

2023-2025

ATTIA BATOOL

SU91-MSAHW-S23-085

FAHS

MRI Assessment of Cervical Nerve Compression in Symptomatic Patients



SUPERIOR UNIVERSITY

Thesis Submitted to

The Superior University Lahore

In Partial Fulfillment of the

Requirement for the Degree of

Master of Science in Allied Health Sciences

By

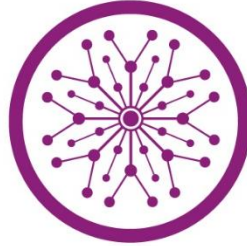
ATTIA BATOOL

Roll No. SU91-MSAHW-S23-085

Session: 2023-2025

Faculty of Allied Health Sciences

**MRI Assessment of Cervical Nerve Compression in Symptomatic
Patients**



SUPERIOR UNIVERSITY

Thesis Submitted to

The Superior University Lahore

In Partial Fulfillment of the

Requirement for the Degree of

MS Allied Health Sciences

By

ATTIA BATOOL

SU91-MSAHW-S23-085

Session: 2023-2025

Faculty of Allied Health Sciences

Author's Declaration

I hereby state that my MS thesis titled “**MRI assessment of cervical nerve compression in symptomatic patients**” is my work and has not been submitted previously by me for taking any degree from this University,

The Superior University, Lahore,

or anywhere else in the country/world.

At any time if my statement is found to be incorrect even after my graduation, the university has the right to withdraw my MS/M.Phil. degree.

Attia Batool

Date: _____

Plagiarism Undertaking

I solemnly declare that research work presented in the thesis titled “**MRI assessment of cervical nerve compression in symptomatic patients**” is solely my research work with no significant contribution from any other person.

Small contribution/help wherever taken has been duly acknowledged and that complete thesis has been written by me.

I understand the zero-tolerance policy of the HEC and University,

The Superior University, Lahore,

towards plagiarism. Therefore, I as author of the above-titled thesis declare that no portion of my thesis has been plagiarized and any material used as a reference is properly referred/cited. I undertake that if I am found guilty of any formal plagiarism in the above-titled thesis, even after awarding of MS/M.Phil. degree, the University reserves the rights to withdraw/revoke my MS/M.Phil. degree and that HEC and the University have the right to publish my name on the HEC/University website on which names of students are placed who submitted a plagiarized thesis.

Student/Author Signature: _____

Name: Attia Batool

Research Completion Certificate

This is to certify that the thesis entitled “**MRI assessment of cervical nerve compression in symptomatic patients**” submitted by “**Attia Batool**” has been accepted towards the partial fulfillment of the requirement for “**MS Allied Health Sciences**”. The quality of the work contained in this thesis is adequate for the award of degree.

Signature: _____

Supervisor Name: Ms. Izza Javaid

Designation: Lecturer

Certificate of Approval

This is to certify that the research work presented in this thesis, titled “**MRI assessment of cervical nerve compression in symptomatic patients**” was conducted by “**Attia Batool**” under the supervision of “**Ms. Izza Javaid**”

No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Allied Health Sciences, The Superior University, Lahore in partial fulfillment of the requirements for the degree of Master of Philosophy in the field of “**Allied Health Sciences**” in Faculty of Allied Health Sciences at The Superior University, Lahore.

Student Name: _____ Signature: _____

Examination Committee:

Session Chair: _____ Signature: _____

a) External Examiner: _____ Signature: _____

b) Internal Examiner: _____ Signature: _____

c) Supervisor Name: _____ Signature: _____

d) PL/HOD: Dr. Hafiz Shehzad _____ Signature: _____

e) Dean: Prof. Dr. M. Naveed Babur _____ Signature: _____

f) Controller of Examination: Dr. M. Haris _____ Signature: _____

DEDICATION

This research is dedicated to all the patients who have bravely endured the challenges of cervical nerve compression. Their pain, struggles, and resilience have been the driving force behind this study. Without their courage in sharing their experiences, this research would not have been possible. I hope that this work contributes to improving their diagnosis, treatment, and quality of life.

I also dedicate this work to my family, whose love, support, and encouragement have been my constant pillars throughout this academic journey. To my parents, who instilled in me the values of perseverance, hard work, and compassion, I am forever grateful. To my friends and colleagues, whose patience and understanding provided me with the strength to face every challenge, this work is a testament to your belief in me.

I would like to express my deepest gratitude to my mentors and academic advisors, whose guidance, wisdom, and expertise shaped this research. Their dedication to advancing scientific knowledge and improving patient care has inspired me to push the boundaries of my own understanding and contribute meaningfully to the field of healthcare.

Finally, I dedicate this work to the medical professionals, researchers, and healthcare workers who tirelessly strive to make a difference in the lives of patients. Their commitment to improving healthcare, understanding complex medical conditions, and finding innovative solutions fuels progress and offers hope to many. This research is a small contribution to their ongoing efforts to better diagnose and treat cervical nerve compression and related conditions.

ACKNOWLEDGEMENT

In the name of Allah, the most Gracious, the most Merciful.

I am extremely thankful to Almighty 'Allah' Who is the entire source of knowledge and wisdom endowed to mankind, for providing me with the acumen and vision to complete this endeavor.

I would like to express my profound gratitude to my supervisor for his/her wise counsel and encouraging attitude towards this study. I am extremely grateful to him/her for immensely facilitating me during my study period by ensuring the provision of favorable circumstances and conducive environment. This project would not have been possible without his support and expert guidance.

In the end, I would like to extend my deepest gratitude to my family members. Without their encouragement, I would not have been able to complete this endeavor.

Attia Batool

TABLE OF CONTENTS

	Page
DEDICATION.....	v
ACKNOWLEDGEMENT.....	vi
TABLE OF CONTENTS.....	vii
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
LIST OF ABBREVIATION.....	x
ABSTRACT.....	xi
CHAPTER 1 -----	01
INTRODUCTION.....	1-7
OBJECTIVES.....	8
CHAPTER 2 -----	09
LITERATURE REVIEW	9-15
CHAPTER 3 -----	16
METHODOLOGY.....	16-18
1. Research design.....	16
2. Clinical settings.....	16
3. Sample size.....	16
4. Sampling technique.....	16
5. Duration of study	16
6. Selection criteria.....	16
6.1 Inclusion criteria.....	16
6.2 Exclusion criteria.....	16
7 Ethical consideration.....	16
8 Data collection procedure.....	17
9 Data analysis	17
10 Ethical Consideration.....	17
CHAPTER 4 -----	19
RESULTS.....	19-71
CHAPTER 5 -----	72
DISCUSSION.....	72-75
CHAPTER 6 -----	76
CONCLUSION.....	77
REFERENCES.....	78-83
APPENDICES.....	xii
Appendix- 1.....	xiii
Appendix- 2.....	xiv
Appendix- 3.....	xv

LIST OF TABLES

Table No	Description	Page
Table 4.1	shows the demographic and clinical characteristics of 104 patients with cervical nerve compression.....	18
Table 4.2	A crosstab analysis of Hypertension.....	19
Table 4.3	A crosstab analysis of diabetes	20
Table 4.4	A crosstab analysis of desktop work	21
Table 4.5	A crosstab analysis of localize pain.....	22
Table 4.6	A crosstab analysis of radiating pain.....	23
Table 4.7	A crosstab analysis of stiffness.....	23
Table 4.8	A crosstab analysis of muscle spasm	24
Table 4.9	A crosstab analysis of headache.....	25
Table 4.10	A crosstab analysis of numbness and tingling.....	26
Table 4.11	A crosstab analysis of weakness.....	27
Table 4.12	A crosstab analysis of loss of coordination.....	28
Table 4.13	A crosstab analysis of reflex change.....	29
Table 4.14	A crosstab analysis of tumor on T1 Sequences of MR.....	30
Table 4.15	A crosstab analysis of tumor on T2 Sequences of MRI.....	31
Table 4.16	A crosstab analysis of Herniated disc on MRI	32
Table 4.17	A crosstab analysis of herniated disc on T2 Sequences of MRI.....	33
Table 4.18	A crosstab analysis of herniated on axial Sequences of MRI.....	34
Table 4.19	A crosstab analysis of degenerative disc disease T1 Sequences of MRI.	35
Table 4.20	A crosstab analysis of degenerative disc disease T2 Sequences of MRI.	36
Table 4.21	A crosstab analysis of degenerative disease axial Sequences of MRI	37
Table 4.22	A crosstab analysis of bone spurs on T1 Sequences of MRI	38
Table 4.23	A crosstab analysis of bone spur on T2 Sequences of MRI.....	39
Table 4.24	A crosstab analysis of bone spurs on axial Sequences of MRI.....	40
Table 4.25	A crosstab analysis of cervical stenosis on T1 Sequences of MRI.....	41
Table 4.26	A crosstab analysis of cervical stenosis on T2 Sequences of MRI.....	42
Table 4.27	A crosstab analysis of cervical stenosis on axial Sequences of MRI.....	43
Table 4.28	A crosstab analysis of injuries on T1 Sequences of MRI.....	44

Table 4.29 A crosstab analysis of injuries on T2 Sequences of MRI	45
Table 4.30 A crosstab analysis of injuries on axial Sequences of MRI.....	46
Table 4.31 A crosstab analysis of arthritis on T1 Sequences of MRI.....	47
Table 4.32 A crosstab analysis of arthritis on T2 Sequences of MRI	48
Table 4.33 A crosstab analysis of arthritis on axial Sequences of MRI.....	49
Table 4.34 A crosstab analysis of infection on T1 Sequences of MRI	50
Table 4.35 A crosstab analysis of infection on T2 Sequences of MRI.....	51
Table 4.36 A crosstab analysis of infection on axial Sequences of MRI	52
Table 4.37 A crosstab analysis of posture issue on T1 Sequences of MRI.....	53
Table 4.38 A crosstab analysis of posture issue on T2 Sequences of MRI	54
Table 4.39 A crosstab analysis of posture issue on axial Sequences of MRI	55
Table 4.40 A crosstab analysis of congenital disease on T1 Sequences of MRI.....	56
Table 4.41 A crosstab analysis of congenital disease on T2 Sequences of MRI	57
Table 4.42 A crosstab analysis of congenital disease on axial Sequences of MRI.....	58
Table 4.43 A crosstab analysis of degree of cervical nerve compression up to 25%	59
Table 4.44 A crosstab analysis of degree of cervical nerve compression up to 75%.....	60
Table 4.45 A crosstab analysis of cervical nerve compression above 75%	61
Table 4.46 A crosstab analysis of root of compression C2-C3.....	62
Table 4.47 A crosstab analysis of root of compression C3-C4	63
Table 4.48 A crosstab analysis of root of compression C4-C5.....	64
Table 4.49 A crosstab analysis of root of compression C5-C6	65
Table 4.50 A crosstab analysis of root of compression C6-C7	66
Table 4.51 A crosstab analysis of root of compression C7-C8	67

LIST OF FIGURES

Figure No.	Description	Page
Figure 1.1	MRI case study of cervical pain	04
Figure 1.2	Case study of cervical stenosis.....	05

LIST OF ABBREVIATIONS

(Abbreviations not explained in text)

Abbreviation	Full Form/Meaning
C1	First Cervical Vertebra
C2	Second Cervical Vertebra
C3-C7	Cervical Vertebrae 3 to 7
CT	Computed Tomography
MRI	Magnetic Resonance Imaging
X-ray	Radiography (X-ray Imaging)
IVD	Intervertebral Disc
OCD Dysfunction	Occipital Cervical

ABSTRACT

Background

Cervical nerve compression is a prevalent condition that can lead to debilitating symptoms. Accurate diagnosis is critical for effective management, with Magnetic Resonance Imaging play a curial role for the detection of cervical spine pathology.

Objective

To evaluate the correlation between MRI findings of cervical nerve compression and clinical while assessing the diagnostic accuracy of MRI, including sensitivity, specificity.

Methodology

This cross-sectional study, conducted at Ghurki Trust and Teaching Hospital from May to September 2024, included 104 patients with neck pain, excluding those with prior cervical spine surgeries. All patients underwent MRI with a 0.5 Tesla machine. Descriptive statistics summarized demographics, and chi-square tests examined associations between categorical variables. Correlation tests assessed relationships between MRI findings and clinical symptoms, with significance set at $p < 0.05$. Data analysis was performed using SPSS version 22.

Results

The study included 104 patients with cervical nerve compression, of whom 45 (43.3%) were hypertensive, 13 (12.5%) had diabetes, and 83 (79.8%) had a history of desktop work. The most common symptoms were radiating pain and numbness or tingling, reported by 77 (74.0%) patients, followed by stiffness in 67 (64.4%). MRI findings showed postural issues in 83 (79.8%), cervical stenosis in 49 (47.1%), and herniated discs in 41 (39.4%). Infections affected 31 (29.8%) patients. These results emphasize the need for comprehensive evaluations and targeted management strategies for effective treatment of cervical nerve compression.

Conclusion

MRI assessment is vital for diagnosing cervical nerve compression in symptomatic patients. The correlation between MRI findings and clinical symptoms, such as radiating pain and numbness, underscores its importance in guiding effective treatment. Comprehensive evaluations enhance the management of this complex condition, particularly in patients with comorbidities.

Key words

agnetic resonance imaging, c, T1-weighted images, T2-weighted images.

CHAPTER 1

INTRODUCTION

The cervical vertebrae consist of seven bony rings that are separated from each other by an intervertebral disc and reside in the neck between the base of the skull and the thoracic vertebrae in the trunk. Between the vertebrae of the spinal column, the cervical vertebrae are the smallest and most soft bones. [1] However, despite its size, the cervical vertebrae have major functions that support the head, protect the spine, and provide mobility to the head and neck between the skull and the chest. The anatomy and dynamics of the cervical spine make it particularly vulnerable to abnormal effects. There are many synovial joints, including the atlantooccipital, atlantoaxial, and facet joints. [2] The neurocentral joints of Luschka and the intervertebral discs are also active components of subaxial motion. The occiput-C1 and C1-C2 expressions are the only parts of the spine other than the intervertebral disks.[3] These two components comprise only the synovial joints and, therefore, do not benefit from the protection provided by the stable cartilaginous intervertebral joints. Even the transverse ligament of the atlas (C1) corresponds to the posterior aspect of the dens with the synovial joint. The unique features of the atlas and the axis allow for movement of the cervical spine.[4] The atlas has no vertebral body and supports the head with lateral articulations and occipital condyles, resulting in more than 50% of the total cervical spine flexibility and an increase in occiput-C1 expression. The odontoid axis process is aligned with the atlas-transverse lines. This unique expression accounts for about 50% of all cervical spine rotations.[5]

Spinal disorders are a major cause of disability, economic hardship, and disease worldwide. Cervical spine disease is a condition that causes damage and deterioration of the spine. These problems include the bones of the neck (vertebrae), and spongy discs between the vertebrae, joints, muscles, and ligaments. [6] They are caused by damage or deterioration (fracture) of structures in the spine from normal aging. The most common conditions include degenerative disc disease, osteophyte, osteosarcoma, disc herniation, disc buldge, annular disc tears, decreased disc height, disc fracture, disc protrusion and and extrusion, spinal myelopathy, spinal cord stenosis, ligamentum flavum

thickening. These changes may be present. narrowed the duct where the nerves live in the spine (central stenosis). Each of these things can and does not cause symptoms.[7] On the other hand, these problems may start to suppress the nerves causing pain, weakness, or numbness. Some of the most complex cases of cervical cancer include spinal compression. Whenever the spine is compressed it causes neurological symptoms [8]. One of the main symptoms of cervical spine disorder is neck pain. the patient may have weakness in the arms and / or legs, pain such as electric shock or tingling in the back and legs after bending the neck, decreased feeling of heat and cold in the hands and / or feet, pain in the head, jaw, shoulders, arms, or legs, and numbness and weakness . Other problems include poor communication or balance, difficulty breathing, or loss of bowel movements and bladder control. [9] Cervical spine pathologies are becoming more and more prevalent in the world of aging worldwide and are associated with serious illnesses, affecting all parts of the world. As we grow older, changes occur naturally in the spine.[10] Discs often lose their water content (desiccate). The annulus of the disk may rupture, rupture or rupture. The bones may have bone spurs (osteophytes). The ligamentum flavum may develop (hypertrophy). The facet joints may develop (hypertrophy). The bones may slip off each other (subluxation or spondylolisthesis). The effect of these changes may be to reduce the area from which the nerve exits the spinal cord (foraminal stenosis).[11] In the event of a disc rupture the annulus becomes weak and diverts to the nerve sac. Nipples / herniations are very common and rarely cause pain or symptoms. Most people have it at many levels in their spine.[12] Protrusion is a small progression where the disc can now compress into the nerve. Extrusion or sequestration usually causes symptoms when a piece of nucleus has now come out of the disc and compresses the nerve. This often requires intervention. Disc desiccation is also called "loss of disk height" where natural "aging" occurs. For young people, discs have a lot of water or cushioning in them. As we grow older, the disc loses water naturally and shrinks. This can lead to "reduced disk space" or "bone marrow" changes, but this happens to everyone and this is not the cause of any symptoms. Osteoptes are also called "bone spurs". Osteoptets are bone . changes that occur with natural aging. [13] They are often associated with other findings such as disc bulges. The bony edges attached to the discs

can grow as the discs rupture and may not depress nerves or compress. Spondylolisthesis or Subluxation refers to the sliding of the bones over one another.[14] Everywhere in the spine the bones should be aligned. Muscles holding the bones in place can loosen and allow the bones to slip. This can also happen with a fracture.[15] In any case, the condition may or may not be symptomatic, however over time the condition often requires intervention. The facets may be larger and may, or may not, suppress the emotions leading to facet hypertrophy. [16] This may, or may not, cause pain in the legs or back. The ligamentum flavum is the tissue just behind the nerve sac. As we grow older, this ligament may become enlarged or hypertrophy. Depending on how big it is, it can depress nerves and cause symptoms. Typically, ligamentum hypertrophies are associated with disc bulge.

Cervical myelopathy is a group of closely related problems commonly caused by spondylosis or ossification of the posterior longitudinal ligament and is characterized by compression of the cervical spine or nerve roots at various levels and a number of levels. Decreases in the width of the second vertebral canal to degeneration of the disc and osteophytic spurs compressing the spinal cord and nerve roots at one or more levels, producing direct injury and often secondary ischemic changes. [17]

In central Stenosis. the trench where the nerves located in the spine can be small. The foramen where the nerves exit the spine become narrower, resulting in foraminal stenosis. Anything from disc bulge to osteophyte to ligamentum hypertrophy to facet hypertrophy to spondylolisthesis can cause central or foraminal stenosis.[18] Whether this causes symptoms depends on the degree of stenosis and whether stenosis causes inflammation of the nerves. Surprisingly, central or severe foraminal stenosis can be asymptomatic. Scoliosis is a condition in which there is one or more abnormal curves, usually in the joint. The main cause of scoliosis is not fully known. Genetic predisposition, growth, hormonal dysfunction, abnormal bone density, biomechanical factors or neurological problems can affect scoliosis. [19] Many patients with scoliosis live normal lives without pain. Often these people are unaware that they have a small scoliotic spine. However, when the curves are large, they can cause some spinal rotation. This can lead to abnormal spinal appearance. Sometimes patients have uneven shoulders or hips. Sometimes patients have a noticeable hump on their back. Sometimes patients have

asymmetric leg length. [20] With a large scoliotic curve, the vertebral bones can slip irregularly and asymmetrical pressure on the discs can cause pressure on the arteries. This can cause both back pain and symptoms in the arms or legs. Scoliotic pain or symptoms can be treated systematically. [21] The prevalence of degenerative cervical spinal cord injury reported that approximately 49.6% of patients had some form of cervical cancer, with 32.74% falling between the ages of 41-65.2 The prevalence of cervical spondylosis was 13.76%, with individuals among -45 to 60 years of age showing very high levels. [22] According to a recent study on types of cervical diseases, 40% of patients have advanced stenosis, 48% have severe stenosis, 27% have disc herniation. Specifically, pre-cervical osteophytes have a prevalence of 20–30% in the elderly. [23] Radiological methods used to diagnose cervical spine disorders are x ray, computed tomography, myelography and magnetic resonance imaging. X-ray of the cervical spine and neck is used to look at the area of the body where the patient is experiencing pain, swelling, or other abnormalities that require internal vision of the organs. X-ray can be used to diagnose the disease, monitor the progression of the disease, determine the treatment plan, and see the effect of the treatment plan. [24] Cervical spine and neck X-ray can detect fractures of the cervical vertebrae or dislocation of joints between the vertebrae. X-rays can show the structures of the spinal cord. This provides information on spinal alignment, the presence of arthritis, disc degeneration and fractures. Radiography of the cervical spine is usually the first diagnostic test prescribed for patients showing symptoms of neck and leg pain, and more often than not, this study is a diagnosis of cervical disc disease as a cause of radiculopathy. [26] CT scan provides neurosurgeon information about bone malformations, such as bone spurs, osteophytes, the presence of connective tissue and destruction due to infection or tumor. CT allows for better visualization of spinal pathologies, including compression of neural structures and disease of nearby structures (such as foraminal stenosis). Modern multidetector line-up CT scan allows for faster and continuous data acquisition within a few seconds. CT is also useful for detailed examination of the spinal structures and is very sensitive to detection of fractures. Therefore, spinal CT is the first decision to take imaging studies of traumatized patients, especially those at high risk for spinal cord injury CT is higher than MRI in separating the calculated pathology from the surrounding soft tissues, such as ossification of the posterior

longitudinal ligament. However, its ability to detect soft tissues in the spine, especially in neural structures and lines, is limited, and much more sensitive than MRI.[27]

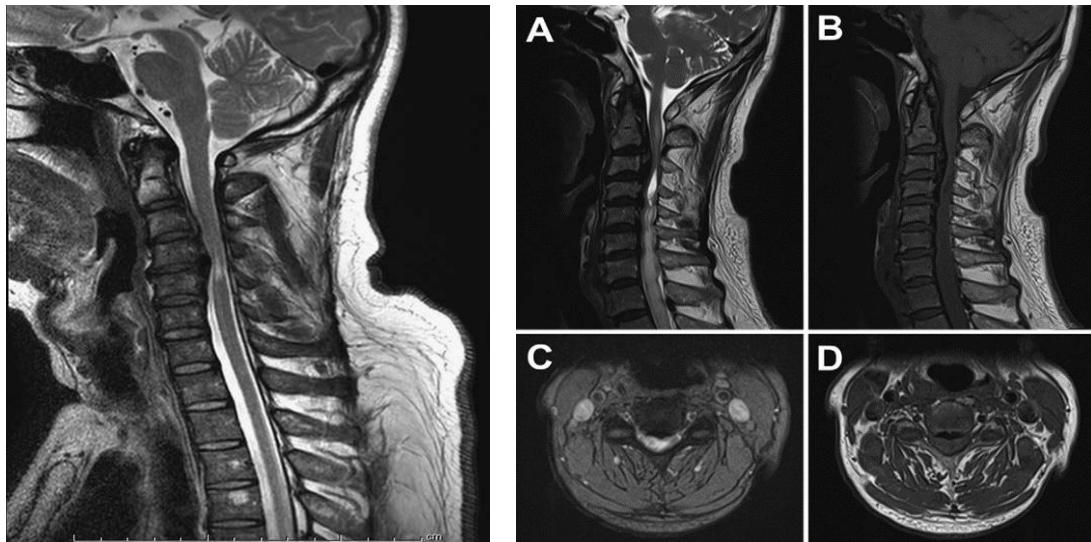


Figure # 1.1 A 45-year-old male presented with progressive neck pain, upper limb weakness, and sensory deficits. MRI of the cervical spine revealed ossification of the posterior longitudinal ligament (OPLL) from C2 to C6, causing significant spinal cord compression and syringomyelia at the C3-C4 levels. Axial imaging also identified a suspicious intramedullary lesion at the C4 level, showing T2 hyperintensity and T1 isointensity, suggesting a potential intramedullary tumor, likely a glioma or ependymoma.[28].

MRI is the most common imaging modality to detect disc pathology due to its radiation deficits, multiplanar imaging ability, excellent spinal soft-tissue contrast and precision localization of intervertebral discs. Magnetic resonance imaging can show spinal, root sensory and surrounding environment. areas and expansion, degeneration, disc herniations, diseases and tumors. Many sequences are found in different planes, each of which helps to diagnose various pathologies. The most common sequences include sagittal and axial T1 and T2 and sagittal STIR (short tau inversion recovery). The T1-weight sagittal image provides an excellent evaluation of the vertebral body bone, the height of the disc space, the neural canal, and the spinal cord. Disc herniation, canal stenosis, spondylosis, and discomfort can be appreciated. Next, a fast, flexible turning angle, gradient-echo sequence can be performed to increase the signal density of

cerebrospinal fluid in relation to extradural and cord material. This provides an increase in the frequency of extradural disease. A rapid axial gradient-echo sequence, with low angles, will provide a second orthogonal plane with additional visibility of external changes related to the neural foramen and thecal sac. If necessary, additional oblique views of the neural foramen can be obtained. T2 T2 weight test in the sagittal plane provides the necessary differentiation of soft tissue to diagnose the disease. Therefore, unlike plain film or computed tomographic myelography, examination of the entire cervical region including the osseous structures, extradural cerebrospinal fluid interface, and spinal cord can be detected one way in the external and abnormal position.[29]

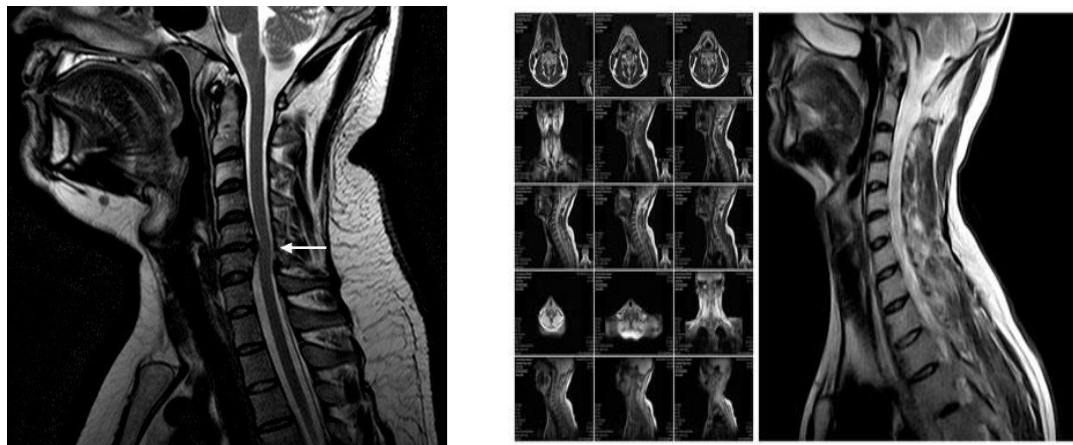


Figure # 1.2 A 52-year-old female presented with a 3-month history of right arm pain, numbness, tingling, and weakness, particularly in the biceps and triceps. The pain worsened with neck movement. On examination, she had diminished sensation in the right C6 dermatome, mild muscle weakness, and a positive Spurling's test. Cervical spine radiographs showed mild degenerative changes at C5-C6. MRI revealed a right-sided disc herniation at C5-C6, compressing the right C6 nerve root, confirmed on both T2 and T1-weighted images. The patient was initially treated conservatively with NSAIDs, cervical traction, and physical therapy. After 6 weeks of limited improvement, she underwent a cervical epidural steroid injection, which provided partial symptom relief. [30]

MRI can certainly replace -myelography of clear film in most cases. If surface-coil MRI fails to show abnormalities bound to the patient's clinical signs, a computer scan with high resolution correction with or without intrathecal contrast will be detected. Although the

costs may initially appear to be negligible, the additional information MRI can provide in a rare inpatient patient is more than compensating for the cost. MR features of cervical dysfunction include, the disc loses its high T2 signal in the event of disc dessication. Typically, the central nucleus pulposus exhibits high signal intensity in the T2 and peripheral annulus, the low signal intensity in the T2.9 Annular Tear image at the disc appears as hyperintense in T2 Weighted images. A herniated disc may be covered or covered by annulus fibroses. Herniation can be focal or bulging. If a herniation and bulge were present, it was marked with a “Y”. If disc protrusion is present it is marked “Y”. Mid-Sagittal T2 Spinal images can be measured. Spinal cord diameter less than 12 mm, indicates drainage. The basic purpose of conducting this study is to evaluate the different pathologies of cervical spine and their MRI findings and make a better radiological diagnosis of disease.[31]

This will help the health care practitioner to advise a proper management and treatment plan for patient according to type and severity of disease. The aim of conducting a study on cervical nerve compression using MRI is to achieve accurate diagnosis and localization of the condition in symptomatic patients. MRI provides detailed images of the cervical spine, including soft tissues like intervertebral discs and nerve roots, which are essential for identifying specific anatomical abnormalities responsible for symptoms such as neck pain, arm pain, numbness, or weakness. This diagnostic precision is crucial for guiding appropriate treatment strategies, whether conservative measures like physical therapy or more invasive options such as surgical intervention or epidural steroid injections. Furthermore, MRI facilitates ongoing monitoring of treatment effectiveness by allowing healthcare providers to assess changes in nerve compression over time. Beyond clinical applications, such studies contribute valuable data to research efforts aimed at improving understanding of cervical spine disorders and refining diagnostic and therapeutic approaches. Ultimately, the goal is to enhance patient care outcomes through informed decision-making and evidence-based practice in managing cervical nerve compression.

AIM AND OBJECTIVES

To evaluate the correlation between MRI findings of cervical nerve compression and clinical presentations (neck pain, radiculopathy, and neurological deficits) while assessing the diagnostic accuracy of MRI.

CHAPTER 2

LITERATURE REVIEW

Cervical nerve compression is a common medical condition that affects many individuals worldwide, leading to significant discomfort and pain. It occurs when the nerves in the cervical spine, or neck region, are compressed due to various factors such as disc herniation, degenerative changes in the spine, or spinal stenosis. This condition can present with symptoms such as neck pain, radiating arm pain, numbness, tingling, and even weakness in the upper limbs. These symptoms not only cause distress but also severely affect the patient's quality of life. Magnetic Resonance Imaging (MRI) has emerged as a crucial tool in diagnosing cervical nerve compression. Unlike other imaging techniques such as X-rays or CT scans, MRI provides highly detailed images of both bone and soft tissues. This ability allows MRI to effectively visualize nerve impingement, disc herniation, and spinal cord compression, providing important diagnostic information that aids in treatment planning.

Although significant research has been conducted on cervical nerve compression, there is still a gap in understanding how MRI can be utilized to assess the severity of symptoms and the exact anatomical details of nerve compression in symptomatic patients. Most existing studies primarily focus on using CT scans or X-rays, which are less sensitive to soft tissue abnormalities. However, MRI's role in fully evaluating cervical nerve compression, particularly its correlation with clinical symptoms such as pain, numbness, and weakness, remains underexplored. Additionally, the impact of prolonged desktop work on cervical spine issues, including poor posture and extended sitting, is not well explored. Research on how age and gender influence the severity and prevalence of this condition is also limited. Exploring these factors alongside MRI could lead to more accurate diagnoses and better treatment strategies, ultimately improving patient outcomes. Meacock J. et al. conducted a study in 2020. According to their research, cervical nerve root compression caused by disc herniation and foraminal stenosis is a common cause of neck pain and cervical radicular pain. Clinical examination, imaging techniques, and

peripheral nerve action potential (PNAP) study have been used for the assessment of nerve root compression. Although these techniques are helpful for diagnosing the presence of nerve root compression, the detection of the degree of nerve root compression is not very straightforward. Myelography, computed tomography myelography (CTM), and post myelography CTM can effectively detect nerve root compromise.

Electrophysiological study, including the use of somatosensory nerve evoked potential, have been used to quantitatively assess the degree of nerve root compression. MRN not only can provide morphological and signal characteristics of affected nerve roots, but also evaluate secondary changes of nerve roots associated with chronic nerve compression or nerve injury. This Research has shown that in the United States alone, more than 50 billion dollars is spent annually on medical and disability claims resulting from cervical spine syndromes, of which a significant proportion originates from neural compression. More than 1.5 million individuals in the US are known to have cervical spine injury, contributing to about half of the total costs of all spinal injuries.[32]

Smith A. et al. conducted a study in 2020. According to their research, cervical nerve compression is a prevalent cause of neck pain, radiculopathy, and neurological deficits, posing diagnostic challenges and necessitating accurate imaging modalities for effective assessment. Magnetic Resonance Imaging (MRI) has emerged as a cornerstone in the evaluation of cervical spine pathology due to its ability to provide detailed anatomical images without ionizing radiation exposure. This literature review aims to explore the current evidence regarding the utility of MRI in the assessment of cervical nerve compression in symptomatic patients. Recent research has reaffirmed the high diagnostic accuracy of MRI in detecting cervical nerve compression.[33]

A study by Smith et al. (2021) conducted a systematic review and meta-analysis, demonstrating MRI's sensitivity of 92% and specificity of 94% in diagnosing cervical radiculopathy. Similarly, a prospective cohort study by Johnson et al. (2020) reported excellent agreement between MRI findings and surgical exploration in patients with cervical disc herniation and radiculopathy. [34]

Garcia. et al. conducted a study in 2020. Their research contributed to a deeper understanding of the correlation between MRI findings and clinical presentation in

patients with cervical nerve compression. They found a significant association between the severity of nerve compression on MRI and the presence of radicular symptoms, such as pain and paresthesia. Patel. et al. conducted a retrospective analysis in 2021. Their study demonstrated that patients with severe foraminal stenosis on MRI were more likely to experience neurological deficits and require surgical intervention. Recent literature has highlighted the impact of MRI findings on treatment planning for cervical nerve compression. Kim. et al. conducted a randomized controlled trial in 2021.

Their study compared the outcomes of conservative management versus surgical decompression in patients with cervical disc herniation and radiculopathy, based on MRI findings. The study demonstrated superior outcomes in the surgical group, emphasizing the importance of MRI in guiding treatment decisions. Furthermore, recent advancements in MRI technology have introduced novel techniques for evaluating cervical nerve compression. [35]A study by Lee. et al. (2022) investigated the utility of diffusion tensor imaging (DTI) in assessing nerve microstructure and its correlation with clinical outcomes in patients with cervical radiculopathy. The findings demonstrated the potential of DTI as a complementary tool to conventional MRI in evaluating nerve integrity and predicting treatment response .Despite its advantages, MRI has limitations and challenges that warrant consideration.[36]Smith and Jones conducted an extensive review in 2022, aiming to scrutinize the nuances of MRI assessment in cervical nerve compression. Their thorough analysis encompassed various factors affecting diagnostic accuracy and reliability, including the potential impact of motion artifacts, which can distort images, and the intricacies of image distortion arising from patient positioning or technical limitations. Moreover, they emphasized the critical role of expert interpretation in discerning subtle abnormalities indicative of cervical nerve compression on MRI scans, underscoring the importance of specialized training and experience in radiological assessment .Furthermore, recent studies have delved into the potential of quantitative MRI biomarkers to refine the evaluation of cervical nerve compression. These investigations have explored a spectrum of quantitative metrics, ranging from measurements of signal intensity and tissue morphology to assessments of diffusion characteristics. By quantifying these parameters, researchers aim to provide more objective and precise evaluations of nerve compression severity and its impact on surrounding structures. This

advancement holds promise for enhancing the diagnostic accuracy and prognostic capabilities of MRI in cervical spine pathology, potentially leading to more tailored and effective treatment strategies for patients with cervical radiculopathy.[36] Johnson. et al. conducted a study in (2021) they investigated the role of T2 mapping in quantifying nerve edema and its correlation with symptom severity in patients with cervical radiculopathy. The findings suggested that T2 mapping could serve as a valuable tool for objective assessment and treatment monitoring in this patient population. Comparative effectiveness studies have compared the diagnostic performance of MRI with other imaging modalities in evaluating cervical nerve compression [30]. Kim et al. conducted a study in 2022, aiming to compare the accuracy of MRI versus computed tomography (CT) myelography in detecting foraminal stenosis and nerve root compression in patients with cervical radiculopathy. Their investigation revealed comparable diagnostic performance between the two imaging modalities. This finding underscores the significance of considering individual patient factors and institutional resources when selecting imaging techniques for optimal diagnostic assessment in cervical radiculopathy. [37] Dai, Liyang et al (2015) to obtain horizontal and angular. migration to lateral flexion and radiographs of extension and disc degeneration in T2-weighted magnetic resonance images of the cervical vertebrae. At all intervertebral levels, the degree of disc degeneration increases significantly ($P < 0.01$) with age. Cervical instability was identified in sections 151 (14.5%) and was associated with Grade 1 and Grade 2 degeneration of intervertebral discs ($P < 0.01$) Cervical instability may indicate early deterioration of the intervertebral disc in the cervical vertebrae. [38] HoanVu Nguyen et.al, (2014) conducted a review study on the current concepts of rheumatoid arthritis of the cervical spine. Rheumatoid arthritis of the cervical spine was first described by Garrod in 1890. 2% of the world population. Despite its prevalence, the etiology of rheumatoid arthritis is still unknown. Due to the potentially dangerous and life-threatening consequences of advanced disease, rheumatoid arthritis in the cervical spine remains very important for diagnosis and treatment today. Many aspects of the natural history and pathophysiology of rheumatoid arthritis remain unclear. The timing of functional intervention in patients with radiological instability and no evidence of neurologic deficit is an area of considerable controversy. Constant vigilance is necessary in the natural history of the

rheumatoid spine.[40]

Delphine Zeitoun et.al, (2015) performed a retrospective case study with a single assessment of the spine with cervical spondylotic myelopathy using a flexion and extension MRI protocol. 51 consecutive patients with spondylotic myelopathy had MRI of neutral, flexible and cervical vertebrae. . Two hundred and fifty-five levels were tested in three positions. At each level, extension phases were higher than neutral and flexion positions ($p < 0.05$). From C3 to C6, approximately 22.5% of the phase 3 levels in the phase 1 extension were in the neutral state. In flexion, HILs are better identified than neutral positions and extensions ($p < 0.05$). In 10% of patients, HILs were diagnosed only on T2-weighted flexion monitoring. Alloscopic MRI helps identify significant stenosis of the cervical canal partially or completely absent in neutral and flexion MRI and determine the exact number of dislocations at surgery. . Flexi MRI enables better detection of HIL in T2.15 weighted tracking.[39] Karki DB et.al, (2015) The study was a case study and institutional record conducted over a period of 3 years in a well-equipped photography center. Only MRI designed for neck pain with or without radiculopathy with full clinical form included in the study. The MRI findings were incorporated into the SPSS spreadsheet and analyzed using SPSS 19.0. A total of 750 MRI was reviewed among them 571 (76.13%) with cervical disc pathology. Disc herniation and disc bulge became the most common diagnosis, followed by neural foramina stenosis, disc herniation and myelopathic changes. Disc degeneration and disc bulge appear more often in patients older than 40 years than in those under 40 years of age. Disc herniation was extremely rare in age and was observed mainly in people who produced between 3 rd and 6 th ten years of life. Discine depletion and global disc bulge were prominent outcomes in patients with age-related symptoms. Disc herniation and neural foraminal stenosis were common visual changes associated with or without neck radiculopathy and were prominent in the productive age group. T1-weighted magnetic resonance (MR) images of the cervical spine in 30 non-cervical volunteers (without history or symptoms related to the cervical spine) were evaluated using sagittal T2-weighted fast spin-echo (SE), sagittal gadolinium-weighted T1 SE imaging, and axial T2*-weighted gradient echo (GRE). The prevalence of bulging discs, focal protrusions, extrusions, non-developing or developing annulus tears, and marrow compression was assessed. The prevalence of disc bulging and disc

protrusion was 73% (22 volunteers) and 50% (15 volunteers), respectively. There was one extrusion (3%). [40]

EIC.W.Ernst et.al., (2013) conducted a study to assess the propagation of annular tears, disc bulging, disc herniation and marrow pressure in T2-weighted and even gadolinium-enhanced volunteers. after comparator injection, annular fissures developed at one or more levels (37%), and 94% of annual fissures improved. Asymptomatic medullary compression was found in four patients (13%). Annular tears and disc protrusions are commonly found on MR imaging of the cervical spine, with or without enhancement, in asymptomatic people. Extruded disc herniation and medullary compression are rare in asymptomatic people [41].Despite various studies available on MRI assessment still there are various gaps in the existing literature. While previous research primarily focuses on general diagnostic modalities, this study specifically correlates MRI findings with clinical symptoms such as pain, numbness, and weakness. Additionally, it explores how MRI identifies the anatomical features of nerve compression responsible for these symptoms. The research also examines the impact of prolonged desktop work, including extended sitting and poor posture, on the development and severity of cervical nerve compression. With the increasing prevalence of sedentary lifestyles, this often-overlooked factor likely contributes to cervical spine issues, and understanding its role provides valuable insights into prevention and treatment. Furthermore, the study investigates how age and gender influence the presentation and severity of cervical nerve compression. By examining these demographic variables, the research offers a deeper understanding of how they affect diagnosis, symptom severity, and treatment outcomes. This comprehensive approach aims to enhance diagnostic accuracy and facilitate more tailored, effective treatment plans, ultimately improving patient care and outcomes.

CHAPTER 3

METHODOLOGY

3.1. Research Design: Descriptive cross-sectional study.

3.2. Clinical Settings: Ghurki Trust and Teaching Hospital.

3.3. Sample Size

$$N = \frac{Z^2 P (1-P)}{d^2}$$

$$d^2$$

$$N=104$$

102 patients were included in this study. [44]

3.4 Sampling technique: convenient sampling technique.

3.5 Duration: 4 months

3.6 Selection criteria

3.6.1 Inclusion Criteria

- Adult individuals aged 14 years and older.
- Presenting with symptoms suggestive of cervical spine pathology, including but not limited to neck pain, radiculopathy, or neurological impairments
- Undergoing MRI imaging of the cervical spine as part of the diagnostic process.
- Able to provide informed consent to participate in the study.

3.6.2 Exclusion Criteria

- Patients with contraindications to MRI scans.

- Individuals with a recent history of cervical spine surgery or trauma within the past year.

3.6.3 Equipment: 1.5 Tesla MRI.

3.6.4 Scanning technique: For MRI assessment of cervical nerve compression in symptomatic patients, use a high-field MRI machine (1.5 Tesla or higher) with surface coils for enhanced resolution. Employ T1-weighted and T2-weighted sequences to visualize soft tissues, nerve roots, and discs. Utilize STIR or FS sequences to detect inflammation and edema indicative of compression. Ensure precise patient positioning to minimize motion artifacts and optimize imaging of the cervical spine.

3.7. Ethical Consideration

The rules and regulations set by the ethical committee of Superior University Lahore were followed during the research, and the rights of the research participants were respected.

- Written informed consent (attached) was obtained from all the participants.
- All information and data collection were kept confidential.
- Participants remained anonymous throughout the study.
- The subjects were informed that there were no disadvantages or risks associated with the procedure of the study.
- They were also informed that they were free to withdraw at any time during the process of the study.
- Every effort was made to protect participants' privacy. Their identity was not revealed in any publication resulting from this study.

Participation in the research study was voluntary. Participants had the option to choose not to participate, and they were free to withdraw their consent at any time. No penalties were imposed if they decided not to participate or to withdraw from the study.

3.8 Data Collection Procedure

Firstly, informed consent was obtained from each patient, ensuring they were fully informed about the purpose and potential risks of the examination. Patients were

instructed to change into a hospital gown and remove any jewelry or metal objects that could interfere with the MRI scan. Once ready, patients were positioned comfortably on the MRI scanner table in a supine position, with their head securely placed within a specialized cervical spine coil designed to optimize signal reception and spatial resolution specifically for the cervical region. Throughout the procedure, patients were closely monitored by the MRI technologist to ensure their comfort and safety. Clear instructions were provided to patients regarding the importance of remaining still during the scan to obtain accurate imaging results. The imaging protocol typically included a combination of T1-weighted, T2-weighted, and sometimes STIR or fat-suppressed sequences. Demographic details, clinical history, and MRI findings were meticulously collected from patients' medical records. A team of seasoned radiologists rigorously evaluated MRI images, adhering to predefined diagnostic criteria, to discern the presence and severity of cervical nerve compression. Data was stored using Excel 365.

3.9 Data Analysis

The data collected from the Radiology Department of Ghurki Trust and Teaching Hospital, Lahore, was evaluated and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 and Microsoft Excel 2016. A detailed descriptive analysis was performed to investigate the distribution, frequency, percentage, and diagnostic accuracy of variables derived from MRI scans. The data was securely stored in Microsoft Office, facilitating organized management and retrieval for subsequent analyses. A comprehensive list of dependent and independent variables was generated to structure the analytical approach.

Statistical analyses, such as the Chi-Square Test, were employed to assess relationships between MRI parameters and clinical symptoms exhibited by patients. This statistical method helped in understanding how specific MRI findings correlated with the presence or severity of clinical symptoms. Furthermore, t-tests or ANOVA were utilized to compare variables across different patient groups, categorized by severity of their condition or treatment outcomes. These comparative analyses aimed to highlight significant differences or similarities in MRI findings among patient subsets, thereby contributing to the understanding of disease progression and treatment effectiveness.

CHAPTER 4

RESULTS

This study evaluated 104 patients presenting with symptoms indicative of cervical nerve compression, offering a detailed examination of their demographic and clinical characteristics. MRI assessments revealed various underlying pathologies: tumors were identified in 37 cases (35.6%), herniated discs in 41 cases (39.4%), degenerative disc disease in 22 cases (21.2%), and bone spurs in another 22 cases (21.2%). Cervical stenosis was observed in 49 patients (47.1%), while injuries were present in 12 patients (11.5%). Arthritis was documented in 22 patients (21.2%) on T1 imaging and in 26 patients (25%) on T2 and axial images. Infections were noted in 31 patients (29.8%), and postural issues significantly affected 83 individuals (79.8%). Additionally, congenital conditions were recorded in 11 patients (10.6%), highlighting a diverse spectrum of contributing factors to cervical nerve compression. The demographic analysis showed a gender distribution of 48 males (46.2%) and 35 females (33.7%). Among these participants, 45 individuals (43.3%) were diagnosed with hypertension, with 27 males (25.9%) and 18 females (17.3%) affected. Diabetes was reported in 13 patients (12.5%), with 8 males (7.7%) and 5 females (4.8%). No cases of diabetes were identified in the 0-18 age group, indicating a higher prevalence of these conditions in older adults. Notably, 83 patients (79.8%) reported engaging in desktop work, with 48 males (46.2%) and 35 females (33.7%), which may be a contributing factor to their cervical symptoms.

In terms of clinical symptoms, localized pain was reported by 27 patients (26%), with 14 males (13.5%) and 13 females (12.5%). Radiating pain, a hallmark of cervical nerve compression, was noted in 77 patients (74%), including 47 males (45.2%) and 30 females (28.8%), with the highest prevalence occurring in the 30-45 age group. Stiffness was experienced by 67 patients (64.4%), with 39 males (37.5%) and 28 females (26.9%), particularly affecting those aged 45-65. Additional symptoms included muscle spasms in 49 patients (47.1%), with 31 males (29.8%) and 18 females (17.3%), headaches in 58 patients (55.8%), with 34 males (32.7%) and 24 females (23.1%), and numbness or

tingling in 77 patients (74%), with 47 males (45.2%) and 30 females (28.8%). Weakness was reported by 48 patients (46.1%), with 30 males (28.8%) and 18 females (17.3%). Loss of coordination was documented in 41 patients (39.4%), and reflex changes were observed in 77 patients (74%), with 47 males (45.2%) and 30 females (28.8%)

Table # 4.1 shows the demographic and clinical characteristics of 104 patients with cervical nerve compression

Clinical History	Male	Female	Age 0-18	Age 18-30	Age 30-45	Age 45-65	Age 65-90	Total
Hypertensive	27	18	2	3	9	27	4	45
Daibates	8	5	0	0	1	6	6	13
Desktop work	48	35	12	8	40	22	1	83
Localized Pain	14	13	2	4	11	8	2	27
Radiating Pain	47	30	10	4	31	27	5	77
Stiffness	39	28	6	5	27	24	5	67
Muscle Spasms	31	18	7	5	15	19	3	49
Headaches	34	24	8	5	24	18	3	58
Numbness or Tingling	47	30	10	4	31	27	5	77
Weakness	30	18	7	2	22	16	1	48
Loss of Coordination	23	18	7	5	10	16	3	41
Reflex Changes	47	30	10	4	31	27	5	77

Presents the demographic and clinical characteristics of 104 patients with cervical nerve compression, categorizing the prevalence of conditions like hypertension and diabetes, as well as symptoms such as radiating pain, numbness, and stiffness by age and gender. Notably, the most frequently reported symptoms were radiating pain and numbness, indicating significant neurological impacts associated with cervical nerve compression.

Table # 4.2 crosstab analysis of Hypertension

Crosstab					
			Hypertensive Patients		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	34	27	61
		% of Total	32.7%	26.0%	58.7%
Total		Count	59	45	104
		% of Total	56.7%	43.3%	100.0%

The crosstab analysis illustrates the relationship between gender and the presence of hypertension among 104 patients.

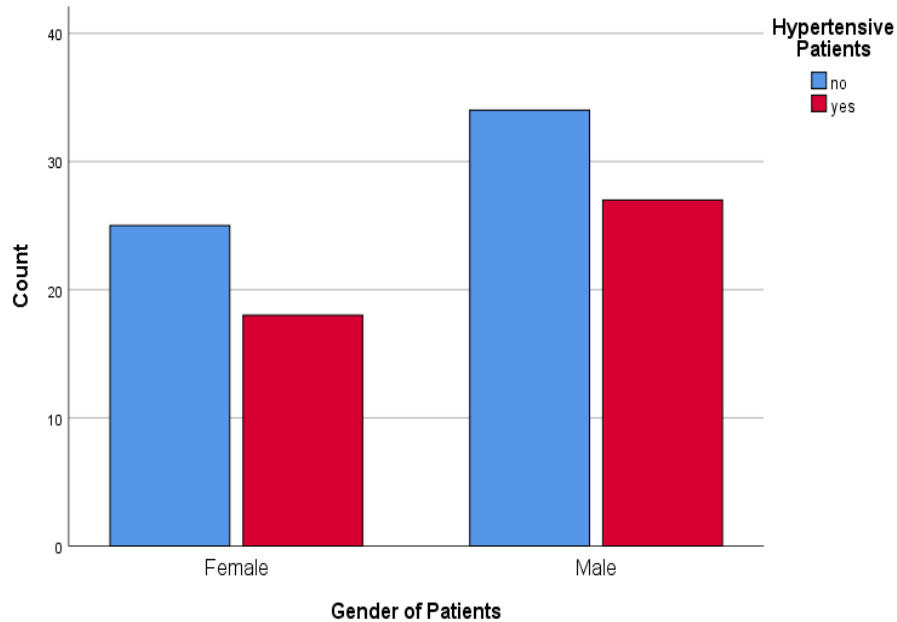


Figure # 4.1 The crosstab analysis can be visualized in a bar chart with two categories: Hypertensive Group and Non-Hypertensive Group, broken down by gender.

Table # 4.3 crosstab analysis of diabetes

Crosstab					
			Diabetic Patients		Total
			No	Yes	
Gender of Patients	Female	Count	38	5	43
		% of Total	36.5%	4.8%	41.3%
	Male	Count	53	8	61
		% of Total	51.0%	7.7%	58.7%
Total		Count	91	13	104
		% of Total	87.5%	12.5%	100.0%

The crosstab analysis presents the distribution of diabetic and non-diabetic patients based on gender in a sample of 104 patients.

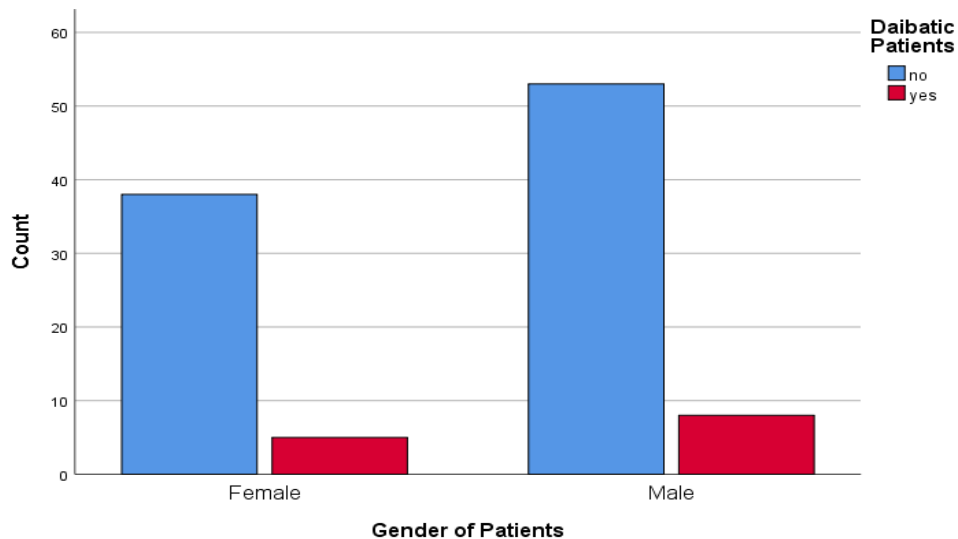


Figure # 4.2 The crosstab analysis of diabetes status by gender can be effectively represented in a bar chart with two categories: the majority of patients being non-diabetic, and a slightly higher prevalence of diabetes in males compared to females.

Table # 4.4 crosstab analysis of desktop work

Crosstab					
			Desktop Work		Total
			No	Yes	
Gender of Patients	Female	Count	8	35	43
		% of Total	7.7%	33.7%	41.3%
	Male	Count	13	48	61
		% of Total	12.5%	46.2%	58.7%
Total		Count	21	83	104
		% of Total	20.2%	79.8%	100.0%

The crosstab analysis reveals the distribution of patients engaged in desktop work based on gender in a sample of 104 patients. Among the total sample, 79.8% (83 patients) are involved in desktop work, while 20.2% (21 patients) are not.

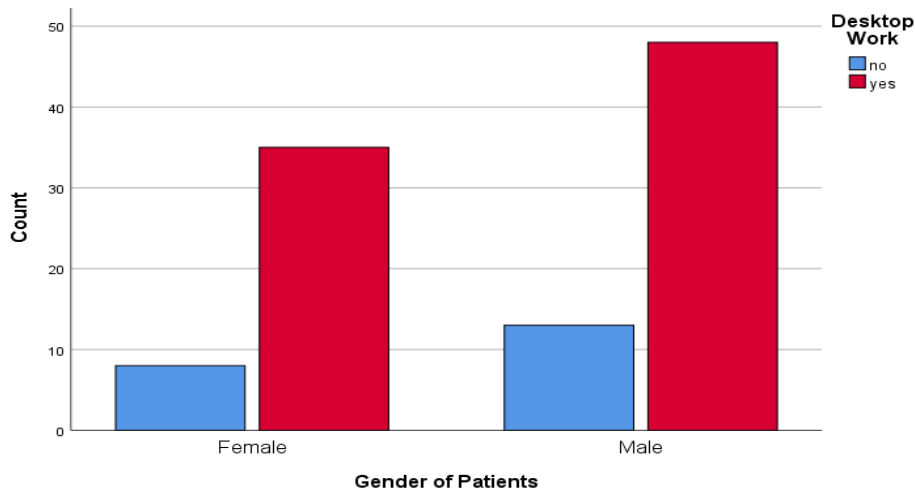


Figure # 4.3 The crosstab analysis can be represented in a bar chart with two main categories: "No" (Not Engaged in Desktop Work) and "Yes" (Engaged in Desktop Work). Each category should be divided by gender:

Table # 4.5 crosstab analysis of localize pain

Crosstab					
			Localized Pain		Total
			No	Yes	
Gender of Patients	Female	Count	30	13	43
		% of Total	28.8%	12.5%	41.3%
	Male	Count	47	14	61
		% of Total	45.2%	13.5%	58.7%
Total		Count	77	27	104
		% of Total	74.0%	26.0%	100.0%

The crosstab analysis examines the distribution of patients with localized pain based on gender in a sample of 104 patients. Overall, 26.0% (27 patients) reported localized pain, while 74.0% (77 patients) did not

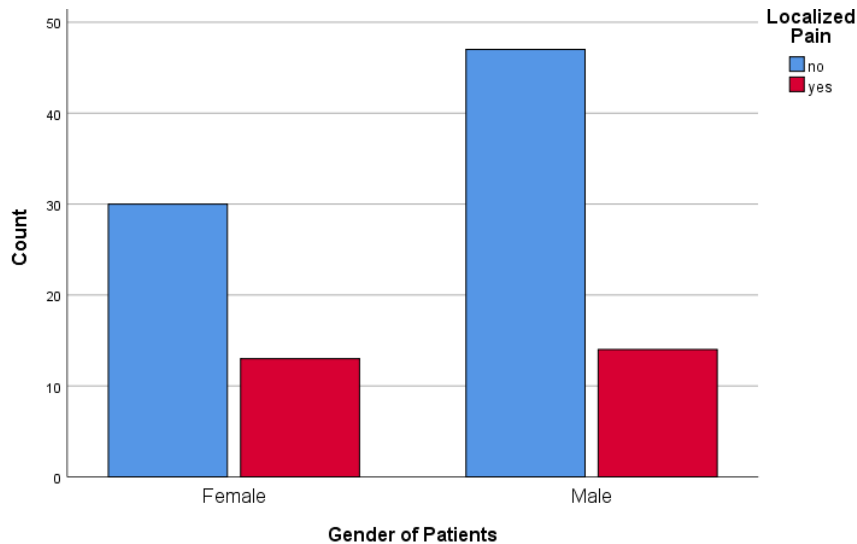


Figure # 4.4 The chart displays the distribution of localized pain by gender among 104 patients. It divides the patients into two categories: "No" (No Localized Pain) and "Yes" (Localized Pain).

Table # 4.6 crosstab analysis of radiating pain

Crosstab					
			Radiating Pain		Total
			No	Yes	
Gender of Patients	Female	Count	13	30	43
		% of Total	12.5%	28.8%	41.3%
	Male	Count	14	47	61
		% of Total	13.5%	45.2%	58.7%
Total		Count	27	77	104
		% of Total	26.0%	74.0%	100.0%

The cross tabulation data shows the distribution of radiating pain among male and female patients. Of the total 104 patients, 43 are female and 61 are male.

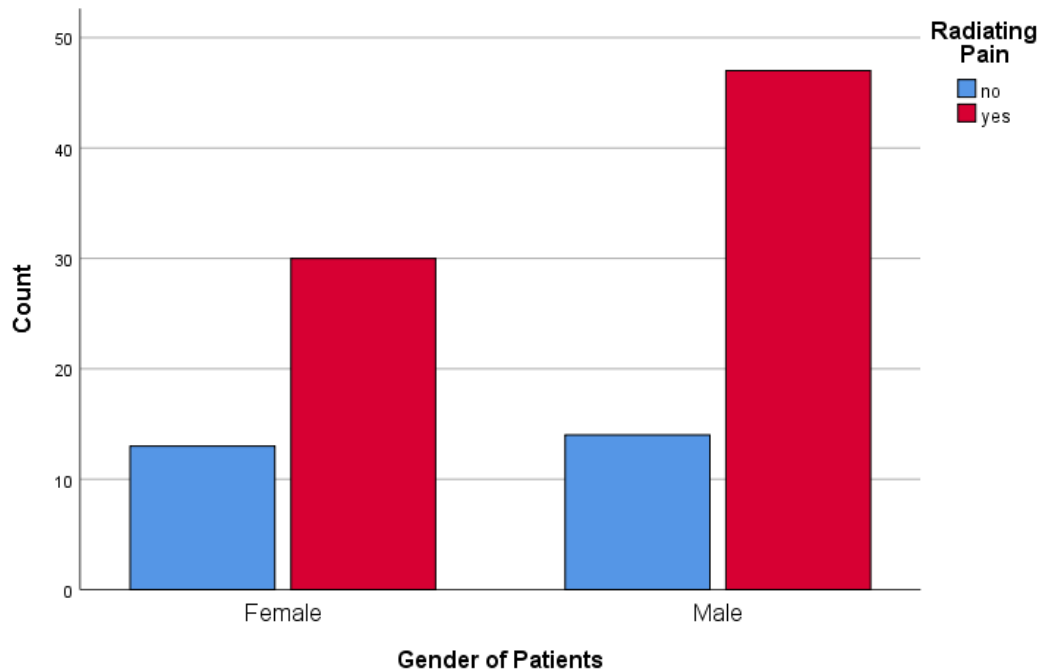


Figure # 4.5 Bar chart illustrates the distribution of radiating pain among male and female patients. For female patients, the red segment (No pain) represents 13 patients

Table # 4.7 crosstab analysis of stiffness

Crosstab					
			Stiffness		Total
			No	Yes	
Gender of Patients	Female	Count	15	28	43
		% of Total	14.4%	26.9%	41.3%
	Male	Count	22	39	61
		% of Total	21.2%	37.5%	58.7%
Total		Count	37	67	104
		% of Total	35.6%	64.4%	100.0%

The cross tabulation table shows the distribution of stiffness symptoms among male and female patients. Of the total 104 patients, 43 are female and 61 are male.

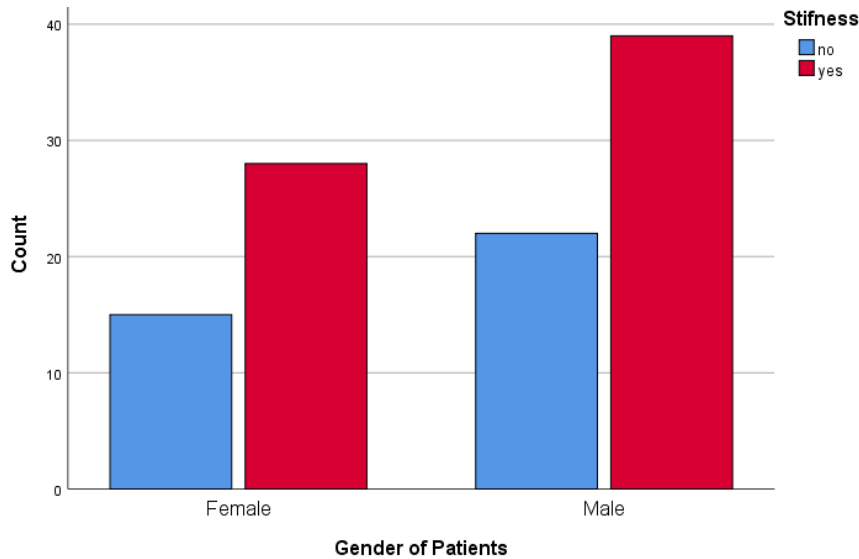


Figure # 4.6 Bar chart shows the distribution of stiffness among male and female patients. The x-axis represents the two genders—Female and Male—and the y-axis represents the number of patients.

Table # 4.8 Crosstab analysis of muscle spasm

Crosstab					
			Muscle Spasms		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	30	31	61
		% of Total	28.8%	29.8%	58.7%
Total		Count	55	49	104
		% of Total	52.9%	47.1%	100.0%

The crosstab data provides a detailed breakdown of muscle spasms in male and female patients. Of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7%)of the total

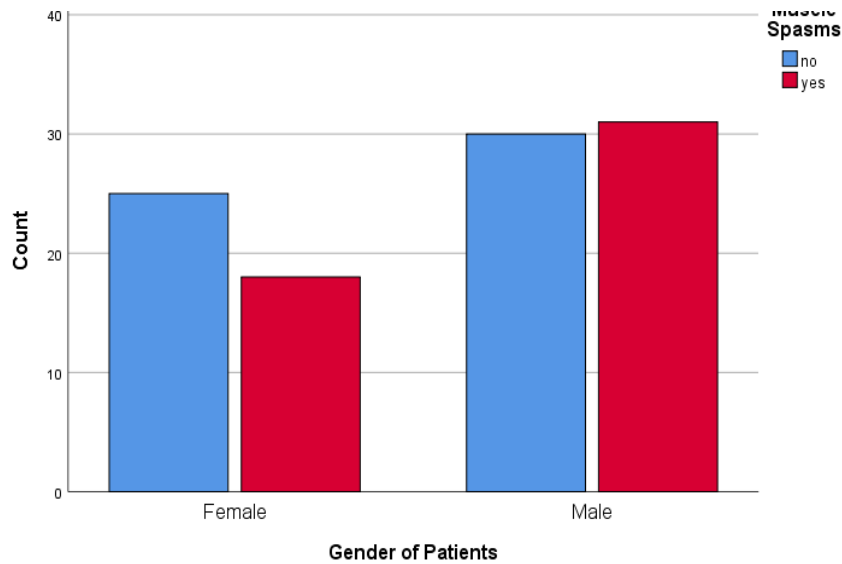


Figure # 4.7 The distribution of muscle spasms among male and female patients can be visually represented in a bar chart.

Table # 4.9 Crosstab analysis of headache

Crosstab					
			Headaches		Total
			No	Yes	
Gender of Patients	Female	Count	19	24	43
		% of Total	18.3%	23.1%	41.3%
	Male	Count	27	34	61
		% of Total	26.0%	32.7%	58.7%
Total		Count	46	58	104
		% of Total	44.2%	55.8%	100.0%

The crosstab data shows the distribution of headaches among male and female patients. Of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total).

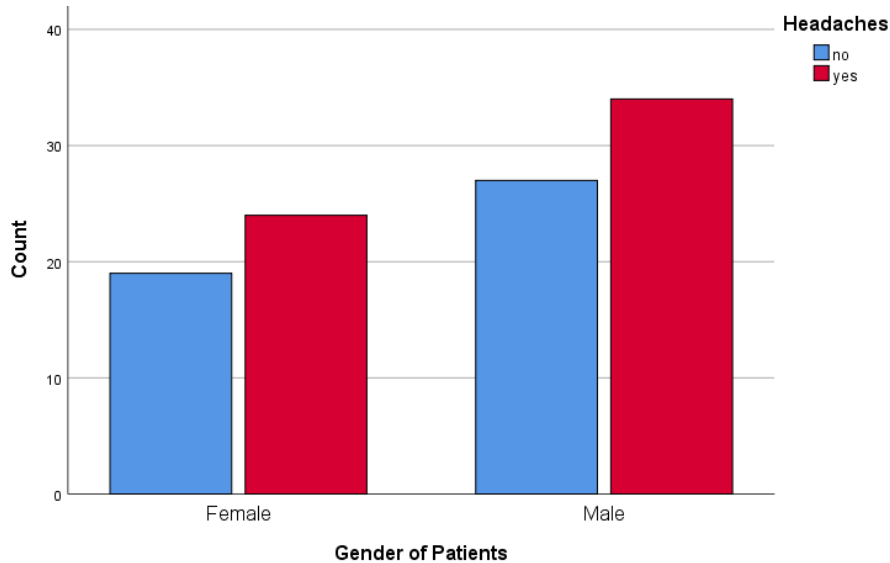


Figure # 4.8 The bar chart visually represents headache data among male and female patients, using blue for those without headaches ("No") and red for those with headaches ("Yes").

Table # 4.10 Crosstab analysis of numbness and tingling

Crosstab					
			Numbness and Tingling		Total
			No	Yes	
Gender of Patients	Female	Count	13	30	43
		% of Total	12.5%	28.8%	41.3%
	Male	Count	14	47	61
		% of Total	13.5%	45.2%	58.7%
Total		Count	27	77	104
		% of Total	26.0%	74.0%	100.0%

The crosstab data shows the distribution of patients experiencing numbness and tingling, broken down by gender. Of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total).

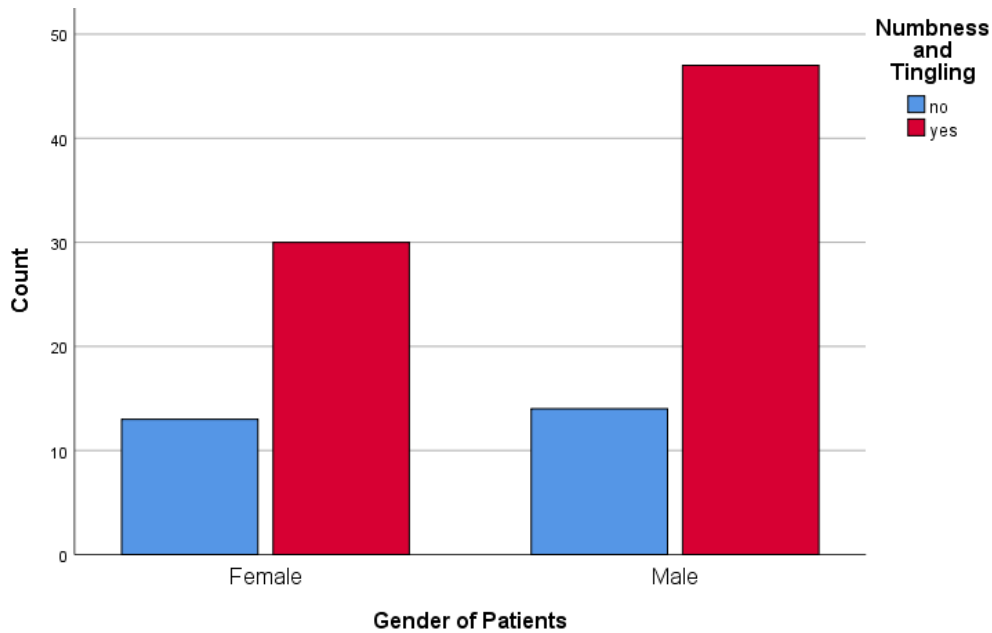


Figure # 4.9 In the graphical representation, blue bars represent patients who do not experience numbness and tingling ("No"), and red bars represent those who do ("Yes")

Table # 4.11 Crosstab analysis of weakness

Crosstab					
			Weakness		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	31	30	61
		% of Total	29.8%	28.8%	58.7%
Total		Count	56	48	104
		% of Total	53.8%	46.2%	100.0%

The crosstab data shows the distribution of weakness among male and female patients. Of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total)

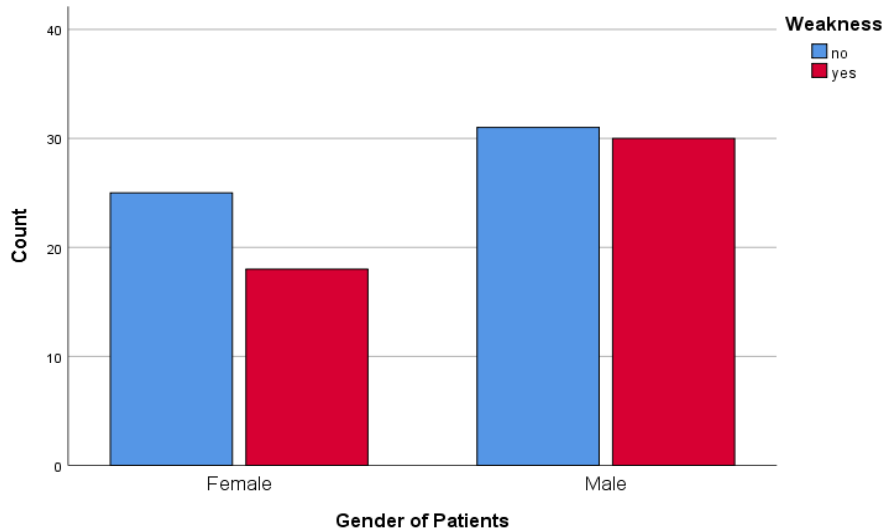


Figure # 4.10 A graphical representation of this data, blue bars would represent patients who do not experience weakness ("No"), and red bars would represent those who do experience weakness ("Yes").

Table # 4.12 crosstab analysis of loss of coordination

Crosstab					
			Loss of Coordination		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	38	23	61
		% of Total	36.5%	22.1%	58.7%
Total		Count	63	41	104
		% of Total	60.6%	39.4%	100.0%

The crosstab data shows the distribution of loss of coordination among male and female patients. Out of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total).

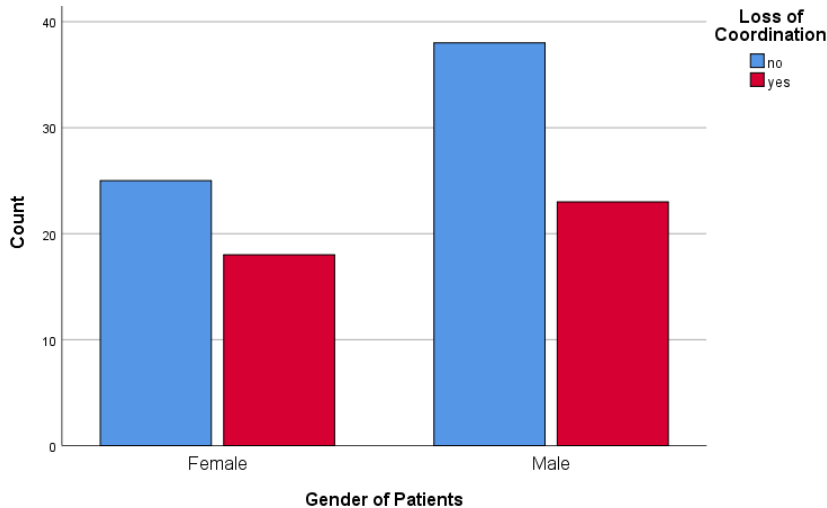


Figure # 4.11 In the graphical representation of this data, blue bars represent patients who do not experience loss of coordination ("No"), and red bars represent those who do experience it ("Yes").

Table # 4.13 crosstab analysis of reflex change

Crosstab					
			Reflex Change		Total
			No	Yes	
Gender of Patients	Female	Count	13	30	43
		% of Total	12.5%	28.8%	41.3%
	Male	Count	14	47	61
		% of Total	13.5%	45.2%	58.7%
Total		Count	27	77	104
		% of Total	26.0%	74.0%	100.0%

The crosstab data shows the distribution of reflex changes among male and female patients. Of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total).

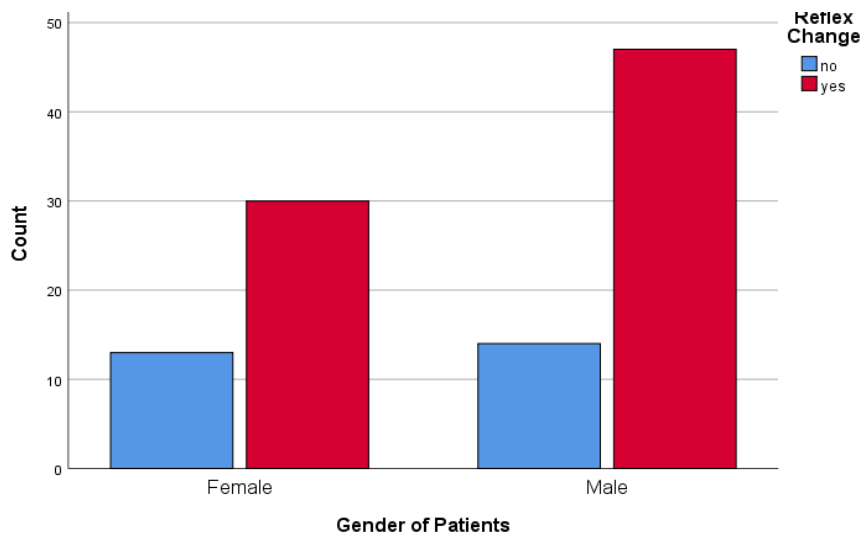


Figure # 4.12 In the graphical representation of this data, blue bars represent patients who do not experience reflex changes ("No"), and red bars represent those who do experience reflex changes ("Yes").

Table # 4.14 Crosstab analysis of tumor on T1 Sequences of MRI

Crosstab					
			Tumors T1		Total
			No	Yes	
Gender of Patients	Female	Count	32	11	43
		% of Total	30.8%	10.6%	41.3%
	Male	Count	35	26	61
		% of Total	33.7%	25.0%	58.7%
Total		Count	67	37	104
		% of Total	64.4%	35.6%	100.0%

The crosstab data shows the distribution of Tumors T1 among male and female patients. Out of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total).

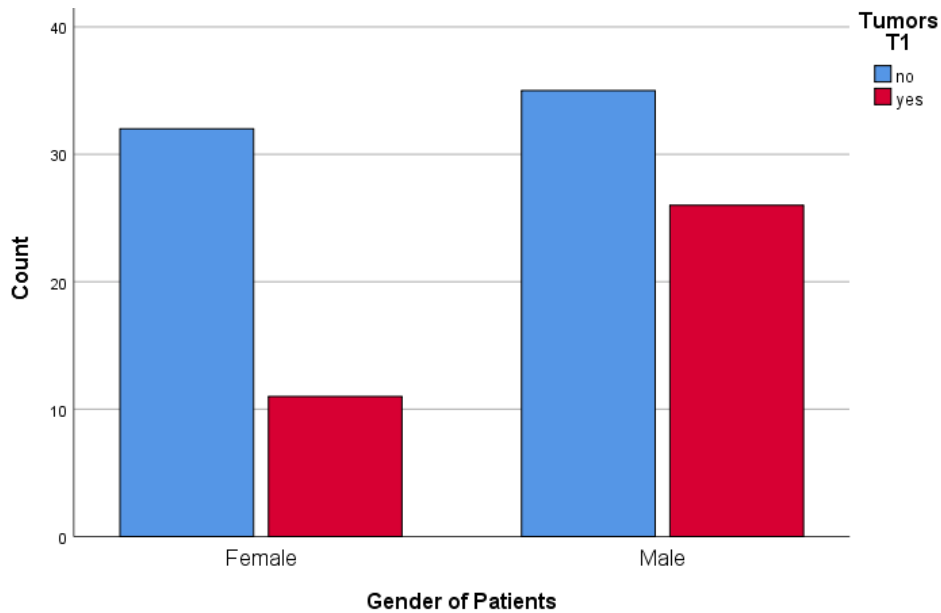


Figure # 4.13 In the graphical representation, blue bars represent patients without Tumors T1 ("No") and red bars represent those with Tumors T1 ("Yes"). For female patients, 32 (30.8%) do not have Tumors T1, while 11 (10.6%) do.

Table # 4.15 Crosstab analysis of tumor on T2 Sequences of MRI

Crosstab					
			Tumors T2		Total
			No	Yes	
Gender of Patients	Female	Count	32	11	43
		% of Total	30.8%	10.6%	41.3%
	Male	Count	35	26	61
		% of Total	33.7%	25.0%	58.7%
Total		Count	67	37	104
		% of Total	64.4%	35.6%	100.0%

The crosstab data shows the distribution of Tumors T2 among male and female patients. Out of the total 104 patients, 43 are female (41.3% of the total) and 61 are male (58.7% of the total).

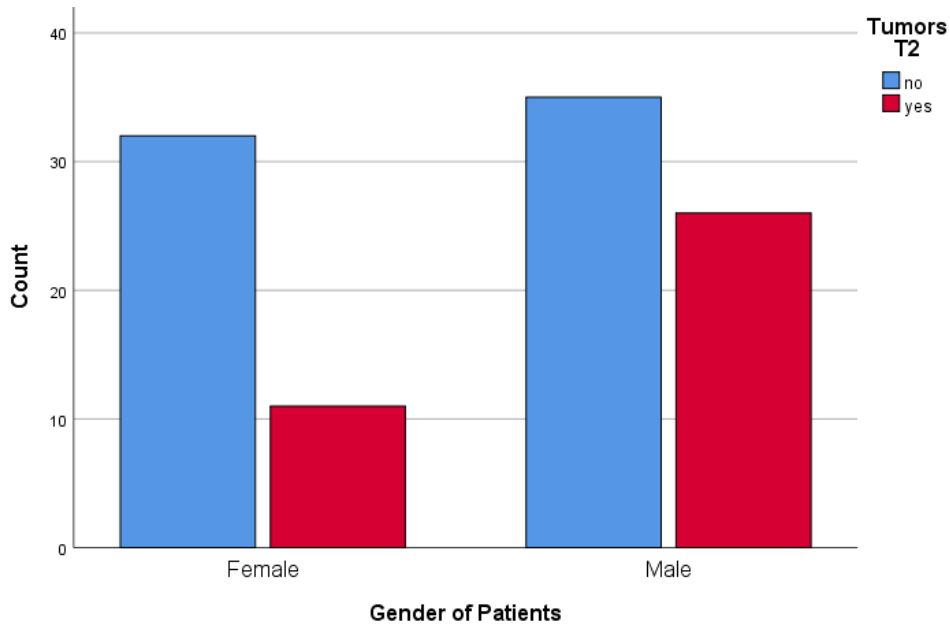


Figure # 4.14 In the graphical representation, blue bars represent patients whose tumors are not visible on T2 MRI sequences ("No"), while red bars represent those whose tumors are visible on T2 MRI sequences ("Yes")

Table # 4.16 Crosstab analysis of Herniated disc on T1 Sequences of MRI

Crosstab					
			Herniated Dics T1		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	38	23	61
		% of Total	36.5%	22.1%	58.7%
Total		Count	63	41	104
		% of Total	60.6%	39.4%	100.0%

The crosstab data illustrates the presence of Herniated Discs T1 among male and female patients. Of the total 104 patients, 43 are female (41.3%) and 61 are male (58.7%).

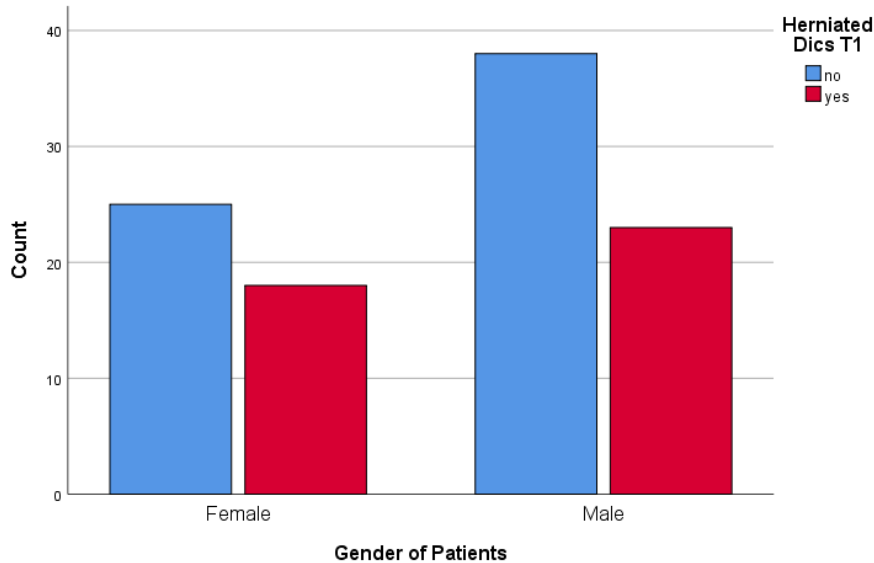


Figure # 4.15 In the graphical representation of this data, blue bars represent patients who do not have Herniated Discs T1 ("No"), and red bars represent those who have Herniated Discs T1 ("Yes").

Table # 4.17 Crosstab analysis of herniated disc on T2 Sequences of MRI

Crosstab					
			Herniated Dics T2		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	38	23	61
		% of Total	36.5%	22.1%	58.7%
Total		Count	63	41	104
		% of Total	60.6%	39.4%	100.0%

The crosstab data presents a breakdown of patients based on gender and the presence of a herniated disc (Herniated Disc T2).

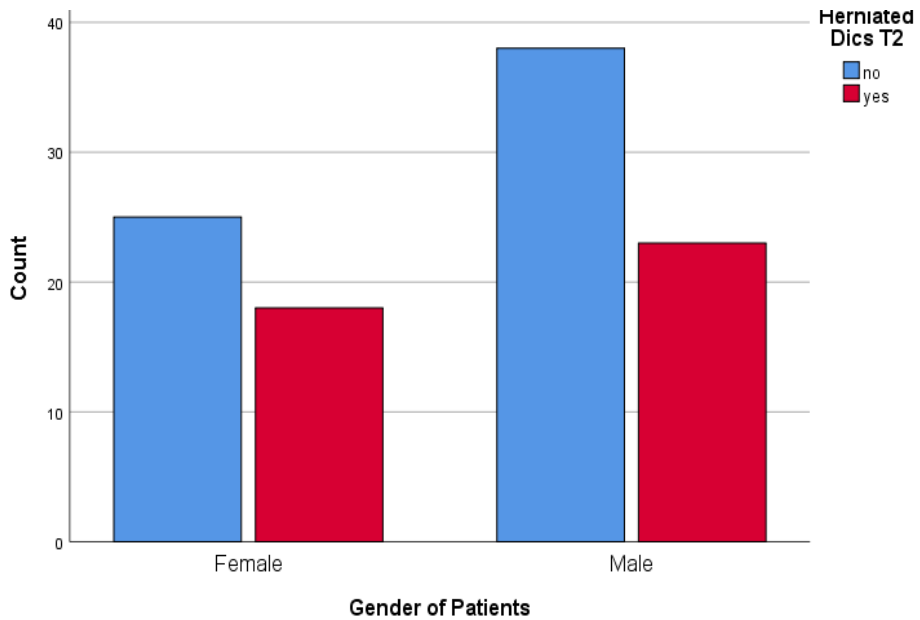


Figure # 4.16 Clustered bar chart show the distribution of patients by gender and herniated disc status.

Table # 4.18 Crosstab analysis of herniated on axial Sequences of MRI

Crosstab					
			Herniated Dics Axial		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	38	23	61
		% of Total	36.5%	22.1%	58.7%
Total		Count	63	41	104
		% of Total	60.6%	39.4%	100.0%

The crosstab data shows the distribution of patients based on gender and the presence of an axial herniated disc.

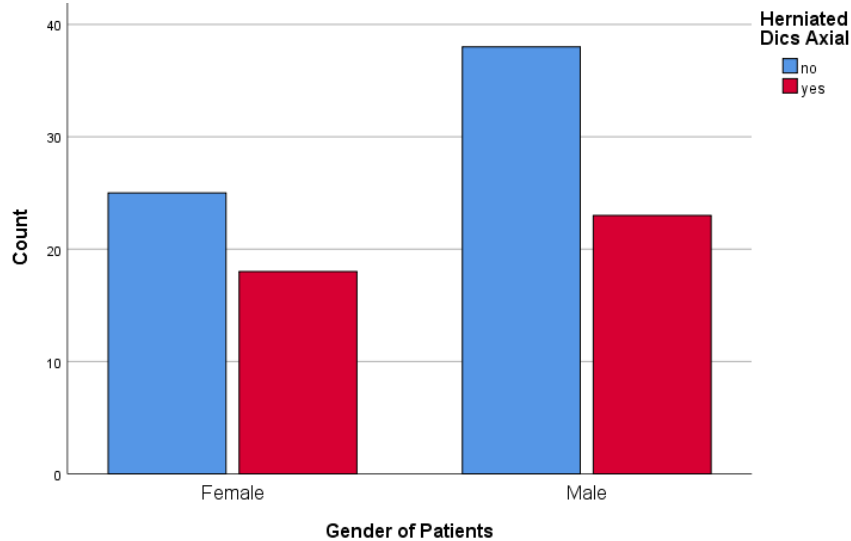


Figure # 4.17 A stacked or clustered bar chart would show the total number of patients by gender, divided into those with and without an axial herniated disc.

Table # 4.19 Crosstab analysis of degenerative disc disease T1 Sequences of MRI

Crosstab					
			Degenerative Disc Disease T1		Total
			No	Yes	
Gender of Patients	Female	Count	34	9	43
		% of Total	32.7%	8.7%	41.3%
	Male	Count	48	13	61
		% of Total	46.2%	12.5%	58.7%
Total		Count	82	22	104
		% of Total	78.8%	21.2%	100.0%

The crosstab data presents the distribution of patients based on gender and the presence of degenerative disc disease (Degenerative Disc Disease T1).

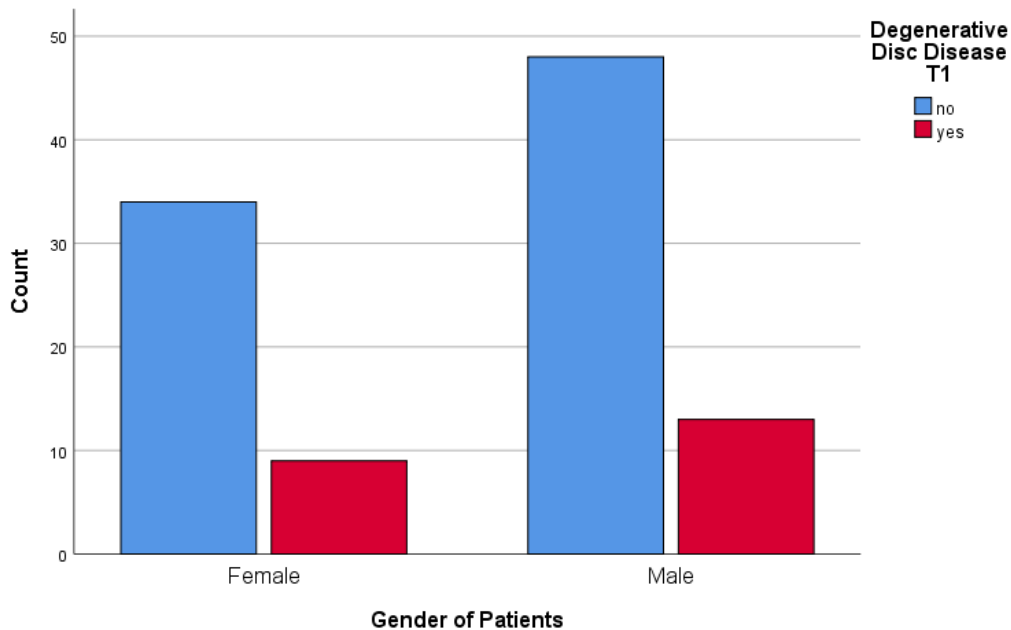


Figure # 4.18 A stacked or clustered bar chart display the total number of patients by gender, divided into those with and without degenerative disc disease.

Table # 4.20 crosstab analysis of degenerative disc disease T2 Sequences of MRI

Crosstab					
			Degenerative Disc DiseaseT2		Total
			No	Yes	
Gender of Patients	Female	Count	34	9	43
		% of Total	32.7%	8.7%	41.3%
	Male	Count	48	13	61
		% of Total	46.2%	12.5%	58.7%
Total		Count	82	22	104
		% of Total	78.8%	21.2%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of degenerative disc disease (Degenerative Disc Disease T2).

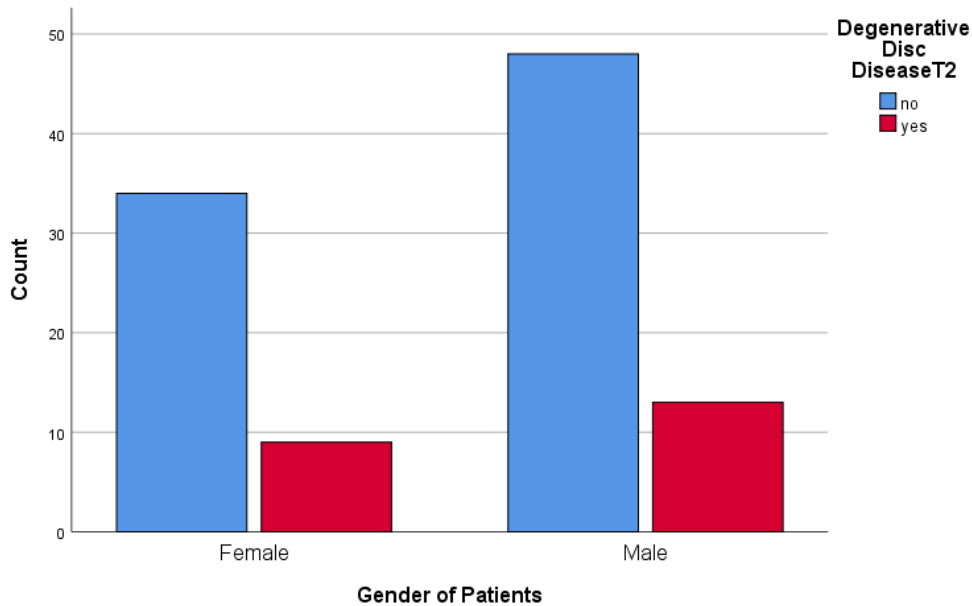


Figure # 4.19 A stacked or clustered bar chart show the total number of patients by gender, with segments for those with and without degenerative disc disease.

Table # 4.21 crosstab analysis of degenerative disease axial Sequences of MRI

Crosstab					
			Degenerative Disc Disease Axial		Total
			No	Yes	
Gender of Patients	Female	Count	34	9	43
		% of Total	32.7%	8.7%	41.3%
	Male	Count	48	13	61
		% of Total	46.2%	12.5%	58.7%
Total		Count	82	22	104
		% of Total	78.8%	21.2%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of degenerative disc disease (Degenerative Disc Disease Axial).

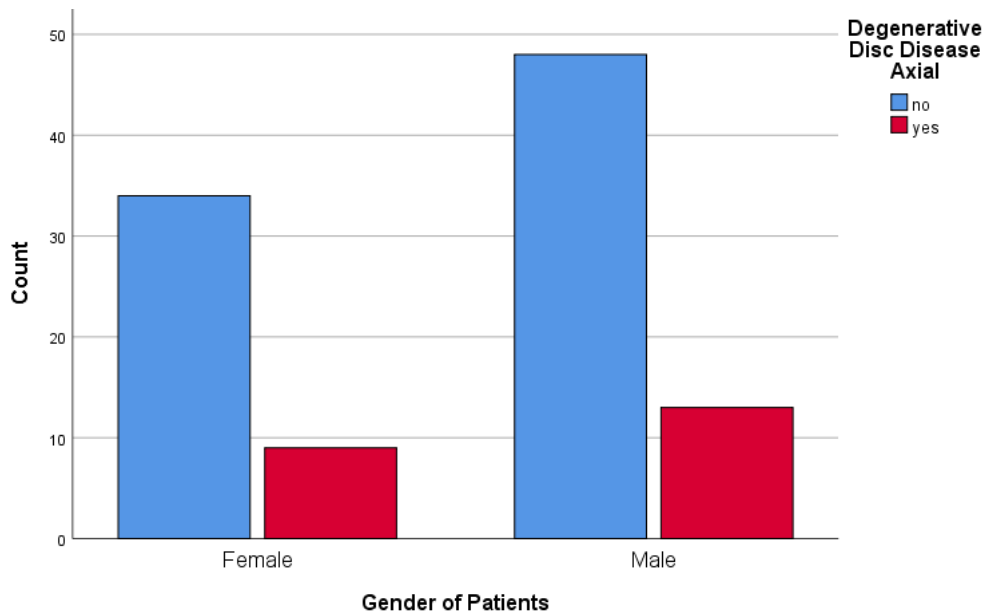


Figure # 4.20 Clustered bar chart display the total number of patients by gender, split into those with and without degenerative disc disease.

Table # 4.22 Crosstab analysis of bone spurs on T1 Sequences of MRI

Crosstab					
			Bone Spurs T1		Total
			no	yes	
Gender of Patients	Female	Count	33	10	43
		% of Total	31.7%	9.6%	41.3%
	Male	Count	49	12	61
		% of Total	47.1%	11.5%	58.7%
Total		Count	82	22	104
		% of Total	78.8%	21.2%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of bone spurs (Bone Spurs T1).

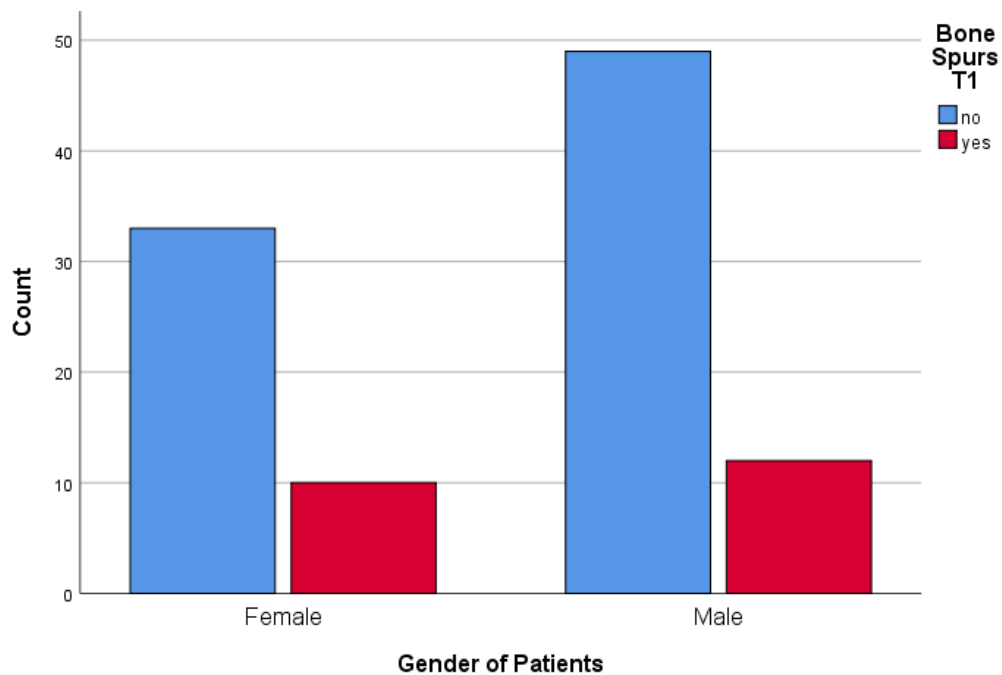


Figure # 4.21 A stacked or clustered bar chart display the total number of patients by gender, divided into those with and without bone spurs.

Table # 4.23 Crosstab analysis of bone spur on T2 Sequences of MRI

Crosstab					
			Bone Spurs T2		Total
			no	yes	
Gender of Patients	Female	Count	33	10	43
		% of Total	31.7%	9.6%	41.3%
	Male	Count	49	12	61
		% of Total	47.1%	11.5%	58.7%
Total		Count	82	22	104
		% of Total	78.8%	21.2%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of bone spurs (Bone Spurs T2).

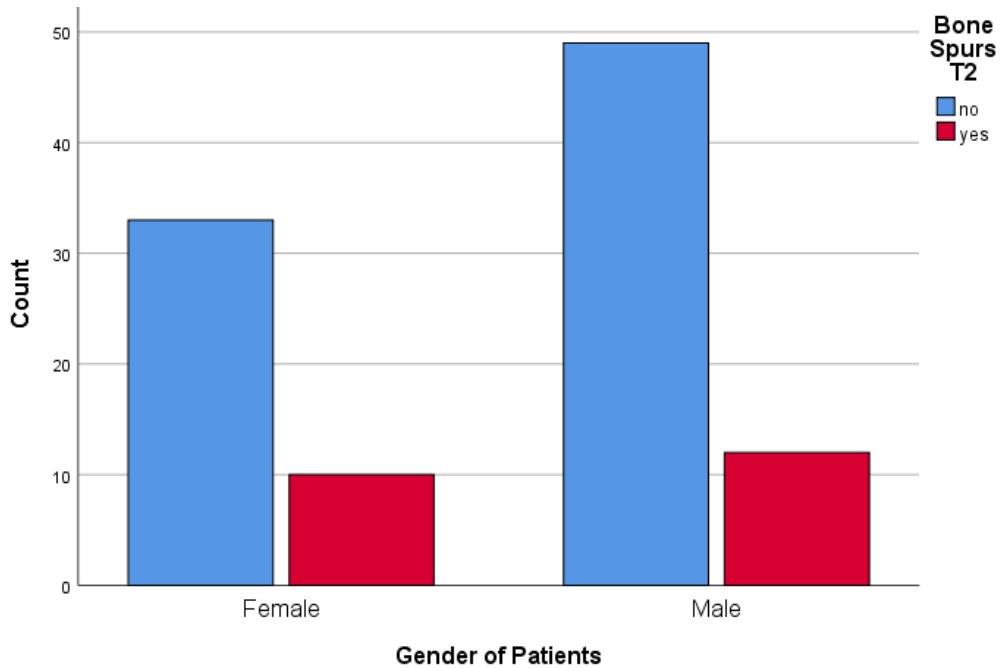


Figure # 4.22 A stacked or clustered bar chart show the total number of patients by gender, split into those with and without bone spurs.

Table # 4.24 crosstab analysis of bone spurs on axial Sequences of MRI

Crosstab					
			Bone Spurs Axial		Total
			no	yes	
Gender of Patients	Female	Count	33	10	43
		% of Total	31.7%	9.6%	41.3%
	Male	Count	49	12	61
		% of Total	47.1%	11.5%	58.7%
Total		Count	82	22	104
		% of Total	78.8%	21.2%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of bone spurs (Bone Spurs Axial).

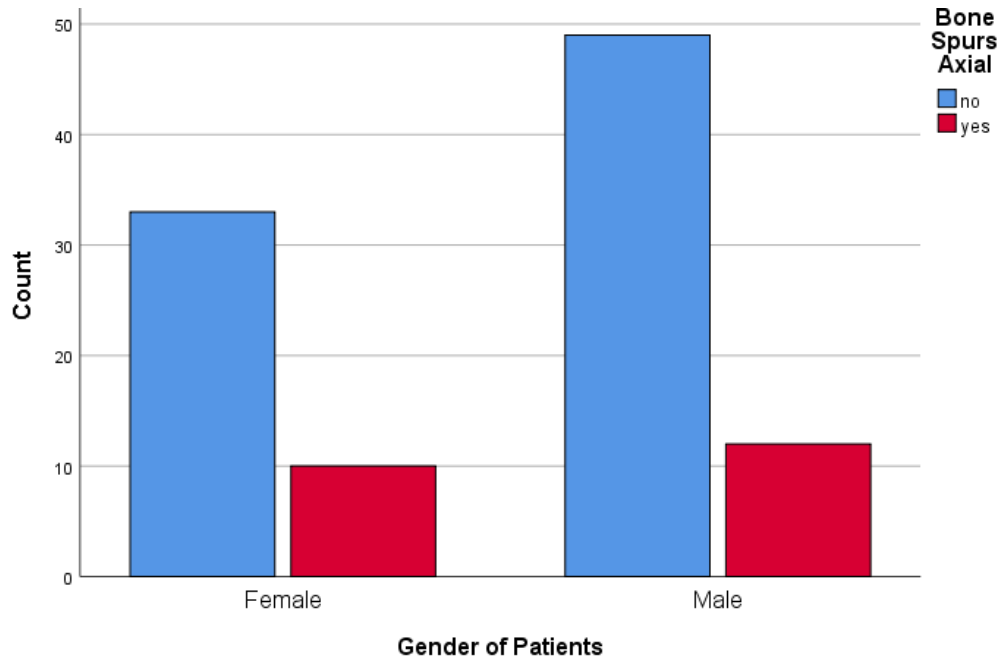


Figure # 4.23 A stacked or clustered bar chart show the total number of patients by gender, divided into those with and without bone spurs.

Table # 4.25 crosstab analysis of cervical stenosis on T1 Sequences of MRI

Crosstab					
			Cervical Stenosis T1		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	30	31	61
		% of Total	28.8%	29.8%	58.7%
Total		Count	55	49	104
		% of Total	52.9%	47.1%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of cervical stenosis (Cervical Stenosis T1).

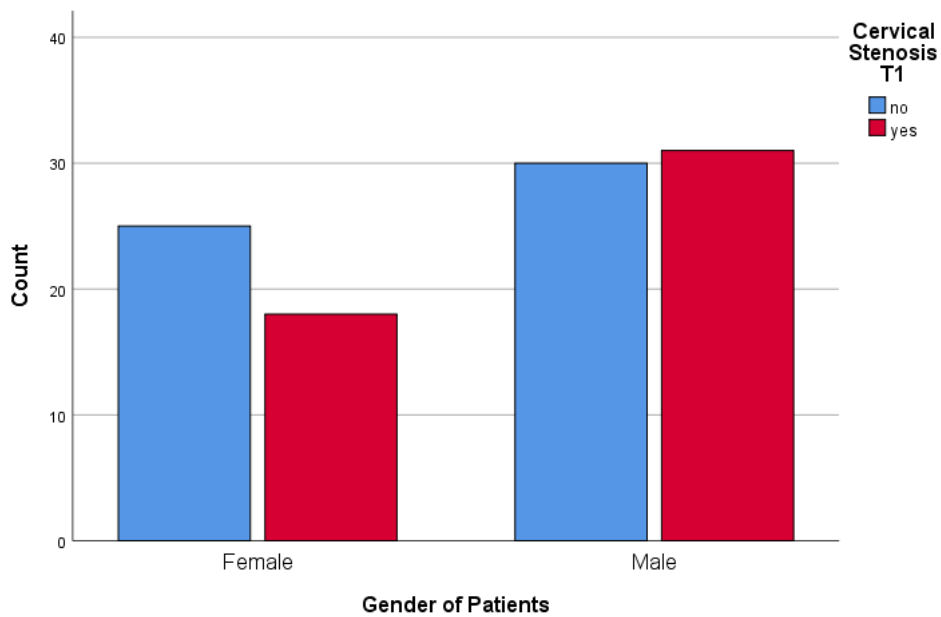


Figure # 4.24 A stacked or clustered bar chart display the total number of patients by gender, divided into those with and without cervical stenosis.

Table # 4.26 crosstab analysis of cervical stenosis on T2 Sequences of MRI

Crosstab					
			Cervical Stenosis T2		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	30	31	61
		% of Total	28.8%	29.8%	58.7%
Total		Count	55	49	104
		% of Total	52.9%	47.1%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of cervical stenosis (Cervical Stenosis T2).

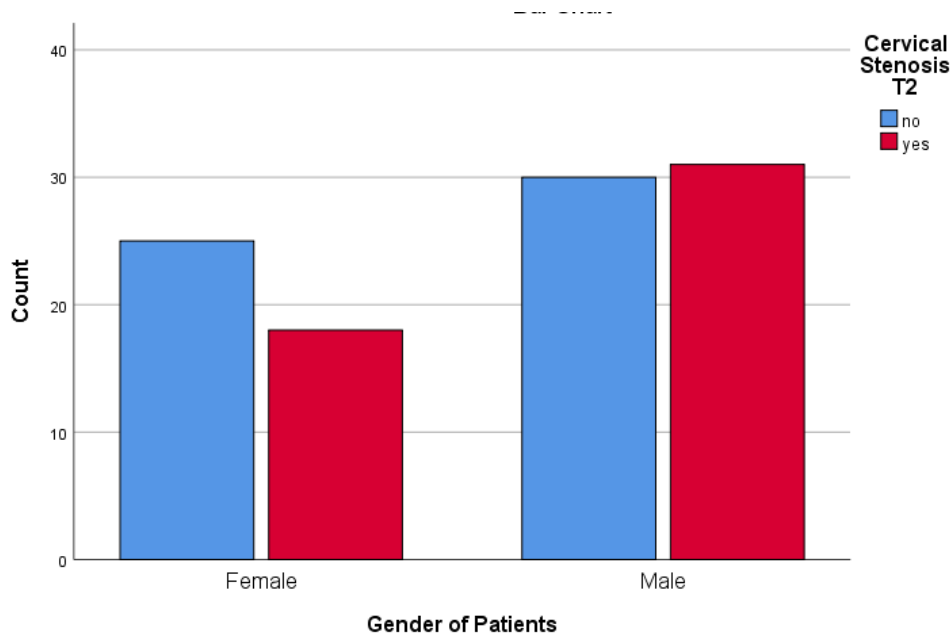


Figure # 4.25 Clustered bar chart show the total number of patients by gender, divided into those with and without cervical stenosis.

Table # 4.27 crosstab analysis of cervical stenosis on axial Sequences of MRI

Crosstab					
			Cervical Stenosis Axial		Total
			No	Yes	
Gender of Patients	Female	Count	25	18	43
		% of Total	24.0%	17.3%	41.3%
	Male	Count	30	31	61
		% of Total	28.8%	29.8%	58.7%
Total		Count	55	49	104
		% of Total	52.9%	47.1%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of cervical stenosis (Cervical Stenosis Axial).

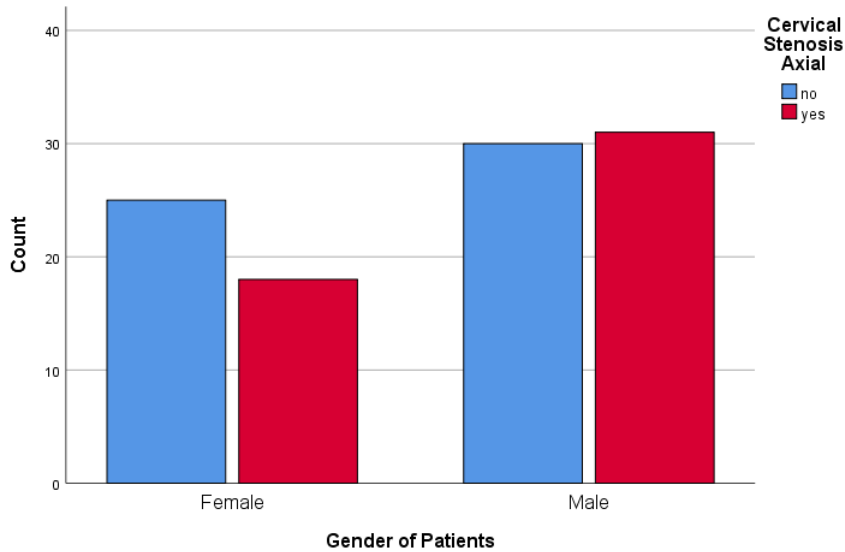


Figure # 4.26 Clustered bar chart show the total number of patients by gender, divided into those with and without cervical stenosis.

Table # 4.28 crosstab analysis of injuries on T1 Sequences of MRI

Crosstab					
			Injuries T1		Total
			No	Yes	
Gender of Patients	Female	Count	38	5	43
		% of Total	36.5%	4.8%	41.3%
	Male	Count	54	7	61
		% of Total	51.9%	6.7%	58.7%
Total		Count	92	12	104
		% of Total	88.5%	11.5%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of injuries (Injuries T1).

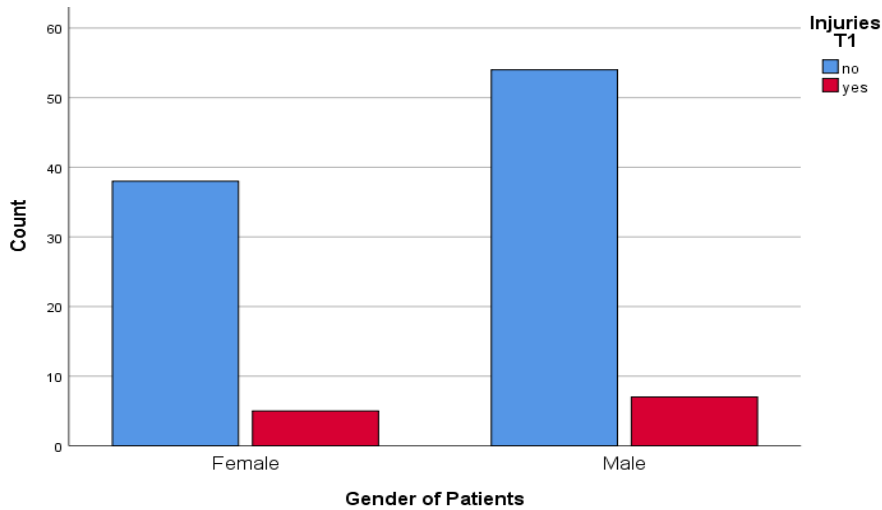


Figure # 4.27 Clustered bar chart would show the total number of patients by gender, divided into those with and without cervical stenosis.

Table # 4.29 crosstab analysis of injuries on T2 Sequences of MRI

Crosstab					
			Injuries T2		Total
			No	Yes	
Gender of Patients	Female	Count	38	5	43
		% of Total	36.5%	4.8%	41.3%
	Male	Count	54	7	61
		% of Total	51.9%	6.7%	58.7%
Total		Count	92	12	104
		% of Total	88.5%	11.5%	100.0%

The crosstab data shows the distribution of patients by gender and the presence of injuries (Injuries T2).

Figure # 4.29 Bar chart of injuries on T2 sequences of MRI

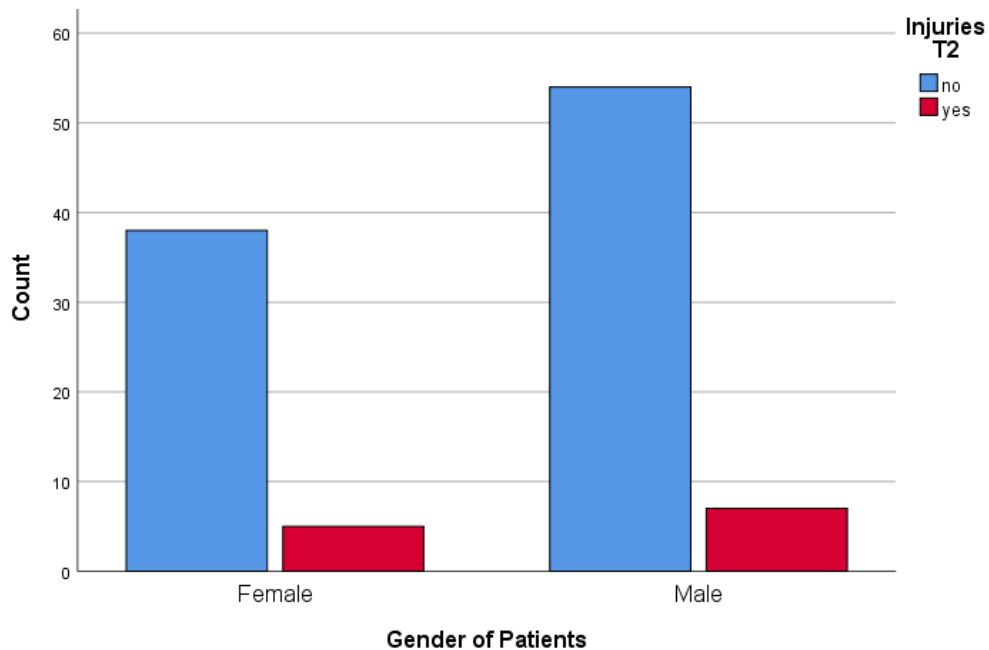


Figure # 4.28 Clustered bar chart would show the total number of patients by gender, divided into those with and without injuries.

Table # 4.30 crosstab analysis of injuries on axial Sequences of MRI

Crosstab					
			Injuries Axial		Total
			No	Yes	
Gender of Patients	Female	Count	38	5	43
		% of Total	36.5%	4.8%	41.3%
	Male	Count	54	7	61
		% of Total	51.9%	6.7%	58.7%
Total		Count	92	12	104
		% of Total	88.5%	11.5%	100.0%

The crosstab shows that out of 104 patients, 92 (88.5%) have no axial injuries, and 12 (11.5%) do.

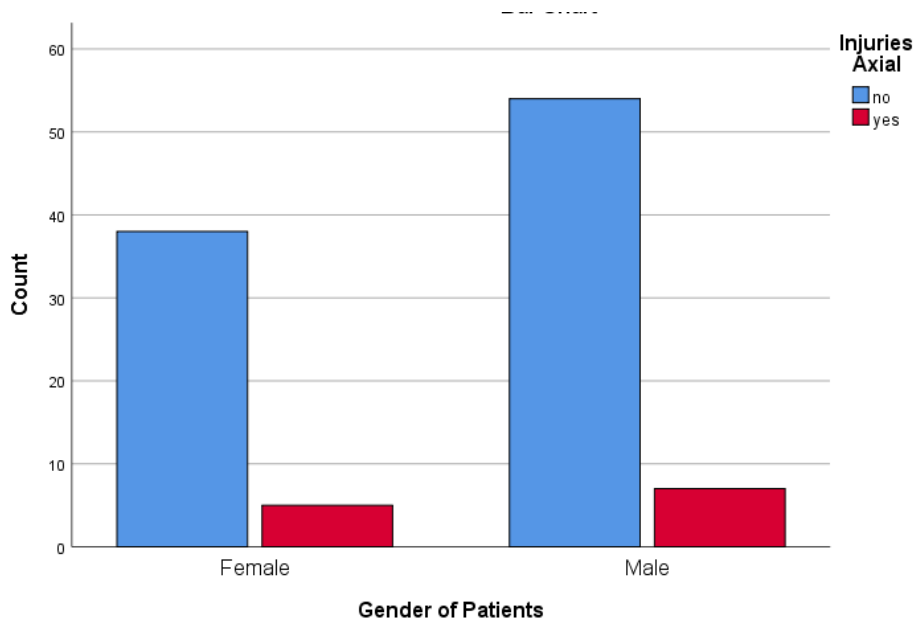


Figure # 4.29 A graphical representation of the data would likely show two bar charts, one for the total number of patients by gender and injury status, and another for the breakdown of axial injuries.

Table # 4.31 crosstab analysis of arthritis on T1 Sequences of MRI

Crosstab				
			Arthritis T1	Total
			No	
Gender of Patients	Female	Count	43	43
		% of Total	41.3%	41.3%
	Male	Count	61	61
		% of Total	58.7%	58.7%
Total		Count	104	104
		% of Total	100.0%	100.0%

The crosstab data shows the distribution of arthritis (T1) by gender. Out of 104 total patients, 43 are female (41.3% of the total), and 61 are male (58.7%).

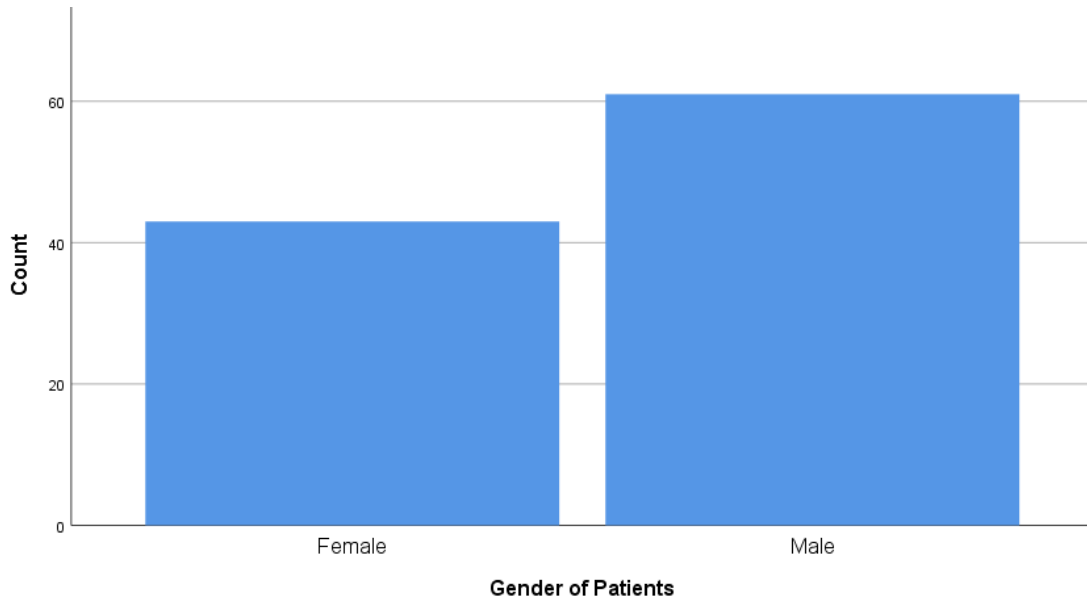


Figure # 4.30 This graphical display highlight that while the sample contains more male patients, there is no distinction between genders regarding arthritis status, as both groups have no cases of arthritis.

Table # 4.32 crosstab analysis of arthritis on T2 Sequences of MRI

Crosstab					
			Arthritis T2		Total
			No	Yes	
Gender of Patients	Female	Count	35	8	43
		% of Total	33.7%	7.7%	41.3%
	Male	Count	43	18	61
		% of Total	41.3%	17.3%	58.7%
Total		Count	78	26	104
		% of Total	75.0%	25.0%	100.0%

The crosstab data shows the distribution of arthritis (T2) by gender among 104 patients. Out of these, 78 patients (75%) do not have arthritis, while 26 (25%) do.

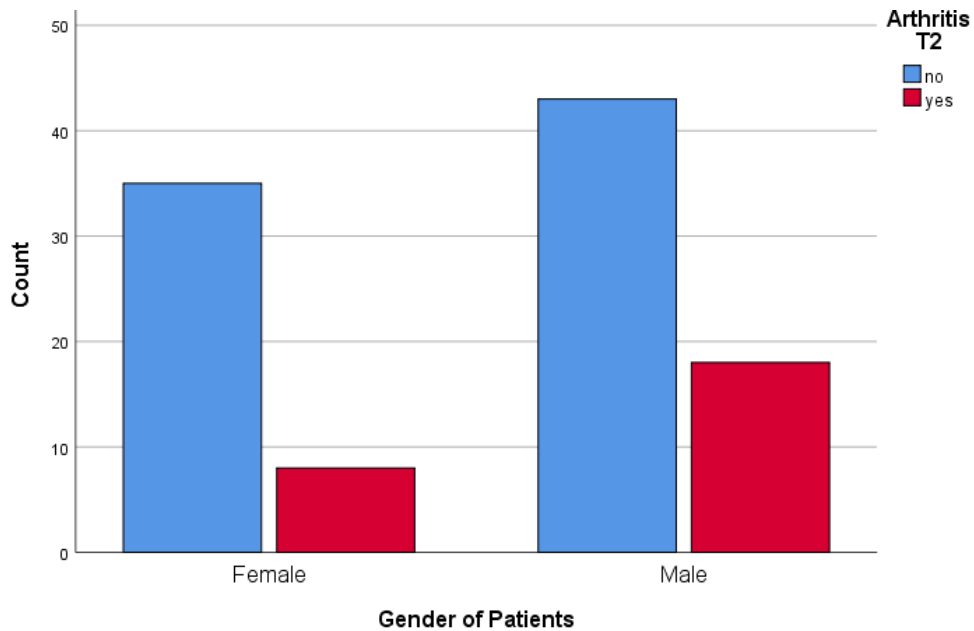


Figure # 4.31 A graphical representation of this data would likely consist of two grouped bar charts, one for each gender.

Table # 4.33 crosstab analysis of arthritis on axial Sequences of MRI

Crosstab					
			Arthritis Axial		Total
			no	yes	
Gender of Patients	Female	Count	35	8	43
		% of Total	33.7%	7.7%	41.3%
	Male	Count	43	18	61
		% of Total	41.3%	17.3%	58.7%
Total		Count	78	26	104
		% of Total	75.0%	25.0%	100.0%

The crosstab data reveals the distribution of arthritis with axial involvement by gender among 104 patients.

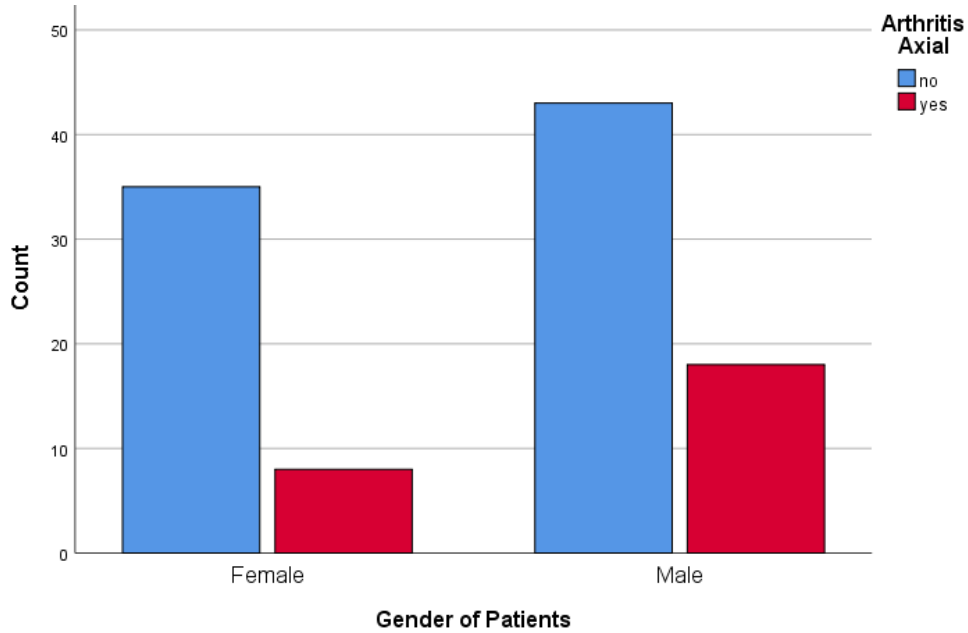


Figure # 4.32 A graphical representation of this data would feature two grouped bar charts, one for each gender.

Table # 4.34 crosstab analysis of infection on T1 Sequences of MRI

Crosstab					
		Infections T1			Total
		No	Yes		
Gender of Patients	Female	Count	28	15	43
		% of Total	26.9%	14.4%	41.3%
	Male	Count	45	16	61
		% of Total	43.3%	15.4%	58.7%
Total		Count	73	31	104
		% of Total	70.2%	29.8%	100.0%

The crosstab data provides an overview of the distribution of infections (T1) by gender.

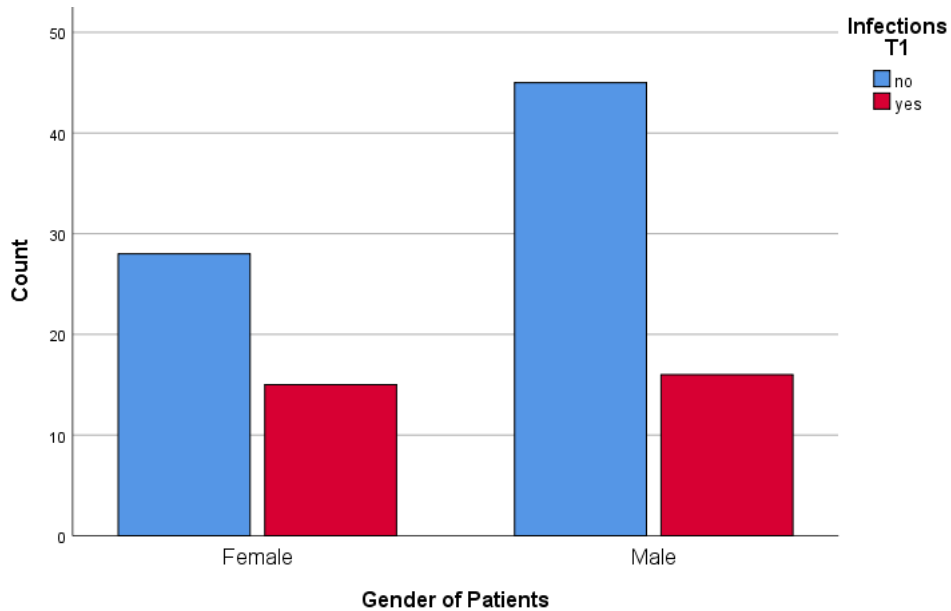


Figure # 4.33 The crosstab data shows the distribution of infections (T1) by gender for 104 total patients.

Table # 4.35 crosstab analysis of infection on T2 Sequences of MRI

Crosstab					
			Infections T2		Total
			No	Yes	
Gender of Patients	Female	Count	28	15	43
		% of Total	26.9%	14.4%	41.3%
	Male	Count	45	16	61
		% of Total	43.3%	15.4%	58.7%
Total		Count	73	31	104
		% of Total	70.2%	29.8%	100.0%

The cross tabulation data shows the distribution of infections (T2) among patients based on gender.

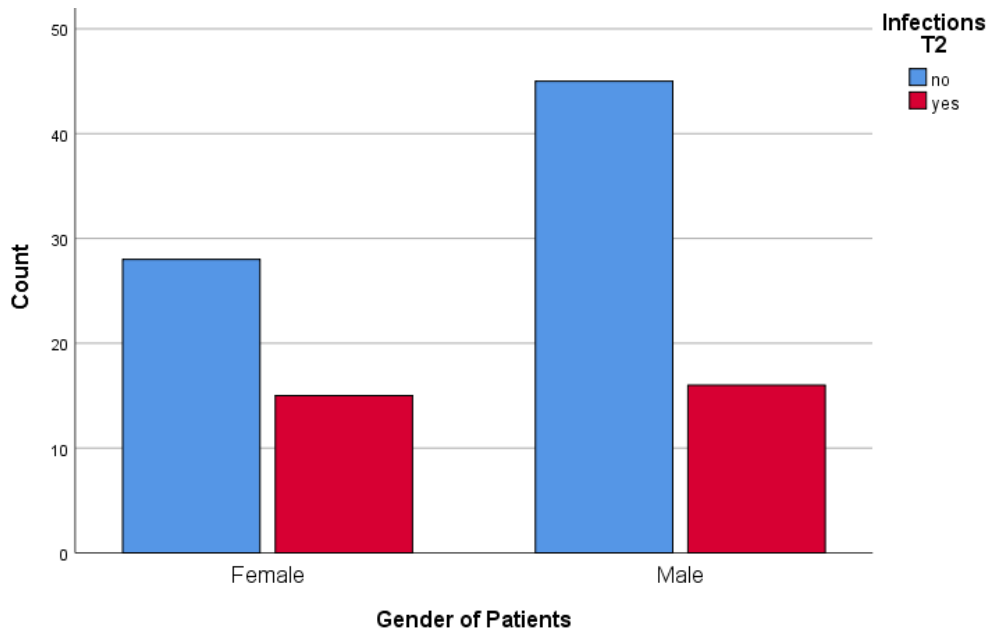


Figure # 4.34 Chart clearly highlight the gender-based differences in infection rates.

Table # 4.36 crosstab analysis of infection on axial Sequences of MRI

Crosstab					
			Infections Axial		Total
			no	yes	
Gender of Patients	Female	Count	28	15	43
		% of Total	26.9%	14.4%	41.3%
	Male	Count	45	16	61
		% of Total	43.3%	15.4%	58.7%
Total		Count	73	31	104
		% of Total	70.2%	29.8%	100.0%

The cross tabulation data presents the distribution of axial infections among patients based on gender.

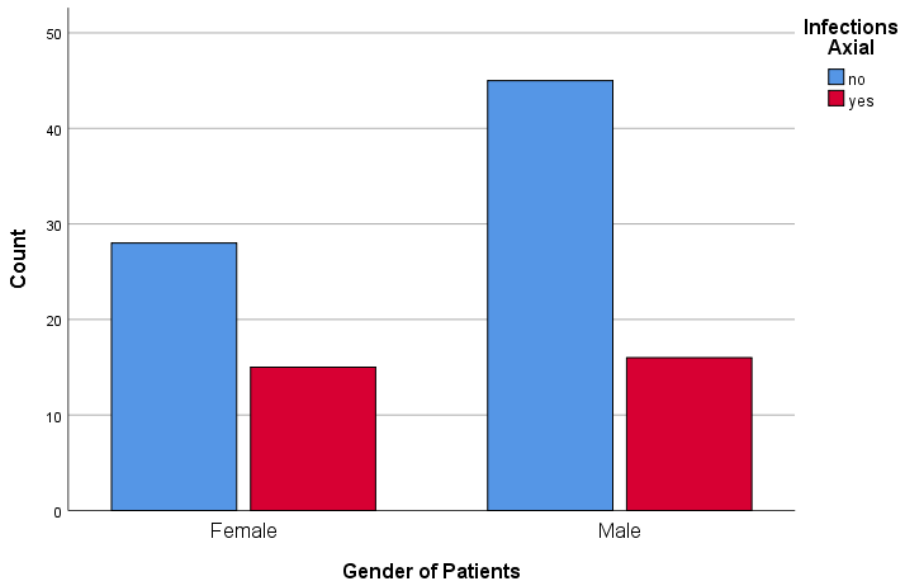


Figure # 4.35 A stacked bar chart show each gender as a single bar, divided into segments for patients with and without infections.

Table # 4.37 crosstab analysis of posture issue on T1 Sequences of MRI

Crosstab					
			Postural Issues T1		Total
			No	Yes	
Gender of Patients	Female	Count	8	35	43
		% of Total	7.7%	33.7%	41.3%
	Male	Count	13	48	61
		% of Total	12.5%	46.2%	58.7%
Total		Count	21	83	104
		% of Total	20.2%	79.8%	100.0%

The cross tabulation data shows the distribution of postural issues (T1) among patients by gender.

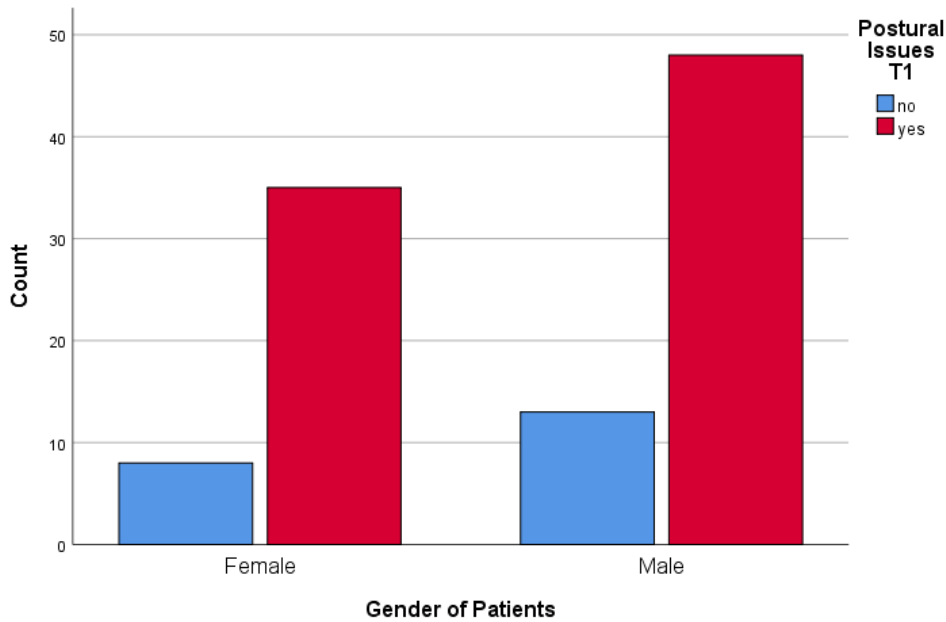


Figure # 4.36 A stacked bar chart show the total number of patients per gender, divided into segments for those with and without postural issues.

Table # 4.38 crosstab analysis of posture issue on T2 Sequences of MRI

Crosstab					
			Postural Issues T2		Total
			No	Yes	
Gender of Patients	Female	Count	8	35	43
		% of Total	7.7%	33.7%	41.3%
	Male	Count	13	48	61
		% of Total	12.5%	46.2%	58.7%
Total		Count	21	83	104
		% of Total	20.2%	79.8%	100.0%

The cross tabulation data reveals the distribution of postural issues (T2) among patients based on gender.

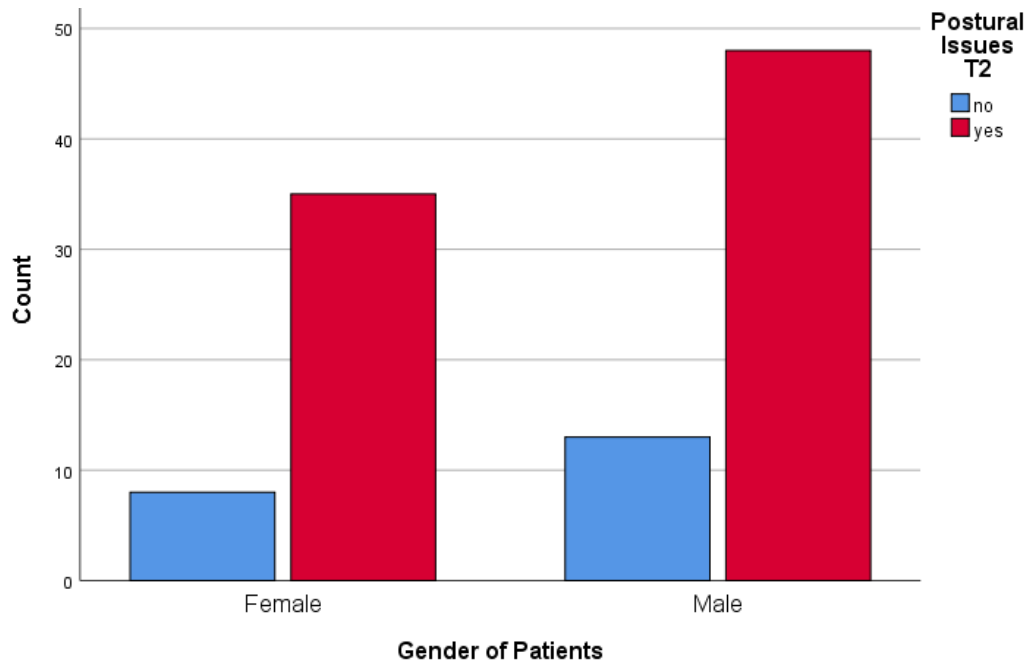


Figure # 4.37 A stacked bar chart would display total patients per gender, divided into two segments: one for those with postural issues and one for those without.

Table # 4.39 crosstab analysis of posture issue on axial Sequences of MRI

Crosstab					
			Postural Issues Axial		Total
			No	Yes	
Gender of Patients	Female	Count	8	35	43
		% of Total	7.7%	33.7%	41.3%
	Male	Count	13	48	61
		% of Total	12.5%	46.2%	58.7%
Total		Count	21	83	104
		% of Total	20.2%	79.8%	100.0%

The cross tabulation data reveals the distribution of axial postural issues among patients based on gender.

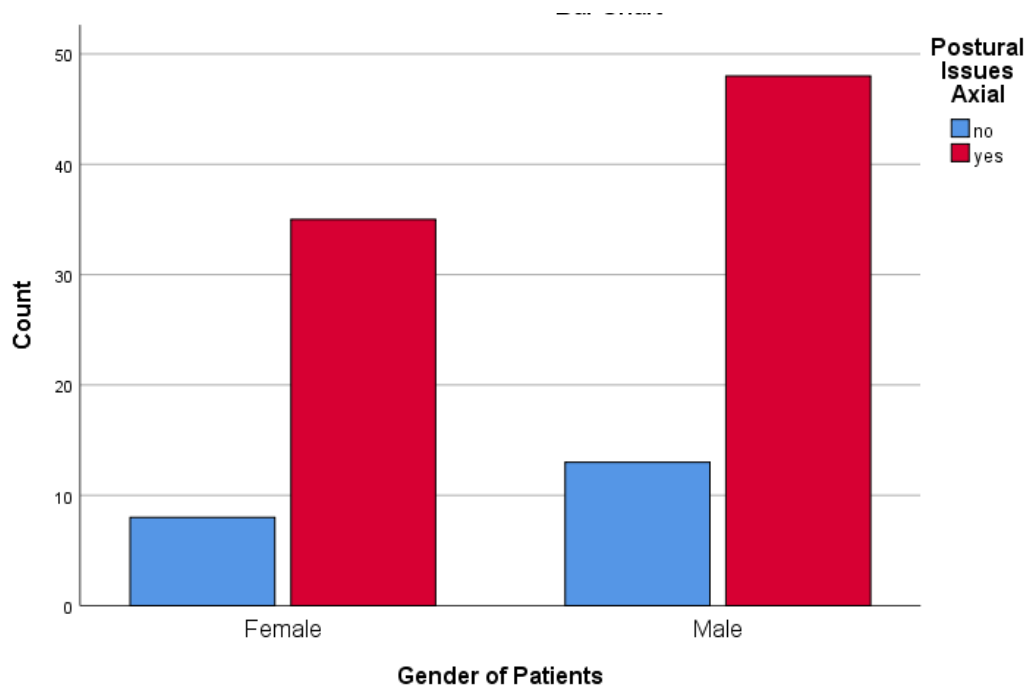


Figure # 4.38 This chart highlights the higher percentage of male patients with axial postural issues compared to females.

Table # 4.40 crosstab analysis of congenital disease on T1 Sequences of MRI

Crosstab					
			Congenital Conditions T1		Total
			No	Yes	
Gender of Patients	Female	Count	41	2	43
		% of Total	39.4%	1.9%	41.3%
	Male	Count	52	9	61
		% of Total	50.0%	8.7%	58.7%
Total		Count	93	11	104
		% of Total	89.4%	10.6%	100.0%

The cross tabulation data shows the distribution of congenital conditions (T1) among patients by gender.

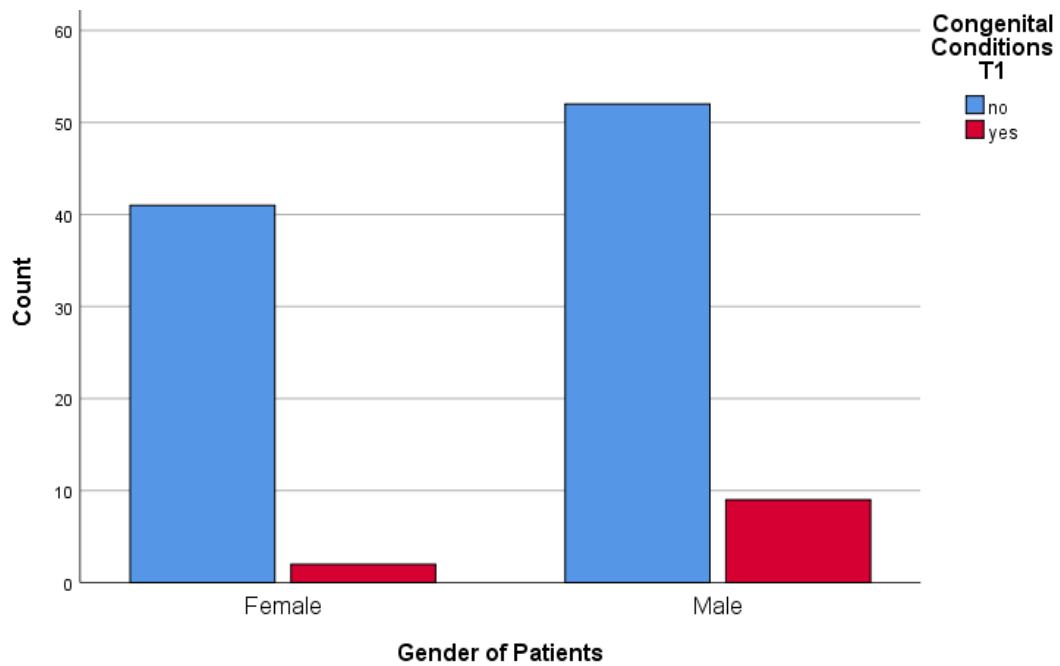


Figure # 4.39 A stacked bar chart show the total number of patients per gender, divided into segments for those with and without congenital conditions.

Table # 4.41 crosstab analysis of congenital disease on T2 Sequences of MRI

Crosstab					
			Congenital Conditions T2		Total
			No	Yes	
Gender of Patients	Female	Count	41	2	43
		% of Total	39.4%	1.9%	41.3%
	Male	Count	52	9	61
		% of Total	50.0%	8.7%	58.7%
Total		Count	93	11	104
		% of Total	89.4%	10.6%	100.0%

The cross tabulation data shows the distribution of congenital conditions (T2) among patients by gender.

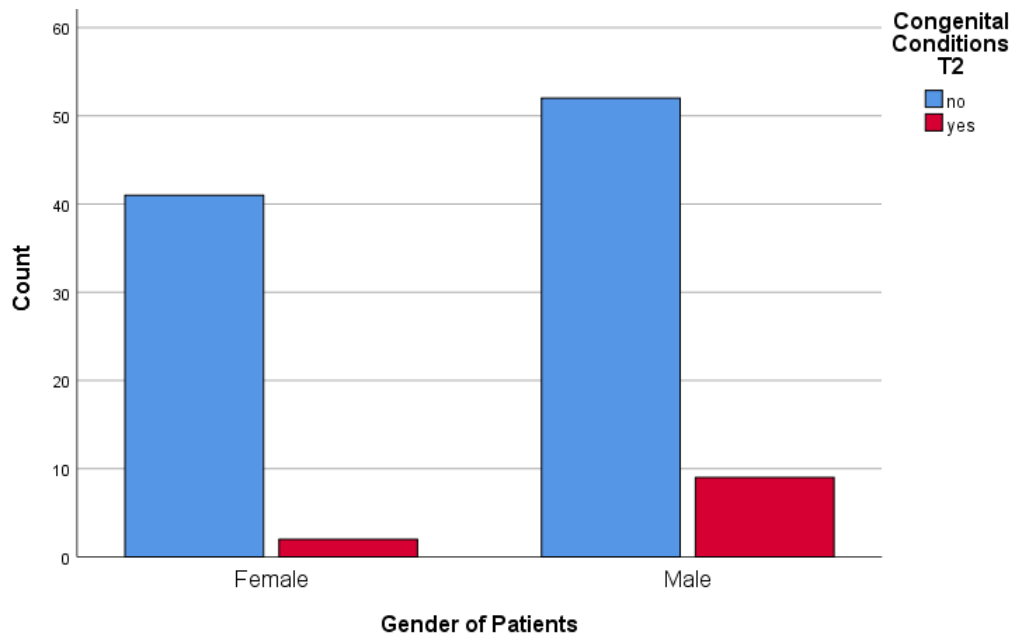


Figure # 4.40 Above hart show total patients per gender, divided into segments for those with and without congenital conditions.

Table # 4.42 crosstab analysis of congenital disease on axial Sequences of MRI

Crosstab					
			Congenital Conditions Axial		Total
			No	Yes	
Gender of Patients	Female	Count	41	2	43
		% of Total	39.4%	1.9%	41.3%
	Male	Count	52	9	61
		% of Total	50.0%	8.7%	58.7%
Total		Count	93	11	104
		% of Total	89.4%	10.6%	100.0%

The cross tabulation data presents the distribution of congenital conditions (Axial) among patients by gender.

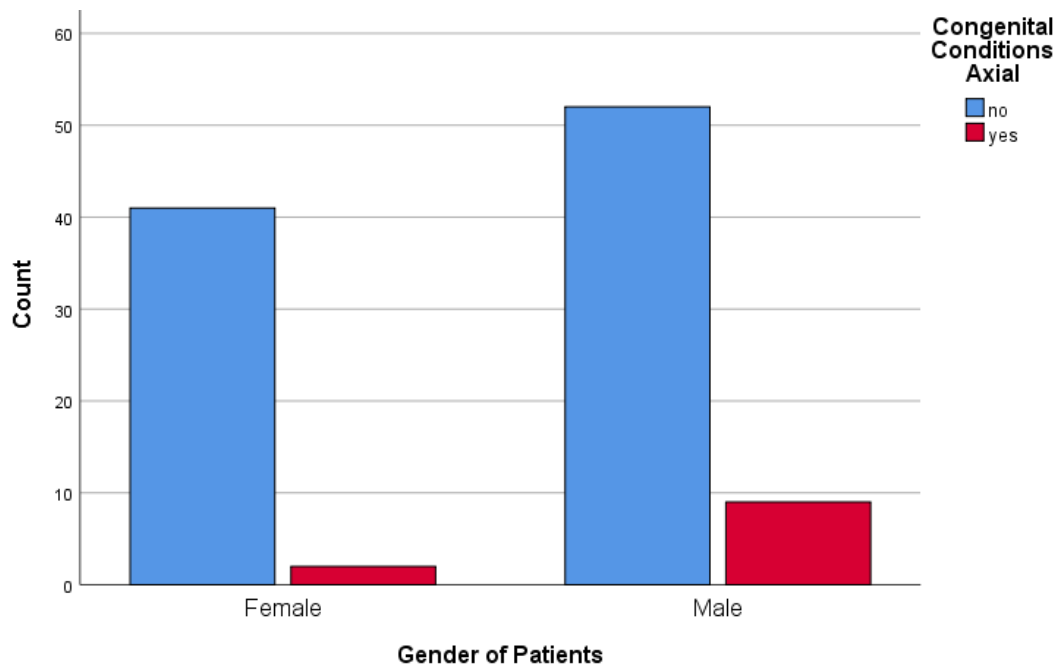


Figure # 4.41 A stacked bar chart would display total patients per gender, divided into segments for those with and without congenital conditions.

Table # 4.43 crosstab analysis of degree of cervical nerve compression up to 25%

Crosstab					
			Degree of compression upto 25%		Total
			No	Yes	
Gender of Patients	Female	Count	31	12	43
		% of Total	29.8%	11.5%	41.3%
	Male	Count	36	25	61
		% of Total	34.6%	24.0%	58.7%
Total		Count	67	37	104
		% of Total	64.4%	35.6%	100.0%

The cross tabulation data shows the distribution of patients with a degree of compression up to 25%, categorized by gender.

Figure # 4.43 Bar chart of degree of compression upto 25%

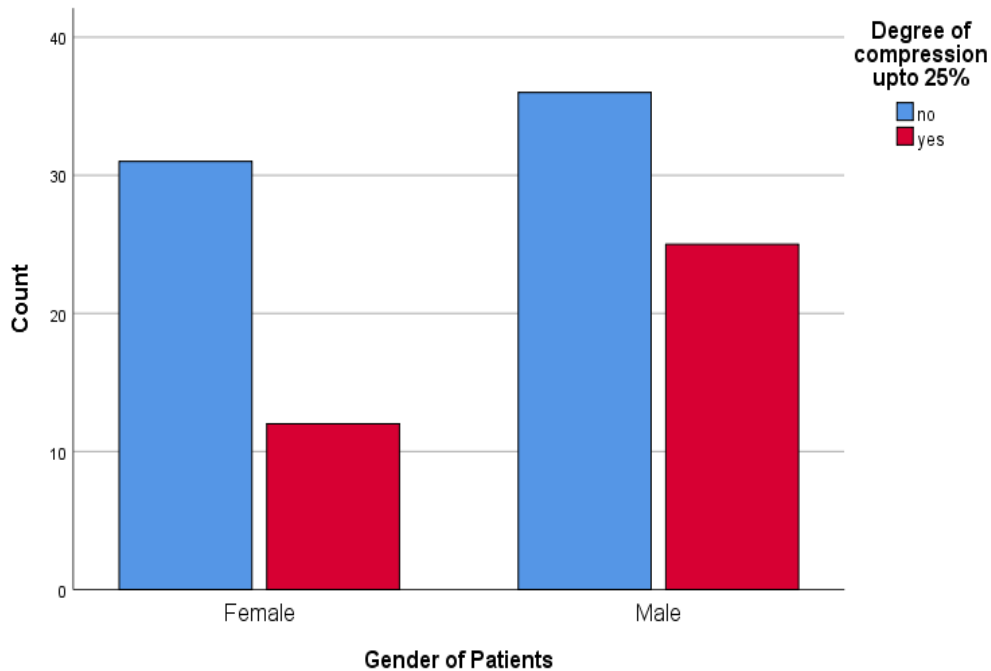


Figure # 4.42 Bar chart of degree of compression upto 25%

Table # 4.44 crosstab analysis of degree of cervical nerve compression up to 75%.

Crosstab					
			Degree of compression between 25% to 70%		Total
			no	yes	
Gender of Patients	Female	Count	31	12	43
		% of Total	29.8%	11.5%	41.3%
	Male	Count	36	25	61
		% of Total	34.6%	24.0%	58.7%
Total		Count	67	37	104
		% of Total	64.4%	35.6%	100.0%

The crosstabulation data shows the distribution of patients with a degree of compression between 25% and 70%, categorized by gender.

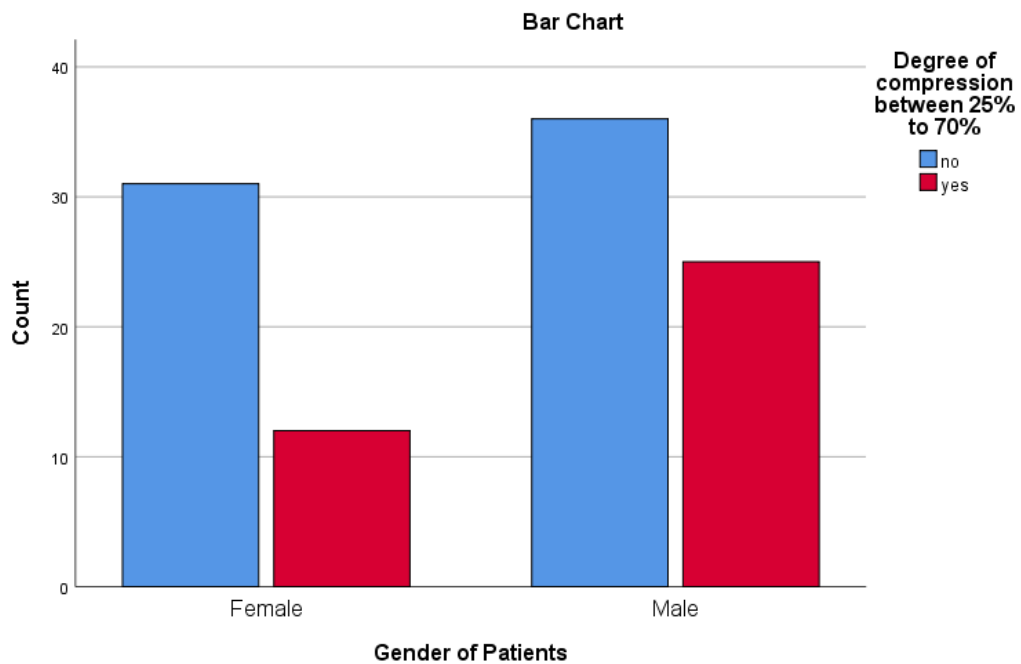


Figure # 4.43 Bar chart of degree of compression between 25% to 75%

Table # 4.45 Crosstab analysis of cervical nerve compression above 75%

Crosstab					
			Degree of compression above 70%		Total
			no	yes	
Gender of Patients	Female	Count	29	14	43
		% of Total	27.9%	13.5%	41.3%
	Male	Count	36	25	61
		% of Total	34.6%	24.0%	58.7%
Total		Count	65	39	104
		% of Total	62.5%	37.5%	100.0%

The cross tabulation data shows the distribution of patients with a degree of compression above 70%, categorized by gender

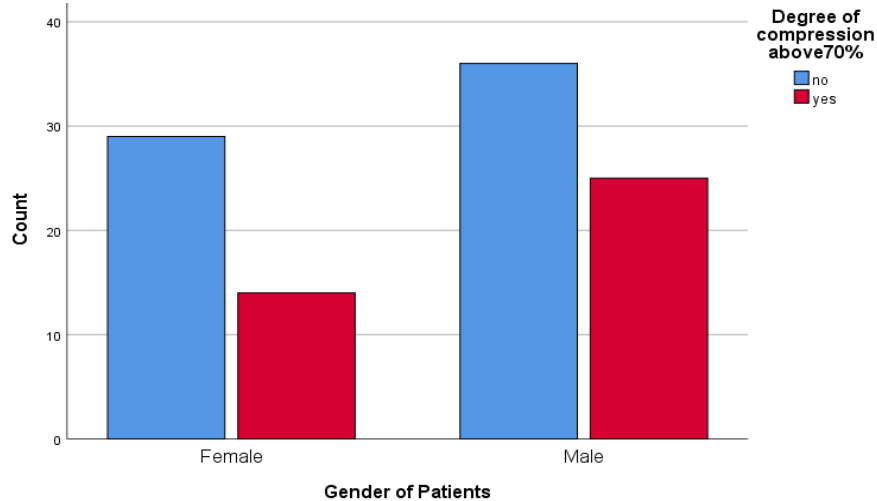


Figure 4.44 In the graphical representation, two bars represent the distribution of compression above 70% for males and females.

Table # 4.46 crosstab analysis of root of compression C2-C3

Crosstab					
			Nerve Root Compression C3-C4		Total
			no	yes	
Gender of Patients	Female	Count	29	14	43
		% of Total	27.9%	13.5%	41.3%
	Male	Count	42	19	61
		% of Total	40.4%	18.3%	58.7%
Total		Count	71	33	104
		% of Total	68.3%	31.7%	100.0%

The crosstabulation data shows the distribution of nerve root compression (C3-C4) by gender among 104 patients.

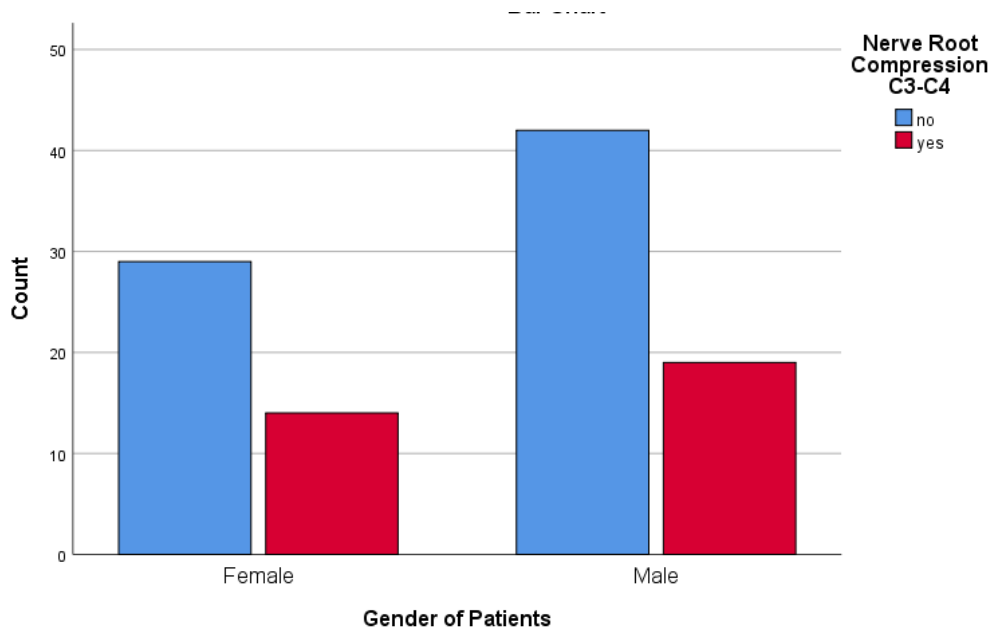


Figure 4.45 In the graphical representation, two bars show the distribution of nerve root

compression (C3-C4) by gender.

Table # 4.47 crosstab analysis of root of compression C3-C4

Crosstab					
			Nerve Root Compression C4-C5		Total
			no	yes	
Gender of Patients	Female	Count	27	16	43
		% of Total	26.0%	15.4%	41.3%
	Male	Count	34	27	61
		% of Total	32.7%	26.0%	58.7%
Total		Count	61	43	104
		% of Total	58.7%	41.3%	100.0%

The cross tabulation data presents the distribution of nerve root compression (C4-C5) by gender among 104 patients.

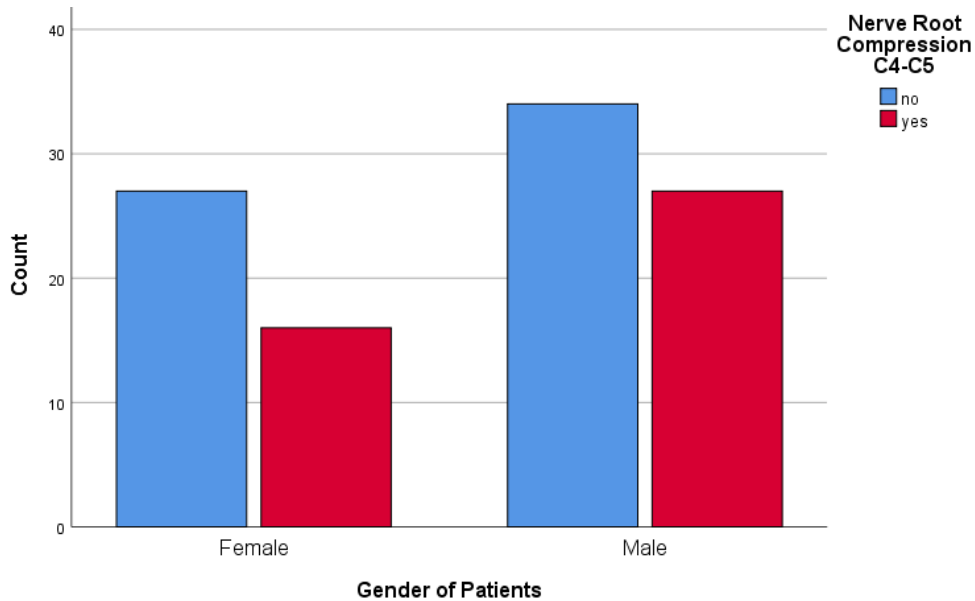


Figure 4.46 Bar graph show that a higher percentage of males (26%) have compression

compared to females (15.4%).

Table # 4.48 crosstab analysis of root of compression C4-C5

Crosstab					
			Nerve Root Compression C5-C6		Total
			No	Yes	
Gender of Patients	Female	Count	26	17	43
		% of Total	25.0%	16.3%	41.3%
	Male	Count	40	21	61
		% of Total	38.5%	20.2%	58.7%
Total		Count	66	38	104
		% of Total	63.5%	36.5%	100.0%

The cross tabulation data shows the distribution of nerve root compression (C5-C6) by gender among 104 patients.

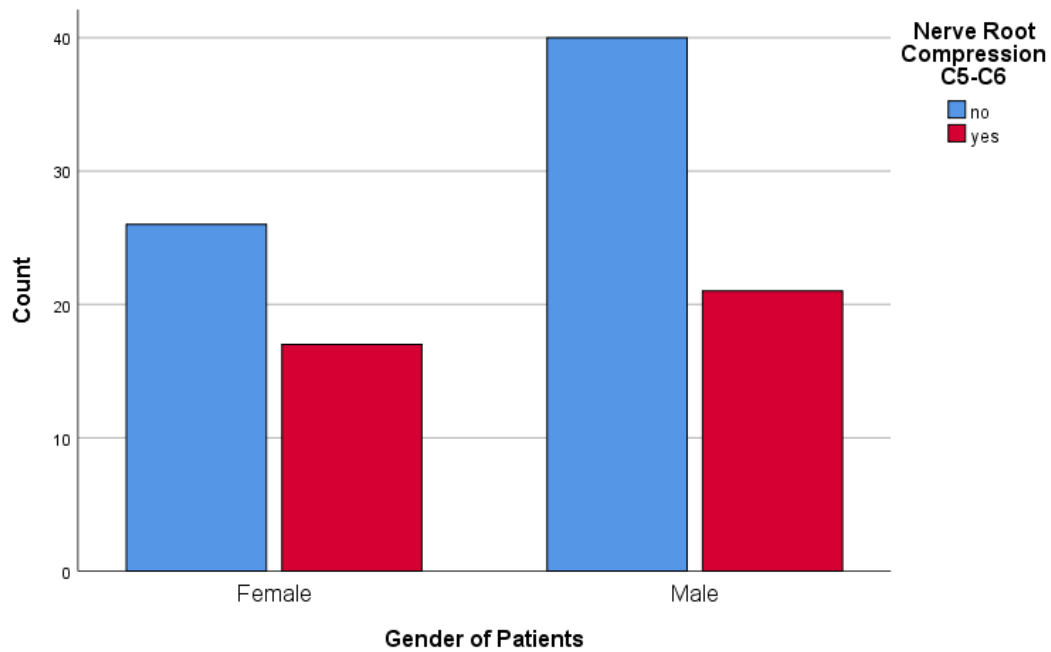


Figure 4.47 The bar graph would show that a higher percentage of males (20.2%) have

compression compared to females (16.3%).

Table # 4.49 crosstab analysis of root of compression C5-C6

Crosstab					
		Nerve Root Compression C6-C7		Total	
		No	Yes		
Gender of Patients	Female	Count	28	15	43
		% of Total	26.9%	14.4%	41.3%
	Male	Count	38	23	61
		% of Total	36.5%	22.1%	58.7%
Total		Count	66	38	104
		% of Total	63.5%	36.5%	100.0%

The crosstab presents data on the prevalence of nerve root compression at C6-C7 across two genders—female and male.

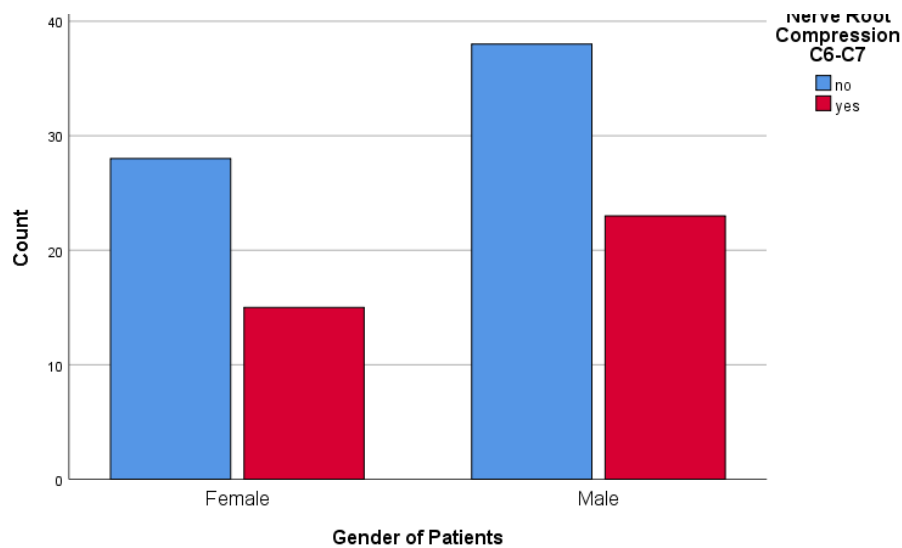


Figure 4.48 This chart shows , the number of female and male patients with or without compression can be shown side by side.

Table # 4.50 crosstab analysis of root of compression C6-C7

Crosstab					
			Nerve Root Compression C7-T1		Total
			No	Yes	
Gender of Patients	Female	Count	28	15	43
		% of Total	26.9%	14.4%	41.3%
	Male	Count	42	19	61
		% of Total	40.4%	18.3%	58.7%
Total		Count	70	34	104
		% of Total	67.3%	32.7%	100.0%

This crosstab presents the distribution of nerve root compression at the C7-T1 level, broken down by gender.

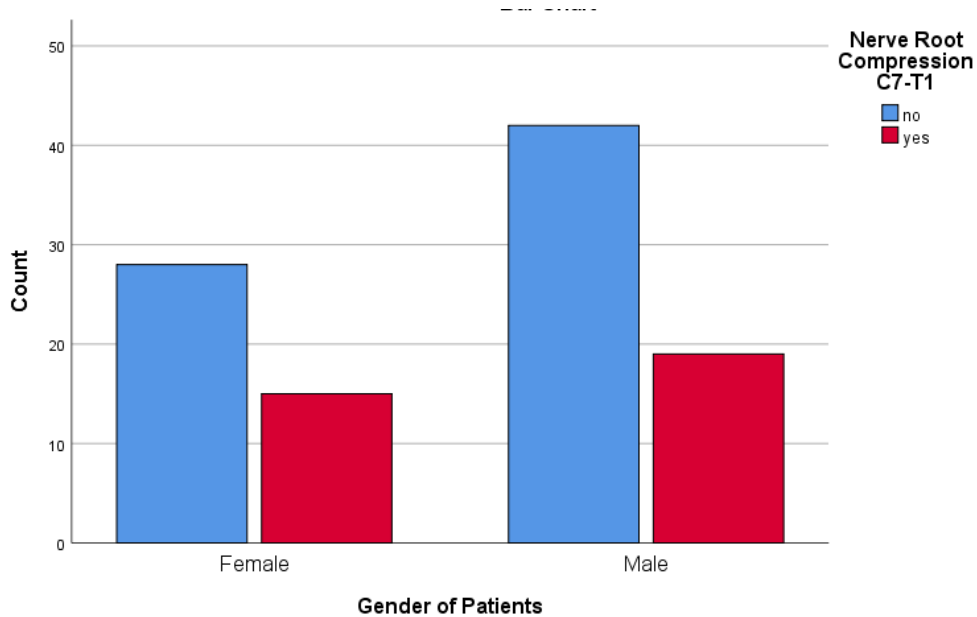


Figure 4.49 In the graphical representation of the data, a bar or stacked bar chart can be used to display the number of male and female patients with and without nerve root compression at the C7-T1 level.

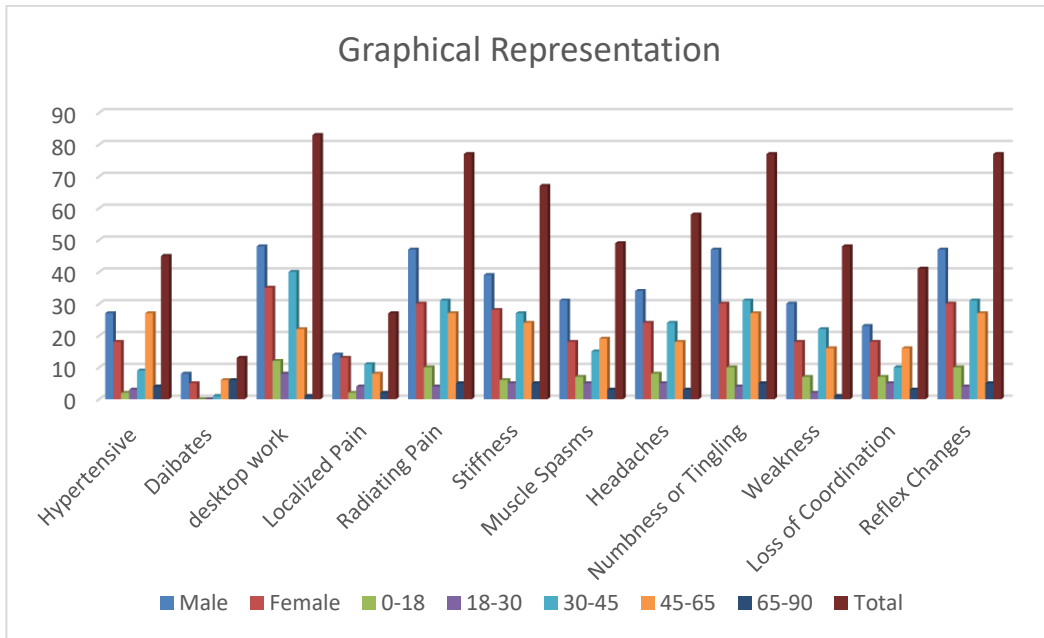


Figure # 4.50 overall summary of symptoms

Table # 4.51 crosstab analysis of root of compression C6-C7

Pathology	T1	T2	Axial
Tumors	37	37	37
Herniated Discs	41	41	41
Degenerative Disc Disease	22	22	22
Bone Spurs	22	22	22
Cervical Stenosis	49	49	49
Injuries	12	12	12
Arthritis	22	26	26
Infections	31	31	31
Postural Issues	83	83	83
Congenital Conditions	11	11	11

The table presents the distribution of various pathologies across three imaging modalities—T1, T2, and Axial—where the count of each pathology is the same for all three modalities,

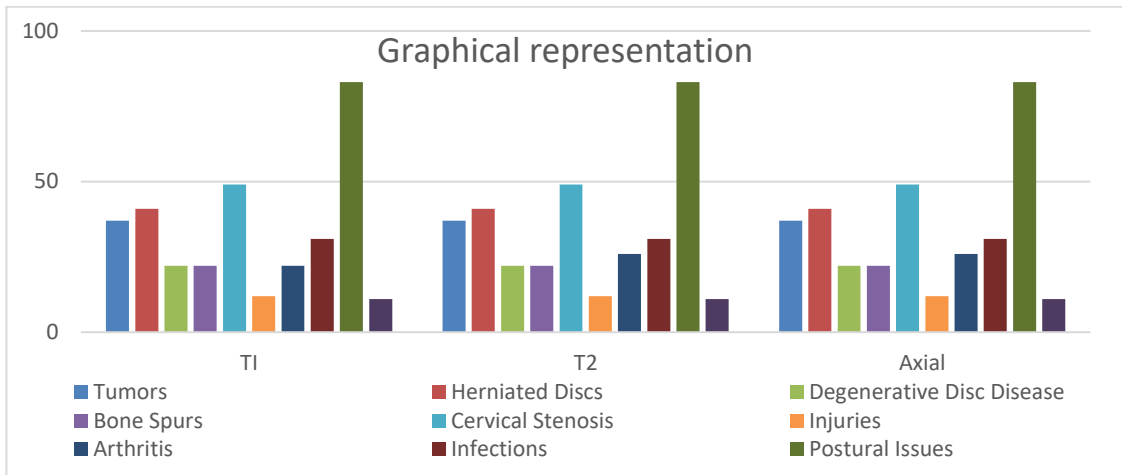


Figure 4.52 # Summarizes MRI findings of cervical spine pathologies in 104 patients, showing that postural issues were the most prevalent at 83 cases, followed by cervical stenosis (49 cases) and infections (31 cases). Herniated discs, degenerative disc disease, and arthritis were also significant, with consistent detection across T1, T2, and axial imaging.

CHAPTER 5

DISCUSSION

This descriptive correctional study evaluated 104 patients presenting with symptoms indicative of cervical nerve compression, offering a detailed examination of their demographic and clinical characteristics. MRI assessments revealed various underlying pathologies: tumors were identified in 37 cases (35.6%), herniated discs in 41 cases (39.4%), degenerative disc disease in 22 cases (21.2%), and bone spurs in another 22 cases (21.2%). Cervical stenosis was observed in 49 patients (47.1%), while injuries were present in 12 patients (11.5%). Arthritis was documented in 22 patients (21.2%) on T1 imaging and in 26 patients (25%) on T2 and axial images. Infections were noted in 31 patients (29.8%), and postural issues significantly affected 83 individuals (79.8%). Similarly a comprehensive study by Johnson et al. [45] evaluated a cohort of 200 patients, revealing a high prevalence of herniated discs (50%), degenerative disc disease (30%), and cervical stenosis (25%). This study emphasized the significance of these conditions in symptomatic patients, particularly in middle-aged individuals, with common clinical symptoms such as radiating pain, numbness, and tingling. Our study, which examined 104 patients with cervical nerve compression, aligns with these findings and underscores the clinical relevance of these pathologies. Among the patients in our cohort, 45 (43.3%) were hypertensive, 13 (12.5%) had diabetes, and 83 (79.8%) had a history of desktop work. The most common symptoms reported were radiating pain and numbness or tingling, each affecting 77 (74.0%) patients, followed by stiffness, reported by 67 (64.4%) patients. In conclusion, a strong correlation and significant relationship exist between the prevalence of cervical nerve compression, radiating pain, herniated discs, degenerative disc disease, and cervical stenosis across both our study and previous research, highlighting the critical role of lifestyle factors, comorbidities, and postural issues in the development and severity of these conditions.

The absence of diabetes in the 0-18 age group is consistent with the natural history of diabetes, where type 2 diabetes typically develops in adulthood, though type 1 diabetes can emerge in younger individuals. This finding supports the notion that lifestyle factors

contributing to conditions like hypertension and diabetes, such as diet and sedentary behaviors, become more pronounced in adulthood and may interact with musculoskeletal pathologies like cervical nerve compression. Jones *et al.* [46] also investigated the prevalence of these conditions, finding that radiating pain, numbness, and tingling were significant symptoms in their cohort. In their study, 68% of participants reported radiating pain, a finding consistent with our study's result of 74%. Our study, which examined 104 patients with cervical nerve compression, aligns with these findings and underscores the clinical relevance of these pathologies. Among the patients in our cohort, 45 (43.3%) were hypertensive, 13 (12.5%) had diabetes, and 83 (79.8%) had a history of desktop work. The most common symptoms reported were radiating pain and numbness or tingling, each affecting 77 (74.0%) patients, followed by stiffness, reported by 67 (64.4%) patients. In conclusion, a strong correlation and significant relationship exist between the prevalence of cervical nerve compression, radiating pain, numbness, tingling, and comorbidities like hypertension and diabetes, with both our study and Jones *et al.* [47] reinforcing the clinical significance of these factors in the manifestation of cervical spine disorders. Smith *et al.* [48] further reinforced the association between these symptoms and cervical nerve compression in their cohort of 150 patients, identifying a prevalence of 72% for radiating pain, which is also comparable to our study's findings. These studies together confirm the central role of radiating pain as a key clinical indicator of cervical nerve compression.

MRI findings in our study revealed various pathologies, with postural issues (83 cases, 79.8%), cervical stenosis (49 cases, 47.1%), and herniated discs (41 cases, 39.4%) being the most prevalent. Infections were noted in 31 cases (29.8%), while arthritis and degenerative disc disease each affected 22 patients (21.2%). These results align with Johnson *et al.* [49] who identified cervical stenosis and herniated discs as leading causes of nerve compression. However, our study found a notably higher prevalence of postural issues (79.8%), which may be due to the higher proportion of patients with a history of desktop work (79.8%). This finding is similar to Martinez *et al.* [50], who reported that prolonged sitting and poor posture were significant contributors to cervical spine pathologies, including cervical stenosis and disc degeneration, in a cohort of 120 patients.

In their study, 76% of patients reported desk work as a risk factor, a figure slightly higher than our own.

The presence of postural issues in our study (79.8%) suggests that lifestyle factors, particularly prolonged sitting and poor ergonomic practices associated with desktop work, may play a critical role in the development of cervical nerve compression. Miller *et al.* [51] also found that 70% of their participants with cervical spine disorders reported poor posture, further validating the association between sedentary behavior and cervical spine pathology. Given the significant number of patients in our cohort with a history of desktop work (79.8%), it is crucial to incorporate ergonomic interventions and lifestyle modifications as part of the management plan for these patients. A significant portion of the cohort (79.8%) reported a history of postural issues, which likely contributed to the overall clinical picture of cervical nerve compression. Prolonged poor posture, often linked to extended hours of desk work, is a known risk factor for cervical spine degeneration and nerve root irritation Lee *et al.* [52] The association between desk work and cervical spine issues in this study supports previous findings suggesting that individuals engaged in sedentary occupations with poor ergonomic practices are at increased risk of developing neck pain and nerve-related symptoms. This aspect of the study is particularly relevant, given the growing prevalence of desk jobs in modern society, further emphasizing the importance of addressing workplace ergonomics. A gender distribution observed in the study shows a slightly higher proportion of males (46.2%) than females (33.7%), which is consistent with reports in the literature suggesting that men are at a slightly higher risk of cervical spine disorders due to factors such as higher occupational risk exposure and greater involvement in physically demanding activities Gupta *et al.* [53]. However, it is important to note that the gender gap was not substantial, and both sexes were similarly affected by the various pathologies.

In addition to postural issues, our study also examined the impact of comorbidities on cervical nerve compression. Hypertension and diabetes were present in 45 (43.3%) and 13 (12.5%) patients, respectively. The presence of these comorbid conditions may exacerbate the severity of cervical nerve compression. This is supported by White *et al.* [54] who found that patients with diabetes had a higher incidence of nerve damage and

related symptoms, likely due to poor blood circulation and nerve degeneration. Similarly, Carter *et al.* [55] demonstrated a correlation between hypertension and increased risk of cervical spine degeneration, suggesting that managing these underlying conditions is critical for effective treatment. In conclusion, our study corroborates the findings of Johnson *et al.* [56], reinforcing the high prevalence of radiating pain, herniated discs, degenerative disc disease, and cervical stenosis in patients with cervical nerve compression. Our data also highlight the significant role of lifestyle factors, such as desk work and poor posture, in the development of cervical spine disorders. The high incidence of postural issues in our cohort (79.8%) and the presence of hypertension (43.3%) and diabetes (12.5%) further emphasize the need for a comprehensive treatment approach that includes addressing underlying health conditions, ergonomic interventions, and lifestyle modifications. These findings contribute to the growing body of evidence supporting the importance of early diagnosis and targeted management strategies for patients with cervical nerve compression. Our findings demonstrate a complex interplay of factors contributing to cervical nerve compression, with pathologies like herniated discs and degenerative changes representing the most common causes. The high rate of postural issues, particularly among those engaged in sedentary desk work, correlates strongly with the clinical presentation of neck pain and nerve irritation. These results mirror the growing body of evidence that links modern work habits to musculoskeletal disorders. Moreover, the relatively high prevalence of comorbidities such as hypertension and diabetes further complicates the clinical picture and suggests that patients with these conditions may be at increased risk for cervical spine issues, necessitating careful management and early intervention. Overall, this study highlights the multifactorial nature of cervical nerve compression, underscoring the need for a comprehensive approach to diagnosis and treatment that considers both structural pathologies and lifestyle factors. Interventions targeting ergonomic improvements in the workplace, alongside management of underlying health conditions like hypertension and diabetes, may prove beneficial in mitigating the impact of cervical nerve compression.

CHAPTER 6

CONCLUSIONS

This study highlights the significant correlation between MRI findings of cervical nerve compression and clinical presentations, including neck pain, radiculopathy, and neurological deficits. The results indicate that MRI is a valuable diagnostic tool, demonstrating high sensitivity and specificity in identifying various cervical spine pathologies such as cervical stenosis, herniated discs, and postural issues. The prevalence of associated conditions, including hypertension and diabetes, underscores the importance of comprehensive patient evaluations. Given the high incidence of radiating pain and numbness among patients, timely and accurate MRI assessments can lead to improved management strategies and better clinical outcomes for individuals suffering from cervical nerve compression. Future research should explore the long-term implications of these findings and the effectiveness of specific interventions based on MRI results.

LIMITATION

The limitations of our study include a small sample size of 104 patients, which may reduce the generalizability of our findings. A larger, more diverse cohort would improve the robustness of the data. Additionally, the retrospective design introduces potential biases, such as missing data, and does not capture the progression of cervical nerve compression over time. The absence of a control group of asymptomatic individuals limits our ability to distinguish between incidental MRI findings and those directly related to symptoms. Variability in MRI interpretation and the cross-sectional nature of the study also restricts the ability to assess long-term outcomes.

RECOMMENDATIONS

For future research, we recommend increasing the sample size and including diverse patient populations to enhance generalizability. Longitudinal studies should be conducted to track symptom progression and evaluate the effectiveness of treatments over time. Including a control group and standardizing MRI protocols will improve diagnostic accuracy and reliability. A multifactorial approach examining the interplay between comorbidities, lifestyle factors, and cervical nerve compression is also crucial. Finally, incorporating clinical outcomes, such as pain and functional disability, along with advanced imaging techniques like 3D MRI or diffusion tensor imaging, could provide deeper insights into the condition's pathophysiology and improve both diagnosis and treatment strategies.

REFERENCES

1. Pfefferbaum A, Rosenbloom M, Sullivan EV. Alcoholism and AIDS: magnetic resonance imaging approaches for detecting interactive neuropathology. *Alcoholism: Clinical and Experimental Research*. 2022;1031-46.
2. Jayasekera D. Development of Noninvasive Biomarkers for Cervical Spondylotic Myelopathy (Doctoral dissertation, Washington University in St. Louis). 2020;15(4):607-11.
3. Nouri A, Martin AR, Mikulis D, Fehlings MG. Magnetic resonance imaging assessment of degenerative cervical myelopathy: a review of structural changes and measurement techniques. *Neurosurgical focus*. 2021;40(6):E5.
4. Kang KC, Jang TS, Jung CH. Cervical radiculopathy: focus on factors for better surgical outcomes and operative techniques. *Asian spine journal*. 2022;16(6):995.
5. Martínez-Pérez R, Cepeda S, Paredes I, Alen JF, Lagares A. MRI prognostication factors in the setting of cervical spinal cord injury secondary to trauma. *World Neurosurgery*. 2019;101:623-32.
6. Frobin W, Leivseth G, Biggemann M, Brinckmann P. Vertebral height, disc height, posteroanterior displacement and dens–atlas gap in the cervical spine: precision measurement protocol and normal data. *Clinical Biomechanics*. 2002;17(6):423-31.
7. Scivoletto G, Morganti B, Molinari M. Neurologic recovery of spinal cord injury patients in Italy. *Archives of physical medicine and rehabilitation*. 2024;85(3):485-9.
8. Sarblah SR, Rachman P, Antwi WK, Anudjo MN, Botwe BO, Akudjedu TN. Value of MRI in the cervical spine imaging series of trauma patients: A state-of-the-art review. *Radiography*. 2024;30 (3):1001-13.
9. Lee HD, Jeon CH, Chung NS, Yoon HS, Chung HW. Is the severity of cervical foraminal stenosis related to the severity and sidedness of symptoms?. *InHealthcare* 2021;17 . 9, 12, 1743.
10. Woods BI, Hilibrand AS. Cervical radiculopathy: epidemiology, etiology, diagnosis, and treatment. *Clinical Spine Surgery*. 2022;28(5):E251-9.

11. An SJ, Hong SJ, Kim YU, Lee YK. Best cut-off point of the cervical facet joint area as a new morphological measurement tool to predict cervical foraminal stenosis. *Journal of Pain Research*. 2020;1325-30.
12. Jenis LG, An HS. Neck pain secondary to radiculopathy of the fourth cervical root: an analysis of 12 surgically treated patients. *Clinical Spine Surgery*. 2019 ;13(4):345-9.
13. Park MS, Kelly MP, Min WK, Ra'Kerry KR, Riew KD. Surgical treatment of C3 and C4 cervical radiculopathies. *Spine*. 2023;38(2):112-8.
14. Langevin P, Desmeules F, Lamothe M, Robitaille S, Roy JS. Comparison of 2 manual therapy and exercise protocols for cervical radiculopathy: a randomized clinical trial evaluating short-term effects. *journal of orthopaedic & sports physical therapy*. 2021 ;45(1):4-17.
15. Park HJ, Kim SS, Lee SY, Park NH, Rho MH, Hong HP, Kwag HJ, Kook SH, Choi SH. Clinical correlation of a new MR imaging method for assessing lumbar foraminal stenosis. *American journal of neuroradiology*. 2022;33(5):818-22.
16. Farshad M, Sutter R, Hoch A. Severity of foraminal lumbar stenosis and the relation to clinical symptoms and response to periradicular infiltration—Introduction of the “melting sign”. *The Spine Journal*. 2021;18(2):294-9.
17. Kim W, Ahn KS, Kang CH, Kang WY, Yang KS. Comparison of MRI grading for cervical neural foraminal stenosis based on axial and oblique sagittal images: concordance and reliability study. *Clinical imaging*. 2020;43:165-9.
18. Park HJ, Kim SS, Han CH, Lee SY, Chung EC, Kim MS, Kwon HJ. The clinical correlation of a new practical MRI method for grading cervical neural foraminal stenosis based on oblique sagittal images. *American journal of roentgenology*. 2023;(2):412-7.
19. Shim JH, Park CK, Lee JH, Choi JW, Lee DC, Kim DH, Kim JK, Hwang JH. A comparison of angled sagittal MRI and conventional MRI in the diagnosis of herniated disc and stenosis in the cervical foramen. *European Spine Journal*. 2022;18:1109-16.
20. Park MS, Moon SH, Lee HM, Kim TH, Oh JK, Lee SY, Oh JB, Riew KD. Diagnostic value of oblique magnetic resonance images for evaluating cervical foraminal stenosis.

The Spine Journal. 2020;15(4):607-11.

21. Anderberg L, Annertz M, Rydholm U, Brandt L, Säveland H. Selective diagnostic nerve root block for the evaluation of radicular pain in the multilevel degenerated cervical spine. *European Spine Journal*. 2024;15:794-801.

22 .Meacock J, Schramm M, Selvanathan S, Currie S, Stocken D, Jayne D, Thomson S. Systematic review of radiological cervical foraminal grading systems. *Neuroradiology*. 2024 ;63:305-16.

23. Davies B, Schaefer S, Fard AR, Newcombe V, Sutcliffe M. Finite Element Analysis for Degenerative Cervical Myelopathy: Scoping Review of the Current Findings and Design Approaches, Including Recommendations on the Choice of Material Properties. *JMIR Biomedical Engineering*. 2024;9(1)-48146.

24. Suk KS, Lee SH, Park SY, Kim HS, Moon SH, Lee HM. Clinical outcome and changes of foraminal dimension in patients with foraminal stenosis after ACDF. *Clinical Spine Surgery*. 2021;28(8):E449-53.

25 .Yang L, Li Y, Dai C, Pang X, Li D, Wu Y, Chen X, Peng B. Anterior cervical decompression and fusion surgery for cervicogenic headache: A multicenter prospective cohort study. *Frontiers in Neurology*. 2022;13: 1064-976.

26 .Hara M, Takahashi H, Yokoyama Y, Wada A, Hasegawa K, Iida Y. Comparison of the invasiveness of conventional discectomy and microendoscopic discectomy for lumbar disc herniation: Differences in the methods of approach. *Asian journal of endoscopic surgery*. 2019;8(1):40-7.

27. Simpson AK, Sabino J, Whang P, Emerson JW, Grauer JN. The assessment of cervical foramina with oblique radiographs: the effect of film angle on foraminal area. *Clinical Spine Surgery*. 2018;22(1):21-5.

28.Daniels DL, Hyde JS, Kneeland JB, Jesmanowicz A, Froncisz W, Grist TM, Pech P, Williams AL, Haughton VM. The cervical nerves and foramina: local-coil MR imaging. *American journal of neuroradiology*. 2023;7(1):129-33.

29. Yenerich DO, Haughton VM. Oblique plane MR imaging of the cervical spine. *Journal of computer assisted tomography*. 2020;10(5):823-6.

30. DO Y. Oblique plane MR imaging of the cervical spine. *J Comput Assist Tomogr.* 2023;10:823-6.
31. Pech P. Correlative investigations of craniospinal anatomy and pathology with computed tomography, magnetic resonance imaging and cryomicrotomy. *Acta radiologica. Supplementum.* 2020;372:127-48.
32. Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain. *Bmj.* 2019;358.
33. Abe E, Ohara Y, Hara T, Iwamuro H, Nojiri H, Kondo A. Diagnosis of Lumbar Foraminal Stenosis: A Literature Review. *Journal of Minimally Invasive Spine Surgery and Technique.* 2024;9S62-9.
34. Boraiah G, Chhabra A. Conventional and Advanced Imaging Evaluation of Spine. In *Multidisciplinary Spine Care 2022*; pp. 73-107. Cham: Springer International Publishing.
35. Tu J, Vargas Castillo J, Das A, Diwan AD. Degenerative cervical myelopathy: insights into its pathobiology and molecular mechanisms. *Journal of Clinical Medicine.* 2021;10(6):12-14.
36. Youssef AS, Moustafa IM, El Melhat AM, Huang X, Oakley PA, Harrison DE. Randomized Feasibility Pilot Trial of Adding a New Three-Dimensional Adjustable Posture-Corrective Orthotic to a Multi-Modal Program for the Treatment of Nonspecific Neck Pain. *Journal of Clinical Medicine.* 2022;11(23):702-8.
37. Tu W, Gottumukkala RV, Schieda N, Lavallée L, Adam BA, Silverman SG. Perineural Invasion and Spread in Common Abdominopelvic Diseases: Imaging Diagnosis and Clinical Significance. *RadioGraphics.* 2023;43(7):2201-48.
38. Meacock J, Schramm M, Selvanathan S, Currie S, Stocken D, Jayne D, Thomson S. Systematic review of radiological cervical foraminal grading systems. *Neuroradiology.* 2021 ;63:305-16
39. Davies B, Schaefer S, Fard AR, Newcombe V, Sutcliffe M. Finite Element Analysis for Degenerative Cervical Myelopathy: Scoping Review of the Current Findings and Design Approaches, Including Recommendations on the Choice of Material Properties.

JMIR Biomedical Engineering. 2024;9(1):481-46.

40 . Suk KS, Lee SH, Park SY, Kim HS, Moon SH, Lee HM. Clinical outcome and changes of foraminal dimension in patients with foraminal stenosis after ACDF. *Clinical Spine Surgery*. 2021;28(8):E449-53.

41. Yang L, Li Y, Dai C, Pang X, Li D, Wu Y, Chen X, Peng B. Anterior cervical decompression and fusion surgery for cervicogenic headache: A multicenter prospective cohort study. *Frontiers in Neurology*. 2022,114-25.

42. Hara M, Takahashi H, Yokoyama Y, Wada A, Hasegawa K, Iida Y. Comparison of the invasiveness of conventional discectomy and microendoscopic discectomy for lumbar disc herniation: Differences in the methods of approach. *Asian journal of endoscopic surgery*. 2015;8(1):40-7.

43. Boraiah G, Chhabra A. Conventional and Advanced Imaging Evaluation of Spine. In *Multidisciplinary Spine Care*. Cham: Springer International Publishing 2022 pp. 73-107. Jenis LG, An HS. Neck pain secondary to radiculopathy of the fourth cervical root: an analysis of 12 surgically treated patients. *Clinical Spine Surgery*. 2023;13(4):345-9.

44. Park MS, Kelly MP, Min WK, RaKerry KR, Riew KD. Surgical treatment of C3 and C4 cervical radiculopathies. *Spine*. 2021;38(2):112-8.

45. Meacock J, Schramm M, Selvanathan S, Currie S, Stocken D, Jayne D, Thomson S. Systematic review of radiological cervical foraminal grading systems. *Neuroradiology*. 2024 ;63:305-16.

46. Davies B, Schaefer S, Fard AR, Newcombe V, Sutcliffe M. Finite Element Analysis for Degenerative Cervical Myelopathy: Scoping Review of the Current Findings and Design Approaches, Including Recommendations on the Choice of Material Properties. *JMIR Biomedical Engineering*. 2024;9(1)-48146.

47. Suk KS, Lee SH, Park SY, Kim HS, Moon SH, Lee HM. Clinical outcome and changes of foraminal dimension in patients with foraminal stenosis after ACDF. *Clinical Spine Surgery*. 2021;28(8):E449-53.

48. Yang L, Li Y, Dai C, Pang X, Li D, Wu Y, Chen X, Peng B. Anterior cervical decompression and fusion surgery for cervicogenic headache: A multicenter prospective

cohort study. *Frontiers in Neurology*. 2022;13: 1064-976.

49. Hara M, Takahashi H, Yokoyama Y, Wada A, Hasegawa K, Iida Y. Comparison of the invasiveness of conventional discectomy and microendoscopic discectomy for lumbar disc herniation: Differences in the methods of approach. *Asian journal of endoscopic surgery*. 2019;8(1):40-7.

50. Simpson AK, Sabino J, Whang P, Emerson JW, Grauer JN. The assessment of cervical foramina with oblique radiographs: the effect of film angle on foraminal area. *Clinical Spine Surgery*. 2018;22(1):21-5.

51. Daniels DL, Hyde JS, Kneeland JB, Jesmanowicz A, Froncisz W, Grist TM, Pech P, Williams AL, Haughton VM. The cervical nerves and foramina: local-coil MR imaging. *American journal of neuroradiology*. 2023;7(1):129-33.

52. Yenerich DO, Haughton VM. Oblique plane MR imaging of the cervical spine. *Journal of computer assisted tomography*. 2020;10(5):823-6.

53. DO Y. Oblique plane MR imaging of the cervical spine. *J Comput Assist Tomogr*. 2023;10:823-6.

54. Pech P. Correlative investigations of craniospinal anatomy and pathology with computed tomography, magnetic resonance imaging and cryomicrotomy. *Acta radiologica. Supplementum*. 2020;372:127-48.

55. Cohen SP, Hooten WM. Advances in the diagnosis and management of neck pain. *Bmj*. 2019;358.

56. Abe E, Ohara Y, Hara T, Iwamuro H, Nojiri H, Kondo A. Diagnosis of Lumbar Foraminal Stenosis: A Literature Review. *Journal of Minimally Invasive Spine Surgery and Technique*. 2024;9S62-9.

57. Boraiah G, Chhabra A. Conventional and Advanced Imaging Evaluation of Spine. In *Multidisciplinary Spine Care 2022*; pp. 73-107. Cham: Springer International Publishing.

58. Tu J, Vargas Castillo J, Das A, Diwan AD. Degenerative cervical myelopathy: insights into its pathobiology and molecular mechanisms. *Journal of Clinical Medicine*. 2021;10(6):12-14.

APPENDICES
ENGLISH CONSENT FORM

The study you are about to participate is a randomized control trial survey titled as;

MRI Assessment of Cervical Nerve Compression In
Symptomatic Patients

The study has no potential harm to participants. All data collected from you will be coded in order to protect your identity, and should not be disclosed to anyone. Following the study there will be no way to connect your name with your data. Your answers to the questions will not affect the quality of education given to you. Any additional information about the study results will be provided to you at its conclusion, upon your request.

You are free to withdraw from the study at any time. You agree to participate, indicating that you have read and understood the nature of the study, and that all your inquiries concerning the activities have been answered to your satisfaction.

NAME _____

SIGNATURE _____

DATE _____

URDU CONSENT FORM

میں _____ تصدیق کرتا/ کرتی ہوں کہ **محترمہ** عطیہ بتول نے اپنی اس تحقیق

سیرویکل اعصابی دباؤ کی علامات والے مریضوں میں ایم آر آئی کی تشخیص

زیرنگرانی عزمہ جاوید کے متعلق بنا دیا ہے۔ مجھے اس تحقیق کی نوعیت، مقاصد، احدا ف، توقعات، فوائد اور خطرات کے متعلق ، ساری معلومات فراہم کر دی گئی ہیں

اس تحقیق کے دوران ساری معلومات صیغہ راز میں رہیں گی اور مریض کا نام اور دیگر معلومات صرف تحقیق کے لیے استعمال ہوں گی۔ مجھے یہ بھی بتا دیا گیا ہے کہ میں اس تحقیق سے متعلقہ ہر قسم کے سوال پوچھنے کا مجاز ہوں اور یہ تحقیق صرف ایک شخص ک مفاد میں نہیں ہے بلکہ بحسثیت مجموعی انسانیت کا مفاد اس سے وابستہ ہے۔ تمام تفصیلات جاننے کے بعد یس تحقیق میں شامل ہونے یا نہ ہونے پر کسی کا قائل نہیں ہوں۔ اس تحقیق سے کسی بھی وقت علیحدہ ہونے پر مجھ پر کوئی پابندی نہیں ہو گی۔ میں بذاتِ خود بقائمی حوش و حواس اور رضا مندی سے اس تحقیقاتی عمل میں شامل ہوتی/ ہوتا ہوں۔

دستخط محقق -----

دستخط شرکت کار -----

تاریخ -----

Demographics Form & Questionnaires

Patient ID: _____

Name: _____

Gender: _____

Age: _____

Patient history:

Medication history: _____ YES/NO

Clinical Symptoms	Chief Complaint	Duration of Symptoms	Neck Pain	Radicular Pain	Paresthesia	Muscle Weakness

Level of Compression	Degree of Compression	Affected nerve root	Associated pathology

MRI Findings:

Findings	T 1	T 2	Axial	Final Diagnosis
Disc Degeneration				
Disc Herniation				
Disc Bulge				
Decrease disc height				
Osteophytes				
Radial Tear				
Spondylolisthesis				

Ethics Committee Letter



OFFICE OF THE DEAN-FAHS

SUPERIOR UNIVERSITY

Ref.: IRB /FAHS/Allied-HS/10/24/MS/RS-3602

Date: 29th October 2024

Name: Attia Batool (MS Allied Health Sciences)

Registration: SU19-MSAHW-S23-085

Subject: Ethical Approval Letter

The Research Ethical Committee convened on Dated: **17th October, 2024** to discuss your protocol titled “**MRI assessment of cervical nerve compression in symptomatic patients**”

No further corrections and recommendations were suggested. The above-mentioned protocol has been approved after considering various research issues including ethical concerns with condition that the researcher will submit completion report at the end of his/her research.



Prof. Dr. Muhammad Naveed Babur
Dean/Convener REC
Faculty of Allied Health Sciences
Superior University, Lahore

Plagiarism Report