Sudan University of Science and Technology

College of Graduate Studies

Evaluation of disc Prolapses in Cervical Spine using Magnetic Resonance Imaging

تقييم الإنزلاق الغضروفي للفقرات العنقية بإستخدام التصوير بالرنين المغناطيسي

A thesis Submitted for Partial Fulfillment of Requirements

ofM.Sc. degree in Diagnostic Radiological

By:

Mutasim Mahdi Hassan

Supervisor:

Dr. Asma Ibrahim Ahmed

(2016)

الآيـة

قال تعالى:

{هُوَ الَّذِي يُصَوِّرُكُمْ فِي الأَرْحَامِ كَيْفَ يَشَاءُ لاَ إِلَـهَ إِلاَّ هُوَ الْعَزِيزُ الْحَكِيمُ }

صدق الله العظيم

(آل عمران:6)

Dedication:

To everyone who lightened a dark spot in my mind ……..to my parents, to my family and my friend

Acknowledgment:

Firstly I thank my god for help to finish this work successfully.

I would like to express my deepest thanks to my super visor DR. Asma Ibrahim for her guidance.

I would like to thanks the MRI department of Royal Care International Hospital to talk with me for their cooperation in data collections.

I would like to thanks MR.Suhiab Mohamed Salih to help me in statistical analysis.

I also need to thanks all those who provided me the possibility to complete this work.

Abstract

MRI examination of cervical inter vertebral disc spine was done for 56 patients in Royal Care International Hospital to evaluate the efficiency of MRI image for detections of inter vertebral disc prolapsed at cervical spine. The aim of this study to assess the inter vertebral disc using MRI.This statistical study was conduct at Royal Care International Hospital from September to December 2016. Closed MRI machine were used. A total of 56 patient (male 30, female 26).with age range (20-76) who refer to MRI department. The result of study revealed that the mean and standard deviation of age, weight and heightwere 51.89-+15.94(years),83.36+-12.787(kg) and 178.16+10.931 (cm) respectively.Analysiswas obtained the researcher found the following: Males are more effect than females

Disc prolapse affect the cervical spine in people at the age of 62-75 years old. Common site of disc prolapse at the region of c2, c3, c4, c5, c6.

Disc prolapse can be detected with MRI by 99 %.MRI is procedure to choice in evaluation of inter vertebral disc prolapse. but it is not the only factor to determine the inter vertebral disc prolapse etiology , for that proper history and clinical examination are very necessary to determine the type of image needed , and also allow the technologist to focus the effort of examination at the proper disc prolapse level.

مستخلص البحث

تم إجراء الفحص بالرنين المغناطيسي للقرص الفقري العنقي ل 56 مريضا في مستشفى رويال كير العالمية لتقييم كفاءة التصوير بالرنين المغناطيسي للكشف عن الانزلاق في العمود الفقري العنقي.هدفت هذه الدراسة لتقييم القرص الفقري العنقي باستخدام التصوير بالرنين المغناطيسي. أجريت هذه الدراسة الإحصائية في مستشفى رويال كير العالمية من سبتمبر إلى ديسمبر 2016. تم استخدام آلة التصوير بالرنين المغنطيسي المغلقة. في مجموعه 56 مريض (30ذكور ، 26إناث)الفئة العمرية (20-76).

وكشفت نتيجة الدراسة أن الوسط الحسابي والانحراف المعياري للسن والوزن والطول كان 51.89- + 15.94 (سنوات)، 83.36 + -12.787 (كغ) و 178.16 + 10.931 (سم) على التوالي و وجد أن الذكور أكثر تأثرا من الإناث ,وأكثر فئه عمريه تأثرا من 62-75 سنة.

ووجد أن أكثر مناطق معرضه للإصابه بالإنزلاق الغضروفي هي الفقرات العنقيه (الثانيه,الثالثه,الرابعه,الخامسه ,السادسه).

يمكن الكشف عن انزلاق القرص بإستخدام التصوير بالرنين المغناطيسي بنسبة 99٪ . ولكن ليس هو العامل الوحيد لتحديد المسببات، لذلك التاريخ السليم والفحص السريري ضروريجدا لتحديد نوع الصورة المطلوبة، وأيضا السماح للتقني لتركيز جهود الفحص في مستوى الفقره المنزلقه.

`Table of Contents

List of Figure

<u>**List of Table**</u>

List of abbreviations:

MRI	magnetic resonance imaging
C.S	Cervical Spine
CT	computed tomography
GE	General electric
T	tesla
FOV	Field of view
HIZ	high-intensity zone
ADCs	apparent diffusion coefficients
MRA	magnetic resonance angiography
MDCT	multidetector-row computed tomography
NIS	number of involved segments
T1	Longitudinal relaxation time
T2	Transverse relaxation time
TR	Time of rebate
TE	Time to echo
AP	Antro posterior
RF	Radio frequency
SE	Spine echo
C1	First cervical vertebra
C2	Second cervical vertebra
C3	Third cervical vertebra
C4	Forth cervical vertebra
C5	Fifth cervical vertebra
C6	Six cervical vertebra
C7	Seven cervical vertebra
HNP	Herniated nucleus pulposes
spss	Statistical package for social science

Chapter One

Introduction

1-1 Introduction:

Vertebra bone of the neck and back provides structural support for the spine, protect and encases the spinal cord.

Radiologist and orthopedic surgeons use a number of different terms when they refer to disc problems , herniated disc ruptured disc , protruded disc , prolapsed disc and slipped disc generally all mean the same things.

The disc line between the end surfaces of the bony blocks (vertebrae) that make up the spine. They have a soft center with is sarwondid by tough outer ring, the disc allow move mint of the spine and also act as shock absorber. The nerve witch run from the brain to the arm and leg lies within spinal canal. As the nerves leave the spine to go to the musicale and skin, they pass very close to back of the disc. When disc is damage the soft center may slip out (prolapsed) and pass on nerve. The usual place for such prolapsed to occur in the lower back (lumber) region or occur in the neck (cervical) region.(Drake et.al,2009).

Inter vertebral disc space and disc prolapsed and most common pathology associated in the vertebral column .the cervical spine is the second common site. Spinal imaging firstly applied by plain x-ray and myelography replaced by computed tomography and recently MRI , these procedures regarding economic status of the patient and radiation protection .(keyomars,et.al,2015). MRI has opened new horizons in the diagnosis and treatment of many musculatal diseases. it demonstrates abnormalities in the bones and soft tissue before they become evident at other imaging modalities . the exquisite soft tissue contrast resolution , noninvasive nature and multiplanner capabilities of MR imaging make it especially valuable for the detection and assessment of verify of soft tissue disorder of the ligament (e.g. sprain) tendons (tendonitis , rupture , dislocation)another soft tissue strictures (e.g. sinuses tarsal syndrome , synovial disorders) MR imaging has also been shown to be highly sensitive in the detection and staging of number for musculoskeletal infections including cellulites and osteomyelitis in addition, MR imaging is excellent for the early detection and assessment of number of osseous abnormalities such as bone contusion , streets and insufficiency fractures, osteochondral fractures, osteonecrosis and transient bone marrow edema.

The first choice in diagnosing the cervical spine disc prolapsed in the emergency x-ray department is conventional x-ray radiograph. Conventional x-ray is use full for evaluating the spinal trauma. such as fractures , subluxation and arthopathies such as rheumatoid arthritis , x-ray generate imaging by striking a detector that either exposes a film or in sends the image to a computer . a dense tissue the body such as bones absorbs many of x-rays and looks white on an x-ray image. Less dense tissue such as muscles and organs absorb fewer of the x-ray and look like shades of grey on an x-ray image. X-ray that passes only through air looks black on image.

Claustrophobia is common problem in MRI examination room the sight of the magnet bore and un familiar surroundings increase their anxiety. The enclosing nature of the bore and equipment such as head coil in verify exaggerates any claustrophobic or nervous tendons

(Drake et.al, 2009).

1-2 Problems:

The inter vertebral disc disease continue to be common public health problem even with modern medicine in the 21 century. The MRI considers best modality to evaluate of disc prolapses in cervical spine using magnetic resonance imaging.

1-3 Objectives:

1-3-1 General objective:

Evolution of disc prolapses in cervical spine using magnetic resonance imaging.

1-3-2 Specific objectives:

- MRI imaging chractization of the inter vertebral disc prolapse change of the cervical spine.
- To evaluate which disk is mostly affected.
- To correlate between the vertebral disc with patient age.
- To correlate which gender affected.(male or female).
- To identify the changes associated with the cervical inter vertebral disc prolapse.

Chapter Two

Chapter Two

2-1 Theoretical back ground and literature review:

Anatomy of cervical spine (C-spine).The C-spine consists of seven vertebrae (C1–C7) and supports the weight of the head (Approximately 14 pounds). The first two vertebrae are called the axis and atlas, respectively, and do not have a disc between them, but are closely bound together by a complex of ligaments. The C1 (axis) “ring” rotates around the odontoid or “peg” of C2 (atlas), allowing for almost 50% of total cervical rotation. The spinal canal is housed within the cervical vertebrae and is widest between the C1 and C3 levels (A-P diameter 16–30 mm) and narrows as it progresses caudally (14–23 mm). When the neck is fully extended, this canal can narrow an additional 2–3 mm. (Drake et.al, 2009).

Cervical spine vertebrae differ from lumbosacral vertebrae in several ways. First, there are foramina on each side which allow passage of the vertebral arteries. Additionally, the facet joints in the C-spine have steeper angles which allow for more rotation between vertebrae without subluxation. The most important difference, however, is the nonsynovial joint, known as the uncovertebral joint or “joint of Luschka.” During midlife, this joint prevents a disc rupture from directly pressing onto the nerve root. This means that most disc herniation in the neck occur posteriorly (unlike the LS spine, in which most herniations occur laterally).

As we age, these joints can form osteophytes that can impinge upon the nerve root or compress the cervical cord directly causing cervical myelopathy The cervical spine is made up of the first 7 vertebrae, referred to as C1-7 (see the images below). It functions to provide mobility and stability to the head while connecting it to the relatively immobile thoracic spine. The cervical spine may be divided into 2 parts: upper and lower.(Drake et.al, 2009).

2-1-1Upper cervical spine:

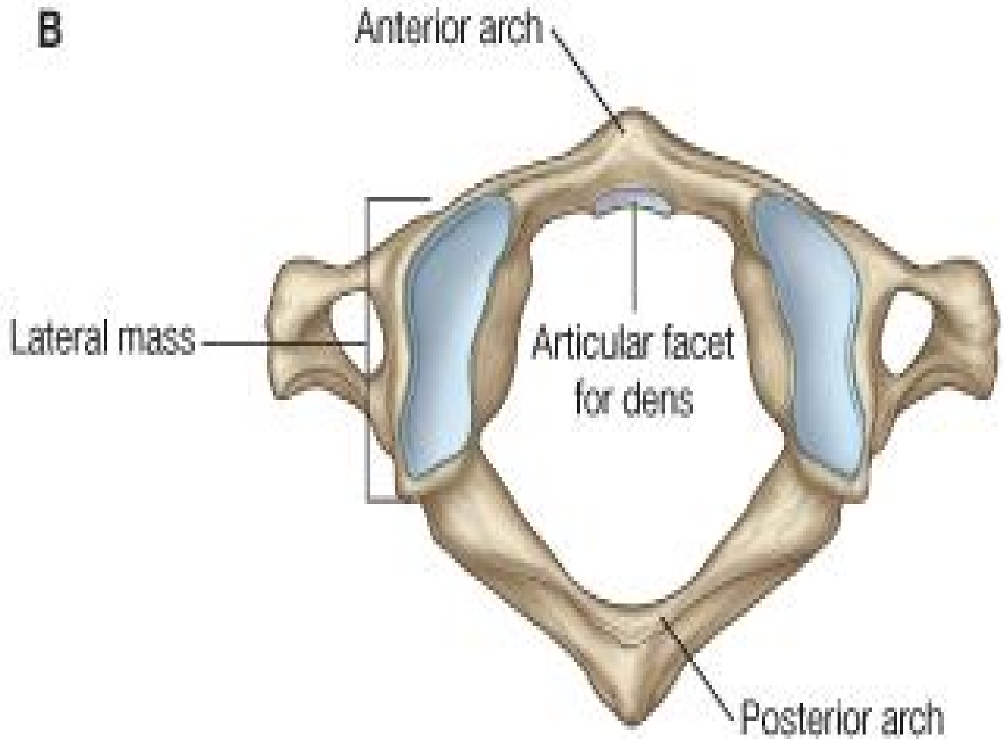
The upper cervical spine consists of the atlas (C1) and the axis (C2).These first 2 vertebrae are quite different from the rest of the cervical spine (see the image below). The atlas articulates superiorly with the occiput (the atlanto-occipital joint) and inferiorly with the axis (the atlantoaxial joint). The atlantoaxial joint is responsible for 50% of all cervical rotation; the atlanto-occipital joint is responsible for 50% of flexion and extension. The unique features of C2 anatomy and its articulations complicate assessment of its pathology.

Atlas (C1).The atlas is ring-shaped and does not have a body, unlike the rest of the vertebrae. Fused remnants of the atlas body have become part of C2, where they are called the odontoid process, or dens. The odontoid process is held in tight proximity to the posterior aspect of the anterior arch of the atlas by the transverse ligament, which stabilizes the atlantoaxial joint. The apical, alar, and transverse ligaments, by allowing spinal column rotation, provide further stabilization and prevent posterior displacement of the dens in relation to the atlas.(Drake et.al, 2009).

The atlas is made up of a thick anterior arch, a thin posterior arch, 2 prominent lateral masses, and 2 transverse processes. The transverse foramen, through which the vertebral artery passes, is enclosed by the transverse process.

On each lateral mass is a superior and inferior facet (zygapophyseal) joint. The superior articular facets are kidney-shaped, concave, and face upward and inward. These superior facets articulate with the occipital condyles, which face downward and outward. The relatively flat inferior articular facets face downward and inward to articulate with the superior facets of the axis.

According to Steele's rule of thirds, at the level of the atlas, the odontoid process, the subarachnoid space, and spinal cord each occupy one third of the area of the spinal canal. . (pansky,1996).



Fig(2.1) shows atlas (C1)(Stephen Kishner,etal,2015)

The axis has a large vertebral body, which contains the odontoid process (dens). The odontoid process articulates with the anterior arch of the atlas via its anterior articular facet and is held in place by the transverse ligament. The axis is composed of a vertebral body, heavy pedicles, laminate, and transverse processes, which serve as attachment points for muscles. The axis articulates with the atlas via its superior articular facets, which are convex and face upward and outward. (pansky,1996).

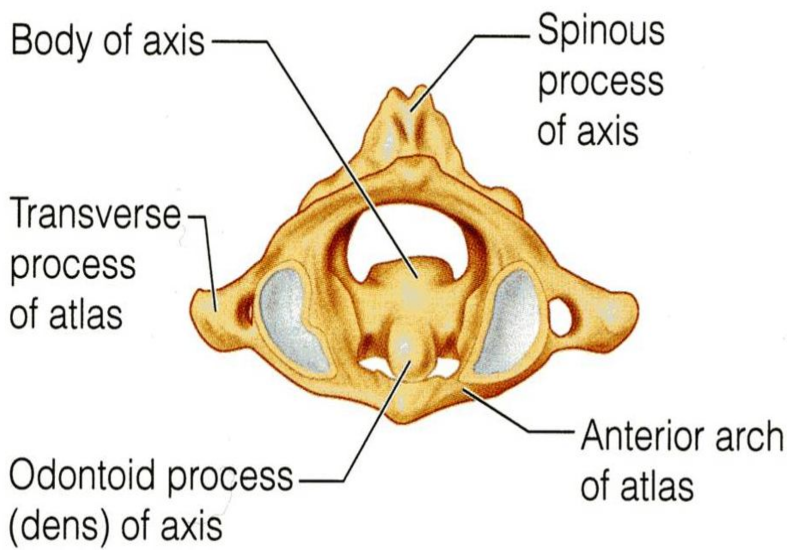


Fig (2-2) shows the axis(c2)(Stephen Kishner,etal,2015)

2-1-2Lower cervical spine**:**

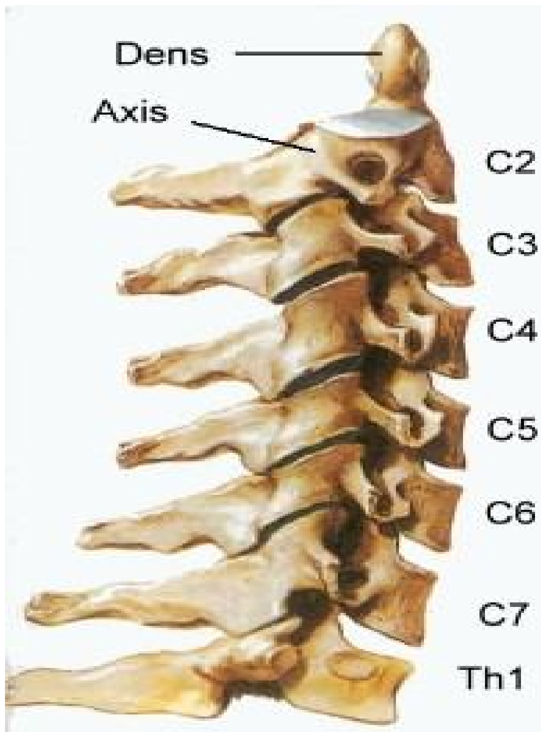
The 5 cervical vertebrae that make up the lower cervical spine, C3-C7, are similar to each other but very different from C1 and C2. Each has a vertebral body that is concave on its superior surface and convex on its inferior surface (see the image below). On the superior surfaces of the bodies are raised processes or hooks called uncoated processes, each of which articulates with a depressed area on the inferior lateral aspect of the superior vertebral body.(Drake et.al, 2009).

2-1-3Intervertebral disks

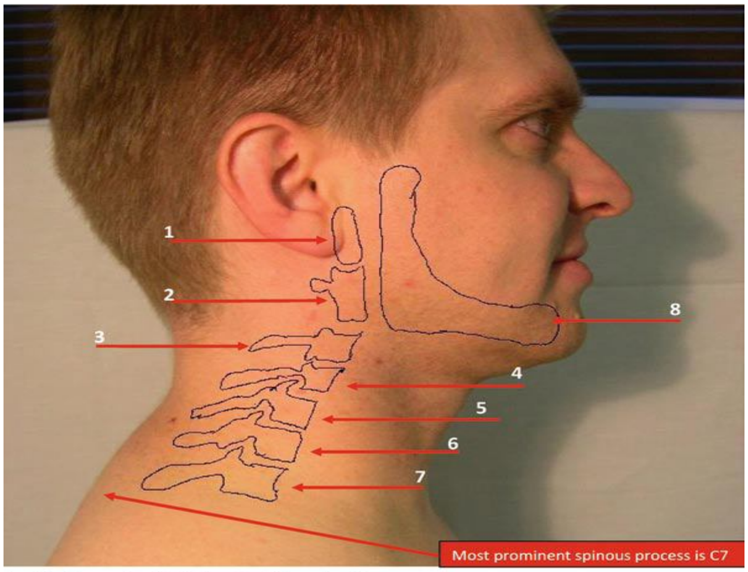
Intervertebral discs are located between the vertebral bodies of C2-C7. Intervertebral disks are located between each vertebral body caudate to the axis. These disks are composed of 4 parts: the nucleus pulpous in the middle, the annulus fibrosis surrounding the nucleus, and 2 end plates that are attached to the adjacent vertebral bodies. They serve as force dissipaters, transmitting compressive loads throughout a range of motion. The disks are thicker anteriorly and therefore contribute to normal cervical lordosis.

The intervertebral disks are involved in cervical spine motion, stability, and weight-bearing. The annular fibers are composed of collagenous sheets (lamellae) that are oriented at a 65-70° angle from the vertical and alternate in direction with each successive sheet. As a result, they are vulnerable to injury by rotation forces because only one half of the lamellae are oriented to withstand force applied in this direction.

The middle and outer one third of the annulus is innervated by nociceptors. Phospholipase A2 has been found in the disc and may be an inflammatory mediator. (Haughton,2006).



Fig(2-3) shows all cervicalvertebrahttps://www.spineuniverse.com/conditions/neck-pain/degenerative-cervical-spine-disorders



1 – C1 Atlas 2 – C2 Axis 3 – C3 4 – C4
5 – C5 6 – C6 7 – C7 8 – Mandible

Fig(2-4) shows all part of cervical spine

http://www.spine-health.com/conditions/spine-anatomy/cervical-spine-anatomy-and-neck-pain

The human spine consists of alternating bony vertebrae and intervertebral discs extending from the neck to the coccyx. The upper portion of the spine in the region of the neck is called the cervical spine. (pansky,1996).

This portion allows movement of the neck and supports the head during head movements. The intervertebral discs are the ‘shock absorbers’ of the body and are composed of an outer strong fibrous membrane and an inner ‘jelly-like’ nucleus giving both strength and elasticity.

A disc prolapse occurs when there is a weakening in the outer membrane leading to a protrusion of the inner nucleus. This protrusion usually heads poster laterally towards the lateral parts of spinal canal which contains the nerve root. Occasionally the protrusion heads more centrally and can cause compression of the spinal cord. (Drake et.al, 2009).

There is no known cause of cervical disc prolapses. Heavy lifting and straining may exacerbate the condition. Traumatic disc prolapses may occur with localized high velocity pressure. The presence of any associated cervical canal stenosis will result in a higher likelihood of neurological symptoms with a cervical disc prolapse(Haughton,2006).

SIGNS AND symptoms**:** a variety of symptoms are present with a cervical disc prolapse may occur due to the acute disc rupture itself, and any pressure that may occur on neurological structures as a result and includes: neck pain, radicular (arm) pain, focal neurological deficits (weakness, numbness, tingling),myelopathy.

Neck Pain**:**Severe neck pain radiating to the back of the head and down between the shoulder blades may be present with an acute disc prolapse. This is due to the sensory innervation of the disc annulus itself.

There will often be associated muscle spasm, aimed at limiting movement of the neck and relieving pain. However, spasm in itself may cause generalizedneck pain.

Radicular (arm) pain & Focal Neurological DeficitsApostero-lateral disc prolapse may result in pressure on the exiting nerve roots. The nerve roots supply power and sensation to the arms and severe radicular pain (pain shooting into the arm) may occur in a specific nerve distribution. Numbness and tingling may also occur in the same region. Continued pressure on the nerve roots may result in permanent damage and weakness of the arm.

2-1-4Myelopathy:

A large or central disc prolapse may result in pressure on the spinal cord. This may result in disruption of the nerve signals to the legs and cause spastic legs, hyper-reflexes legs and difficulty walking (myelopathy).

It may also result in radicular symptoms with pain shooting into the arms, torso or legs. There may also be loss of control of the bowel and bladder function. (Haughton,2006).

Cervical Disc Prolapse: investigations:

Plain x-rays – these are usually taken to rule out any fracture or misalignment. Dynamic x-rays taken in flexion and extension may be performed to document any instability. Plain x-rays do not give any information on nerve root or spinal cord

Compression.

CT C-spine – this is usually ordered by the GP for neck pain/radicular symptoms. It gives some information on bony alignment but often fails to demonstrate a disc prolapse. Occasionally it is combined with a milligram to demonstrate any functional compression/obstruction.

MRI C-spine – this is the gold standard in looking for cervical disc prolapses and to delineate the degree of nerve root or spinal cord compression. (Haughton,2006).

2-2 The Cervical Spine: Roles and Functionalities(physiology)

The cervical spine performs several crucial roles, including

Housing and protecting the spinal cord. A bundle of nerves that extends from the brain and runs through the cervical spine and thoracic spine (upper and middle back) prior to ending just before the lumbar spine (lower back), the spinal cord relays messages from the brain to the rest of the body.

Supporting the head and its movement. The cervical spine literally shoulders a big load, as the head weighs on average between 10 and 13 pounds. In addition to supporting the head, the cervical spine allows for the head's flexibility, including rotational, forward/back and side bending motions.

Facilitating flow of blood to the brain. Vertebral openings (vertebral foramen) in the cervical spine provide a passageway for vertebral arteries to pass and ensure proper blood flow to the brain. These openings are present only in the vertebrae of the cervical spine

The movement of nodding the head takes place predominantly through flexion and extension at the atlanto-occipital joint between the atlas and the occipital bone. However, the cervical spine is comparatively mobile, and some component of this movement is due to flexion and extension of the vertebral column itself. This movement between the atlas and occipital bone is often referred to as the "yes joint", owing to its nature of being able to move the head in an up-and-down fashion.

The movement of shaking or rotating the head left and right happens almost entirely at the joint between the atlas and the axis, the atlanto-axial joint. A small amount of rotation of the vertebral column itself contributes to the movement. This movement between the atlas and axis is often referred to as the "no joint", owing to its nature of being able to rotate the head in a side-to-side fashion

http://www.spine-health.com/conditions/spine-anatomy/cervical-spine-anatomy-and-neck-pain

2-3Pathology

Degenerative Cervical Spine Disorders

The cervical spine is the most flexible anatomic region in the axial skeleton. Distinct segments of the cervical spine give us the ability to perform complex neck motions like head turning or tilting and to carry weight or absorb impact while protecting the delicate spinal cord and nerve roots that pass through te cervical vertebra. Vital supportive structures of the cervical spine, such as the discs, facet joints, and surrounding ligaments, are subject to repetitive injury and degeneration from normal activities, such as work or sports, and from aging, stress, or trauma.

The Occipito-cervical Junction

Instability in the atlanto-occipital joint results in hyper mobility of the junction between the head and the neck, which can cause severe pain or paralysis. It may result from rheumatoid arthritis or congenital defects that can accelerate degenerative arthropathy. The Neurospinal Disorders Program at UCSF uses the latest developments in imaging, computer-assisted surgery, and instrumentation to provide safer and more-effective decompression and arthrodesis.

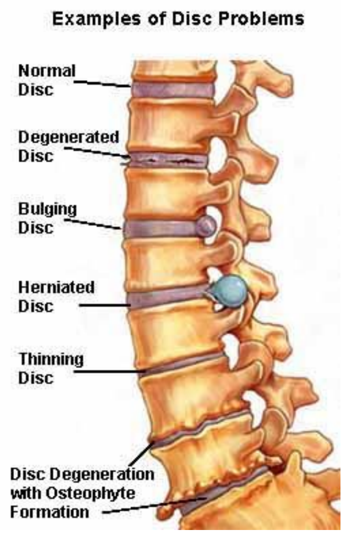
The Atlanto-Axial (C1-2) Joint

Chronic C1-2 instability and subsequent joint degeneration is primarily caused by trauma, congenital odontoid insufficiency, or rheumatoid arthritis. Our neurosurgeons have substantial experience with complex surgical procedures, including use of either transarticular screws or pedicle screws to restore stability to this segment without injuring the vertebral arteries.

Degenerative Cervical Disorders ,Cervical Spinal Stenosis,

An important feature of disc degeneration is the reaction that the bone undergoes. Because the normal relationships of the bones are lost, there is a condition of instability. This refers to one vertebra moving in an abnormal manner in relation to the next vertebra.

To attempt to stabilize this excess motion, bone grows outward. These outward growths are called osteophytes. Osteophytes can be found near the disc spaces and around the facet joints. Osteophytes take up space. If they grow in areas where nerves or the spinal cord are nearby, they can impinge or compress these structures. This can cause pain, numbness, tingling, or weakness to varying degrees. This is known as cervical stenosis



Fig(2-5) shows cervical spine stenosis

Cervical Disc Herniation**:** Disc degeneration can sometimes follow a slightly different course. In the process of sustaining increased mechanical loads, the outer aspect of the disc, known as the anulusfibrosus, can become stressed. With time, small tears can form in the anulus.

This outer ring normally keeps the soft, gel-like center of the disc contained. The gel center, known as the nucleus, can be ejected from the disc through an anular tear. This is called a disc herniation. If the disc herniates in the direction of the spinal cord or nerve root, it can cause neurologic compromise. Disc herniations in the cervical spine can be serious. If significant enough, they can cause paralysis of both the upper and lower extremities, though this is extremely rare.

In most cases, a patient complains of neck pain associated with radiating pain to one arm. This is caused by compression of a nerve root, rather than the spinal cord itself. With time, some herniated discs resolve or shrink by themselves. Sometimes, disc herniations can persist, causing prolonged symptoms and neurologic problems, which may lead to surgical considerations.

2-3-1 Cervical Spondylosis:

This rather elaborate sounding word is really nothing more than a description of what happens to the vast majority of our cervical spines as we get older. The term spondylosis refers to the bony overgrowths associated with aging of the spine.

Though it is hypothesized, as discussed, that osteophytes form because of micro-instability and disc degeneration, this is not certain. It is known that a high percentage of patients without any neck pain or other symptoms have spondylosis of the spine.

In some people, however, spondylosis may be associated with neck pain. Spondylosis is likely the end result of disc degeneration that has been present for a very long time.

https://www.spineuniverse.com/conditions/neck-pain/degenerative-cervical-spine-disorders

2-3-2 Cervical disc herniation:

The bones (vertebrae) that form the spine in your back are cushioned by round, flat discs. When these discs are healthy, they act as shock absorbers for the spine and keep the spine flexible. If they become damaged, they may bulge abnormally or break open (rupture), in what is called a herniated or slipped disc. Herniated discs can occur in any part of the spine, but they are most common in the neck (cervical) and lower back (lumbar) spine. The seven vertebrae between the head and the chest make up the cervical spine.

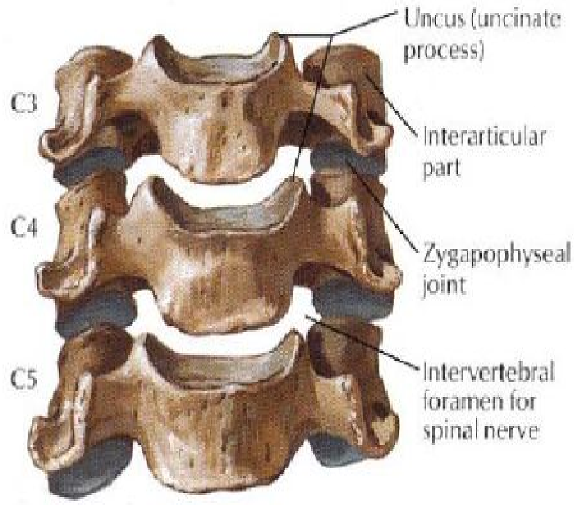
2-4 MRI of Cervical Disc Prolapse

The presence of intractable radicular pain and neurological deficit is an indication for operative neurosurgical treatment. Neurosurgical treatment aims to relieve symptoms via decompressing nerves and with or without stabilizing the spine (Sutton david,2003).

The disc herniation is the condition in which a tear in the annulus fibrosis "outer firmer ring" of an intervertebral disc allow the soft central portion nucleus prolapse" to lodge out. When the disc introduce into the spinal cord disc displacement or herniation it my compress the spinal cord or nerve.(JNeurosci,2005).

Herniated nucleus pulposes (HNP) result from repetive cervical stress or, rarely from a single traumatic incident. Increased risk may occur because of vibration stress, heavy lifting, prolonged sedentary position whiplash accidents frequent acceleration /deceleration. Aging also plays an important role. (keyoumars,2015).

Manifestation of HNP is divided into sub categories by type (disc bulge, protrusion, extortion, sequestration). Disc bulge describe generalized symmetrical extension of the disc margin the margins of the adjacent vertebral end plates. Disc protrusion describes herniation of nuclear material extinction of the disc margin. Extrusion applies to herniation of nucleuses material resulting in an anterior extradural mass attaches to the nucleus of origin, often via pedicles. Disc sequestration refers to sab ration of material from the disc, which ultimately comes to lie in the spinal canal. (keyoumars,2015).



Fig(2-6) show lower cervical part

www.vbsc.org.au

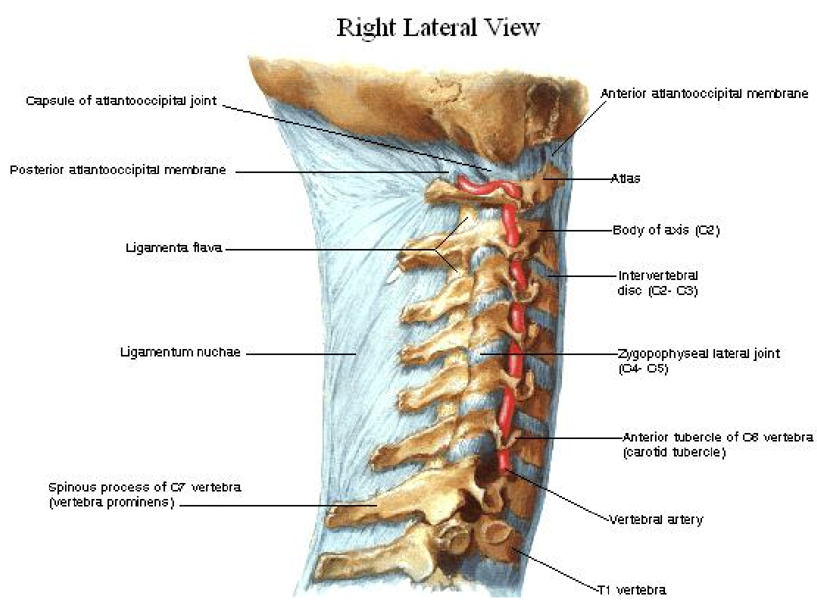


Fig (2-7) show all cervical spine, ligament and artery

www.vbsc.org.au

2-4-1 Protocol and Technique:

We recruited a total of 56 volunteers male and female; . Most of them were known to the investigators, and were chosen to provide a range of age groups in both genders. No subject had any current symptoms related to the cervical spine, such as neck pain or brachialgia, and had no previous history of disease or trauma to the cervical spine or brain which had needed medical care. These criteria were confirmed by a questionnaire before MRI, but no detailed neurological examination was performed. It was difficult to exclude possible minor symptoms in the past, since episodes of mild neck pain, brachialgia or shoulder girdle pain could be forgotten; MRI is often used for patients with cervical spine disorders.

Its high sensitivity for detecting disc disease1-4 allows it to show degeneration in both symptomatic and asymptomatic patients. Bodenet al5 consider that abnormal MRI findings in asymptomatic subjects are false-positive results, since itfor this reason we used the criterion of medical care for a cervical disorder.

Imaging**.**We performed MRI using a 1.5 T MRI scanner (Signa: GE Medical Systems, Milwaukee, Wisconsin) with a phased array coil or a 0.5 T MRI scanner (Resona; Yokogawa Medical Systems, Tokyo, Japan) with a surface neck coil. With the 1.5 T scanner we obtained T1-weighted sagittal images (T1WSI), T2-weighted sagittal images (T2WSI), and T1-weighted axial images (T1WAI) using fast spin-echo sequences (T1WI: TR/TE 520/12 ms, echo train length 4; T2WI: 5000/102 ms, echo train length 16; slice thickness 5 mm, no slice gap, field of view (FOV) 24 cm for sagittal images and 16 cm for axial images, matrix 256 _ 192, 4 excitations). With the 0.5 T scanner, we obtained conventional spin-echo images (T1WI: TR/TE

450 to 500/20 ms; T2WI: 2000/100 ms; slice thickness 7 mm, no slice gap, FOV 25 cm for sagittal images and 20 cm for axial images, matrix 256 _ 256 or 256 _ 192, 2 excitations for T2WSI and 4 excitations for T1WSI and T1WAI).

We examined 134 subjects using the 1.5 T and 363 with the 0.5 T scanner. The age distribution of the subjects in these two groups was matched approximately, although most of the teenagers and men in their fifties were studied using the 0.5 T scanner

Interpretation.Before any of the MRI images were studied, a grading system was developed by spine surgeons and a neuroradiologist to evaluate disc degeneration, posterior disc protrusion, anterior disc protrusion, narrowing of the disc space and foraminal stenosis. We defined disc degeneration as a decrease in signal intensity on T2WSI, graded from 0 to 2. Anterior or posterior protrusion was recorded if disc material extended beyond the confines of the vertebral bodies on T1WSI.5 Disc protrusion with bony spurs was recorded only when the disc material.

2-5previous study:

Ali Hassan A. Ali et al 2014 Cervical spine is considered to be the most moving part of vertebral column. It is located in a very important part of the body i.e. neck having some very important structures related to it. Any age related changes occurring in such a part of vertebral column may lead to many disorders and disabilities. Complete familiarity of this entire region anatomically as well as radiologically is therefore of utmost importance for the diagnosis and management of such disorders. Aim of this work is to evaluate the frequency of age related degeneration in cervical spine in Saudi adult asymptomatic subjects using CT scan images. Methods: In this study, 105 cases of symptomless adults ranging between 18 - 90 years of age were included. The cases were classified into 3 groups; adult group (18 - 35 years old), middle age group (36 - 55 years old) and old age group (56 - 90 years old). Their CT scans were performed in the department of radiology, King Khalid Hospital, Al Kharj and studied for any age related changes. Results: The first age group category included 35 cases; 20 had normal and 15 degenerative changes. The second category included 35 cases; 3 had normal and 32 degenerative changes. The third category included 35 cases. Single had normal and 34 degenerative changes. Conclusion: Asymptomatic degenerative changes are common in the cervical spine after 30 years of age in Saudi adult asymptomatic subjects.

Kerttula et al 2001 Magnetic resonance imaging (MRI) provides important information about structural and biochemical changes in organs. MRI is also an effective imaging method for the evaluation of spinal disorders. However, many of its potential applications - particularly diffusion imaging - have not yet been thoroughly explored. The purpose of this study was to determine the MRI-detectable changes in the intervertebral disc after trauma and to test the feasibility of diffusion-weighted MR imaging of the intervertebral discs. A minipig model was used in the experimental study to determine the MRI changes in the intervertebral disc after peripheral annular lesions in different time frames. Three of eight discs with experimental annular lesions had a normal annular appearance in MRI. Annular lesions, when detectable, were manifested as a bulging of the disc or as a high-intensity zone (HIZ) inside the annulus. Either the signal intensity or the area of bright signal intensity in the nucleus had nearly always decreased after one month, but they were still detectable even in cases where no signs of annular trauma could be seen in the MR images. The histology of HIZ is presented for the first time: clusters of nuclear cells and disorganized granulation tissue with capillaries were detected in the HIZ area. Fourteen patients 8 to 21 years of age with histories of vertebral fracture at least one year previously and 14 asymptomatic healthy control subjects 8 to 22 years of age were studied by MRI. In these young people a vertebral fracture, especially with end-plate injury, proved to be a notable risk factor for initiating disc degeneration. The apparent diffusion coefficients (ADCs) of the thoracolumbar intervertebral discs were determined in three orthogonal directions in 18 healthy young volunteers aged 8-22 years. The ADCs were also determined in 10 young patients with previous vertebral fractures, and clear decreases were found in the ADCx and ADCy directions, but in the ADCz direction values had not changed significantly as compared to the values in the controls. The most marked changes were observed in the degenerated discs, followed by those in the discs with a normal signal intensity adjacent to the primary trauma area. Diffusion-weighted MR imaging affords a useful tool for evaluating disc diseases in the early phases. Additionally, 37 adult volunteers without back symptoms were studied by MRI and by magnetic resonance angiography (MRA) and it was found that the status of the lumbar arteries significantly explained the diffusion values in the lumbar intervertebral discs. The correlation between disc degeneration and diffusion was mostly linear, but not significant.

Stolworthy DK et al 2015 Animal models have historically provided an appropriate benchmark for understanding human pathology, treatment, and healing, but few animals are known to naturally develop intervertebral disc degeneration. The study of degenerative disc disease and its treatment would greatly benefit from a more comprehensive, and comparable animal model. Alpacas have recently been presented as a potential large animal model of intervertebral disc degeneration due to similarities in spinal posture, disc size, biomechanical flexibility, and natural disc pathology. This research further investigated alpacas by determining the prevalence of intervertebral disc degeneration among an aging alpaca population. Twenty healthy female alpacas comprised two age subgroups (5 young: 2-6 years; and 15 older: 10+ years) and were rated according to the Fireman-grade for degeneration of the cervical intervertebral discs. Incidence rates of degeneration showed strong correlations with age and spinal level: younger alpacas were nearly immune to developing disc degeneration, and in older animals, disc degeneration had an increased incidence rate and severity at lower cervical levels. Advanced disc degeneration was present in at least one of the cervical intervertebral discs of 47% of the older alpacas, and it was most common at the two lowest cervical intervertebral discs. The prevalence of intervertebral disc degeneration encourages further investigation and application of the lower cervical spine of alpacas and similar camelids as a large animal model of intervertebral disc degeneration.

Mario Matsumoto et al 1998 studied degenerative changes in the cervical intervertebral discs of 497 asymptomatic subjects by MRI and evaluated disc degeneration by loss of signal intensity, posterior and anterior disc protrusion, narrowing of the disc space and foramina stenosis. In each subject, five disc levels from C2-C3 to C6-C7 were evaluated. The frequency of all degenerative findings increased linearly with age. Disc degeneration was the most common observation, being present in 17% of discs of men and 12% of those of women in their twenties, and 86% and 89% of discs of both men and women over 60 years of age. We found significant differences in frequency between genders for posterior disc protrusion and foraminal stenosis. The former, with demonstrable compression of the spinal cord, was observed in 7.6% of subjects, mostly over 50 years of age. Our results should be taken into account when interpreting the MRI findings in patients with symptomatic disorders of the cervical spine.

Eijiro Okada et al 2010 Abstract An association between progression of cervical disc degeneration and that of lumbar disc degeneration has been considered to exist. To date, however, this association has not yet been adequately studied. Age-related changes in the cervical intervertebral discs were evaluated by magnetic resonance imaging (MRI) in patients with lumbar disc herniation, and compared with the MRI findings of healthy volunteers without lower back pain. The purpose of this study was to clarify whether the prevalence of asymptomatic cervical disc degeneration is higher in patients with lumbar disc herniation than in healthy volunteers. The study was conducted on 51 patients who were diagnosed as having lumbar disc herniation and underwent cervical spine MRI. The patients consisted of 34 males and 17 females ranging in age from 21–83 years (mean 46.9 ± 14.5 years) at the time of the study. The control group was composed of 113 healthy volunteers (70 males and 43 females) aged 24–77 years (mean 48.9 ± 14.7 years), without neck pain or low back pain. The percentage of subjects with degenerative changes in the cervical discs was 98.0% in the lumbar disc herniation group and 88.5% in the control group ($p = 0.034$). The presence of lumbar disc herniation was associated significantly with decrease in signal intensity of intervertebral disc and posterior disc protrusion in the cervical spine. None of the MRI findings was significantly associated with the gender, smoking, sports activities, or BMI. As compared to healthy volunteers, patients with lumbar disc herniation showed a higher prevalence of decrease in signal intensity of intervertebral disc and posterior disc protrusion on MRI of the cervical spine. The result of this study suggests that disc degeneration appears to be a systemic phenomenon.(11)

JiSook Yi et al 2015 to assess inter-modality variability when evaluating cervical intervertebral disc herniation using 64-slice multidetector-row computed tomography (MDCT) and magnetic resonance imaging (MRI). Materials and Methods: Three musculoskeletal radiologists independently reviewed cervical spine 1.5-T MRI and 64-slice MDCT data on C2–3 though C6–7 of 51 patients in the context of intervertebral disc herniation. Interobserver and intermodality agreements were expressed as unweighted kappa values. Weighted kappa statistics were used to assess the extents of agreement in terms of the number of involved segments (NIS) in disc herniation and epicenter measurements collected using MDCT and MRI. Results: The interobserver agreement rates upon evaluation of disc morphology by the three radiologists were in fair to moderate agreement (k = 0.39–0.53 for MDCT images; k = 0.45–0.56 for MRIs). When the disc morphology was categorized into two and four grades, the inter-modality agreement rates were moderate (k-value, 0.59) and substantial (k-value, 0.66), respectively. The inter-modality agreements for evaluations of the NIS (k-value, 0.78) and the epicenter (k-value, 0.79) were substantial. Also, the interobserver agreements for the NIS (CT; k-value, 0.85 and MRI; k-value, 0.88) and epicenter (CT; k-value, 0.74 and MRI; k-value, 0.70) evaluations by two readers were substantial. MDCT tended to underestimate the extent of herniated disc lesions compared with MRI. Conclusion: Multidetector-row computed tomography and MRI showed a moderate-to-substantial degree of inter-modality agreement for the assessment of herniated cervical discs. MDCT images have a tendency to underestimate the anterior/ posterior extent of the herniated disc compared with MRI.

Dean K. Stolworthy et al 2015 study models have historically provided an appropriate benchmark for understanding human pathology, treatment, and healing, but few animals are known to naturally develop intervertebral disc degeneration. The study of degenerative disc disease and its treatment would greatly benefit from a more comprehensive, and comparable animal model. Alpacas have recently been presented as a potential large animal model of intervertebral disc degeneration due to similarities in spinal posture, disc size, biomechanical flexibility, and natural disc pathology. This research further investigated alpacas by determining the prevalence of intervertebral disc degeneration among an aging alpaca population. Twenty healthy female alpacas comprised two age subgroups (5 young: 2–6 years; and 15 older: 10þ years) and were rated according to the Pfirrmann-grade for degeneration of the cervical intervertebral discs. Incidence rates of degeneration showed strong correlations with age and spinal level: younger alpacas were nearly immune to developing disc degeneration, and in older animals, disc degeneration had an increased incidence rate and severity at lower cervical levels. Advanced disc degeneration was present in at least one of the cervical intervertebral discs of 47% of the older alpacas, and it was most common at the two lowest cervical intervertebral discs. The prevalence of intervertebral disc degeneration encourages further investigation and application of the lower cervical spine of alpacas and similar camelids as a large animal model of intervertebral disc degeneration. 2015 Orthopaedic Research Society.(11)

Chapter Three

Chapter Three

Material and Methods:

3-1Material:

3-2-Patients and Methods:

Type of study:

This is descriptive and analytic study

Place and time of study:

This study was performed at Radiology department of Royal care international hospital, during the period from September to December 2016.

3-3 Study sample:

This study included 56 patients all selected from patients who were referred to the MRI Scan. (Gender).

3-4 Data collection:

The data were collected by account the number of MRI scans in master data table (appendix).

Data Analysis:

The data were analyzed by using SPSS program version 20 and excel data sheet, variables using descriptive tables, frequency, percentage distribution tables, cross tabulation between the variables and then all data were presented in graphs as bar graph and scatter plot diagram.

3-5 MRI Technique:

Patient positioning:

The patient lining supine on the examination couch with their knees elevated over atom bad, for comfort and to flatten the lumber and cervical spine so that the spine lining near the coil. The coil should extend c1 from to c7 to adequate cover of the cervical region. The patient is positioning so that the longitudinal alignment light lies in the mid line.(Cathrerine Westbrook,etal.2011)

3.6 Patient consideration:

Many patients are in severe pain especially if they are suffering from prolapsed cervical disc. Make the patient as comfortable as possible with pads supporting their knees in slightly flexion position. Small pads placed in lumber curve often help to alleviate sciatica and other types of back pain. Due to excessively loud gradient noise associated with some sequences, ear plugs must always be provided to prevent hearing impairment..(Cathrerine Westbrook,etal.2011)

Chapter Four

Results

Chapter Four

Table(4.1) shows statistical parameters for all patients

	age	weight	high
Mean	51.89	83.36	178.16
Median	52.50	84.00	180.00
Std. Deviation	15.948	12.787	10.931
Minimum	20	55	140
Maximum	85	120	197

Table (4.2) shows gender distribution

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female valied	26	46.4	46.4	46.4
Male	30	53.6	53.6	100.0
Total	56	100.0	100.0	

Table (4.3) shows indications distribution of for patients:

Indication		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disk	17	30.4	30.4	30.4
	Fell down	1	1.8	1.8	32.1
	Neck Pain	25	44.6	44.6	76.8
	Num press	1	1.8	1.8	78.6
	with out	1	1.8	1.8	80.4
	Upper pain	1	1.8	1.8	82.1
	RTA	2	3.6	3.6	85.7
	Hand pain	1	1.8	1.8	87.5
	Trauma	7	12.5	12.5	100.0
	Total	56	100.0	100.0	

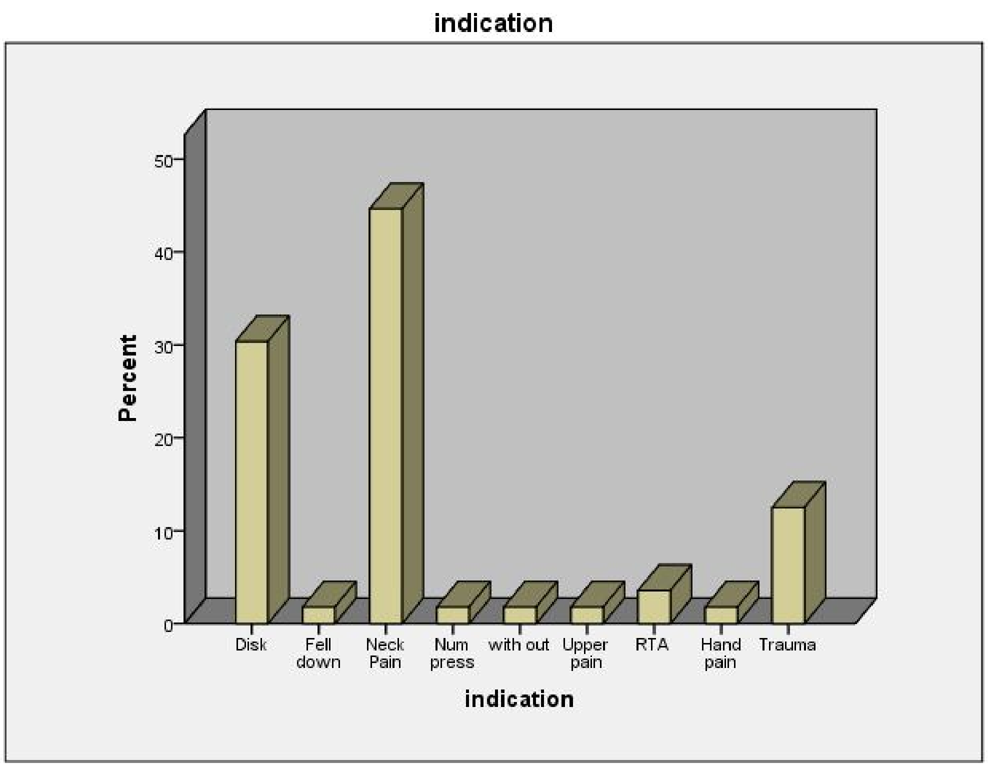


Figure 4.1 shows indications distribution of for patients

Table (4.4) shows age group percentage

age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30	8	14.3	14.3	14.3
	31-40	6	10.7	10.7	25.0
	41-50	12	21.4	21.4	46.4
	51-60	12	21.4	21.4	67.9
	61-75	14	25.0	25.0	92.9
	>76	4	7.1	7.1	100.0
	Total	56	100.0	100.0	

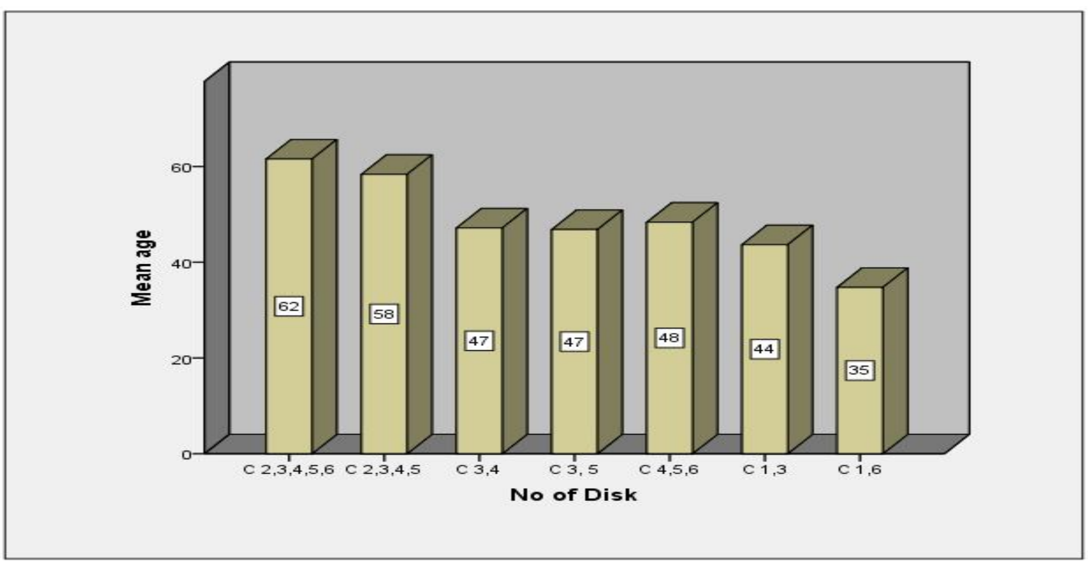


Figure 4.2shows correlation between site of disc and patient age

Table 4.5 show the indications of disk according to cervical disk

Indication		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disk	17	30.4	30.4	30.4
	Fell down	1	1.8	1.8	32.1
	Neck Pain	25	44.6	44.6	76.8
	Numbness	1	1.8	1.8	78.6
	with out	1	1.8	1.8	80.4
	Upper pain	1	1.8	1.8	82.1
	RTA	2	3.6	3.6	85.7
	Hand pain	1	1.8	1.8	87.5
	Trauma	7	12.5	12.5	100.0
	Total	56	100.0	100.0	

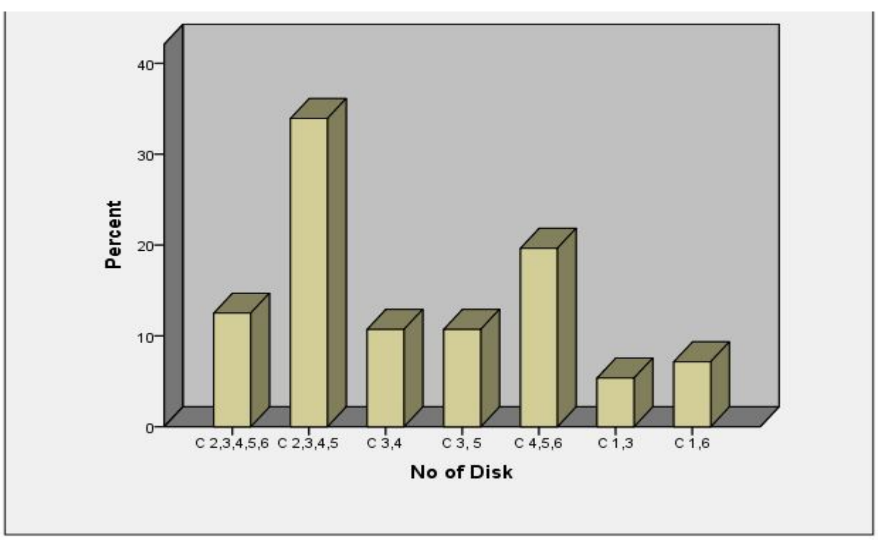


Figure 4.3 show the percentage of common site of disc prolapse

Table 4.5 show Age group percentage

age	Frequency	Percent	Valid Percent	Cumulative Percent
20-30	8	14.3	14.3	14.3
31-40	6	10.7	10.7	25.0
41-50	12	21.4	21.4	46.4
51-60	12	21.4	21.4	67.9
61-75	14	25.0	25.0	92.9
>76	4	7.1	7.1	100.0
Total	56	100.0	100.0	

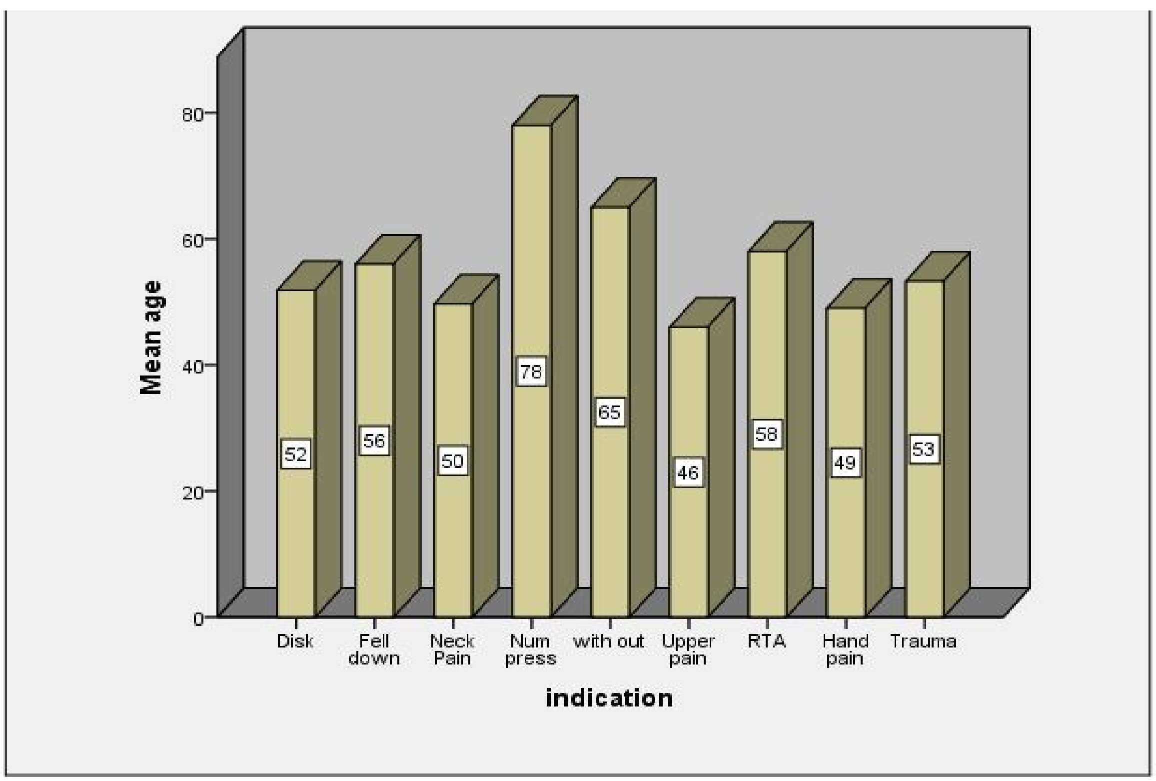


Figure 4.4 shows corilations petwen patient age and indications

Table 4.5 show Age group percentage

age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30	8	14.3	14.3	14.3
	31-40	6	10.7	10.7	25.0
	41-50	12	21.4	21.4	46.4
	51-60	12	21.4	21.4	67.9
	61-75	14	25.0	25.0	92.9
	>76	4	7.1	7.1	100.0
	Total	56	100.0	100.0	

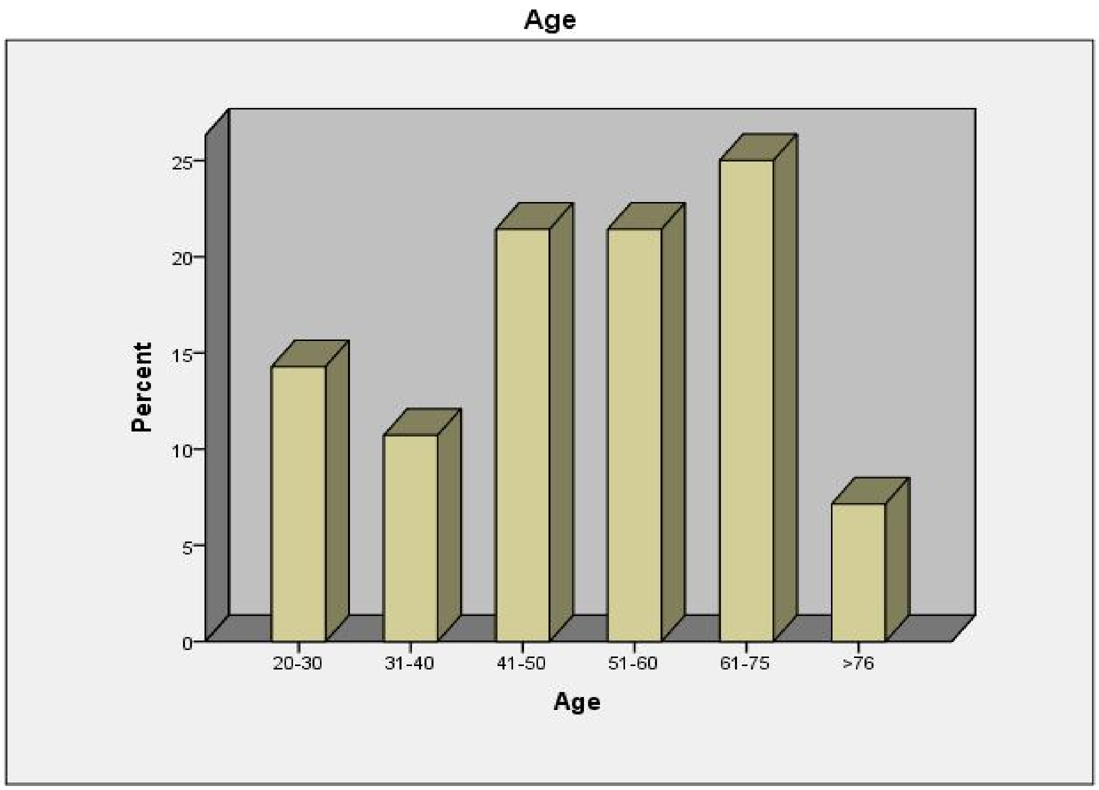


Fig 4.5 show distribution of age groups

Chapter Five

Discussion, Conclusion &Recommendations

5.1Discussion:

Inter vertebral disc prolapse are the most common medical problem, the aim of this study was to assess of inter vertebral disc prolapse using MRI..This study conducted on 56 patient who refer to MRI department 30 males and 26 females their age from 20 to 76 years old and Wight range from 55 to 120.

In this study the researcher evaluated the incidence of cervical disc prolapsed using MRI technology and collected data and tables according to the reports of cases and he found the following:

Males are more affected than females (53.6) and (46.4) respectively. Table (4-2)

The disc prolapsed affect the age of (61-75) More than the others. Table (4-5).

The most indication for disc prolapsed is neck pain, then history of disc and thin trauma (44.6), (30.4), (12.5) respectively table (4.3)

The most common site of cervical disc prolapsed is (c2-c6) figure (4.2) and its most in patient between (50-60) diagram (4.5).

5-2 Conclusion:

Inter vertebral disc prolapse is the most common case of neck pain, numbness and disc prolapse.MRI was very sensitive in diagnosis of cervical disc prolapsed.Cervical disc prolapsed had moreincidences in males than female's .the cervical disc prolapsed more common in age at 61-75.The most common indications is neck pain ,The common site of disc prolapsed is c2-c6

5-3 Recommendations:

MRI center should be availed for more assessment ofcervicalinter vertebral disc prolapse.

MRI should be considered the stander imaging modality for detecting disc prolapse due to its advantage of lack radiation, anon invasive multiplaner imaging modality with superior soft tissue contrast resolution with can biter define the inter vertebral disc prolapse in the spine.

X-ray forms must show clinical data to be considered when selecting the necessary examination.

The patient who has significant symptoms should make MRI directly because the x-ray has more hazards.

This research can be widened by including more aspects such as frequency of symptoms and their relation with patient history and work of the patients.

Other researcher should increase the number of samples for more accurate results.

Reference:

Cathreine Westbrook,2011 Handbook of MRI Technique, United Kingdom,A Jon Wily&Sons,Ltd.Publication,

Drake R,vogl W, Mitchell AVM, Mitchell 2009A.Grays Anatomy for Midecalstudent,NewYork,NY:Churchill Livigstone,2nd edition,.

Haughton V2006:.Imaging intervertebral disc deganration .JBone Joint Surg Am.88(Suppl 2):15-20.

http://www.spine-health.com/conditions/spine-anatomy/cervical-spine-anatomy-and-neck-pain

https://www.spineuniverse.com/conditions/neck-pain/degenerative-cervical-spine-disorders

Jodi Boling ,MSN RNCNS CNRN,etal.2007 , cervical spine Surgery AGuiden to preoperative and postoperative patient care,AANN American Assocican of Neuroscience Nurses 4700W.LAKE avenue Glen view IL 60025-1485/88/557-2266.

KeyoumarsAshkan,2015 degenerativecervical Spine disease, London neurosurgery partnership, http://www.bupacromwellhospital.com/for-health-professionals/doctors-library/degenarative-cervical - spine - disease/

PanskyB.Review1996of Gross Anatomy. New Yourk, Ny:McGraw-Hill Medical,6th edition.

Stephen Ryan,etal,2004,Anatomy for DiognosticImaging,The Spinal Colum ,2ndedition.

Sutton David, 2003Text book of radiology and imaging , volume 2 Chulhill,seven edition,.

www.vbsc.org.au

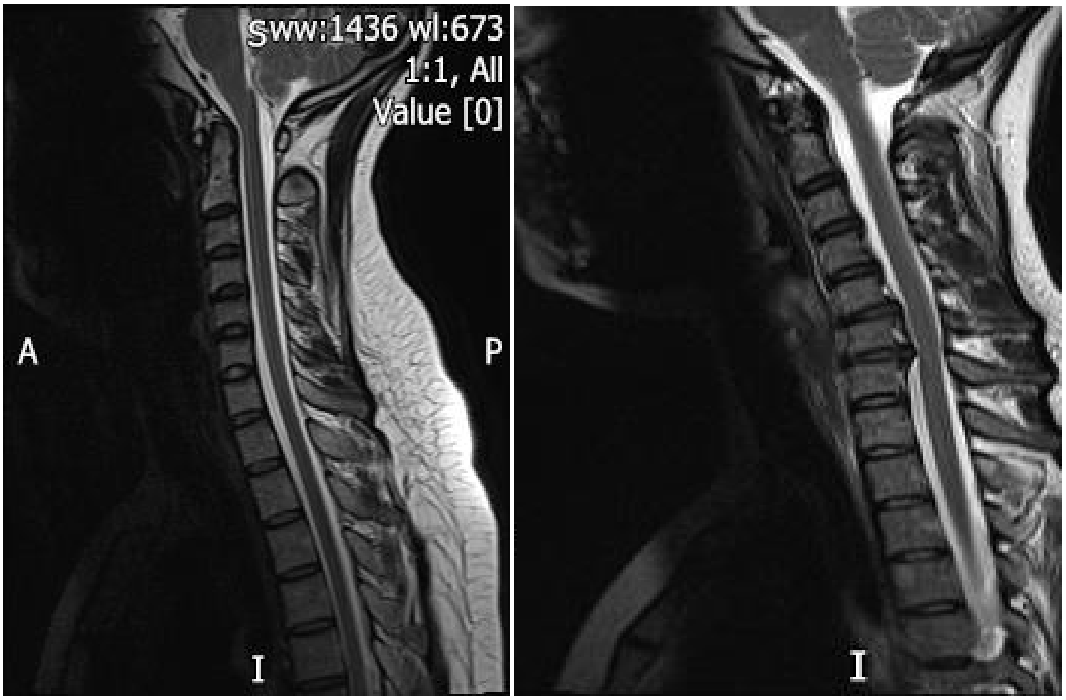
Appendix

Sudan university of science and technology

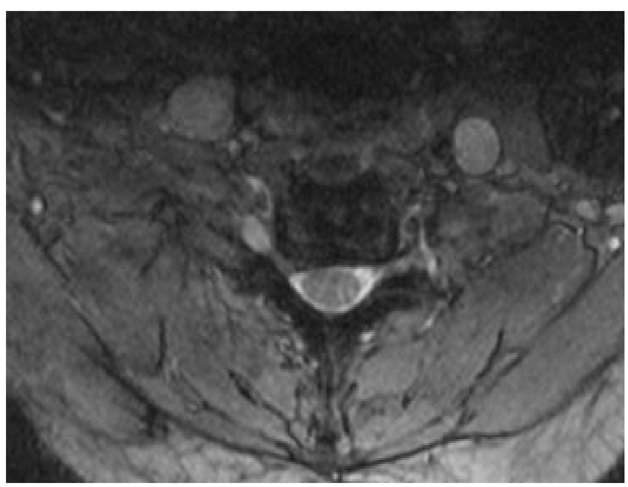
College of graduate studies

Data collection sheet

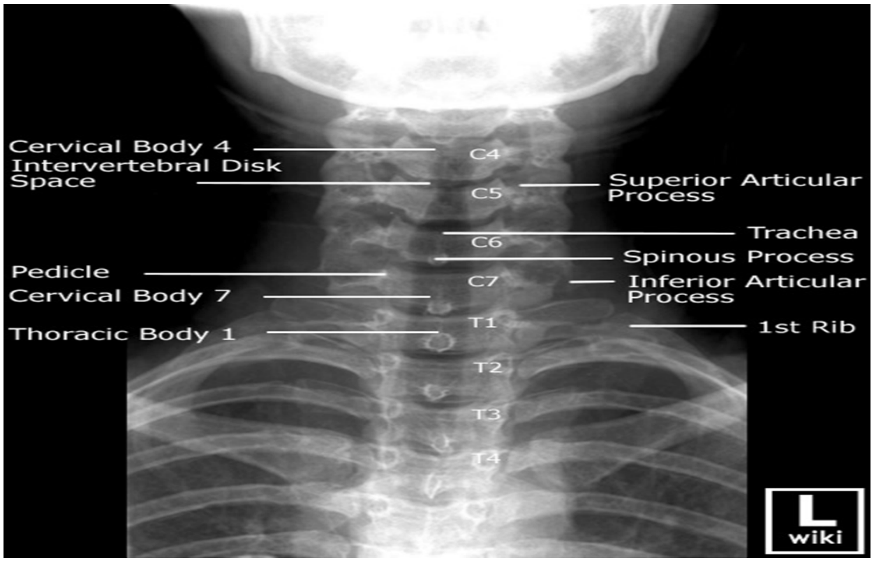
gender	age	high	weigh	NOD	indication



MRI T2 CERVICAL SPINE TO SHOW SPINAL CORD AND INTER VERTIBRAL



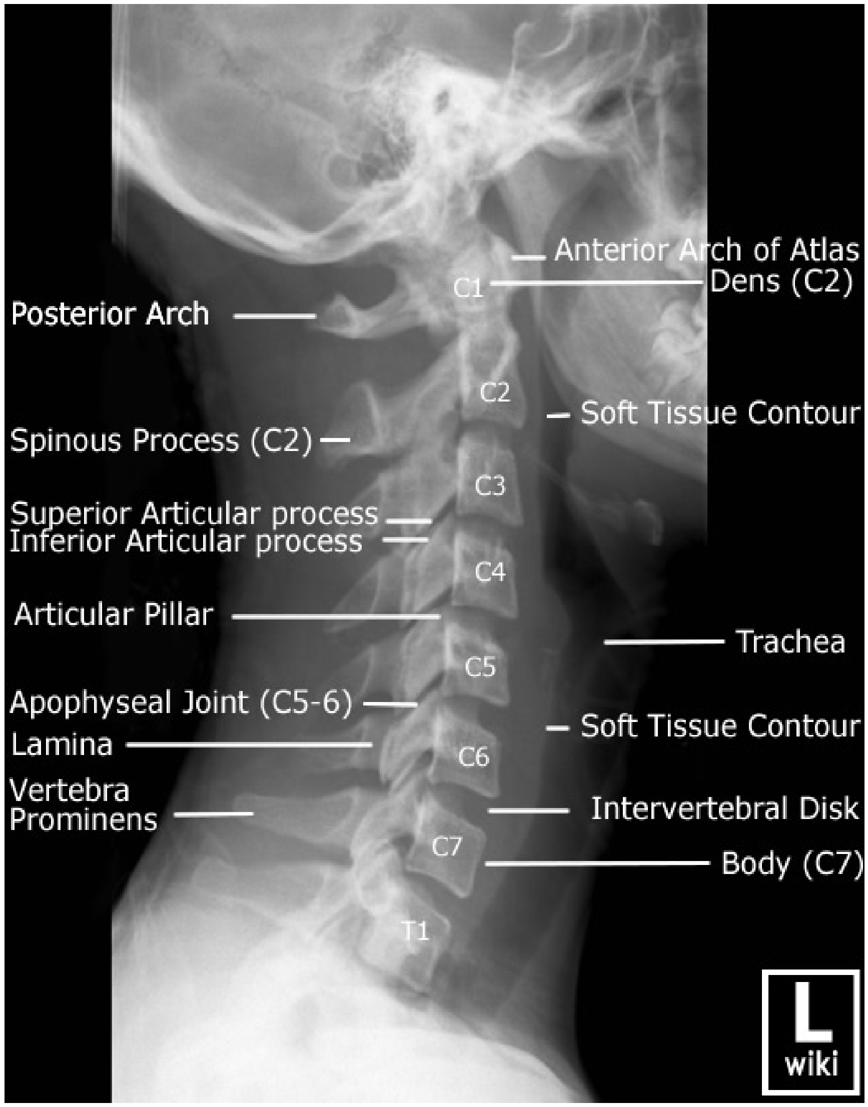
AXIAL T2 MRI SHOW THE SERVICAL DISC PROLAPS



X-ray AP view

Coronal CT scan

CT cervical spine to show any fracture



X-ray lateral view