Sudan University of Science and Technology
College of Graduate Studies

Evaluation of Cervical Spine Inter Vertebral Disc Prolapsed Using Magnetic Resonance Imaging

تقييم الانزلاق الغضروفي للفقرات العنقية باستخدام التصوير بالرنين المغناطيسي

A Thesis Submitted for partial Fulfillment of M.Sc. Degree in Diagnostic Radiological Technology

Prepared by:

Zakia MohammedElhassan Ahmed Abdalrahim

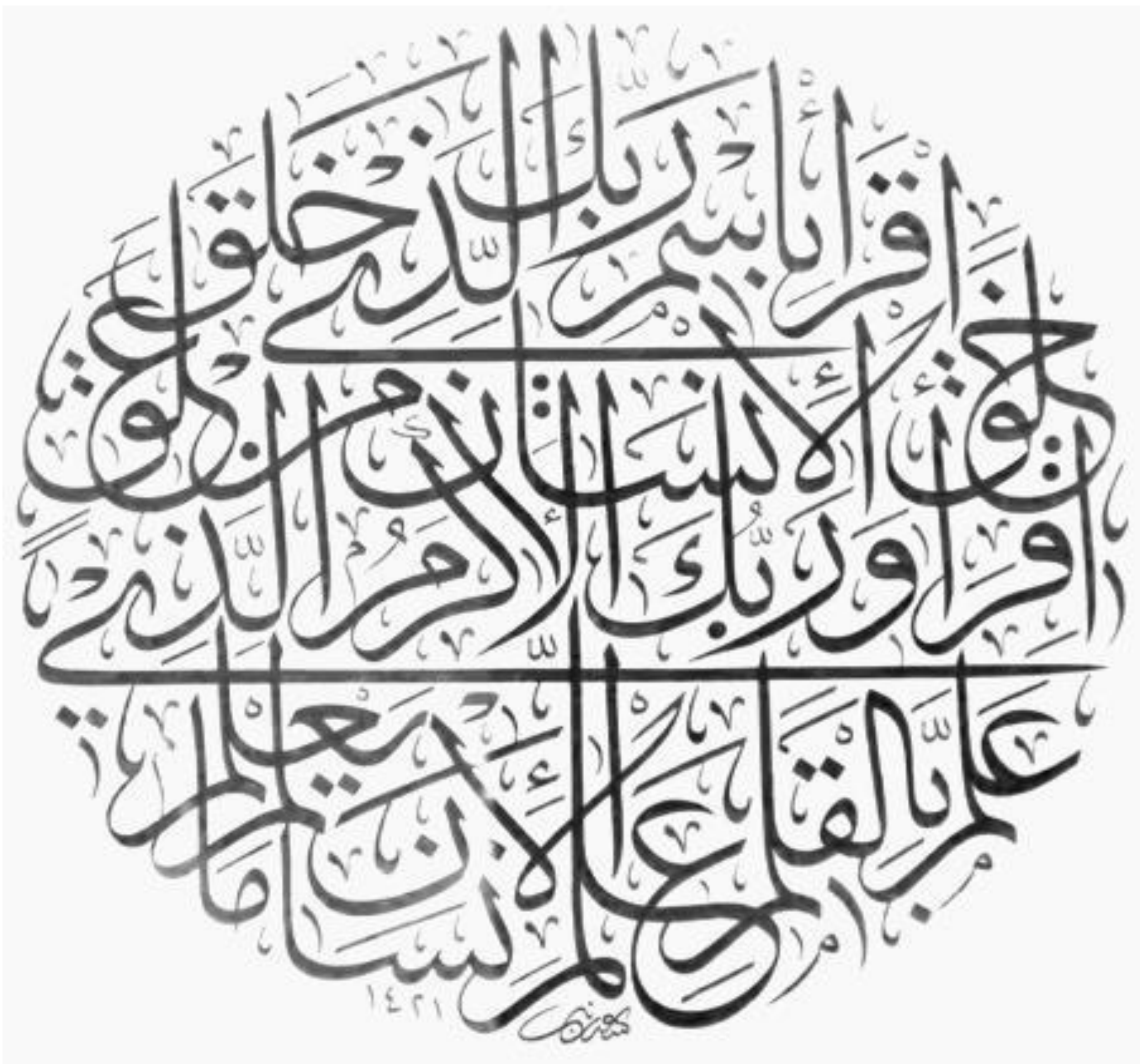
Supervisor by:

Dr . Babiker Abdulwahab A.A

2018

الأيـــــة

قال تعالى:



صدق الله العظيم

سورة العلق الاية (5-1).

Dedication

Dedicated To the Soul Of My Father, who I Keep In My Heart And who's Memories I will cherish Forever.

To My loving Mother Manal Abdalrahim Who Is my Source of Encouragement and Inspiration who's selfless character kept me encouraged & nurtured Throughout My whole life.

To brothers and sister who lit my way and supported me through all my difficulties much of love.

TO everyone who has guided with warm words of encouragement and advice.

Acknowledgement

Firstly great praise and thanks be to Allah for completion this research.

I would like to express my deepest thanks and gratitude to my supervisor Dr. Babiker Abdulwahab who gave me much of his time for guidance and careful supervision and correction of this work during this period to completion of my research.

I would also like to thank Al zytuona Hospital and the Modern Medical Center department for their cooperation in data collections.

Finally Special thanks for all friends, teachers, colleagues.

List of Content

Chapter Three

Material And Method

List of Abbreviations

MRI	magnetic resonance imaging
C.S	Cervical Spine
CT	computed tomography
HNP	Herniated nucleus pulposus
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
B_0	magnetic field strength
MS	Multiple seclerosis
PE gating	Preiphral gating
SE	Spin echo
FSE	Fast spin echo
GRE	Gradient echo
BGRE	balanced gradient echo
T1	Longitudinal relaxation time
T2	Transverse relaxation time
PD	Proton density
FOV	Field of view
NEX	Number of excitations
NSA	Number of signal averages
SNR	Signal to noise ratio
CSE	Conventional Spin Echo
P	Posterior
A	Anterior
R	Right
L	Left
GMN	Gradient moment nulling
CSF	Cerebrospinal Fluid
S-I	superior to inferior
STIR	Short T1Inversion Recovery
BMI	Body mass index
Fig	Figure
NO	Number

List of Figure

List of Table

Abstract

This was a descriptive and analytic study, the main objective of this study was to evaluate cervical intervertebral disc prolapsed by using magnetic resonance imaging.

The study was conduct at the Al zytuona Hospital and the Modern Medical Center During the period from October 2017 to February2018,Closed MRI machine were used , This study included sample of 60 patients (male 35, female 25) , with age range (20-80) who refer to MRI department. study has come out with many result including that the cervical disc prolapsed is more in male (58.3%) than in female (41.7%) , the most effected age group were the age between (50-60)years ,Common site of disc prolapsed at the region of c2, c3, c4, c5, c6. The most clinical finding for disc prolapsed is neck pain.

The result also showed MRI technique was highly accurate to assessment disc prolapsed, it also a very sensitive modality to diagnose it.

As conclude to this study the magnetic resonance imaging is a noninvasive test and it superior to soft tissue , nerves and discs are clearly visible , and this study was revealing MRI is best choice to evaluate intervertebral disc prolapsed.

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

ملخص البحث

تعتبر هذة الدراسة وصفية تحليلية وكان الهدف الرئيسي من هذه الدراسة لتقييم الانزلاق الغضروفي للفقرات العنقية باستخدام الرنين المغناطيسي .

أجريت الدراسة في مستشفى الزيتونة والمركز الطبي الحديث خلال الفترة من اكتوبر 2017 إلى فبراير 2018 ، تم استخدام آلة التصوير بالرنين المغنطيسي المغلقة، وشملت الدراسة عينة من 60 مريضا منهم (35 ذكور و25 إناث) ، تتراوح أعمارهم بين (20 -80)من الذين يراجعون قسم التصوير بالرنين المغناطيسي.ووجد ان الزكور (58.3٪) اكثر تاثرا من الإناث (41.7٪) ، وكانت الفئة العمرية الأكثر تأثرا هي الفئة العمرية بين (50-60) سنة ، ووجد ان اكثر مناطق معرضة للإصابة بالانزلاق الغضروفي هي الفقرات العنقية(الثانية،الثالثة، الرابعة، الخامسة، السادسة) أكثر النتائج السريرية لانزلاق الغضروفي للفقرات العنقية هو آلام الرقبة .

وأظهرت النتيجة أيضا ان تقنية التصوير بالرنين المغناطيسي كانت دقيقة للغاية لتقييم الانزلاق الغضروفي كما أنها حساسة جدا لتشخيص ذلك.

كما توصلت الدراسة الى ان التصوير بالرنين المغناطيسي هو اختبار موسع وانه ذا جودة عالية للانسجة والأعصاب والأقراص بوضوح ، وكشفت هذة الدراسة ان التصوير بالرنين المغناطيسي هو أفضل خيار لتقييم الانزلاق الغضروفي للفقرات العنقية

ووصت هذة الدراسة بضرورة تحويل اى مريض يعانى من اعراض الانزلاق الغضروفى الى قسم الرنين المغنطيسى وذلك لعدم تعريضة لمخاطر الاشعة .

Chapter one

1.1 Introduction

There are 23 total discs in the entire spinal column, and 6 of them are in the cervical spine. Each cervical disc rests between the cervical vertebrae, acts as a shock absorber in the cervical spine, and enables the neck to handle various stresses and loads. Composed of collagen and ligaments, the cervical discs also hold the cervical vertebrae together and allow for flexibility and different movements of the neck.(paul J .Solsar et.al,2016).

The discs need to be well-hydrated in order to maintain their strength and softness to serve as the body's major carrier of axial load.With age the cervical discs lose water, stiffen and become less flexible in adjusting to compression. Such degenerative changes may result in a herniated cervical disc, which is when the disc's inner core extrudes through its outer core and comes in contact with the spinal nerve root. .(paul J .Solsar et.al,2016).

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 . (Drake et.al, 2009).

MRI has opened new horizons in the diagnosis and treatment of many musculoskeletal 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. (Drake et.al, 2009).

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 Problem of the study:

The cervical spine is most common area of pain in the neckcan affect the back of the skull, the neck, shoulder girdle, scapula, arm and hand ,the nerve can affected by compression .So that magnetic resonance imaging (MRI) is capable to accurately diagnose the cause of pain of intervertebral disc prolapsed.

1.3 Objectives:-

1.3.1 General objective:-

To evaluate cervical spine in patients with intervertebral disc prolapsed by using MRI scan.

1.3.2 Specific Objectives:-

- To evaluate which disk 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 prolapsed.

1.4 Significant of the study:-

This study will reveal changes in the cervical spine with the use of MRI. So the purpose of this study is to diagnose Accurate and clear details of cervical spine changes that cannot be detected by X-ray and CT scan.

1.5 Overview of the study:-

The study will fall into five chapters, Chapter one consists ofintroduction that about the cervical anatomy, objectives, significant of the study and the overview of the study. Chapter two includes the literature review, Chapter three detailed the material and methods, Chapter four includesthe presentation of the results, and finally chapter five include the discussions, conclusion, recommendation.

Chapter two
Theoretical back ground

2.1 Anatomy:-

2-1-1 Anatomical description for vertebra:-

The vertebral column has 33 vertebrae - 7 cervical, 12 thoracic, 5lumbar, 5 sacral (fused) and 4 coccygeal (fused) vertebrae. Thespine of the fetus is flexed in a smooth C shape. This is referred toas the 'primary curvature' and is retained in the adult in thethoracic and sacrococcygeal areas. Secondary extension results inlordosis - known as the 'secondary curvature' of the cervical andlumbar spine. . (Stephanie Ryan, etal ,2004).

A typical vertebra has a vertebral body anteriorly and aneural arch posteriorly. The neural arch consists of pedicles laterally and of laminae posteriorly. The pedicles are notched superiorly and inferiorly so that adjoining pedicles are separated by an intervertebral foramen, which transmits the segmental nerves. There are 31 segmental spinal nerves - 8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal . The first seven cervical nerves emerge above the correspondingly named vertebra; the othersemerge below. . (Stephanie Ryan, etal ,2004).

A transverse process arises at the junction of the pedicle and the lamina and extends laterally on each side. The laminae fuse posteriorly as the spinous process. Articular processes project superiorly and inferiorly from each lamina. Articular facets on these processes face posteriorly on the superior facet and anteriorly on the inferior facet. The part of the lamina between the superiorand inferior articular facets on each side is called the pars interarticularis. (Stephanie Ryan, etal ,2004).

The cervical vertebrae most distinctive feature is the presence of the foramen 0*25.tranversarium in the transverse process. This transmits the vertebral artery (except C7) and its accompanying veins and sympathetic nerves,(stephanie Ryan,etal,2004). (Fig. 2.1)

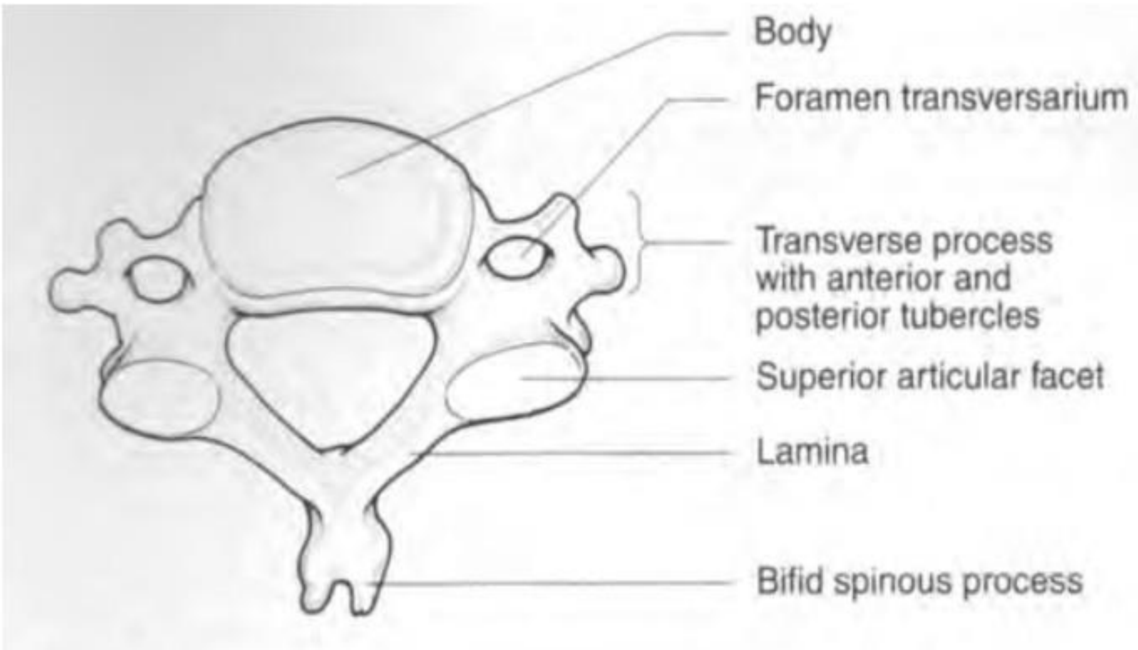


Fig . **(2-1)** cervical vertebra. (Stephanie Ryan,etal ,2004).

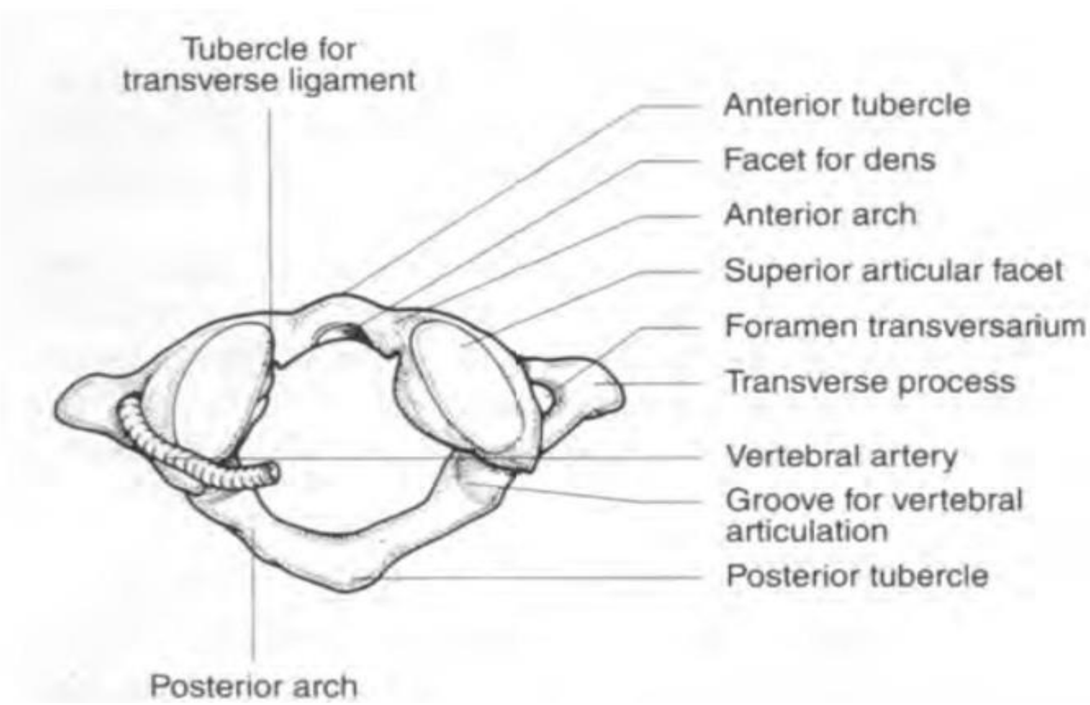


Fig.(2-2) The atlas: Superior View. Stephanie Ryan,etal(2004).

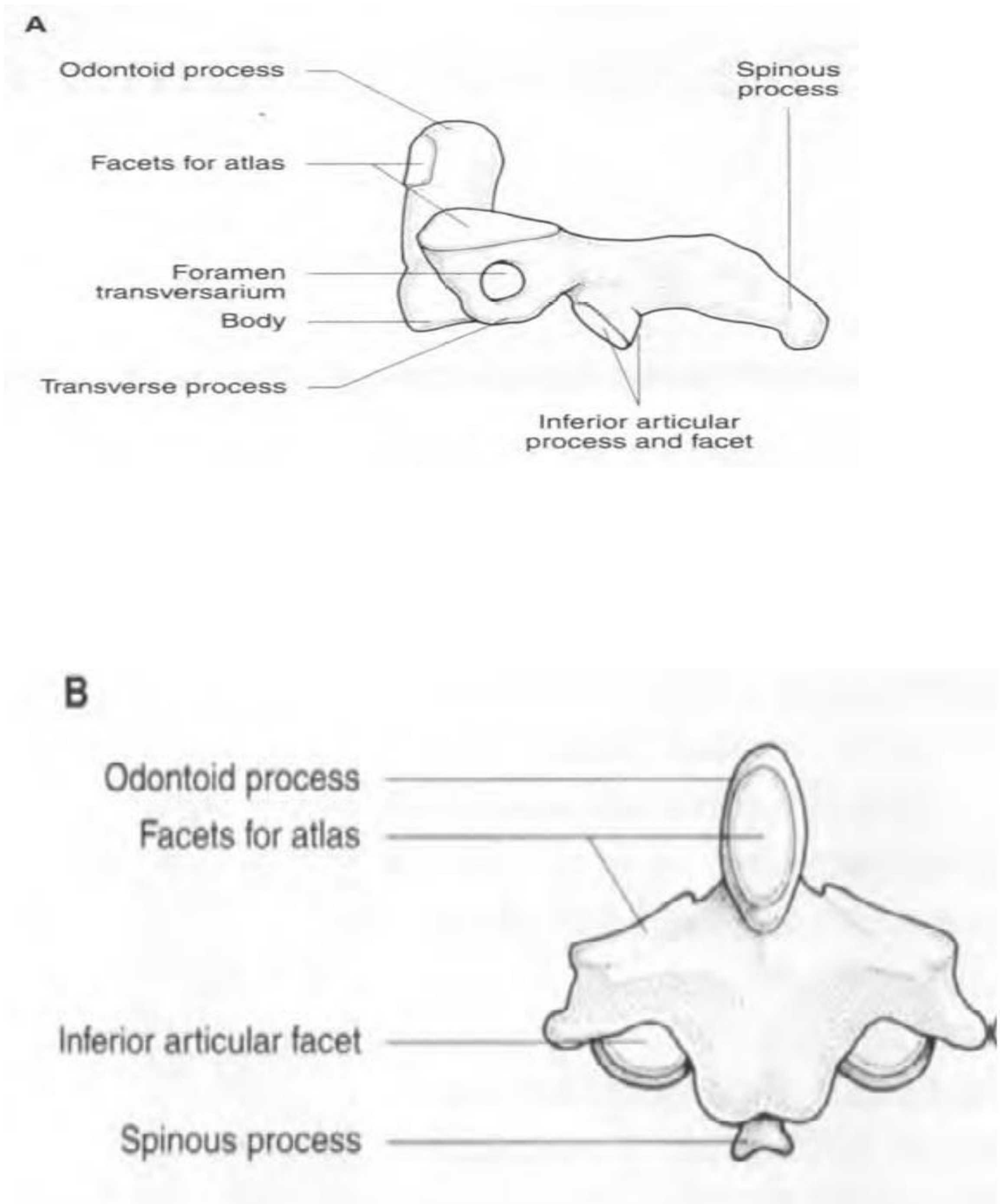


Fig.(2-3) The axis:(A) lateral view (B) anterior view. (Stephanie Ryan, etal,2004).

Small lips are seen on the posterolateral side of the superior surface of the C3-C7 vertebral bodies, with corresponding bevels on the inferior surface. Small joints, called neurocentral joints (of Luschka) or uncovertebral joints, are formed between adjacent cervical vertebral bodies at these sites. These are not true synovial joints although often called so, but are due to degenerative changes in the disc. The cervical vertebral canal is triangular in cross section. The spinous processes are small and bifid, whereas the articular facets are relatively horizontal. (Stephanie Ryan , et al ,2004).

The atlas has no body as it is fused with that of the axis to become the odontoid process. A lateral mass on each side has a superior articular facet for articulation, with the occipital condyles in the atlanto-occipital joint, also an inferior articular facet for articulation with the axis in the atlantoaxial joint. The anterior arch of the atlas has a tubercle on its anterior surface and a facet posteriorly for articulation with the odontoid process. The posterior arch is grooved behind the lateral mass by the vertebral artery as it ascends into the foramen magnum. (Fig. 2.2) . (Stephanie Ryan, etal ,2004).

The odontoid process, which represents the body of the atlas, bears no weight. Like the atlas, the axis has a large lateral mass on each side that transmits the weight of the skull to the vertebral bodies of the remainder of the spinal cord. Sloping articular facets on each side of the dens are for articulation in the atlantoaxial joint. (Fig. 2.3) . (Stephanie Ryan, etal ,2004).

Vertebra prominens - C7 name is derived from its long, easily felt, non-bifid spine. Its foramen tranversarium is small or absent and usually transmits only vertebral veins.(Stephanie Ryan,etal,2004).

2-1-2 Joints Of The Vertebral Column:

Although the movement between individual vertebrae is small, the additive effect of this is great, allowing significant movement of the vertebral column. Maximum movement is at the atlantooccipital and atlantoaxial joints and at the cervicothoracic and thoracolumbar junctions. The joints between the vertebral bodies at the intervertebral discs are secondary cartilaginous joints. The surface of the vertebral bodies in contact with the disc is coated with hyaline cartilage. Small synovial joints between vertebral bodies, called neurocentral joints, occur in the cervical spine as already described. Facet joints occur between the articular processes of the neural arches of the vertebrae.These are synovial joints with a simple capsule attached just beyond the margins of the articular surface. The capsules are looser in the cervical spine than in the thoracic or lumbar spine. The atlantooccipital joint, between the occipital condyle on eachside of theforamen magnum and the superior articular surface of the atlas, is asynovial joint. A fibrous capsule surrounds the synovial membrane and is thickened posteriorly and laterally. In addition, the joint is strengthened by the anterior atlanto-occipital membrane (from the anterior margin of the foramen magnum to the anterior arch of the atlas) and by the posterior atlanto-occipital membrane (from the posterior margin of the foramen magnum to the posterior arch of the atlas). These joints act as a single joint and allow flexion and extension (nodding of the head) and some lateral motion.(Stephanie Ryan,etal,2004).

Three joints make up the atlantoaxial joint: A small synovial joint between the anterior surface of the dens and the posterior aspect of the anterior arch of the atlas; and A synovial joint between each lateral mass of the atlas and of the axis. These joints are strengthened by: The membrana tectoria, which is an upward continuation of the posterior longitudinal ligament from the axis to the anterior margin of the foramen magnum; The cruciform ligament, which has a transverse band attached to the atlas and a vertical band anterior to the membrana tectoria from the posterior aspect of the body of the axis to the margin of the foramen magnum;and The apical and alar ligaments join the tip of the dens to the margin of the foramen magnum. The atlantoaxial joint allows rotation about a vertical axis of the head and atlas on the axis.(Stephanie Ryan,etal,2004).

2-1-3 Ligament Of The Vertebral Column:

The anterior longitudinal ligament extends from the basilar part of the occipital bone along the anterior surface of the vertebral bodies and intervertebral discs as far as the upper sacrum. It is firmly attached to the discs and less firmly to the anterior surface of the vertebral bodies. The posterior longitudinal ligament passes along the posterior surface of the vertebral bodies from the body of the axis to the sacrum. It is firmly attached to the intervertebraldiscs but separated from the posterior surface of the vertebral bodies by the emerging basivertebral veins. The posterior longitudinal ligament continues superiorly as the membrane tectoria from the posterior aspect of the body of the axis to the anterior margin of the foramen magnum. The supraspinous ligament is attached to the tips of the spinous processes from the seventh cervical vertebra to the sacrum. Above level C7 it is represented by the liga¬mentum nuchae, which is a fibrous septum lying in the midline sagittal plane that extends from the spines of the cervical vertebrae to the external occipital protuberance and the external occipital crest. Adjoining laminae are connected by ligamenta flava, which passfrom the anterior surface of one lamina to the posterior surface of the lamina below. The yellow colour that gives them their nameis due to theirsignificant content of elastic tissue. They are the onlymarkedly elasticligament in man, and can stretch on flexion without forming folds on extension that could impinge on dura. Relatively weak ligaments connect adjacent transverse processes – the intertransverse ligaments - and adjacent. (Stephanie Ryan, etal,(2004).

2-1-4 The Intervertebral Disc:

The vertebral bodies are joined by fibrocartilaginous discs, which are adherent to thin cartilaginous plates on the vertebral bodiesabove and below them. The discs are wedge-shaped in the cervical and lumbar regions and consequently contribute to lordosis in these regions; however, in the thoracic region they are flat. The intervertebral discs contribute one-fifth of the total height of the vertebral column. Each disc has a central nucleus pulposus, which is gelatinous in the young subject and becomes more fibrous with age. This is surrounded by an annulus fibrosus of tough fibrous tissue. The annulus is relatively thin posteriorly and this is the usual site of rupture in the degenerate disc. (Stephanie Ryan,etal,2004).

2-1-5 Blood Supply Of The Vertebral Column:

The vertebral bodies and associated structures are supplied by the ascending cervical artery and intercostal and lumbar segmental arteries. Venous drainage of the vertebral bodies is by a pair of basivertebral veins that emerge from the posterior surface of the body to drain to the internal vertebral venous plexus, which in turn drains to the segmental veins. These large valveless veins allow reflux of blood draining from other viscera into the vertebral bodies and are a potential route of spread of disease – particularly malignancy - into the vertebral bodies.(Stephanie Ryan ,et al,2004).

2-1-6 The Spinal Cord:

The spinal cord extends from the medulla oblongata at the foramen magnum to the conus medullaris distally. It extends the entire length of the vertebral canal in a 3-month-old fetus but, because of greater growth in length of the vertebral column than in the spinal cord, the conus lies at the level of the L3 vertebra at birth and atthe lower limit of L1 or upper limit of L2 at the age of 20. The conus may lie even higher in the flexed position that may be used during myelography. Beyond the conus medullaris a prolongation of pia mater extends as a thin cord - the filum terminale. This is attached to the posterior aspect of the first coccygeal segment. From the spinal cord, 31 segmental nerves arise on each side - 8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal . (Stephanie Ryan, etal ,2004).

Although there is no trace of segmentation on the surface of the cord, the part of the spinal cord from which a pair of spinal nerves arises is called aspinal segment. Each spinal nerve arises from a series of rootletswhich fuse to form a dorsal root, with a dorsal root ganglion that carries sensory nerves and a ventral root with motor and autonomic nerves. The dorsal and ventral roots unite at the intervertebral foramen to form the spinal nerve. Spinal nerves C1-C7 exit above the pedicles of the corresponding vertebrae and all other spinal nerves exit below the pedicles of the corresponding vertebrae. Thus the C8 nerve passes under the pedicle of C7 (there is no C8 vertebra) and the L5 nerve passes under the pedicle of the L5 vertebra. Having left the vertebral canal, the spinal nerves divide into dorsal and ventral rami, each of which carry motor and sensory nerves. Owing to the difference in length between the spinal cord and the vertebral canal, the spinal segment from which a nerve arises is separated from the correspondingly named vertebra and the exit foramen. Thus cord segments in the lower cervical spine are one level above the exit foramina, those in the lower thorax two levels above, and those in the lumbar spine three levels above their exit Foramina. Similarly, expansions in the diameter of the spinal cord due to the brachial plexus (C5-T1) and the lumbosacral plexus (L2-S3) cause expansion of vertebral interpedicular distances at higher levels - C4-T2, maximal at C6 for the brachial plexus, and T9-L1/2 (the conus) for the lumbar plexus. Nerve roots take an increasingly greater downward course from cord to exit foramen in the cervical, thoracic and lumbar spinal cord.The lumbar, sacral and coccygeal roots that exit below the conus at L1/2 are contained within the dura as far as its lower limit at S2 and are called the cauda equine. (StephanieRyan,etal,2004).

2-1 .2Physiology:-

The cervical spine functions to provide mobility and stability to the head while connecting it to the relatively immobile thoracic spine. The movement of nodding the head takes place predominantly through flexion and extension at the joint between the atlas and the occipital bone, the atlanto-occipital joint. However, the cervical spine is comparatively mobile, and some component of this movement is due to flexion and extension of the vertebral column itself. The movement 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. (Elsevier Churchill livingstone,2005).

2-3 Pathology:-

2-3-1 Spinal Canal Narrowing (Spinal Stenosis):-

The spinal canal, through which the spinal cord travels, may become progressively narrow because degenerative or aging changes cause the discs and bony overgrowths to bulge into the spinal canal. If very severe spinal canal narrowing occurs, the spinal cord may be compressed, causing neurological symptoms. Abnormal functioning of the spinal cord is called “myelopathy”, and when it is due to aging changes or spondylosis, it is called “cervical spondylitic myelopathy”. Some individuals are born with an unusually narrow spinal canal (congenital spinal stenosis) which predisposes them to spinal cord compression as the normal aging changes progress. Cervical spondylitic myelopathy is usually a painless process, and the symptoms, which are caused by interference of spinal cord function, include numbness, weakness and awkwardness of the hands and stiffness (spasticity) of the legs with progressive difficulty walking (numb, clumsy hands and stiff legs). Due to chronic compression of the spinal cord there can be an abnormal signal within the spinal cord on MRI. (Okada , et al. 2009).

2-3-2Degenerative Cervical Spine Disorders:-

Progressive degenerative changes (aging changes) occur in the cervical spine of all adults. The nucleus portion of the discs gradually dries out and becomes thinner, allowing the adjacent vertebrae to become closer together. As a result, the annulus portion of the discs tends to “bulge”. Because the vertebral bodies come to lie closer together, there is increased wear and tear on the joints of the vertebral column, especially the unco-vertebral joints, the facet joints and disc margins, resulting in the gradual formation of bony overgrowths (“spurs”, “osteophytes”, “osteoarthritis”, “bone hypertrophy” - all synonyms in this context) at the disc margins, at the unco-vertebral joints and at the facet joints. This process is the normal aging process, and it begins in middle life. It is sometimes called “spondylosis”, and is present to a greater or lesser degree in all adults. The vast majority of individuals have these aging changes, even though the changes are quite advanced, are free of pain or any other symptoms. Various aging or degenerative changes such as bulging, degenerated or protruding discs, bony spurs or overgrowths, and facet joint hypertrophy are seen in X-rays, CT scans or MR scansof the cervical spine in over half the adult population. (Okada ,et al. 2009).

2-3-3 Cervical spondylosis:-

describes a non-specific degenerativeprocess of the spine, which may result in varying degrees of stenosis of both the central spinal canal and root canals. (Malcolm ,G.P. (2002).

Spondylosis is generally defined as age- and userelated degenerative changes of the spine. This diagnosisincludes degenerative disc disease and the progressive changesthat occur as a result of disc degeneration, such as osteophyte formation, ligamentous hypertrophy and facet hypertrophy. As the degenerative cascade continues, changes in normal spinal curvature occur. Discdegeneration leads to loss of disc height,more so anteriorly in the cervical spine. . (Malcolm ,G.P. (2002).

Inflammatory Cervical Spine Disease:

Rheumatoid Arthritis-Ankylosing Spondylitis.

Neoplastic Cervical Spine Disease :

Metastatic- Primary.

Deformity of the Cervical Spine :

This can be caused by anumber of conditions, such as congenital anomalies, surgery,osteoporosis, tumor, or inflammatory or degenerative processes.The most common cervical spine deformity is kyphosis.

Infection :

Pyogenic Vertebral Body and Disc Infections-Epidural Spinal Abscess.(Jodi Boling, MSN RNCNS CNRN et al ,2007).

2-3-4 MRI of Cervical Disc Prolapsed:-

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 etal,2005).

2-3-5 Intervertebral disc herniation:-

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 generalizedsymmetrical 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**.**

2-4 Investigations done for Cervical Disc Prolapsed :-

2-4-1Conventional radiography:-

All initial evaluations of cervical spine injuries should begin with plain radiographs. A variety of other imaging modalities may also be used, such as conventional tomography.(Ali Nawaz khan et.al, 2015).

2-4-2Computed tomography:-

CT examinations are performed after myelography to enhance or clarify myelographic findings of intradural and extradural abnormalities. MRI

provides even higher soft tissue sensitivity than CT, andin certain circumstances, it is the modality of choice for imaging the spine (e.g., multiple sclerosis, hydromyelia, syringomyelia). For some conditions, such as spinal stenosis, MRI is equivalent to CT. In some situations, CT is considered superior to MRI, such as in the evaluation of bony abnormalities of the spine.(LOIS E.ROMANS 2009).

2-4-3 Magnetic Resonance Imaging:-

Magnetic resonance imaging now has an established role in the assessment of spinal injuries, because there is often associated spinal cord and nerve root compromise and a relatively common association of unsuspected disc herniation with vertebral fractures. .(Ali Nawaz khan et.al, 2015).

2-5 MRI Physics:-

Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to investigate the anatomy and physiology of the body and the physics of the technique involves the interaction of matter with electromagnetic fields. The human body is largely composed of water molecules, each containing two hydrogen nuclei, or protons. When inside the magnetic field (B_0) of the scanner, the magnetic moments of these protons align with the direction of the field .A radio frequency pulse is then applied, causing the protons to alter their magnetization alignment relative to the field. In response to the force bringing them back to their equilibrium orientation, the protons undergo a rotating motion (precession), much like a spin wheel under the effect of gravity. These changes in magnetization alignment cause a changing magnetic flux, which yields a changing voltage in receiver coils to give the signal. The frequency at which a proton or group of protons in avoxel resonates depends on the strength of the local magnetic field around the proton or group of protons. By applying additional magnetic fields (gradients) that vary linearly over space, specific slices to be imaged can be selected, and an image is obtained by taking the 2-D Fourier transform of the spatial frequencies of the signal (a.k.a., k-space).

Due to the magnetic Lorentz force from B_0 on the current flowing in the gradient coils, the gradient coils will try to move. The knocking sounds heard during an MRI scan are the result of the gradient coils trying to move against the constraint of the concrete or epoxy in which they are secured. These sounds can be very unnerving to the patient, particularly given the tight space in which the patient lays. This behaviour of MRI scanners can be described in terms of a fully coupled acousto-magneto-mechanical system. Solutions to such systems can provide useful insight for design engineers. MRI is used to image every part of the body, and is particularly useful for neurological conditions, for disorders of the muscles and joints, for evaluating tumors, and for showing abnormalities in the heart and blood vessels.(Donald W.Mcrobbie ,et.al 2007).

Fig (2-5-1)MRI machine

(https://en.wikipedia.org/wiki/Physics_of_magnetic_resonance_imaging).

2-5-1 Neck MRI Technique:

ACommon indications Cervical myelopathy,Cervical radiculopathy , Cervical cord compression or trauma ,Assessment of extent of spinal infection or tumour ,Diagnosis of Chiari malformation and cervical syrinx , (Totalextent of syrinx must be determined ,Whole spine imaging may benecessary) ,MS plaques within the cord.(Catherine Westbook,2008).

Equipment:-

Posterior cervical neck coil/volume neck coil/multi-coil array spinalCoil ,Immobilization pads and straps , Pe gating leads if required ,Ear plugs.(Catherine Westbook,2008).

Patient positioning:-

The patient lies supine on the examination couch with the neck coil placed under or around the cervical region. Coils are often moulded to fit the back of the head and neck so that the patient is automatically centred to the coil. If a flat coil is used, placing supporting pads under the shoulders flattens the curve of the cervical spine so that it is in closer proximity to the coil. The coil should extend from the base of the skull to the sternoclavicular joints in order to include the whole of the cervical spine.(Catherine Westbrook,2008).

The patient is positioned so that the longitudinal alignment light lies in the midline, and the horizontal alignment light passes through the level of the hyoid bone (this can usually be felt above the thyroid cartilage/Adam'sapple). The patient's head is immobilized with foam pads and retention straps. Pe gating leads are attached if required.(Catherine Westbrook,2008).

2-5-2Suggested protocol:-

Sagittal/coronal SE/FSE T1 or coherent GRE T2* Acts as a localizer if three-plane localization is unavailable. The coronal or sagittal planes may be used.

Coronal localizer:

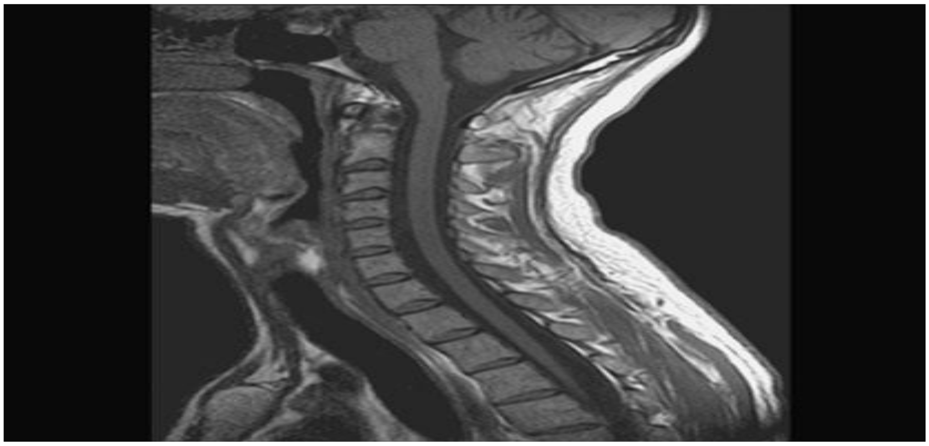
Medium slices/gap are prescribed relative to the vertical alignment light, from the posterior aspect of the spinous processes to the anterior border of the vertebral bodies. The area from the base of the skull to the second thoracic vertebra is included in the image.P 20 mm to A 30 mm

Sagittal localizer:

Medium slice thickness/gap are prescribed on eitherside of the longitudinal alignment light, from the left to the right lateralborders of the vertebral bodies. The area from the base of the skull to thesecond thoracic vertebra is included in the image.L 7 mm to R 7 mm.

Sagittal SE/FSE T1 (Figure 2.5.2)

Thin slices/gap are prescribed on either side of the longitudinal alignmentlight, from the left to the right lateral borders of the vertebral bodies(unless the paravertebral areas are required). The area from the base ofthe skull to the second thoracic vertebra is included in the image.L 22 mm to R 22 m



Fig(2.5.2) Sagittal SE T1weighted midline image throughthe cervical spine.

Sagittal SE/FSE T2 or coherent GRE T2* (Figure 2.5.3)

Slice prescription as for Sagittal T1.Axial/oblique SE/FSE T1/T2 or coherent GRE T2* (Figure 2.5.6)Thin slices/gap are angled so that they are parallel to the disc space orperpendicular to the lesion under examination (Figures 2.5.3 and 2.5.4). Fordisc disease, three or four slices per level usually suffice. For larger lesionssuch as tumour or syrinx, thicker slices covering the lesion and a smallarea above and below may be necessary.

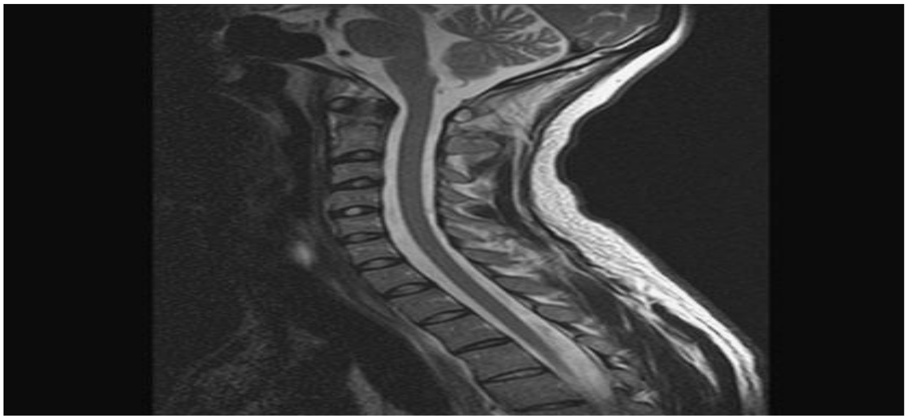


Fig (2.5.3) Sagittal FSE T2weighted midline image through the cervical cord.

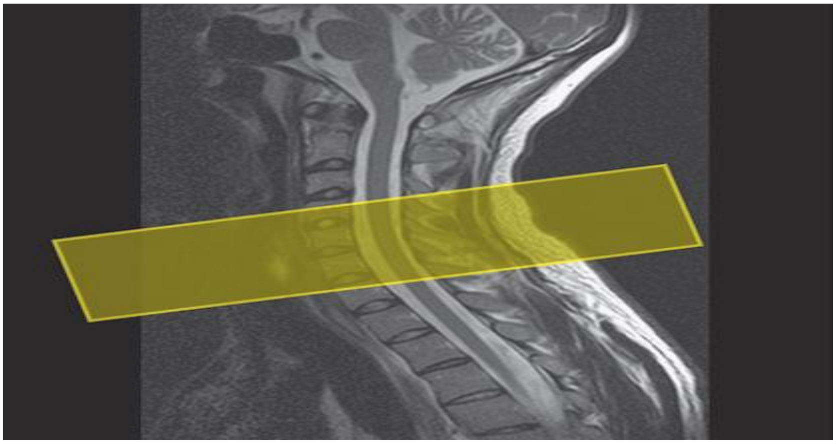


Fig (2.5.4) Sagittal FSE T2 weighted image showing slice prescription boundaries and orientation for axial imaging of the cervical cord

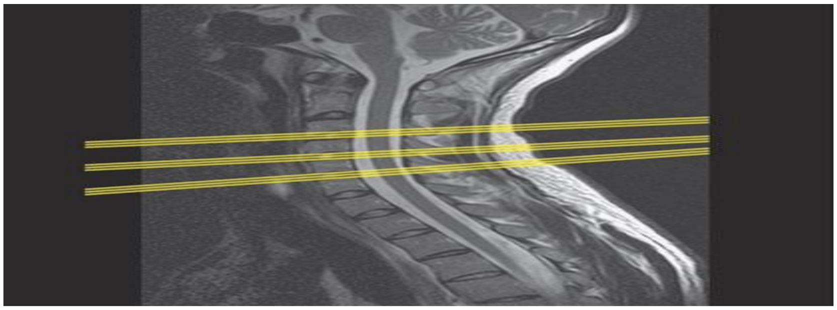


Fig (2.5.5) Sagittal coherent GRE T2* weighted image of the cervical spine showing axial/oblique slice positions parallel to each disc space.

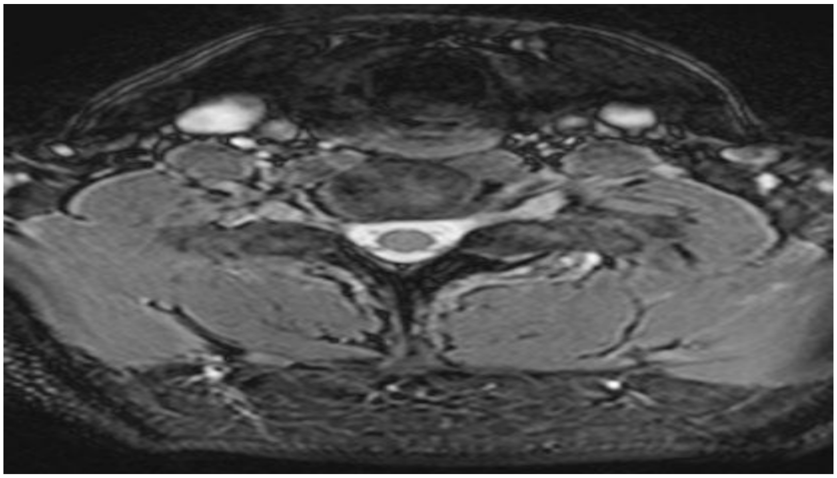


Fig (2.5.6) Axial/oblique coherent GRE T2* weighted image through the cervical cord.

2-5-3Additional sequences:-

Sagittal/axial oblique SE/FSE T1

Slice prescription as for Axial/oblique T2* with contrast enhancement fortumours.

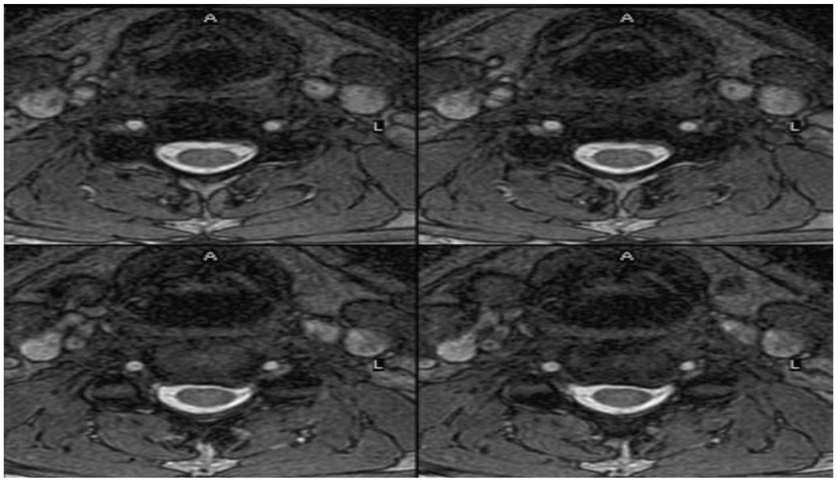
Sagittal SE/FSE T2 or STIRSlice prescription as for Sagittal T2*. An alternative to coherent GRE T2*.

3D coherent/incoherent (spoiled) GRE T2*/T1

Thin slices and a few or medium number of slice locations are prescribedthrough the ROI. If PD or T2* weighting is desired, then a coherent orsteady-state sequence is utilized. If T1 weighting is required an incoherent or spoiled sequence is necessary. These sequences may be acquired in anyplane but, if reformatting is required, isotropic datasets must be acquired.Sagittal SE/FSE T1 or fast incoherent (spoiled) GRE T1/PDSlice prescription as for Sagittal T1, T2 and T2*, **except** neck in flexionand extension to correlate the potential relevance of spondylotic changesto signs and symptoms.

3D balanced gradient echo (BGRE) (Figure 2.5.7)

The contrast characteristics of a BGRE sequence provide for high signalfrom CSF (high T2 / T1 ratio) and thus produces images with high contrastbetween CSF and nerve roots. It is important to remember that because these images are not true T2 weighted, subtle cord lesions such asMS plaques may not be seen. As such they are typically utilized when imaging a patient for radiculopathy (disk disease) rather then myelopathy(cord lesions).



Fig(2.5.7) Axial balanced GRE through the cervical spine.

2-5-4Image optimization:-

Technical issues

The SNR in this region is mainly dependent on the quality of the coil. Posterior neck coils give adequate signal for the cervical spine and cord, but signal usually falls off at the anterior part of the neck, so they are not recommended for imaging structures such as the thyroid or larynx. In addition, flare from the posterior skin surface can be troublesome in sagittal T1 imaging, where the large fat pad situated at the back of the neck returns a high signal. Volume coils produce even distribution of signal, but the SNR in the cord is sometimes reduced compared with a posterior neck coil. Multi-coil array combinations commonly produce optimum SNR, and may be used with a large FOV to include the thoracic spine. This strategy is important when pathology extends from the cervical to the thoracic areas of the cord, e.g. syrinx. Spatial resolution is also important, especially in axial/oblique imaging, as the nerve roots in the cervical region are notoriously difficult to visualize. Thin slices with a small gap and relatively fine matrices are employed to maintain spatial resolution. Ideally 3D imaging is used as this allowvery thin slices with no gap and the volume may be viewed in any plane. MultipleNEX/NSA are also advisable if the inherent SNR is poor. Therefore,unless FSE is utilized, scan times are often of several minutes duration.Fortunately, a rectangular/asymmetric FOV is used very effectively insagittal imaging as the cervical spine fits into a rectangle with its longitudinalaxis running S to I. This facilitates the acquisition of fine matrices inshort scan times. With a reduced FOV in the phase direction, aliasing maybe a problem. In sagittal imaging, this artifact originates from the chinand the back of the head wrapping into the FOV. Increasing the size of theoverall FOV or utilizing oversampling (if available) may eliminate orreduce this artifact. In addition, spatial presaturation pulses brought intothe FOV to nullify signal coming from these structures are effective The multiple 180° RF pulses used in FSE sequences cause lengthening of the T2 decay time

of fat so that the signal intensity of fat on T2weighted FSE images is higher than in CSE. This sometimes makes thedetection of marrow abnormalities difficult. Therefore, when imaging the vertebral bodies for metastatic disease, a STIR sequence should be utilized.
(Catherine Westbrook,2008).

2-5-5 Artifact Problems:

The cervical area is often plagued withartifact. Not only does aliasing from structures outside the FOVobscure the image, but the periodic, pulsatile, motion of CSFwithin the spinal canal produces phase ghosting. The speed offlow is usually quite rapid in the cervical region, and thereforeconventional flow-reducing measures, such as spatialpresaturation and GMN, are less effective than in the lumbarregion where CSF flow is slower. On T1 weighted images, spatialpresaturation pulses placed S and I to the FOV are usuallysufficient. However, on T2 weighted sequences flow artifact iscommonly troublesome. In addition, selecting an S–I phasedirection along with oversampling can also reduce CSF flow artifact in sagittal imaging . As FSE sometimes demonstrates more flow artifact than CSE, it is usually not utilized in thecervical spine. This is especially true on T2 weighted imageswhere flow artifact can totally degrade the image. However, incases where there is severe pathology such as a disc protrusion,FSE often produces images that demonstrate acceptable levels of artifact. This may be because the protruding disc locally slows down the CSF flow. In practice, it is probably worth trying FSE on the T2 images, and only if the artifact is intolerable, repeat thescan using coherent GRE. However, FSE is not commonlyrecommended in axial/oblique imaging because of flow-relatedproblems. When using coherent GRE T2* sequences, GMN shouldbe implemented as this not only increases the signal from CSF, but also reduces artifact from CSF flowing down the canal withinthe slice. In addition the use of balanced GRE reduces flow artifact due to the implementation of balancing gradients . This rapid sequence also works well in 3D imaging as a large volumemay be acquired in a short scan time. However the conspicuity ofnerve roots in the exit foramina may reduce when using a GREsequence due to the magnetic susceptibility effects. Pe gatingminimizes artifact even further but, as the scan time is dependent on the patient's heart rate, it is sometimes rather time-consuming. The implementation of Pe gating is thereforebest reserved for cases of severe flow artifact that cannot bereduced to tolerable levels by other measures.

Multiple NEX/NSA reduce artifact from signal averaging, butresult in an increase in the scan time. Nevertheless their implementation is often necessary, especially where the SNR is poor, and flow artifact severe. Swallowing during data acquisitionis a common source of artifact Spatial presaturation pulses placedover the throat largely eliminate this, but care must be taken notto nullify signal from important anatomy. Another problem in thecervical region is truncation artifact (or Gibbs artifact) thatproduces a thin line of low signal in the cord and mimics a syrinx.Truncation artefact is reduced by selecting a higher phase matrix.

(Catherine Westbrook,2008) .

2-5-6Patient considerations:

Some patients have difficulty placingtheir neck over the posterior neck coil, especially in cases of fixeddeformity. It is important that the neck is as close to the coil aspossible to achieve maximum SNR. Placing pads under thepatient's shoulders flattens the spine, and therefore positions the back of the neck nearer to the coil. Patients with cervical cord trauma, cord compression, or tumours are often severelydisabled. The magnetic safety of any stabilization devices shouldbe established before the examination. Great care must be takenwhen transferring these patients on to the examination couch,and they should be moved as little as possible . Due to excessivelyloud gradient noise associated with some sequences,ear plugs must always be provided to prevent hearingimpairment. (Catherine Westbrook,2008) .

2-5-7Contrast usage:

Contrast is not routinely given for disc disease.However, in cases of leptomeningeal spread of certain tumourssuch as medulloblastoma, contrast invaluable. Other cordlesions such as ependymomas and pinealoblastomas alsoenhance well with contrast, as do infectious processes and activeMS plaques. Bony tumours, especially those that return a low signal on T1 weighted images, enhance with contrast but this often increases their signal intensity so that they are isointensewith the surrounding vertebra. Under these circumstances,chemical/spectral presaturation or the Dixon technique should beimplemented to reduce the signal from fatty marrow in thevertebral bodies. Inversion recovery sequences that suppress fat (STIR) should not be used in conjunction with contrast, as theirinverting pulses may nullify the signal from the tumour that, as a result of contrast enhancement, now has a similar T1 recoverytime to fat.(Catherine Westbrook,2008).

2-2 Previous Study:-

Mario Matsumoto et al 1998 studied degenerative changes in the cervical

Intervertebral discs of 497 asymptomatic subjects by MRI and evaluated discdegeneration by loss of signal intensity, posterior and anterior disc protrusion,narrowing of the disc space and foramina stenosis. In each subject, five disclevels from C2-C3 to C6-C7 were evaluated. The frequency of alldegenerative findings increased linearly with age. Disc degeneration was themost common observation, being present in 17% of discs of men and 12% ofthose of women in their twenties, and 86% and 89% of discs of both men andwomen over 60 years of age. We found significant differences in frequencybetween genders for posterior disc protrusion and foraminal stenosis. Theformer, with demonstrable compression of the spinal cord, was observed in7.6% of subjects, mostly over 50 years of age. Our results should be takeninto account when interpreting the MRI findings in patients with symptomaticdisorders of the cervical spine. .(Matsumoto M, Fujimura Y,etal,1998).

Frode Kolstad ,etal,(2005), this Descriptive study comparingMRI classifications with measurements from radiographs. Theaims is Define the relationship between MRI classified cervicaldisc degeneration and objectively measured disc height. AndAssess the level of inter- and intra-observer errors using MRI indefining cervical disc degeneration. Cervical spine degenerationhas been defined radiologically by loss of disc height, decrease disc and bone marrow signal intensity and discprotrusion/herniation on MRI. The intra- and inter-observer errorusing MRI in defining cervical degeneration influences datainterpretation. Few previous studies have addressed this source oferror. The relation and time sequence between cervical discdegeneration classified by MRI and cervical disc height decreasemeasured from radiographs is unclear. The MRI classification of degeneration was based on nucleus signal, prolapse identificationand bone marrow signal. Two neuro-radiologists evaluated the MR images independently in a blinded fashion. The radiographic discheight measurements were done by a new computer-assisted method compensating for image distortion and permittingcomparison with normal level-, age- and gender-appropriate discheight. Finaly Progressing disc degeneration classified from MRI ison average significantly associated with a decrease of disc heightas measured from radiographs. Within each MRI defined categoryof degeneration measured disc heights, however, scatter in awide range. and The inter-observer agreement between twoneuro-radiologists in both defining degeneration and disc heightby MRI was only moderate. Studies addressing questions relatedto cervical disc degeneration should take this into consideration.(Frode Kolstad ,etal, 2005).

Another study by Ali Hassan A. Ali1, et al (2014) , Aim of this workis to evaluate the frequency of age related degeneration incervical spine in Saudi adult asymptomatic subjects using CT scanimages. Methods: In this study, 105 cases of symptomless adultsranging between 18 - 90 years of age were included. The caseswere classified into 3 groups; adult group (18 - 35 years old),middle age group (36 - 55 years old) and old age group (56 -90years old). Their CT scans were performed in the department ofradiology, King Khalid Hospital, AlKharj and studied for any agerelated changes. The Results in first age group category included35cases; 20 had normal and 15 degenerative changes. Thesecond category included 35 cases; 3 had normal and 32degenerative changes. The third category included 35 cases.Single had normal and 34 degenerative changes. Finally Asymptomatic degenerative changes are common in the cervicalspine after 30 years of age in Saudi adult asymptomatic subjects.(Ali Hassan A. Ali1et al ,2014).

Another study by W. Brinjikji et al (2014). Degenerative changes are commonly found in spine imaging but often occur in pain-free individuals as well as those with back pain. We sought to estimate the prevalence, by age, of common degenerative spine conditionsby performing a systematic review studying the prevalence ofspine degeneration on imaging in asymptomatic individuals.selected age groupings by decade (20, 30, 40, 50, 60, 70, 80years), determining age-specific prevalence estimates. For each imaging finding , we fit a generalized linear mixed-effects model for the age-specific prevalence estimate clustering in the study,adjusting for the midpoint of the reported age interval . the resultsThirty-three articles reporting imaging findings for 3110asymptomatic individuals met our study inclusion criteria. Theprevalence of disk degeneration in asymptomatic individuals increased from 37% of 20-year-old individuals to 96% of 80-yearoldindividuals. Disk bulge prevalence increased from 30% of those 20 years of age to 84% of those 80 years of age. Diskprotrusion prevalence increased from 29% of those 20 years ofage to 43% of those 80 years of age. The prevalence of annularfissure Kincreased from 19% of those 20 years of age to 29% ofthose 80 years of age. Finaly Imaging findings of spine degeneration are present in high proportions of asymptomaticindividuals, increasing with age . Many imaging-baseddegenerative features are likely part of normal aging andunassociated with pain. These imaging findings must beinterpreted in the context of the patient’s clinical condition.(W.Brinjikji et al ,2014).

Chapter Three

3.1Material

3.1.1 Type of study:

This is descriptive and analytic study.

3.1 .2Population of the study:-

This study was conducted on Sudanese population especially in Khartoum population.

3.1.3 Study area and duration:-

This study was performed at Radiology department in A lzytuona Hospital and the Modern Medical Center. During the period from October 2017 to February2018.

3.1.4 Sample size:-

The sample contain 60 patients were selected randomly to patients required to MRI scan.

3.1.5 Inclusion criteria:-

All patients suffering with the cervical intervertebral disc prolapsed at different ages.

3.1.6 Exclusion criteria:-

All patients performed MRI examination of the cervical spine and did not have cervical disc and patients are excluded from magnetic resonance imaging .

3.1.7 MRI Machine:-

In this study MRI machine General Electric MR Scanner with Field Strength 1.5 Tesla.

3.2Method:-

3.2.2 MRI Technique:-

Patient positioning:-

The patient lining supine on the examination couch with their knees elevated over afoam 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)

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..(CathrerineWestbrook,etal.2011)

3.2.3Method of Data collection:-

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

3.2.4 Variable uses of collect data :-

This will depend on { Age, gender } from patient to otheraccording to type of problem.

3.2.5 Method of Data Analysis:-

Data were first summarized into master data sheet, then analyzed by SPSS program and then used Microsoft excel (variables using descriptive tables, frequency, percentage distribution tables, cross tabulation)for data presentation .

Ethical approval of the study :-

The data of the all patients in this study will kept secure to provide privacy to patient information.

Chapter Four

Table (4.1): Shows gender distribution:-

Sex	Frequency	Percent
Male	35	58.3%
Female	25	41.7%
Total	**60**	**100.0**

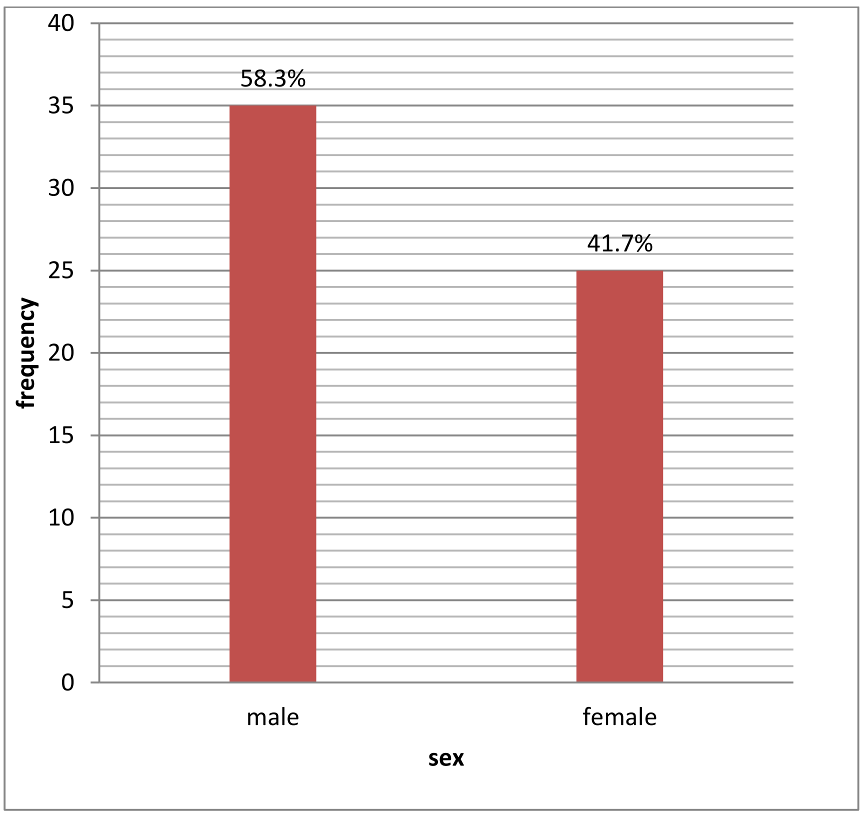


Fig (4.1): illustrated of gender distribution

Table 4.2: Shows Age group distribution:-

Age	Frequency	Percent
20-30	9	12%
30-40	13	21.6%
40-50	8	13.3%
50-60	15	25%
60-70	12	20%
70-80	3	5%
Total	**60**	**100.0**

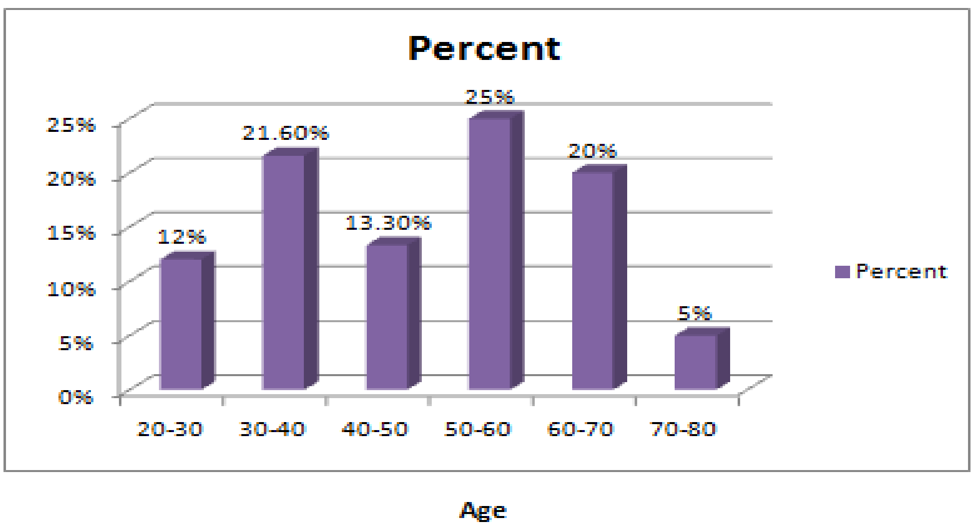


Fig4.2: illustrated of Age group distribution

Table 4.3: Shows common site of Disc affected:-

Disc	Normal	Abnormal
C2-C3	81.7%	18.3%
C3-C4	53.3%	46.7%
C4-C5	36.7%	63.3%
C5-C6	31.7%	68.3%
C6-C7	58.3%	41.7%

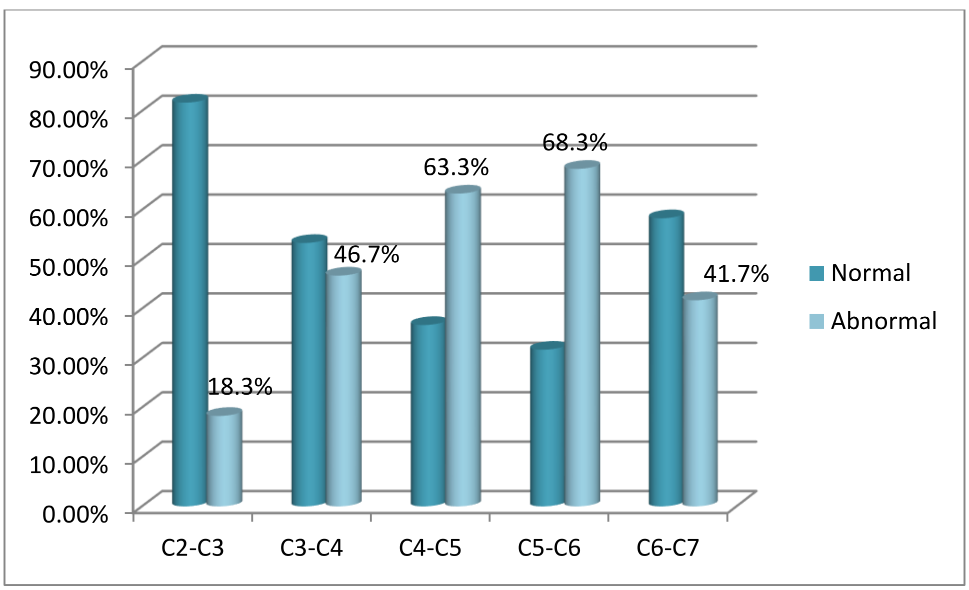


Fig4.3: illustrated for common site of disc affected

Table 4.4: Shows clinical finding distribution for patients:-

Clinical Finding	**Frequency**	**Percent**
Night Pain and Muscles Spasm	8	13.3%
Trembling of Hand	6	10.0%
Neck Pain	15	25.0%
Neck Pain and Back Pain	8	13.3%
Shoulder and Hand Numbness	9	15.0%
Shoulder Pain	14	23.3%
Total	**60**	**100.0**

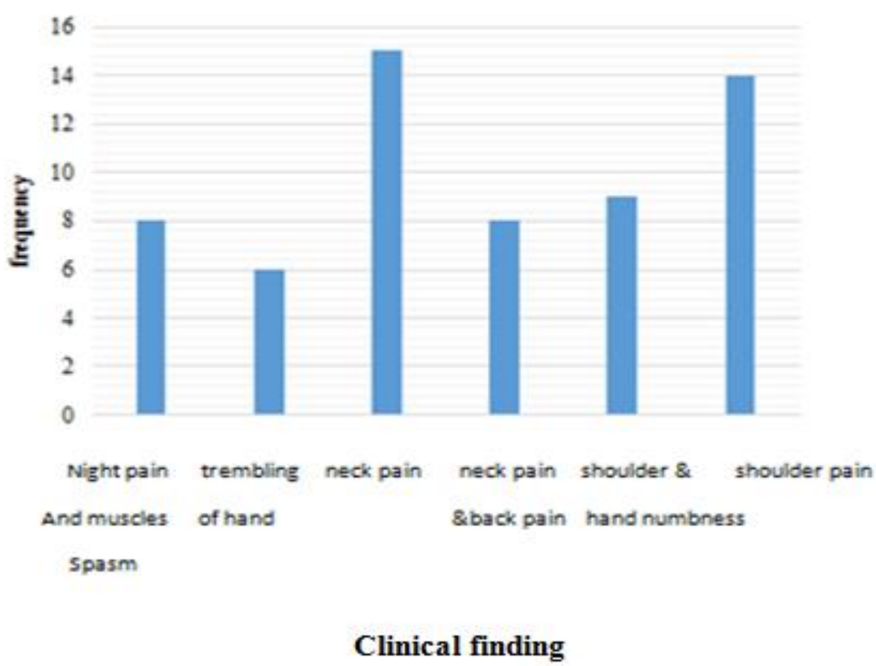


Fig 4.4: illustrated ofclinical finding distribution for patients

Table4.5: Shows correlation between Age group and each disc (C2-C3):-

Age* c2c3		c2c3		Total
		normal	abnormal	
	20-30	7	2	9
	30-40	10	3	13
Age	**40-50**	6	1	7
	50-60	11	2	13
	60-70	12	3	15
	70-80	3	0	3
Total		49	11	60
Correlation were significant at $p \leq 0.05$, $p=0.951$				

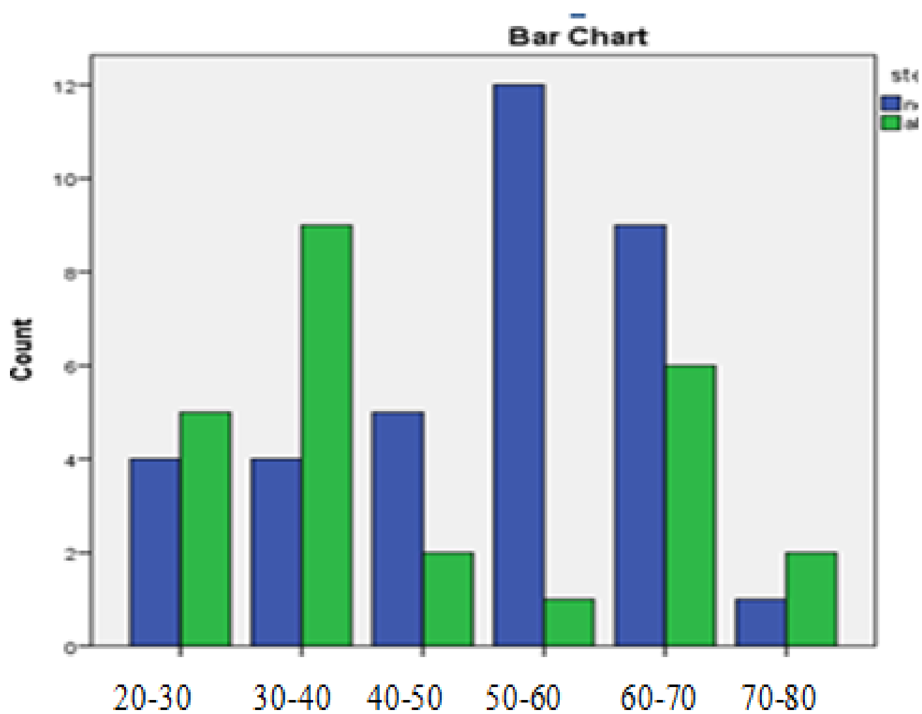


Fig 4.5: illustrated show C2-C3 correlation with Age

Table4.6: Shows correlation between Age group andC3-C4 disc:-

Age*C3-C4		C3-C4		Total
		Normal	Abnormal	
	20-30	**3**	**6**	**9**
	30-40	10	3	13
Age	**40-50**	4	3	7
	50-60	7	6	13
	60-70	8	7	15
	70-80	0	3	3
Total		32	28	60
Correlation Were Significant At P≤0.05, P=0.166				

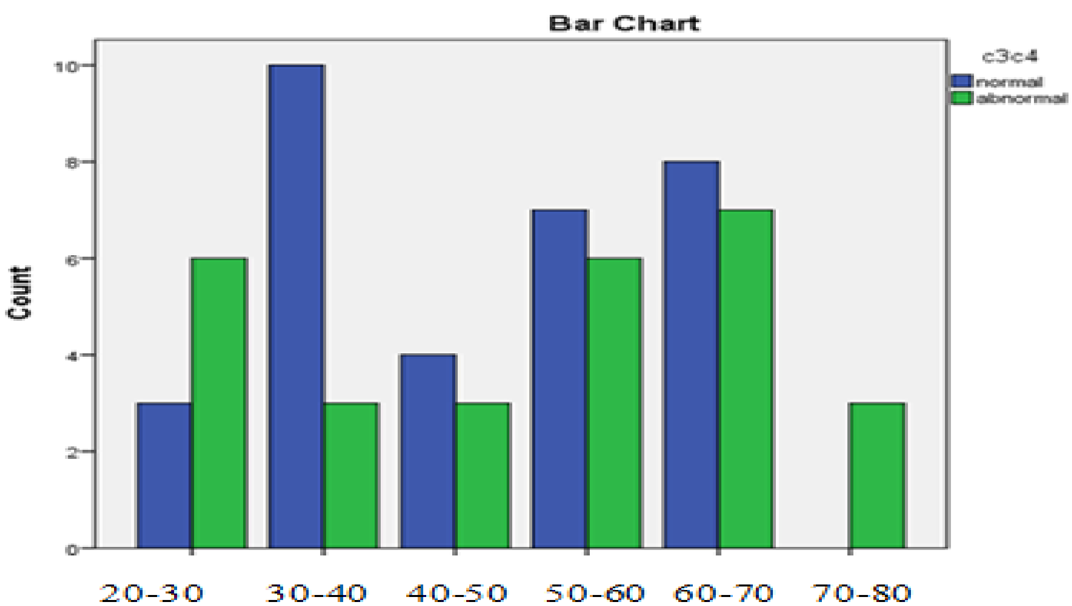


Fig 4.6: illustrated show C3-C4 correlation with Age

Table4.7: Shows correlation between Age group and C4-C5disc:-

Age*C4-C5		C4-C5		Total
		Normal	Abnormal	
	20-30	1	8	9
	30-40	3	10	13
Age	40-50	5	2	7
	50-60	7	6	13
	60-70	6	9	15
	70-80	0	3	3
Total		22	38	60
Correlation Were Significant At P≤0.05, P=0.058				

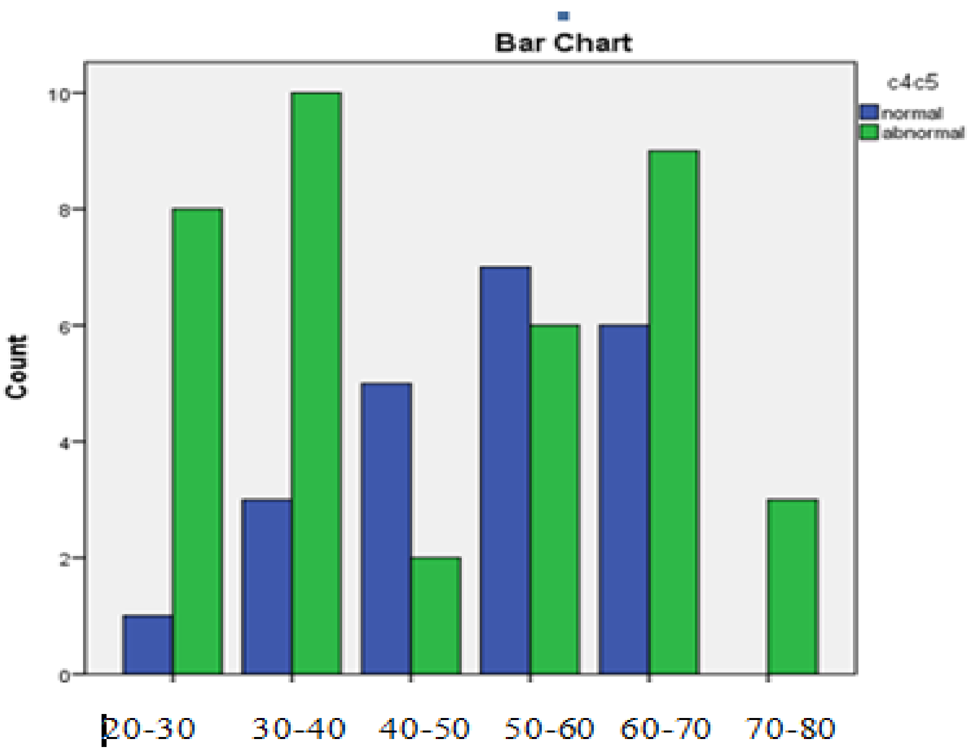


Fig 4.7: illustrated show C4-C5 correlation with Age

Table4.8: Shows correlation between Age group and C5-C6disc:-

Age*C5-C6		C5-C6		Total
		Normal	Abnormal	
	20-30	3	6	9
	30-40	4	9	13
Age	40-50	3	4	7
	50-60	4	9	13
	60-70	4	11	15
	70-80	1	2	3
Total		22	19	41
Correlation Were Significant At P≤0.05, P=0.988				

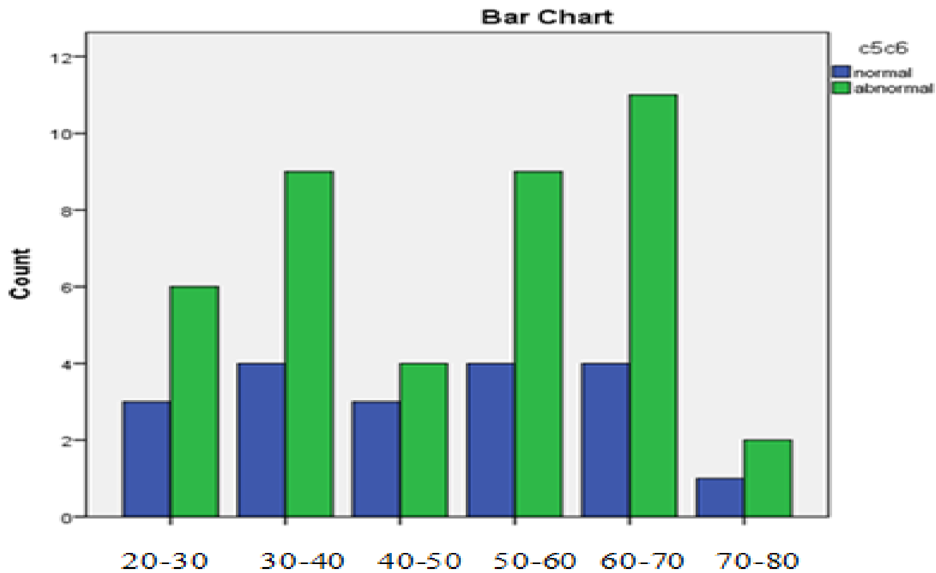


Fig 4.8: illustrated show C5-C6 correlation with Age

Table4.9: Shows correlation between Age group and C6-C7disc:-

Age*C6-C7		C6-C7		Total
		Normal	Abnormal	
	20-30	7	2	9
	30-40	8	5	13
Age	40-50	4	3	7
	50-60	6	7	13
	60-70	7	8	15
	70-80	3	0	3
Total		35	25	60
Correlation Were Significant At P≤0.05, P=0.388				

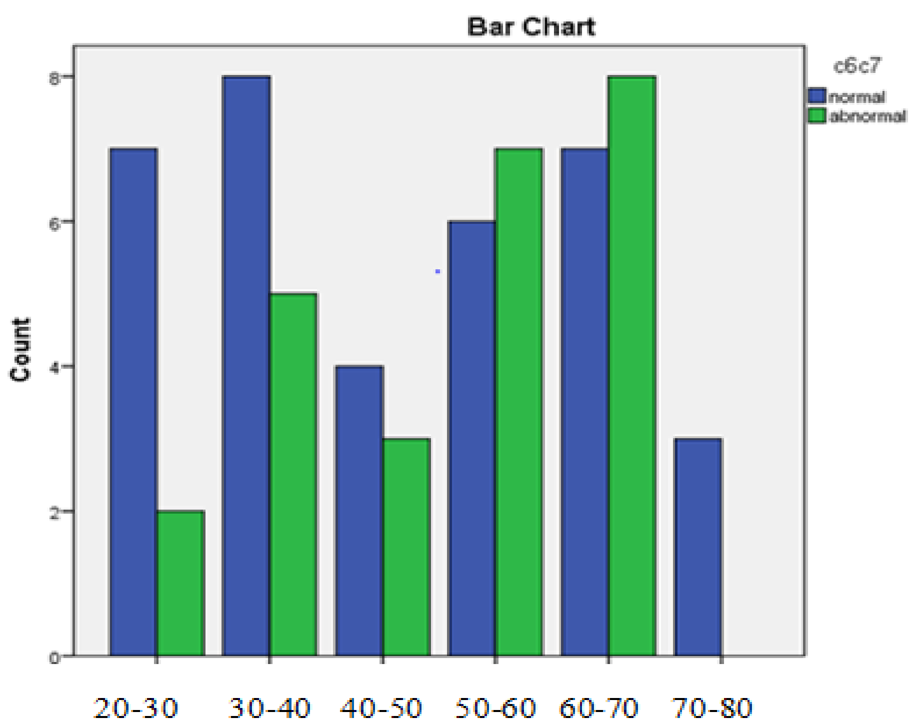
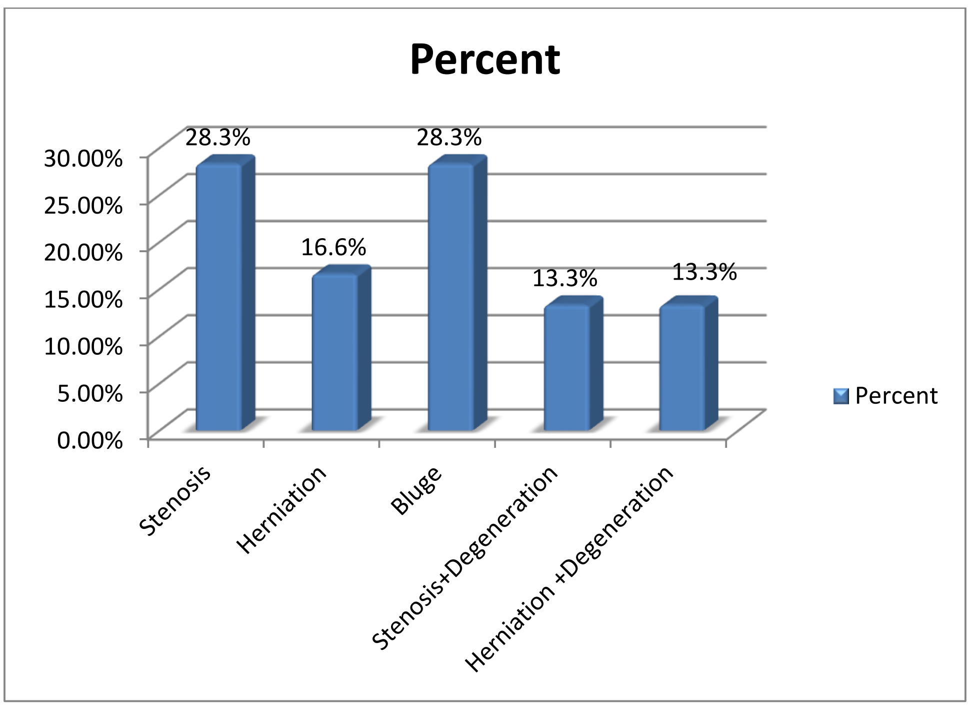


Fig 4.9: illustrated show C6-C7 correlation with Age

Table 4.10: Shows MRI finding:-

MRI Finding	**Frequency**	**Percent**
Stenosis	17	28.3%
Herniation	10	16.6%
Bulge	17	28.3%
Stenosis+Degeneration	8	13.3%
Herniation +Degeneration	8	13.3%
Total	**60**	**100.0**



MRI Finding

Fig4.10: illustrated of MRI Finding

Chapter Five

5.1 Discussion:-

Inter vertebral disc prolapsed are the most common problem of cervical spine. This study conducted on 60 patient who refer to MRI department .

In This study was revealing changes in the cervical spine by using MRI. And collected data according to following tables:-

In the our study 60 patients were had cervical disc prolapsed with different gender 35 male and 25 female respectively Males (58.3%) are more affected than females (41.7%) the result agree with previous study (Eijiro Okada et al 2010) (Table4-1).

The sample was classified according to age starting from (20-80) years old and the most age group affected was (50-60) years old and this result agree with previous study (Matsumoto et al 1997) table (4-2) .

We found the disc prolapsed affected from C2-C3 (18.3%) and to C3-C4(46.7%) and C4-C5 (63.3%) ,C5-C6 (68.3%) C6-C7(41.7%) respectively, but the most common site of disc prolapsed affected from C4-C5 (63.3%) ,C5-C6 (68.3%) (table 4-3).

The most clinical finding for disc prolapsed in this study, is neck pain (25.0%) , Shoulder Pain (23.3%) , Shoulder and Hand Numbness(15.0%), Neck Pain and Back Pain (13.3%) ,Night Pain and Muscles Spasm(13.3%) , Trembling of Hand(10.0%) respectively (table 4-4).

In this study across tabulation for the correlation between age group and each disc showed the relation between age and C2-C3 the most affected age groups (30-40) were significant p value equals 0.951(table 4-5) .

And the relation between age and C3-C4 showed the most age groupaffected (60-70) were significant p value equals 0.166 (table 4-6).

And the relation between age and C4-C5 showed the most age group affected (30-40) were significant p value equals 0.058 (table 4-7).

And the relation between age and C5-C6 showed the most age group affected (60-70) were significant p value equals0.988 (table 4-8).

And the relation between age and C6-C7 showed the most age group affected (60-70) were significant p value equals 0.388 (table 4-9). In this correlation result that a most affected age group was (60-70) and most affected disc was C5-C6.

MRI finding in this study,Stenosis(28.3%) And Bulge (28.3%) , Herniation(16.6%) and Stenosis+Degeneration(13.3%)And Herniation+Degeneration(13.3%) (Table 4-10).

5.2 Conclusion:-

The purpose of this study to evaluate the cervical intervertebral disc prolapsed by using MRI, the study found that the intervertebral disc prolapsed more in males than females, the most affected age group between(50-60) years , The common site of intervertebral disc prolapsed from c2-c3to c6-c7, The most common clinical finding is neck pain.

So that magnetic resonance imaging (MRI) is sensitive &accurately indiagnose the cervical of intervertebral disc prolapsed

5.3 Recommendations:-

MRI center should be availed for more assessment of cervical intervertebral Disc prolapsed.

MRI of cervical spine also must be considered as gold standard in looking for cervical disc prolapsed and to delineate the degree of nerve root or spinal cord compression.

MRI should be considered the stander imaging modality for detecting disc Prolapsed due to its advantage of lack radiation, anon invasive multiplaner Imaging modality with superior soft tissue contrast resolution.

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

Reference:-

- AGuiden to preoperative and postoperative patient care ,AANN American Assocican of Neuroscience Nurses 4700W.LAKE avenue Glen view IL60025-1485/88/557-2266.
- Catherine Westbrook ,(2008)Handbook of MRI Technique, 3rdedition, Part2,140-149
- Cathreine Westbrook,2011 Handbook of MRI Technique, United Kingdom, A Jon Wily &Sons ,Ltd .Publication.
- Chulhill ,seven edition.
- Computed tomography for technologists : a comprehensive text /Lois E. Romans.
- Drake R,vogl W, Mitchell AVM, Mitchell 2009A.Grays Anatomy for
- Frode Kolstad , etal in 2005, Degeneration and height of cervical discs classified from MRI compared with precise height measurements from radiographs, Aug 30th, 2005//Vol. 55 Iss. 3//pgs. 415-420.
- https://emedicine.medscape.com/article/397563-overview.(Ali Nawaz khan et.al, 2015).
- https://en.wikipedia.org/wiki/Physics_of_magnetic_resonance_imaging. .(Donald W.Mcrobbie ,et.al 2007).
- https://www.physio-pedia.com/Cervical_Vertebrae.(Elsevier Churchill livingstone,2005).
- https://www.spine-health.com/conditions/spine-anatomy/cervical-discs.(paul J .Solsar et.al,2016).
- Jodi Boling ,MSN RNCNS CNRN,etal.2007 , cervical spine Surgery
- KeyoumarsAshkan,2015 degenerativecervical Spine disease, London
- Malcolm, G.P. (2002) Surgical Disorders of the Cervicalspine: Presentation and Management of Common Disorders,*Journalof* Neurology, Neurosurgery & Psychiatry, 73, i34-i41
- Midecalstudent,NewYork,NY:Churchill Livigstone,2nd edition,.
- neurosurgery partnership, http://www.bupacromwellhospital.com/for-healthprofessionals/doctors-library/degenarative-cervical - spine - disease/

- Okada E, Matsumoto, M, Ichihara D et al. Aging of the cervical spine in healthy volunteers. A 10 year longitudinal magnetic resonance imaging study. Spine 2009; 34(7): 706-12.
- Stephanie Ryan etal,2004 ,Anatomy for Diagnostic Imaging ,The Spinal Colum,2ndedition,Chapter3,85-95
- Sutton David, 2003Text book of radiology and imaging , volume 2
- W.Brinji,etal,2014,Systematic Literature Review of Imaging Features of spinal Degeneration in Asymtomatic Population, November 27, 2014 as 10.3174/ajnr.A4173

APPENDIX 1

SudanUniversity of Science and Technology

College of Graduate Studies

Data Collection sheet

Age:………..Gender:…………………… Occupation: …………

BMI: weight: ☐ height: ☐

- **Features of disc prolapsed in MRI**:-
- -Affected disc:-

C 2-3 ☐ C 3-4 ☐ C 4-5 ☐

C5-6 ☐ C 6-7 ☐

Clinical finding : ………………………………………..

- **MRI finding:-**

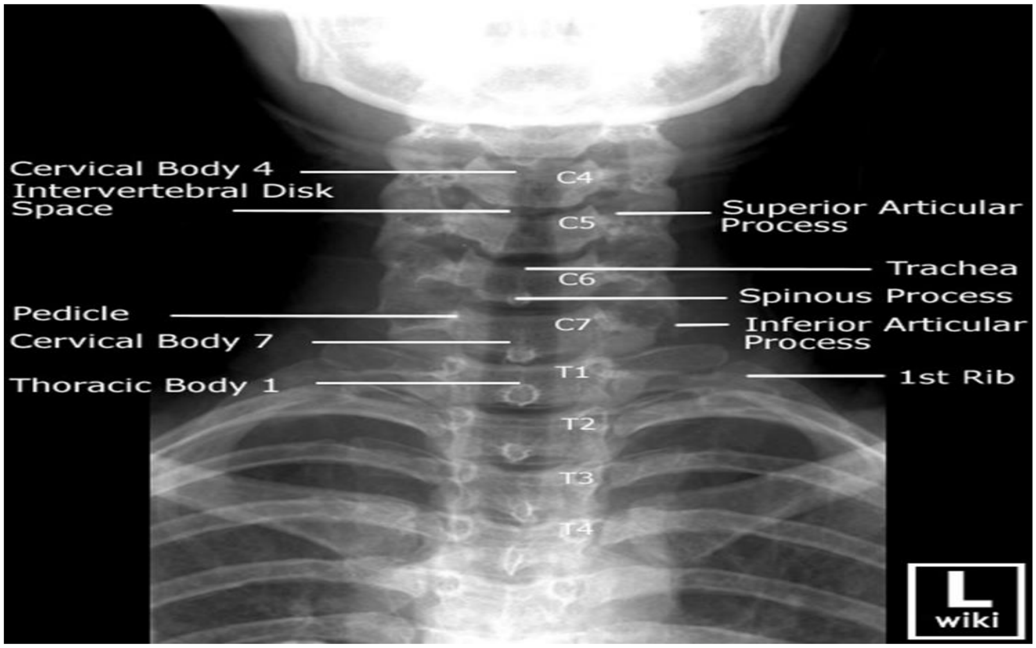
-Disc bulge: -	Found	☐	Non found	☐
-Disc stenosis:-	Found	☐	Non found	☐
-Discherniation:-	Found	☐	Non found	☐
-Disc degeneration:-	Found	☐	Non found	☐

- **Others:-**

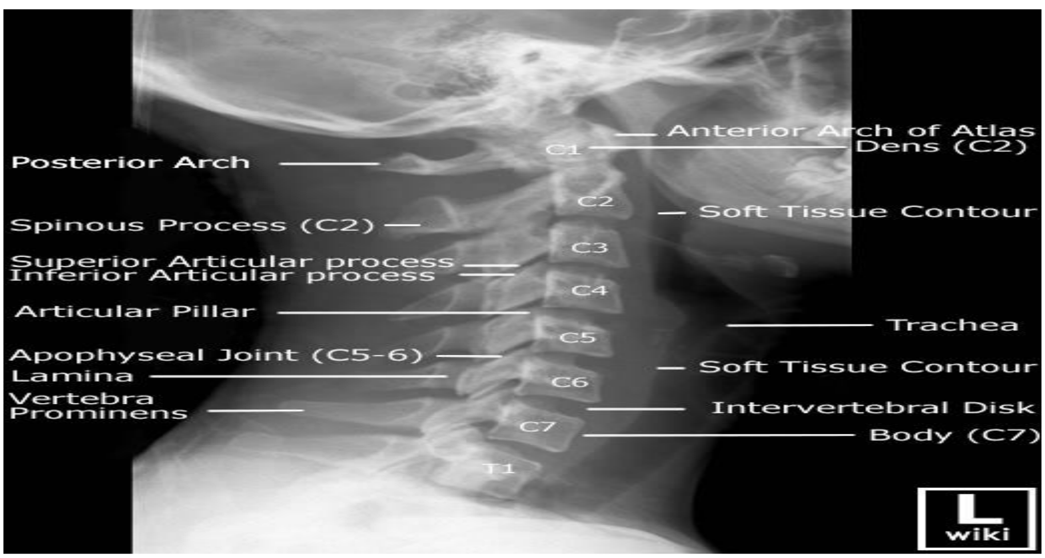
……………………………………………………………………

…………………………………………………………

APPENDIX 2



(A)X-ray AP view



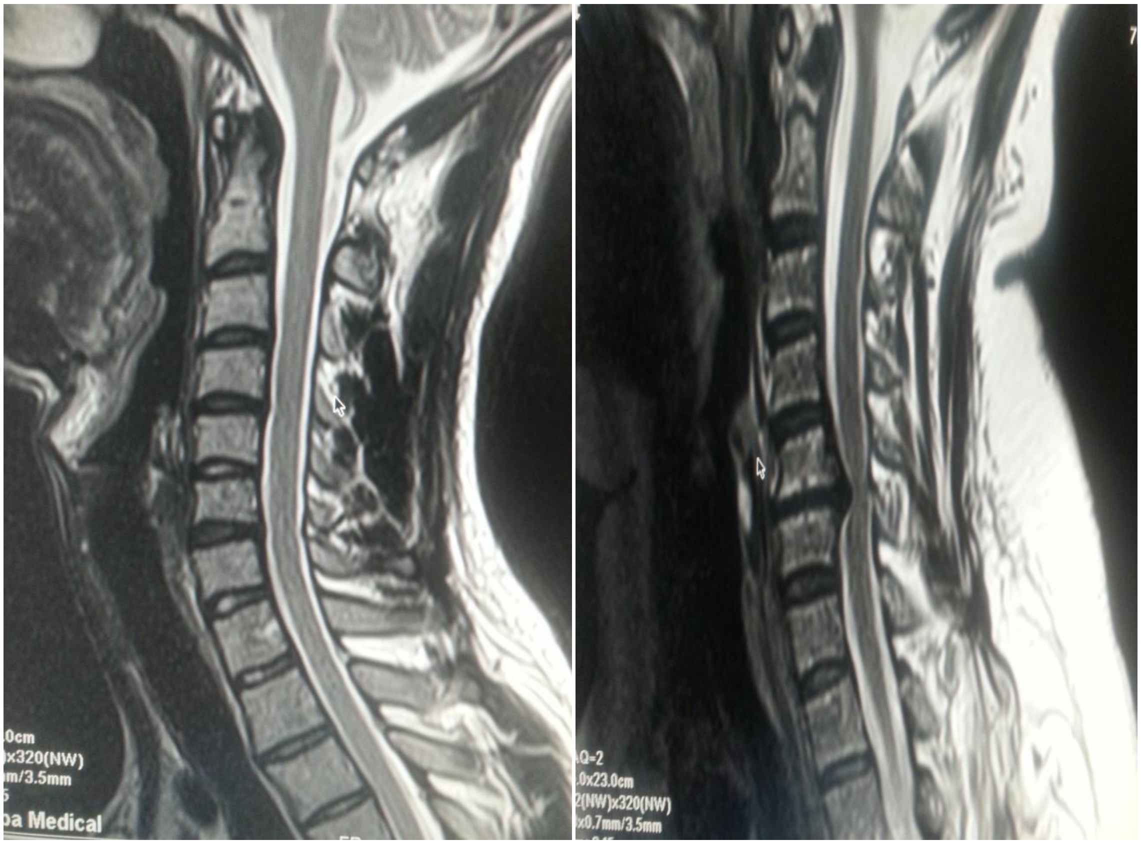
(B) X-ray lateral view

APPENDIX 3

(**A)**Coronal CT scan

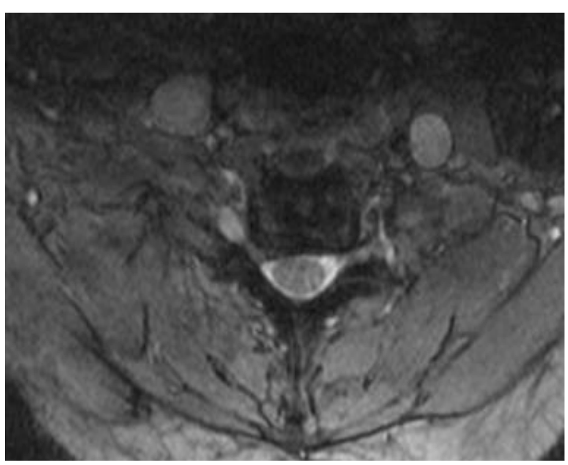
(**B)** CT cervical spine
to show any fracture

APPENDIX 4



(A) stenosis (B)Herniation

MRI T2 Cervical Spine To Show Spinal Cord And Intervertebral



Axial T2 MRI Show The Cervical Disc Prolapsed.