed by L5-S1 (55.3%).
- 24-30 years was the most common age group involved.
- Lumbar canal stenosis was most commonly seen at L4-5 and in age group of 36-40 years (55.5 %).

- The free fragment/sequestrated disc was seen in 3 pateints and was seen as hypointense on both T1 and T2 because of chronicity. The sequestrated segment migrated downwards.
- Sacroilitis was most commonly seen in females.
- Schmorl’s nodes were better detected by MRI.
- Spinal canal stenosis other than degenerative disc was caused by ligamentum flavum hypertrophy and facet joint arthropathy.
- MRI also detected some other incidental finding like hemangiomas and perineural cysts.

CONCLUSION

- From the present study it was concluded that MRI is one of the most comprehensive, non-invasive and safe imaging modality for early diagnosis of low backache.
- In our study the frequency of MRI changes in the spine in the symptomatic patients appears to be higher when compared to other reports in the literature and these changes were more frequent in the (24 to 30 years) age group.
- The most common cause of low back ache was degenerative disc disease involving L4-L5 the most.
- Apart from degenerative diseases, other causes of low backache were also diagnosed.
- Finally MRI provides the best global assessment of diseases of bone marrow, disc, posterior vertebral elements, spinal cord and nerve roots.

BIBLIOGRAPHY

1. Al Saeed O, Al-jarallah K, Raeess M, Sheikh M, Ismail M and Athyal R, Magnetic resonance imaging of the lumbar spine in young Arabs with low back pain, Asian Spine Journal, 2012;6(4): 249-256.
2. Endean A, Palmer K T and David, Potential of MRI findings to refine case definition for mechanical low back pain in epidemiological studies: a systematic review. University of Southampton, UK Spine 2011 January 15; 36(2): 160–169.
3. .Harry .N. Herkowitz, Jiri Dvorak, Gordan Bell, Margareta Nordin "epidemiology and the economics of low back pain" edited by Alf Nachemson, The lumbar spine, 3rd edition, printed in USA 2000,3-8
4. David A wong, Ensor Transfedlt, "preface to the 1st edition" edited by Macnab's Backache 4th edition printed in USA 2001, IX.
5. David A wong, Ensor Transfedlt, "preface to the 1st edition" edited by Macnab's Backache 4th edition printed in USA 2001, 19-25.
6. John W Engstrom, back and neck pain, prinicples of internal medicine, harrison's 16th edition, printed in USA 2005, 19-25
7. Leboeuf-Yde C, Kyvik KO. At what age does low back pain become a common problem? A study of 29,424 individuals aged 12–41 years. Spine 1998; 23:228–34.
8. Bogduk N. Clinical Anatomy of the Lumbar Spine and Sacrum, 3rd Ed. Churchill Livingstone, 1997.
9. Watson KD, Papageorgiou AC, Jones GT, et al. Low back pain in schoolchildren: Occurrence and characteristics. Pain 2002; 97:87–92.

10. Acute low back problems in adults: assessment and treatment. Agency for Health Care Policy and Research. Clin Pract Guide Quick Ref Guide Clin1994;iii-iv,1–25

11. Schutte HE, Park WM. The diagnostic value of bone scintigraphy in patients with low back pain. Skeletal Radiol1983;10:1–4

12. Modic MT, Masaryk T, Boumphrey F, et al. Lumbar herniated disc disease and canal stenosis: prospective evaluation by surface coil MR, CT, and myelography. AJR Am J Roentgenol1986; 147:757–65 20.

13. Jackson RP, Cain JE Jr, Jacobs RR, etal. The neuroradiographic diagnosis of lumbar herniated nucleus pulposus: II. A comparison of computed tomography (CT), myelography, CT-myelography, and magnetic resonance imaging.Spine 1989;14:1362–67

14. Williams AL, Gornet MF, Burkus JK. CT evaluation of lumbar interbody fusion: current concepts. AJNR Am J Neuroradiol 2005;26:2057–66

15. W.G. Bradley Jr. and for the Expert Panel on Neurologic Imaging. ACR APPROPRIATENESS CRITERIA Low Back Pain. AJNR Am J Neuroradiol 28:990 –92 May 2007

16. David S. Jacobs. “Degenerative disease of spine” edited by John R. Haaga, Charles F. Lanzieri, Robert C. Gilkeson, “CT and MR imaging of whole body”. 2003: Vol 1:724-464.

17. Damadian R. Goldsmith M, Minkhoff L. NMR in Cancer. Physiol Chem Phys 1977; 9:97-108.

18. Modic MT, Masaryk TJ, Mulopolous GP et al. Cervical radiculopathy. Prospective evaluation with surface coil MR imaging, CT with metrizamide and metrazamide myelography. Radiology 1986; 161; 653-59.

19. Mc Nee P, Shambrook J, Harris EC, Kim M, Sampson M, Palmer K T and David, Predictors of long term pain and disability in patients with low back pain investigated by magnetic resonance imaging: A longitudinal study, BMC Musculoskeletal Disorders 2011, 12:234.

20. Jacobs DS. Degenerative Disease of the Spine. In : Haaga JR, DograVS, Forsting M ,Gilkeson RC, Hyun KH , Sundaram M, edts., CT and MR of the whole body. 5th ed. Philadelphia: Mosby Elsevier; 2009:p.755-800.

21. Janardhana AP, Rajagopal, Rao S, Kamath A. Correlation between clinical features and magnetic resonance imaging findings in lumbar disc prolapsed. Indian J Orthop2010;44(3):263-26

22. Sadler J.W.. "Skeletal system". Langman's Medical Embryology. 9th edition. Lipincott Williams and Wilkin printed in USA; 2004; 171-197.

23. Jamshid Tchranzadeh, Carol Andrews and Edwars Wang. Lumbar spine imaging. *Radiologic clinics of North America*. 2000; Vol 38(6); 1207-1251.

24. Rinan O Rahinldy and, Fabiola Mulher. The sjeletal system and limbs, human embryology and tetralogy. Edited. 3rd edition. Wiley WISS Publication. Printed in USA: 2001; 362-365.

25. Inderbir Singh. The vertebral Column, Text book of anatomy. 116 1st ed. Jaypee brothers medical publishers (P) Ltd. Priinted in India; Vol 1: 6.0-6.19.

26. Tonya Hines, CMI, Mayfield Clinic/University of Cincinatti Department of Neurosurgery, Ohio 1998-2013.

27. John Pelazo. M.D. "ANATOMY OF THE SPINE". © 2015 Center for Spine Care.

28. Back pain and Spine Physicians in Colorado. Understanding Spinal Anatomy: Ligaments, Tendons and Muscles. Chapter 3: Anatomy of the Spinal Cord

29. Nachum Dafny, Ph.D., Department of Neurobiology and Anatomy, Chapter 3: Anatomy of the Spinal Cord. The UT Medical School at Houston. © 2000 UTHSCH.

30. Dr. Avital Fast, MD, Dorith Goldsher, MD. Navigating the Adult Spine: Bridging Clinical Practice and Neuroradiology. DEMOS MEDICAL PUBLISHING, LLC, New York © 2007.

31. Sether LA, Yu S, Haughton VM, Fischer ME. Intervertebral disc: normal age-related changes in MR signal intensity. Radiology 1990; 177:385–388.

32. Michael T. Modic, Jeffrey S. Ross. Lumbar Degenerative Disc Disease. Radiology: 2007 Oct; 245(1).

33. Fardon DF, Milette PC. Nomenclature and classification of lumbar disc pathology: recommendations of the Combined Task Forces of the Orthopedic American Spine Society, American Societyof Spine Radiology, and American Society of Neuroradiology. Spine 2001; 26:E93–E113.

34. Modic MT, Steinberg PM, Ross JS, et al. Degenerative disc disease: assessment of changes in vertebral body marrow with MR imaging. Radiology 1988; 166:193–199.

35. Afshani E, Kuhn J. Common causes of low back pain in children. Radiographics 1991; 11:269-91.

36. Modic M, Feiglin DH, Pimaino DW, et al. Vertebral osteomyelitis: assessment using MRI.Radiology 1985; 157:157-166.

37. Mark D. Murphey, Louis H. Wetzel, John M. Bramble, Errol Levine, Karen M. Simpson, Herbert B. Lindsley, Sacroiliitis: MR Imaging Findings Radiology 1991; 180:239-244

38. T ERGUN, MD and H LAKADAMYALI, MD. *Pictorial review: CT and MRI in the evaluation of extraspinal sciatica*. The British Journal of Radiology, 83 (2010), 791–803

39. Foley KM, Woodruff JM, Ellis FT, Posner JB. Radiationinduced malignant and atypical peripheral nerve sheath tumors. Ann Neurol 1980; 7:311–18.

40. Ergun T. Bilateral sciatica secondary to mass lesions in the gluteal muscles. Intramuscular metastasis. J Clin Neurosci 2008; 15:1388–426.

41. Bes¸e NS, Ozgu¨rog˘lu M, Dervis¸og˘lu S, Kanberog˘lu K, Ober A. Skeletal muscle: an unusual site of distant metastasis in gastric carcinoma. Radiat Med 2006; 24:150–3.

42. Williams JB, Youngberg RA, Bui-Mansfield LT, Pitcher JD. MR imaging of skeletal muscle metastases. AJR Am J Roentgenol 1997; 168:555–7.

43. Bickels J, Kahanovitz N, Rubert CK, Henshaw RM, Moss DP, Meller I, et al. Extraspinal bone and soft-tissue tumors as a cause of sciatica. Clinical diagnosis and recommendations: analysis of 32 cases. Spine 1999; 24:1611–16.

44. Roncaroli F, Poppi M, Riccioni L, Frank F. Primary nonHodgkin's lymphoma of the sciatic nerve followed by localization in the central nervous system: case report and review of the literature. Neurosurgery 1997; 40:618–21.

45. Wider C, Kuntzer T, Von Segesser LK, Qanadli SD, Bogousslavsky J, Vingerhoets F. Bilateral compressive lumbosacral plexopathy due to internal iliac artery aneurysms. J Neurol 2006; 253:809–10.

46. Nathan Morrell, MD; Robert H. Quinn, M. Hemangioma. American Academy Of Orthopaedic Surgeons. Last reviewed: July 2012.

47. Wang YX, Griffith JF. Effect of menopause on lumbar disc degeneration: potential etiology. Radiology.2010; 257:318–20. [PubMed].

48. Schneider S, Randoll D, Buchner M 2006. Why do women have back pain more than men? A representative prevalence study in the federal republic of Germany. Clin J Pain, 22: 738-747

49. Wijnhoven HA, de Vet HC, Picavet HS 2006. Prevalence of musculoskeletal disorders is systematically higher in women than in men. Clin J Pain, 22: 717-724.

50. Wedderkopp N, Andersen LB, Froberg K, Leboeuf-Yde C 2005. Back pain reporting in young girls appears to be puberty-related. BMC Musculoskel Disord, 6: 52- 56.

51. Resnick Donald. “Degenerative Disease of Spine”, edited by Resnick Donald, “*Diagnosis of Bone and Joint Disorders*”, WB Saunders Printed in USA, 2002; Vol. 2: 1382-1475pp.

52. Cheung KM et al. Prevalence and pattern of lumbar magnetic resonance imaging changes in a population study of one thousand forty-three individuals. Spine (Phila Pa 1976). 2009 Apr 20; 34(9):934-40.

53. Lipson SJ, Muir H. Experimental intervertebral disc degeneration: morphologic and proteoglycan changes over time. Arthritis Rheum. 1981; 24:12–21. [PubMed]

54. Savage RA, Whitehouse GH, Roberts N. The relationship between the magnetic resonance imaging appearance of the lumbar spine and low back pain, age and occupation in males. Eur Spine J 1997; 6:106-14.

55. Takatalo et al. Lumbar Disc Degeneration and Pain. Spine Diagnostics. ©2011, Lippincott Williams & Wilkins. SPINE Volume 36, Number 25, pp 2180–2189.

56. Shafaq Saleem et al. Lumbar disc degenerative disease. Asian Spine J 2013; 7(4):322-334.

57. Schwarzer et al. "The prevalence and clinical features of internal disc disruption in patients with chronic low back pain". Spine (Phila Pa 1976). 1995 Sep 1; 20(17):1878-83.

58. Robert Downey Boutin, Joseph Spacth H, Donald Resnick. "Degenerative diseases of spine" Edited by William W. Orrison, Jr. "*The neuro imaging*". W.B. Saunders. Printed in USA: 2001; Vol 2: 1302-1306.

59. Leonid Kalichman Æ David J. Hunter. Diagnosis and conservative management of degenerative lumbar spondylolisthesis. Eur Spine J (2008) 17:327–335.

60. Remy. S. Nizard, Marc Wybier and Jean-Denis Laredo. Radioloic assessment of lumbar intervertebral instability and degenerative spondylolisthesis. *Radiologic Clinics of North America*. 2001; 39(1): 101-114.

61. Md Abul Hossain et al (2008). MRI Evaluation of Degenerative Diseases of Lumbosacral Spine. Bangladesh Journal of Radiology and Imaging Vol. 16(1): January 2008.

62. Montandon C et al. Sacroiliitis: imaging evaluation. Radiol Bras 2007; 40(1):53–60.

63. Wong M, Vijayanathan S, Kirkham B. Sacroiliitis presenting as sciatica. Rheumatology 2005;44:1323–4[PubMed]

64. Bredella MA, Steinbach LS, Morgan S, Ward M, Davis JC. MRI of the sacroiliac joints in patients with moderate to severe ankylosing spondylitis. AJR Am J Roentgenol 2006; 187:1420–6 [PubMed].

65. Shankar et al. Evaluation of magnetic resonance imaging and radionuclide bone scan in early spondyloarthropathy. Indian Journal of Rheumatology 2009 December. Volume 4, Number 4; pp. 142–148.

66. Blum U et al. Magnetic resonance imaging (MRI) for detection of active sacroiliitis--a prospective study comparing conventional radiography, scintigraphy, and contrast enhanced MRI. J Rheumatol. 1996 Dec;23(12):2107-15

67. CM Sreedhar et al. Sacroiliitis In Routine MRI For Low Back Ache. IJRI, 16:4, November 2006: 644-649.

68. Dosoglu M, Is M, Gezen F, et al. Posterior epidural migration of a lumbar disc fragment causing cauda equina syndrome: case report and review of the relevant literature. Eur Spine J 2001; 10:34851.

69. Oztürk A, Avci E, Yazgan P, Torun F, YücetaŞ S, Karabağ H : Intradural herniation of intervertebral disc at the level of Lumbar 1-Lumbar 2. Turk Neurosurg 17: 134-137, 2007.

70. Khalequzzaman S1, Hoque HW2. Tuberculosis of Spine Magnetic Resonance Imaging (MRI) Evaluation of 42 Cases. MEDICINE today 2012 Volume 24 Number 02.

71. Ishmael Chasi et al. Bone Hemangioma Imaging. Medscape. Updated: Apr 02, 2013.

72. K. A. Matrawy et al. Atypial Hemangioma and Malignant lesions of Spine: DWI. The Egyptian Journal of Radiology and Nuclear Medicine (2013) 44, 259-263.

73. Back.com. "Tumors: Benign." http://www.back.com/causes-tumors-benign.html. Accessed March 8, 2010.

74. Mayo Clinic.com. "Spinal Tumor." By Mayo Clinic staff. http://www.mayoclinic.com/health/spinal-tumor/DS00594/DSECTION=symptoms. Accessed March 8, 2010.

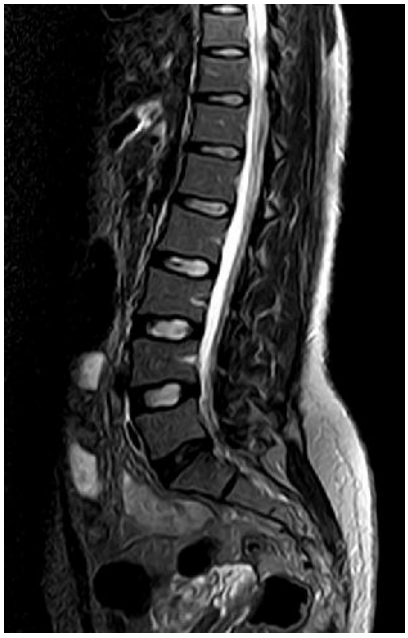
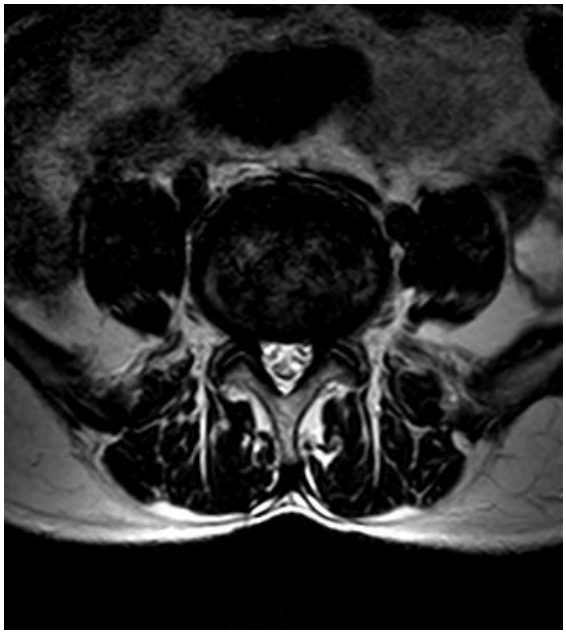
75. Ghelman B, Freiberger RH. An anterior disc herniation demonstrated by discography. Am J Roentgenol 1976; 127:854-5.

76. Seymour R, Williams LA, Rees JI, Lyons K, Lloyd DC. Magnetic resonance imaging of acute intraosseous disc herniation. Clin Radiol 1998; 53:363-8. 3.

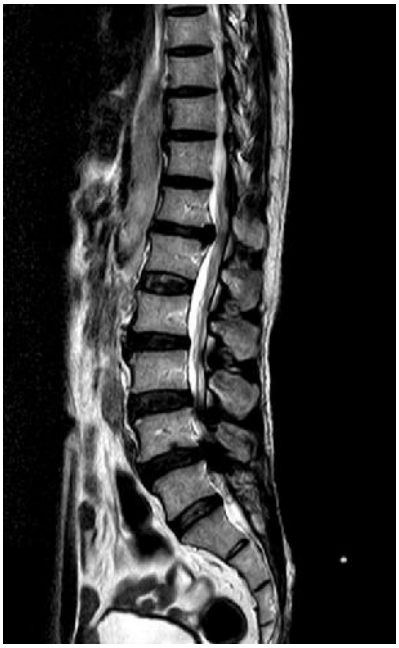
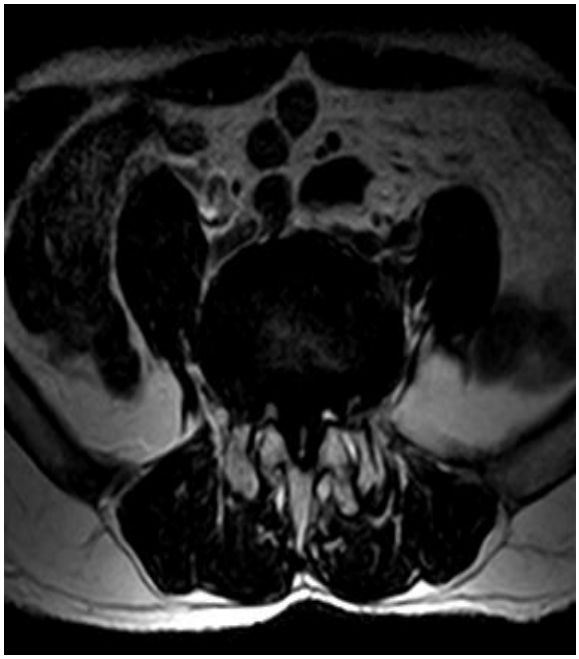
77. Takahashi K, Miyazaki T, Ohnari H, Takino T, Tomita K. Schmorl's nodes and low-back pain: analysis of magnetic resonance imaging findings in symptomatic and asymptomatic individuals. Eur Spine J 1995; 4:56-9.

78. Pfirrmann and Resnick. Spinal Schmorl Nodes: Radiographic-Pathologic Study. Radiology z May 2001. Volume 219 z Number 2.

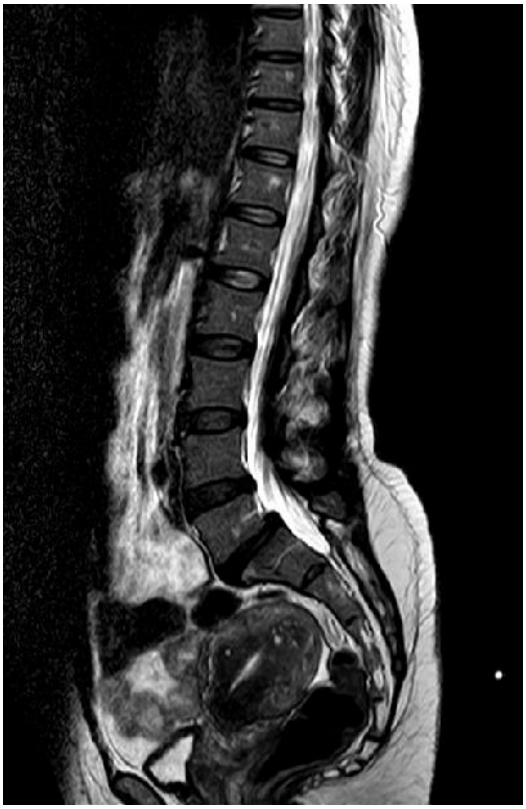
IMAGES

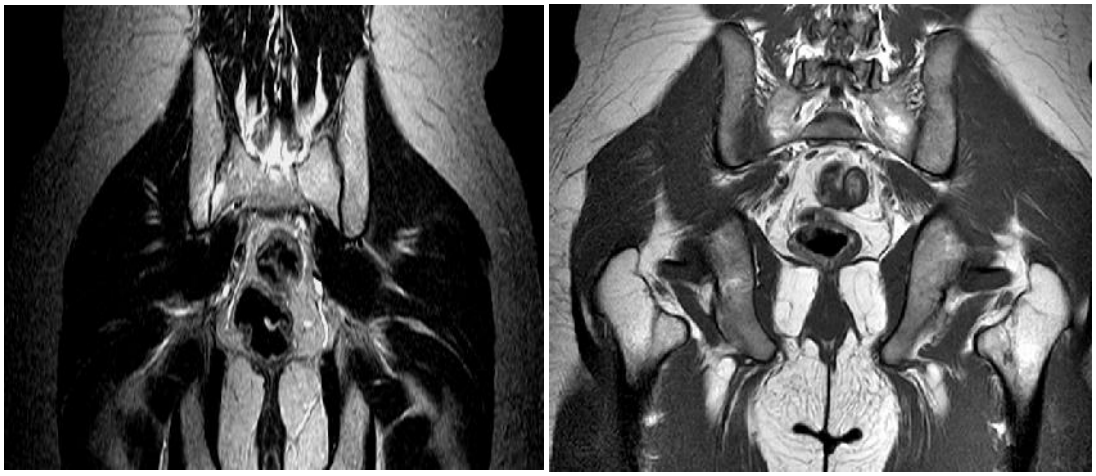
Disc desiccation at L5-S1.
Diffuse disc bulge with broad based posterior disc bulge and inferior migration of disc, at L5-S1 causing severe compression of bilateral traversing nerve roots (R>L) with severe foraminal and spinal canal stenosis

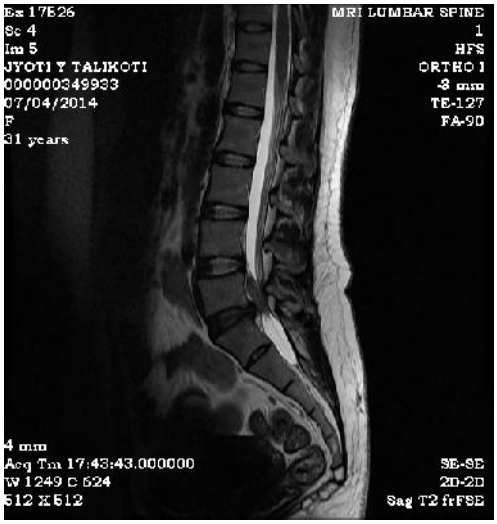
Disc desiccation at all levels with schmorl's nodes.
L4-5: Diffuse disc bulge with disc extrusion into bilateral lateral recesses and neural foramina causing complete stenosis of spinal canal causing severe compression of bilateral L5 nerve root s and mild compression of L4 nerve roots

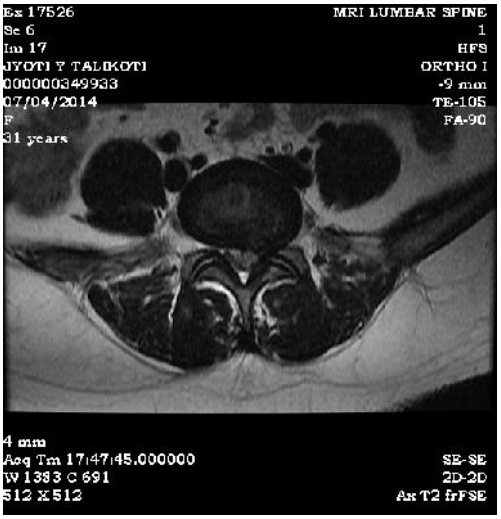


Grade I anterior listhesis of L5 over S1 is noted. Modic type II disc desiccation changes are noted at L4-5 and L5-S1.

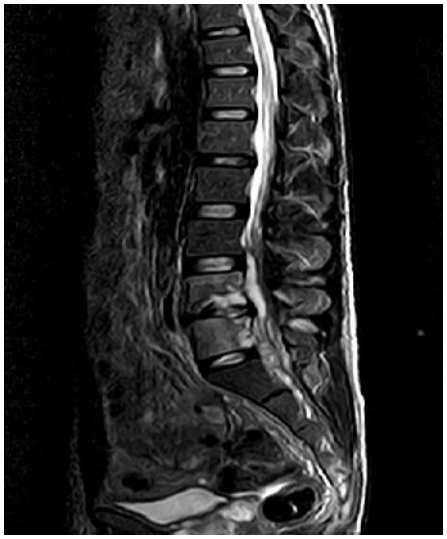


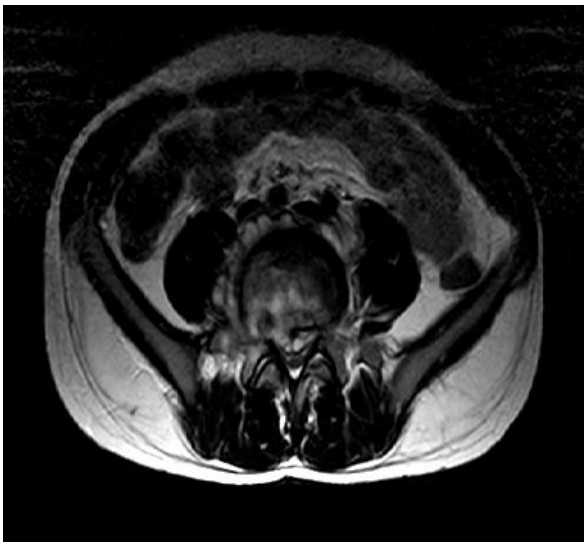
Altered signal changes on right side of sacroiliac joint in inferior aspect – sacroilitis.



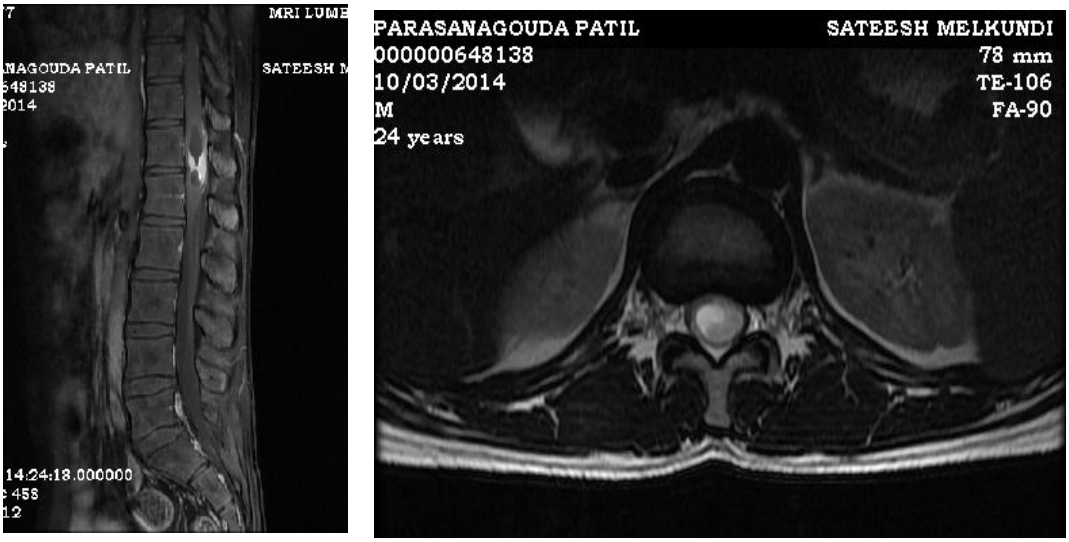


A well-defined fusiform hypointense lesion in the anterior epidural space at L4 level compressing thecal sac and cauda equina nerve roots. Thin incomplete rim enhancement on post contrast study. This most likely represents sequestrated disc.

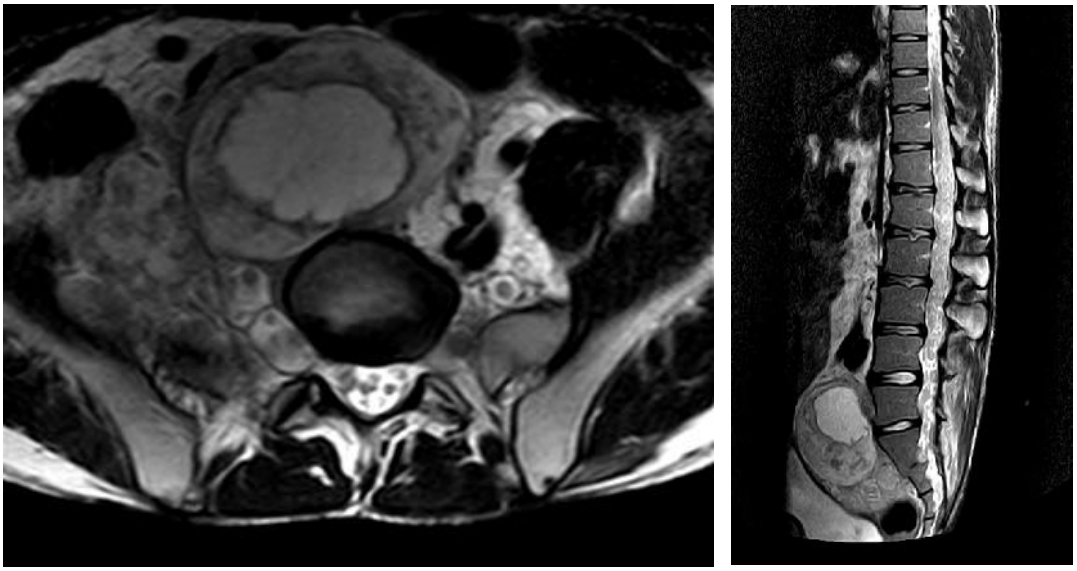




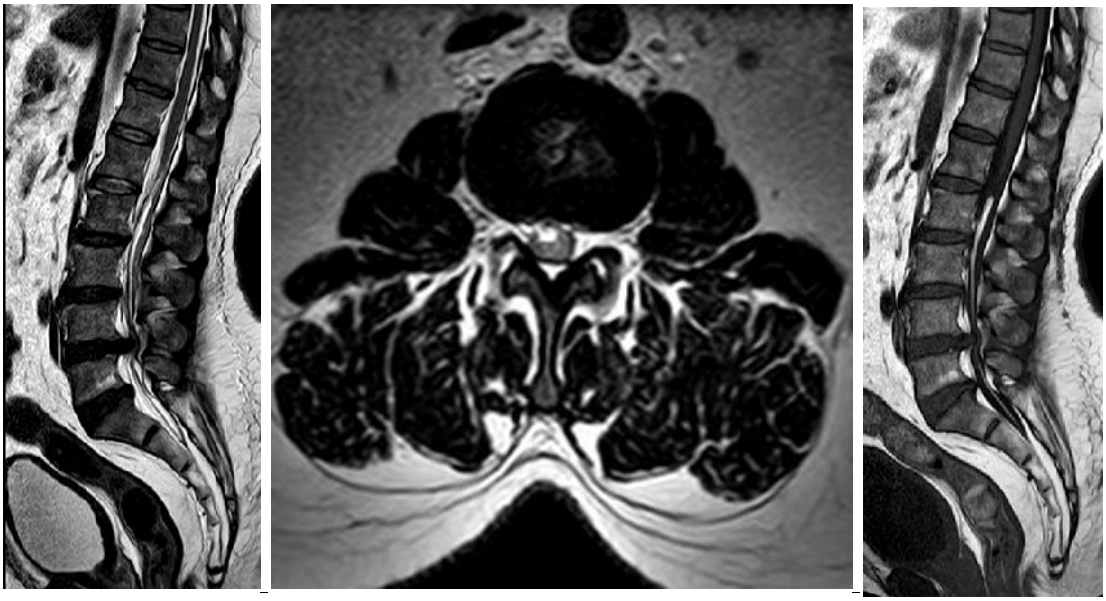
Altered signal intensity of L1 and L5 vertebral bodies & intervening disc with pre & para vertebral collection and also involving of bilateral psoas muscles - suggestive of spondylodiscitis.



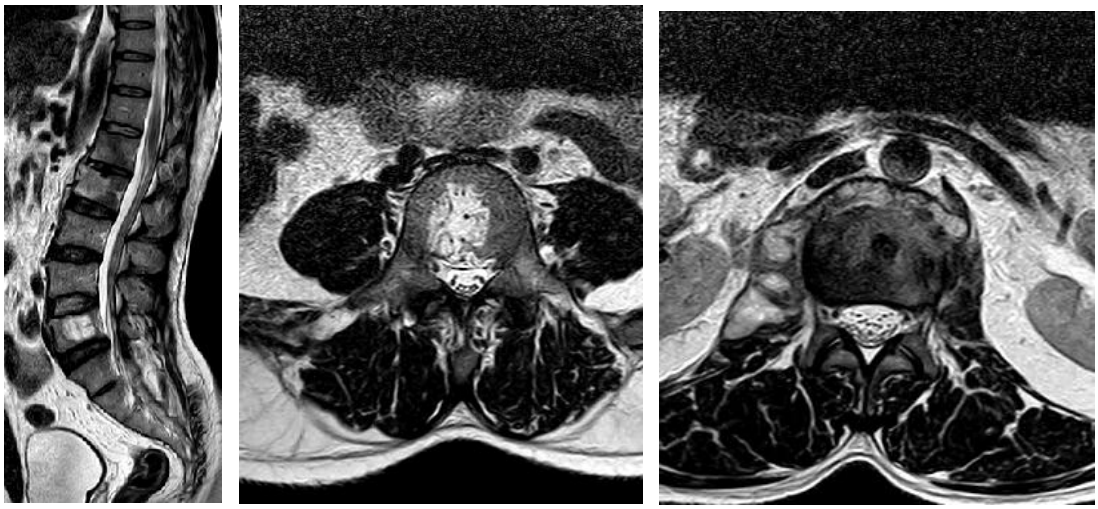
Fairly well defined mixed signal intensity, intramedullary lesion with fusiform expansion of cord at the level of D12 & L1 having both cystic and solid components. Post contrast study shows intense enhancement of the solid components.



T2 Saggital and axial: Mixed intensity lesions seen arising from bilateral neural foraminal – S/o neurofibromas

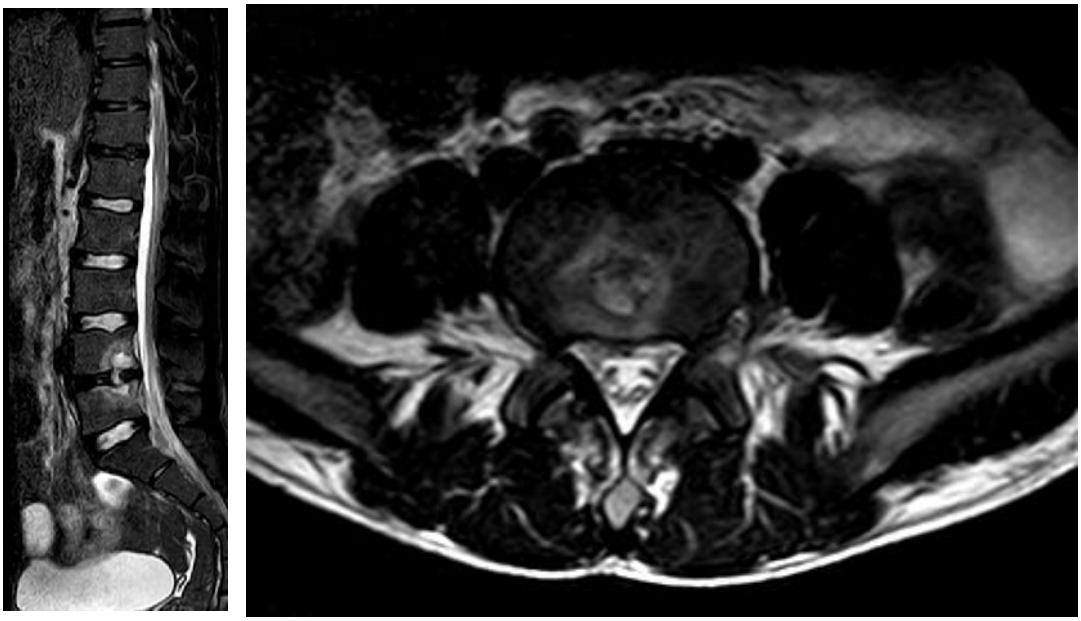


T2 axial, sag and T1 sag images show linear hyperintense signal on T1 and T2WI & hypointense on STIR, extending from the conus to S2 level - suggestive of fibro-lipoma filum terminale.

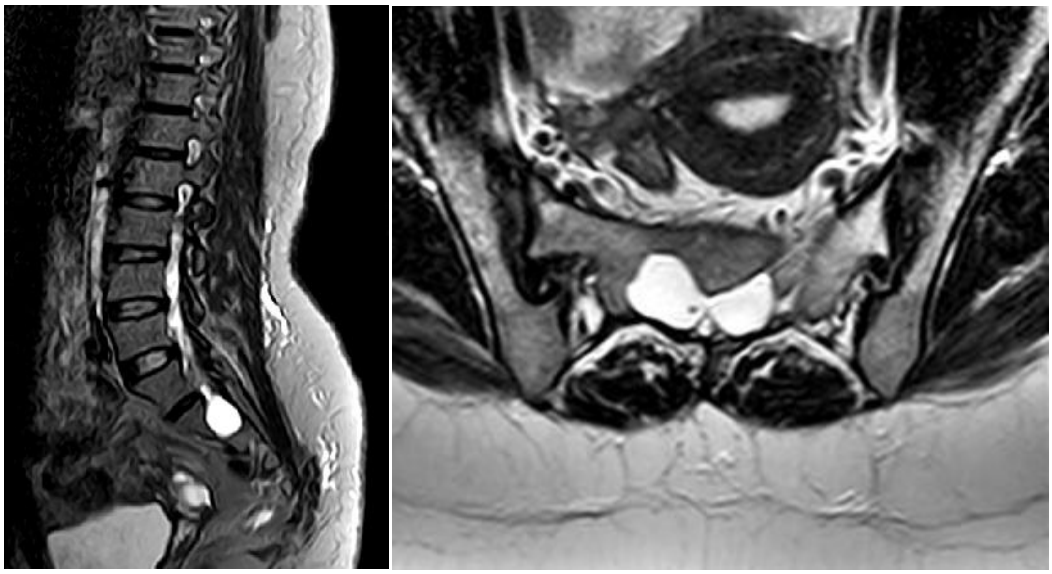


F1) Hemangioma is seen in L4 vertebral body.

2) Altered signal intensity of D12 & L1 vertebral bodies & intervening D12-L1 disc with pre & para vertebral collection and also involving origins of bilateral psoas muscles - suggestive of spondylodiscitis.



T2 axial and sag images show focal defect in the inferior & superior endplates of L3 & L4 respectively with intra-vertebral disc herniation & focal surrounding marrow edema - suggestive of acute schmorl's nodes.



T2 hyperintense lesions noted at S1 and S2 vertebrae levels – perineural cyst.

ANNEXURE – I

ETHICAL CLERANCE CERTIFICATE

B.L.D.E.UNIVERSITY'S
SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR – 586103
INSTITUTIONAL ETHICAL COMMITTEE

Institutional Ethical Committee BLDEU's Shri B.M. Patil Medical College, BIJAPUR-586 103. OUTWARD No. 55/2015 Date. 10/10/15

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 10-10-2015 *at* 3-30 p.m. *scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected and revised version synopsis of the Thesis has accorded Ethical Clearance.*

Title "Evaluation of Low backache in young – adults with MRI"

Name of P.G. Student : Dr. Masudi Sheetal.
Department of Radiodiagnosis

Name of Guide/Co-investigator : Dr. B.N. Lakhkar.
Prof & HOD. Department of Radiodiagnosis.

DR.TEJASWINI VALLABHA
CHAIRMAN

CHAIRMAN Institutional Ethical Committee BLDEU's Shri B.M. Patil Medical College,BIJAPUR-586103.

Following documents were placed before E.C. for Scrutinization.
1)Copy of Synopsis/Research Project
2)Copy of informed consent form.
3)Any other relevant documents.

ANNEXURE – II

PROFORMA

Name: Date:

Age/Sex: O.P.No./I.P.NO

Occupation:

DOA: DOD:

Address:

History of presenting complaints:

General complaints: Low backache, Sciatica, Numbness

Past history : History of similar complaints

General Examination:

Local Examination:

Special tests- 1) SLRT

2) Laseague's test

MRI Features:

Sequences – T1&T2 axial, coronal and sagittal

a) Alignment and curvature

b) Vertebral body signal changes/height

c) IV disc hydration

d) Disc bulge -

-Protrusion/ Extrusion:- Central

- Paracentral
- Foraminal
- Far lateral
- Sequestration

e) Facet joint hypertrophy

f) Flaval ligaments

g) Disc osteophyte complex

h) Lateral recess

i) Spinal canal dimensions- AP/TRANSVERSE

j) Posterior elements

k) Soft tissue

m) Conus Medullaris/spinal nerve root changes.

n) SI joints.

ANNEXURE – III

SAMPLE INFORMED CONSENT FORM

B.L.D.E.U.'s SHRI B.M. PATIL MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, VIJAYAPUR – 586103, KARNATAKA

TITLE OF THE PROJECT: EVALUATION OF LOW BACKACHE IN YOUNG ADULTS WITH MRI.

PRINCIPAL INVESTEGATOR: DR. MASUDI SHEETAL
DEPARTMENT OF RADIO DIAGNOSIS
Email: masudi.sheetal74@gmail.com

PG GUIDE: DR. BHUSHAN N. LAKHKAR
PROFESSOR AND HOD
DEPARTMENT OF RADIO-DIAGNOSIS
SHRI B.M. PATIL Medical College & Research Centre, Sholapur Road,
VIJAYAPUR - 586103

PURPOSE OF RESEARCH:

I have been informed that this study will evaluate causes of low back pain in young adult patients.

I have been explained about the reason for doing this study and selecting me/my ward as a subject for this study. I have also been given free choice for either being included or not in the study.

PROCEDURE:

I/my ward have been explained that, I/my ward will be subjected to 1.5T MRI screening of lumbosacral spine.

RISKS AND DISCOMFORTS:

I/my ward understand that I/my ward may experience some claustrophobic sensation during the procedure. I/my ward understand that necessary measures will be taken to reduce these complications as and when they arise.

BENEFITS:

I/my ward understand that my participation in this study will help to evaluate low back pain causes in young adults.

CONFIDENTIALITY:

I/my ward understand that medical information produced by this study will become a part of this Hospital records and will be subjected to the confidentiality and privacy regulation of this hospital. Information of a sensitive, personal nature will not be a part of the medical records, but will be stored in the investigator's research file and identified only by a code number. The code key connecting name to numbers will be kept in a separate secure location.

If the data are used for publication in the medical literature or for teaching purpose, no names will be used and other identifiers such as photographs and audio or video tapes will be used only with my special written permission. I understand that I may see the photograph and videotapes and hear audiotapes before giving this permission.

REQUEST FOR MORE INFORMATION:

I understand that I may ask more questions about the study at any time. Dr. Masudi Sheetal is available to answer my questions or concerns. I/my ward understand that I will be informed of any significant new findings discovered during the course of this study, which might influence my continued participation.

If during this study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me and that a copy of this consent form will be given to me for careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I/my ward understand that my participation is voluntary and I may refuse to participate or may withdraw consent and discontinue participation in the study at any time without prejudice to my present or future care at this hospital.

I/my ward also understand that Dr. Masudi Sheetal will terminate my participation in this study at any time after he has explained the reasons for doing so and has helped arrange for my continued care by my own physician or therapist, if this is appropriate.

INJURY STATEMENT:

I understand that in the unlikely event of injury to me/my ward, resulting directly to my participation in this study, if such injury were reported promptly, then medical treatment would be available to me, but no further compensation will be provided.

I understand that by my agreement to participate in this study, I am not waiving any of my legal rights.

I have explained to _____ the purpose of this research, the procedures required and the possible risks and benefits, to the best of my ability in patient's own language.

Date:

(Guide) (Investigator)

STUDY SUBJECT CONSENT STATEMENT:

I/my ward confirm that has explained to me the purpose of this research, the study procedure that I will undergo and the possible discomforts and benefits that I may experience, in my own language.

I/my ward have been explained all the above in detail in my own language and I understand the same. Therefore I agree to give my consent to participate as a subject in this research project.

_____ _____

(Participant) Date

_____ _____

(Witness to above signature) Date

MASTER CHART

SL.NO	AGE	SEX	DEGENERATIVE DISC					LUMBAR CANAL	SPONDYL	INFEC	SACROILTIS	TUMOUR	SCHMORL	HEMANGIOMA	RENAL/	PERNEUR	SEQUESTR
			L1-L2(1)	L2-3(2)	L3-L4(3)	L4-L5(4)	L5-S1(5)	STENOSIS	OLISTHESIS	TION	IS		NODE	IOMA	GYNAEC	AL CYSTS	ED DISC
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3.	35	M	0	1	1	1	1	1	0	0	0	0	0	1	0	0	0
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6.	28	M	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
7.	27	F	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
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79.	27	M	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0
80.	37	F	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0
81.	28	M	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
82.	29	F	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
83.	35	M	0	1	0	1	1	1	1	0	0	0	0	0	1	0	0
84.	31	M	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
85.	27	M	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0