

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF RADIOLOGY**



CERVICAL SPINE MRI PATTERNS IN PATIENTS WITH NECK PAIN AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA UNIVERSITY, ADDIS ABABA, ETHIOPIA

INVESTIGATOR: DR. TEWODROS ENDALE (MD, RADIOLOGY RESIDENT)

A SENIOR PAPER TO BE SUBMITTED TO RADIOLOGY DEPARTMENT, COLLEGE OF HEALTH SCIENCE, ADDIS ABABA UNIVERSITY IN PREPARATION FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE STUDY IN RADIOLOGY.

OCTOBER, 2018

ADDIS ABABA, ETHIOPIA

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INVESTIGATOR: DR. TEWODROS ENDALE (MD, RADIOLOGY RESIDENT)

ADVISORS: DR. FEREHIWOT BEKELE (MD, CONSULTANT RADIOLOGIST)

DR. ABEBE MEKONNEN (MD, CONSULTANT RADIOLOGIST)

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ABSTRACT

Background: Neck pain is a common health problem throughout the world causing significant individual disability and economic burden on health care facility. Many factors are mentioned as a cause or association in relation to neck pain of which degenerative and posttraumatic cause are the main ones. There are many studies done in the world dedicated to patterns of cervical spine MRI findings in patients with neck pain but none in Ethiopia despite its impact on health care and economic burden stated worldwide.

Objective: To assess cervical spine MRI patterns in patients presented with neck pain with or without radiculopathy.

Methods: A retrospective record based descriptive study was carried out at Tikur Anbessa Specialized Hospital department of radiology. All patients with neck pain with or without radiculopathy who had cervical spine MRI evaluation between Jun 2017 and March 2018 were included in the study. Cervical spine MR images were acquired using Philips Medical Systems Achieva 16 channels 1.5 T strength MR scanner using standard neck and brain receiving coils. Images were acquired in sagittal plane in T1 weighted (TR/TE in ms of 400/7.8) and in sagittal plane in T2 weighted (TR/TE in ms of 3000/120) turbo spin echo (TSE) with 3 mm slice thickness, slice gap of 3.3 mm and FOV of 213 mm x 213 mm. Axial plane in T2 weighted 3D (TR/TE in ms of 1600/100) turbo spin echo (TSE) with 3 mm slice thickness, slice gap of 1.5 mm and FOV of 140 mm x 140 mm. Sagittal plane Short Tau Inversion Recovery (STIR) was acquired (TR/TE in ms of 2500/60) with 3 mm slice thickness, slice gap of 3.3 mm and FOV of 213 mm x 213 mm. Record review and data collection using structured format was done between February to August 2018. Data was analyzed using SPSS 20.0 software and frequencies, mean, standard deviation, percentages and cross tabulation were determined and summarized.

Results: A total of 160 patients who had cervical spine MRI evaluation for an indication of neck pain during the period under review were included in this study of which 82 (51.3%) patients had manifestations of radiculopathy. There were 71 (44.4%) male and 89 (55.6%) female patients. The mean age was 46.3 ± 13.3 years with a range of 18-85 years. Degenerative cervical spine findings such as intervertebral disc degeneration in the form of desiccation/dehydration, intervertebral disc space loss of height and disc osteophyte complex with resultant neural foramina and/or spinal canal stenoses were the most common imaging findings seen in 127 (79.4%) patients with increasing prevalence with age. Non degenerative imaging findings such as neoplasm and infection were seen in 10 (6.3%) patients only. A total of 23 (14.4%) patients had normal cervical spine MRI evaluation.

Conclusion: Degenerative cervical spine findings were the most common MRI patterns seen in symptomatic patients in this study showing increasing prevalence with age. Cervical spine MRI in patients with neck pain with or without radiculopathy can strongly suggest underlying serious

abnormalities as demonstrated in our study, such as infections or neoplasms, which could definitely affect patient management plan.

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Table of Contents

ABSTRACT	I
ACKNOWLEDGMENT	II
LIST OF FIGURES AND TABLES	IV
ABBREVIATIONS AND ACRONYMS	V
CHAPTER ONE: INTRODUCTION	1
CHAPTER TWO: LITERATURE REVIEW	2
CHAPTER THREE: OBJECTIVES	4
General objective	4
Specific objective	4
CHAPTER FOUR: METHODS AND MATERIALS	5
Study area and period	5
Study design	5
Population	5
Source population	5
Study population	5
Inclusion and exclusion criteria	5
Inclusion criteria	5
Exclusion criteria	5
Sampling technique and sample size	6
Variables and operational definitions	6
Independent variables	6
Dependent variables	6
Operational definitions	6
Data collection	7
Data processing and analysis	7
Ethical considerations	7
CHAPTER FIVE: RESULTS	8
CHAPTER SIX: DISCUSSION	15
CONCLUSION	17
REFERENCES	18
ANNEX: QUESTIONNAIRE	20

LIST OF FIGURES AND TABLES

Figure 1: Age group distribution of patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Figure 2: Frequency of final imaging impression in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Figure 3: A cervical spine MRI imaging of 55 year old male patient presented with neck pain showing degenerative findings, TASH 2017-18

Figure 4: A cervical spine MRI imaging of 52 year old female patient presented with neck pain showing intervertebral disc herniation, TASH 2017-18

Figure 5: A cervical spine MRI imaging of 28 year old female patient with neck pain showing findings of TB spondylitis, TASH 2017-18

Figure 6: A cervical spine MRI imaging of 33 year old male patient with neck pain showing findings of primary intramedullary neoplasm, TASH 2017-18

Table 1: Frequency of imaging findings of IVD degeneration in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Table 2: Distribution of IVD herniation according to age group in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Table 3: Distribution of IVD herniation according to disc level in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

ABBREVIATIONS AND ACRONYMS

ACR- American College of Radiology

CT- Computed Tomography

IVD- Intervertebral Disc

MRI- Magnetic Resonance Imaging

MDCT- Multi Detector Computed Tomography

TASH-Tikur Anbessa Specialized Hospital

TB- Tuberculosis

(1.5)T- (1.5) tesla.

US-Ultrasound

VB- Vertebral Bone

YLDs-Years Lived with Disability

CHAPTER ONE: INTRODUCTION

Neck pain is a common health problem throughout the world causing significant individual disability as well as economic burden on health care facility. In the Global Burden of Disease 2010 Study, neck pain is the 4th highest in terms of disability as measured by YLDs, and 21st in terms of overall burden.[1-4]

There is considerable variability in the epidemiologic studies of neck pain in the world literatures. An overall prevalence of 0.4% to 86.8% with annual prevalence of 30%-50 % to 4.8 % to 79.5 % is mentioned in the general population with more prevalence in women and middle age individuals. There are few small scale studies regarding the prevalence of neck pain in Ethiopia; one study showed the prevalence of neck pain to be 5 % in rural set up while another study on work related neck and shoulder musculoskeletal disorders showed prevalence of 51.7% and 45%, respectively.[2, 5-8]

There are many factors listed in world literatures as a cause or associated factors in relation to neck pain. Post traumatic and degenerative causes are two major areas of perspectives mentioned as etiologic entities. Degenerative etiologies of chronic neck pain mentioned include spondylosis, degenerative disc disease and disc herniation. Degenerative changes can also be caused by prior injury.[9,10]

On the other hand there are others which approach the cause of neck pain with respect to psychosocial, gender, occupational, age and socioeconomic issues and factors rather than structural. Hogg-Johnson et al in their literature review on neck pain in the general population showed the increased prevalence of neck pain with older age and its coexistent with other health problems. In another population based study in Brazil showed association of neck pain with individuals who are widowed or separated, had a low income or low educational level, working in sitting and leaning position and in those with comorbidities.[2,11]

There are many imaging modalities for evaluation of neck pain among which, plain radiograph and magnetic resonance imaging take the lion share. Plain radiograph is usually recommended as the first line modality. Although there are no consensus on the role of MRI in the evaluation of neck pain; considering its magnificent soft tissue resolution; it is said to be a very useful imaging modality in the evaluation of disk herniations, canal encroachment by osteophytes, tumor or infection, fractures, and posttraumatic ligament ruptures of the lower cervical column. Although MRI does not always detect the cause of chronic neck pain, particularly at the craniocervical junction, it is the preferred method for making most diagnoses.[9]

As per the knowledge of the author to date; there is no single study dedicated to MRI patterns of cervical spine in patients with neck pain in Ethiopia despite its impact on health care and economic burden stated worldwide. There is also no standard imaging guideline regarding clinical indications for evaluation of neck pain.

CHAPTER TWO: LITERATURE REVIEW

Neck pain is generally defined as stiffness and/or pain felt dorsally in the cervical region somewhere between the occipital condyles and the vertebral prominence. [12] Although it is stated in the ACR appropriateness criteria that there is considerable controversy in literatures over the etiology of chronic neck pain as well as the role of imaging in its evaluation which poses significant diagnostic and therapeutic dilemmas for the clinician; imaging plays an important role in evaluating patients with chronic neck pain.[9,12,13]

There are many imaging modalities for the evaluation of neck pain. The ACR appropriateness criteria recommends specific imaging modalities for a specific clinical scenario in which plain radiograph is recommended as a mainstay in the initial evaluation of patients with chronic neck pain. The other; usually next imaging modality is MRI which is recommended in patients with concomitant neurologic signs or symptoms, in patients after failed conservative management and in those with radiographic findings of vertebral bone or disc margin destruction. MRI allows for evaluation of bony detail, marrow signal, misalignment, stenosis, and radiculopathy using one test without ionizing radiation, replacing CT as the first-line advanced imaging for the patient with neck pain. It provides excellent contrast between the spinal cord, intervertebral disks, vertebral bodies, and ligamentous structures and assesses multiple additional aspects of soft tissue or osseous abnormalities. There are also a number of specific indications for MRI in the setting of neck pain including suspected malignancy or infection (discitis, osteomyelitis); especially, when radiographs are abnormal. [13, 14]

There are a number of studies on MRI findings of cervical spine in patients with neck pain and/or related symptoms such as radiculopathy. Most studies showed degenerative spine features as the most common imaging findings. In studies done in Nepal and Nigeria in symptomatic patients showed degenerative disc disease to be the most common finding accounting 76.13% and 78.5 % out of 750 and 149 patients respectively. Both studies showed a proportion of patients to have normal MRI studies, 14.4% and 9.4% respectively. Olarinoye-Akorede, *et al.* also showed degenerative changes (spondylosis) to be the most common imaging finding accounting 64.6% in the form of osteophytosis (72.3%), disc herniation (67.7%), disc dehydration (52.3%), exit foraminal stenosis (39.2%), disc space narrowing (24.6%), listhesis (14.6%), and cervical cord compression (53.1%) from 130 patients presented with persistent neck pain.[10,15,16]

Steilen et al. discussed about cervical spondylosis cascade in their paper on chronic neck pain. It was stressed that cervical instability due to causes such as repetitive trauma causing facet joint injuries is the main inciting factor in the initial development of cervical spondylosis with subsequent onset and progression of degenerative changes in different components of the cervical spine including facet joint hypertrophy, disc degeneration and formation of osteophytosis. It was mentioned that the development of spondylosis is silent and asymptomatic and when patients develop symptom, it is generally nonspecific such as neck pain and stiffness. Facet joints are highly innervated by nociceptive free nerve endings and have long been

considered the primary source of chronic spinal pain. It was also mentioned that neurologic symptoms, such as radiculopathy is not a common feature and seen in patients with underlying congenital foraminal narrowing or new onset injury on the background of compromised neural foramina due to facet joint hypertrophy or disc degeneration with resultant nerve root impingement.[17]

It is common to get predominantly degenerative cervical spine changes in patients with neck pain with or without radiculopathy as stated previously. But non degenerative imaging findings can also be seen as a separate entity or in addition to degenerative changes. In separate studies by Karki DB, et al, Mustapha et al. and Olarinoye-Akorede, et al showed non-degenerative findings including traumatic lesions, tumors and infections in symptomatic patients who undergo cervical spine MRI studies.[15,16,18]

Patients with spine infections could present primarily with back or neck pain. Pyogenic and tuberculous infections are the most common spine infections with the latter being the most common worldwide and MRI is said to be the modality of choice for imaging spine infections. Tuberculous spondylitis can be suggested over pyogenic spondylodiscitis on the basis of several characteristic MRI features such as disc space sparing, multilevel subligamentous spread and large abscesses. Regarding spinal tuberculosis, cervical spine involvement is less common compared to thoracic and lumbar locations. Studies done in China and Pakistan on spinal tuberculosis involving 967 and 2000 patients respectively showed cervical spine involvement in 6.41% and 10% respectively. Thoracic spine involvement was the most common involved site followed by lumbar/lumbosacral spine in both studies with back pain found to be the most common clinical symptom.[19-21]

Patients with spinal tumors could present primarily with back or neck pain even though they are not common, accounting only 2-4 % of all primary CNS tumors. In a study done in Dhaka showed 2 cases of space occupying lesion (SOL) in spinal cord out of 60 patients with neck pain.[22-25]

The utility of MRI in the evaluation of patients with chronic neck pain and degenerative cervical disorders is now well established. On the other hand; it is common to find abnormal findings in asymptomatic patients as age progresses as demonstrated in studies of Teresi et al. and Okada et al which showed degenerative spine changes in patients with no symptoms referable to neck. In another comparative study, on 31 individuals comparing MRI changes of cervical spine showed equal prevalence of pathological changes such as disc degeneration, annular tear and disc protrusion in symptomatic and asymptomatic groups. Only disc herniation was exclusively found in the symptomatic group reaching statistical significance. Considering these epidemiological patterns, the relevance of specific MRI findings in the cervical spine may be considered in light of expected changes associated with aging. [13, 26-28]

CHAPTER THREE: OBJECTIVES

General objective

- To assess the cervical spine MRI patterns in patients with neck pain with or without radiculopathy.

Specific objectives

- To describe demographic distribution of patients with neck pain with or without radiculopathy
- To determine the common cervical spine MRI abnormalities seen in patients with neck pain with or without radiculopathy
- To assess the patterns of cervical spine MRI abnormalities in patients with neck pain with or without radiculopathy in relation to demographic distribution

CHAPTER FOUR: METHODS AND MATERIALS

Study area and period

The study was conducted at Department of Radiology, Tikur Anbessa Specialized Hospital, Addis Ababa University, Addis Ababa Ethiopia from February to August 2018. The hospital is the largest tertiary level referral and teaching hospital in the country. It is one of the centers of excellence in Ethiopia in undergraduate, post graduate and subspecialty programs in health science. The radiology department is one of the many departments in the institution with experienced radiologists. It gives radiologic medical service and undertakes academic activities in training of general radiologists as well as medical students. The department also gives fellowship training in collaboration with different western universities mainly USA and Canada universities. The department is equipped with high-tech radiologic machines including high resolution US machines, MDCT machines with 64 and 128 slices and high resolution MR scanner with 1.5 tesla strength.

Study design

Retrospective descriptive study was conducted. Cervical spine MRI studies and clinical data review of patients with neck pain with or without radiculopathy who had MRI evaluation in the time period between Jun 2017 and March 2018 was done.

Population

Source population

All patients of either gender who attend medical care at TASH in the time period between Jun 2017 and March 2018.

Study population

All patients of either gender who had cervical spine MRI evaluation for an indication of neck pain with or without radiculopathy in the time period between Jun 2017 and March 2018.

Inclusion and exclusion criteria

Inclusion criteria

All patients of either gender with clinical data of neck pain with or without radiculopathy and who had cervical spine MRI evaluation at the radiology department.

Exclusion criteria

Patients with clinical data other than neck pain with or without radiculopathy.
Patients with clinical data of trauma to the neck.

Sampling technique and sample size

- The sample size was determined by the formula of sample size estimation for proportion for population >10,000

$$n = \frac{(z_{1-\alpha/2})^2 p(1-p)}{d^2}$$

- $Z_{(1-\alpha/2)}$ =standard normal variate (at α 5% is 1.96)
- P = the proportion of the target population estimated to have particular characteristics
- d=margin of error
- So, using-p value<0.05 ($Z_{1-\alpha/2}$ =1.96)
- P=6.9%, for upper limit prevalence of neck pain in Sub-Saharan East Africa by Hoy et al study on the global burden of neck pain
- d=5%
- Then n was 98.7; so the minimum sample size required was ~99.
- A non-probability convenience sampling technique was utilized in which all patients who had cervical spine MR evaluation in the time period between Jun 2017 and March 2018 that fulfill the inclusion criteria were included in the study.

Variables and operational definitions

Independent variables: age and gender.

Dependent variables: neck pain, radiculopathy, different cervical spine MRI findings and final imaging impression.

Operational definitions (As used by consensus among consultant radiologists at department of radiology at TASH)

- **Radiculopathy:** pain or neurologic symptoms in the distribution of specific nerve root, including motor loss and sensory changes.
- **Intervertebral disc herniation:** a localized (involving less than 50% of the circumference of the disk or less than 180° of the periphery of the disk) displacement of disk material beyond the normal confines of the disk.
- **Intervertebral disc desiccation:** disc with reduced water content, decreased T2 signal intensity of the disc.
- **Disc-osteophyte complex:** intervertebral disc displacement, whether bulge, protrusion or extrusion, associated with calcific ridges or ossification.
- **Ligamentum flavum thickening:** >4 mm ligamentum flavum thickening.
- **Facet joint arthropathy:** reduction in synovial facet joint space with loss of high signal intensity on T2WI.

- **Spinal canal stenosis (narrowing)**: obliteration of the subarachnoid space around the spinal cord with/without compression of the cord.
- **Neural foramina stenosis**: obliteration of the epidural fat and CSF space around the spinal nerve roots.

Data collection

Cervical spine MR images were acquired using Philips Medical Systems Achieva 16 channels 1.5 T strength MR scanner with standard neck and brain receiving coils. Images were acquired in sagittal plane in T1 weighted (TR/TE in ms of 400/7.8) and in sagittal plane in T2 weighted (TR/TE in ms of 3000/120) turbo spin echo (TSE) with 3 mm slice thickness, slice gap of 3.3 mm and FOV of 213mm x 213 mm. Axial plane in T2 weighted 3D (TR/TE in ms of 1600/100 turbo spin echo (TSE)) with 3 mm slice thickness, slice gap of 1.5 mm and FOV of 140 mm x 140 mm. Sagittal plane Short Tau Inversion Recovery (STIR) is acquired (TR/TE in ms of 2500/60) with 3 mm slice thickness, slice gap of 3.3 mm and FOV of 213 mm x 213 mm. Coronal plane acquisition and intravenous gadolinium-based contrast agent use are usually individualized for better characterization in some selected scenarios such as suspected infectious or neoplastic conditions. The images are interpreted by senior consultant neuroradiologists with more than 10 years of experience and fellows in neuroradiology.

MR imaging and clinical data records were retrieved and recorded on a format designed to include patients' sex, age, clinical indication and imaging findings.

Data processing and analysis

The data was cleaned, coded and entered to SPSS version 20 for analysis. Frequencies, mean, standard deviation, percentages and cross tabulation were determined and summarized. Association studies between some of the variables were done using chi square test using (α value of <0.05 as statistically significant association).

Ethical considerations

Data collection was started after getting permission from the ethical review committee of the department of radiology at Addis Ababa University. Patient confidentiality was maintained by omitting patients' name and hospital identification number from data collecting format and selected representative images.

CHAPTER FIVE: RESULTS

A total of 160 patients who had cervical spine MRI evaluation for an indication of neck pain during the period under review were included in this study of which 82(51.3%) patients had manifestations of radiculopathy. There were 71(44.4%) male and 89(55.6%) female patients. The mean age was 46.3 ± 13.3 years with a range of 18-85 years. The highest number of patients (31.9%) was seen in the 5th decade (41-50 years), whereas the least number of patients were seen in extremes of ages i.e. <21(1.9%) and >70 (2.5%) years of ages as shown in Figure 1.

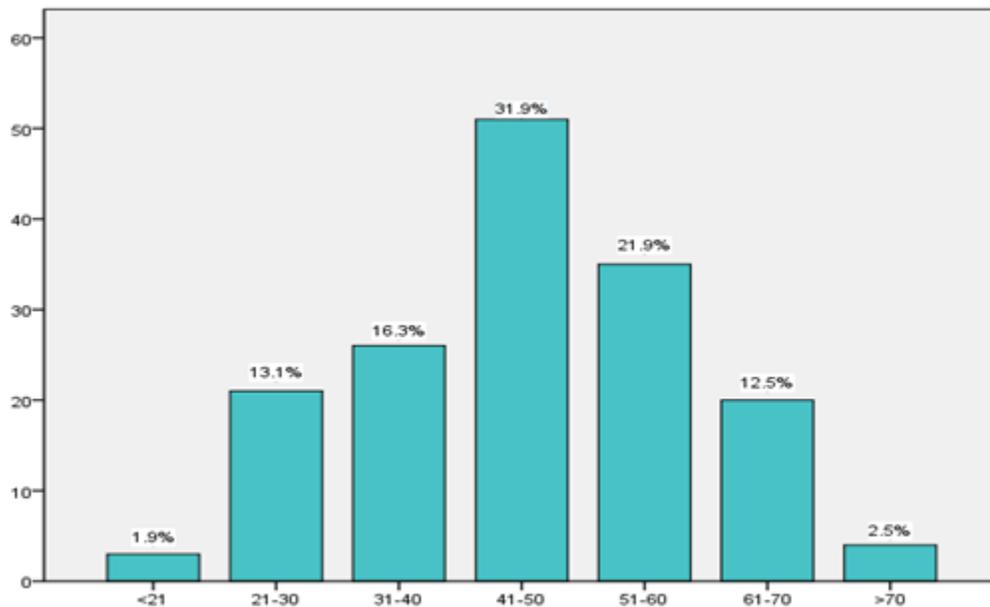


Figure 1: Age group distribution of patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Degenerative cervical spine findings with resultant neural foramina and/or spinal canal stenoses were the most common imaging findings seen in 127(79.4%) patients with 68(53.5%) female patients and 59(46.5%) male patients. Non degenerative imaging abnormalities such as neoplasm and infection were seen in 10(6.3%) patients only. A total of 23(14.4%) patients had normal cervical spine MRI evaluation as represented in Figure 2.

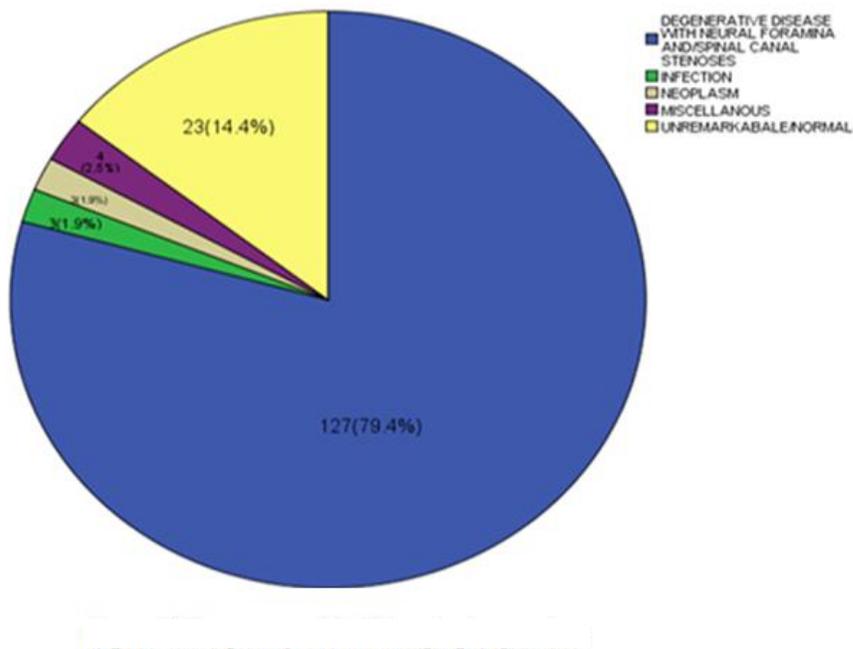


Figure 2: Frequency of final imaging impression in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Intervertebral disc (IVD) degenerative changes in the form of desiccation/dehydration, IVD space loss of height and disc osteophyte complex in combination or alone represent the most common degenerative imaging findings seen in 126 (78.8%) patients and all are multilevel, involving more than one disc level excluding isolated disc herniations. Vertebral bone degeneration in the form of posterior marginal osteophytes alone or in combination with vertebral body loss of height is seen in 120 (75%) patients. Other findings include IVD herniation (excluding disc osteophyte complex), facet and uncovertebral joints and ligamentous degenerative changes.

IVD degenerative changes were seen more commonly in females (52.4%) than males (47.6%) even though the difference doesn't reach statistical significance ($X^2 = 2.528$; $p = 0.112$ which is > 0.05). IVD desiccation and disc osteophyte complex were the two most common degenerative disc findings as demonstrated in Table 1 (see also Figure 3).

Table 1: Frequency of imaging findings of IVD degeneration in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

IVD degenerative finding	Frequency	Percentage
IVD desiccation	87	54.4%
IVD space loss of height	45	28.1%
Disc-osteophyte complex	109	68.1%
Disc osteophyte complex with disc dehydration and/or loss of height	75	46.9%

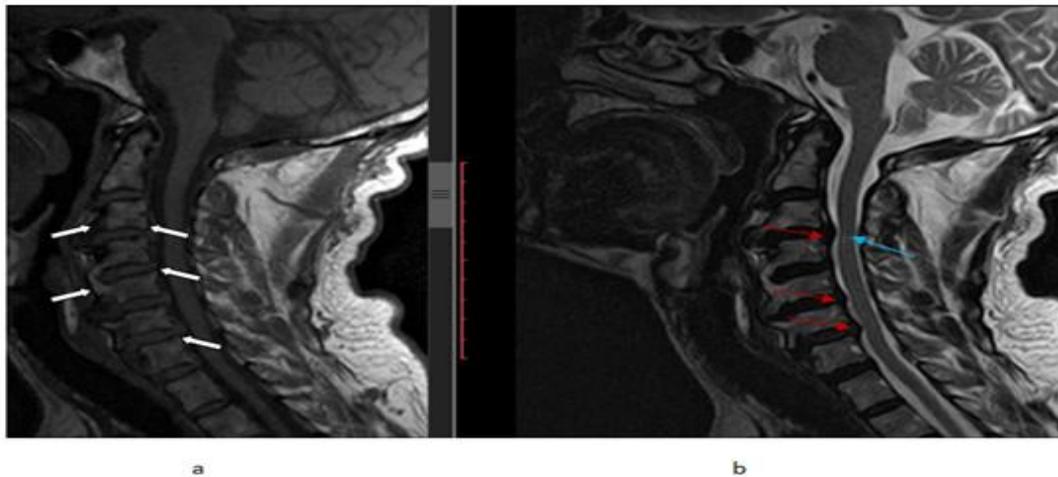


Figure 3: A 55 year old male patient (a) T1W sagittal cervical spine MRI showing multiple level anterior and posterior marginal osteophytes (block arrows) (b) T2W sagittal cervical spine MRI of the same patient showing decreased intervertebral disc signal and height from C2-3 to C6-7 levels with posterior disc osteophyte complexes at C3-C4, C5-C6 and C6-C7 levels (red arrows) There is also focal spinal cord signal change and decreased caliber at C3-C4 level (blue arrow)

Disc osteophyte complex with either disc dehydration and/or loss of height was seen in 75(46.9%) patients, with age > 40 years showing a higher percentage (85.3%) of patients as

compared to age ≤ 40 years (14.7%) which showed statistical significance($\chi^2= 18.071$; p value of 0.000021).

Intervertebral disc herniations excluding those associated with osteophytes (disc osteophyte complexes) were seen in 18(11.25%) patients, out of which 8(44.4%) were male and 10(55.6%) were female patients with the highest number of patients (38.9%) seen in the 5th decade (41-50 years of age) followed by the 3rd decade (27.8%). Only 1(5.6%) patient was seen in age <21 and no patient seen in age >60 years as represented in Table 2. The most commonly involved disc level was C5-C6 (50 %) followed by C4-C5 (44.4%) and C6-C7 (22.2%) levels as shown in Table 3(see also Figure 4).

Table 2: Distribution of IVD herniation according to age group in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Age group	Frequency	Percent
<21	1	5.6
21-30	5	27.8
31-40	2	11.1
41-50	7	38.9
51-60	3	16.7
Total	18	100.0

Table 3: Distribution of IVD herniation according to disc level in patients with neck pain with or without radiculopathy who came for cervical spine MRI evaluation at TASH in 2017-18

Disc level	Frequency	Percent of Cases
C2-C3 LEVEL	2	11.1%
C3-C4 LEVEL	5	27.8%
C4-C5 LEVEL	8	44.4%
C5-C6 LEVEL	9	50.0%
C6-C7 LEVEL	4	22.2%

Single level herniations were seen in 11(61.1%) as compared to multiple level herniations which were seen in 7(38.9%) patients. Single level involvement was more commonly seen in female than male patients but didn't show statistical significance.

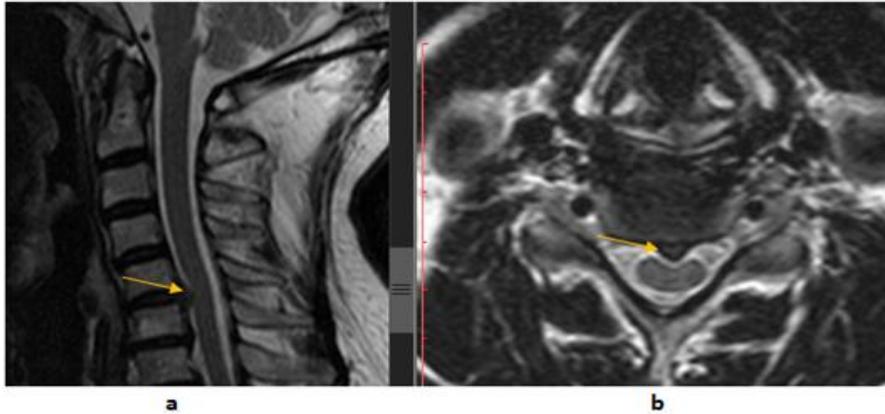


Figure 4: A 52 year old female patient (a) T2W sagittal and (b) T2W axial cervical spine MRI showing C5-C6 level posterior central disc protrusion (arrows) causing spinal canal stenosis and cord compression. There is decreased signal of the included intervertebral discs and straightening of the cervical spine alignment

From overall patients, neural foramina and spinal canal stenoses were seen in 117(73.1%) and 110(68.8%) patients respectively. Imaging findings suggesting spinal cord compression with signal change were seen in 24(15%) patients. Spondylolisthesis was seen in 2(1.3%) patients.

Imaging findings suggesting spine tuberculous infection were seen in 3(1.9%) patients, all presented with chronic neck pain and radiculopathy. Two of the patients had age of 65 years (male) and 28 years (female) with imaging features of spondylitis with epidural extension and cord compression. There was concomitant degenerative spine change in the first patient. In the third patient with age of 25 years (female), imaging showed features of spondylitis with alar ligament and clivus extension and spinal leptomeningeal enhancement with possible meningitis. There was also multiple level subligamentous spread pattern seen in all patients (see Figure 5).

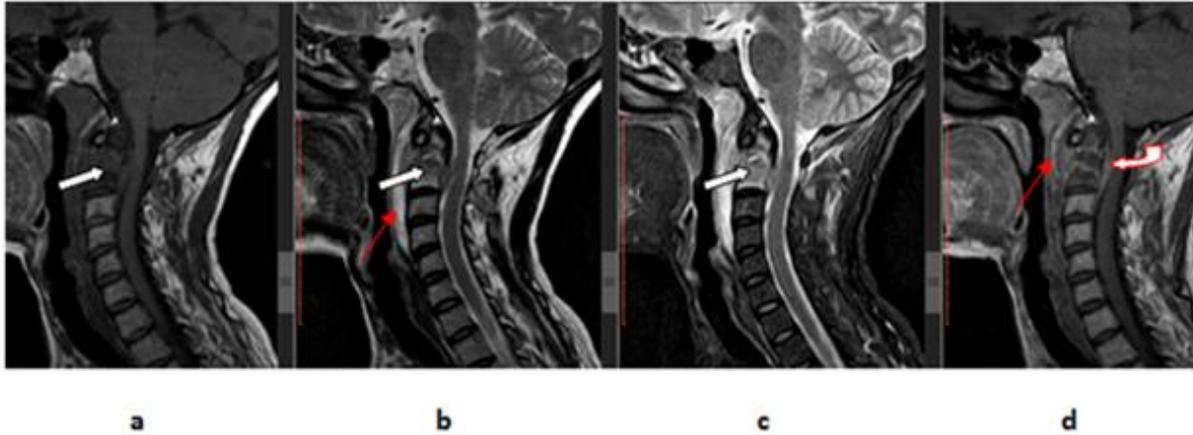


Figure 5: A 28 year old female ((a) T1W, (b) T2W, (c) STIR and (d) T1C+(post contrast) sagittal cervical spine MRI showing C2 vertebral body T1W hypointense(block arrow in a) and T2W hyperintense(block arrow in b) abnormal signal change not suppressed on STIR(block arrow in c). There is thickening of the prevertebral soft tissue which is T2W hyperintense(arrow in b) showing heterogeneous and peripheral post contrast enhancement(arrow in d) with subligamentous spread up to the level of C4. There is enhancing epidural extension component(curved arrow in d). Imaging findings suggest TB spondylitis

Imaging findings suggestive of neoplasm were also seen in 3(1.9%) patients. Intramedullary neoplasm suggesting glioma was seen in two of the patients. The first patient was 33 years old male with imaging findings of well circumscribed heterogeneous central intramedullary T1 isohypointense and T2 intermediate signal lesion showing moderate contrast material enhancement causing slight cord expansion extending from C5 to C7 vertebral levels. There was associated syrinx above and below the lesion (see Figure 6). The second patient is a 24 year old male with imaging finding of T2 hyperintense intramedullary lesion extending from C2 to C4 vertebral level expanding the cord and showing focal contrast material enhancement. Imaging finding suggesting vertebral metastasis was seen in the third thyroid cancer patient with imaging findings of C6 and C7 vertebrae T1 and T2 hypointense marrow signal change with increased signal on STIR image with posterior element involvement. There were also concomitant multilevel degenerative findings.

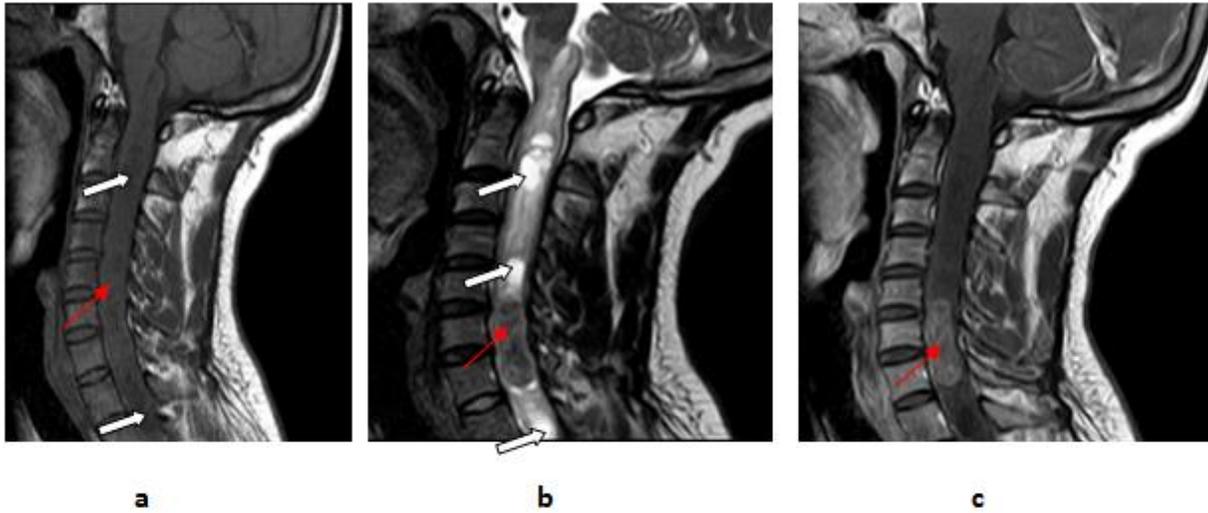


Figure 6: A 33 year old male patient (a) T1W, (b) T2W and (d) T1C+(post contrast) sagittal cervical spine MRI showing well circumscribed T1W and T2W heterogeneously iso to hypointense signal intramedullary lesion(arrow in a and b) with mild cord expansion. The lesion is better delineated on post contrast image(arrow in c) showing moderate enhancement. There is associated syrinx above and below the lesion(block arrows in a and b). Imaging findings suggest intramedullary neoplasm, likely ependymoma; astrocytoma is a differential diagnosis.

Other non-degenerative abnormalities categorized under miscellaneous were seen in 4(2.5%) patients. These are three cases of Chiari I malformation (two with syrinx) and one case of congenital block vertebra.

CHAPTER SIX: DISCUSSION

The role of cervical spine MRI for evaluation of chronic neck pain has been described in many literatures considering its excellent image contrast in demonstrating IVD, spinal cord, vertebral bone marrow, foraminal stenosis and other many aspects of anatomies such as ligamentous structures.[9,13,14] This study assessed cervical spine MRI examinations done for patients presented with neck pain with or without radiculopathy and showed degenerative spine disease as the most common imaging finding, which is in consistent with previous teaching hospital based retrospective and prospective studies done in Nigeria and Dhaka respectively on patients with neck pain.[15,16,25]

Intervertebral disc degenerative findings in the form of desiccation/dehydration, loss of height and disc osteophyte complex in combination or alone represent the most common degenerative findings (78.8%) with involvement of more than one disc level in all cases. Neural foramina and spinal canal stenoses were seen in 73.1% and 68.8% of patients respectively. Increased prevalence of degenerative findings was seen with age, especially with age above 40 years. This is a similar finding with previous retrospective studies done in Nepal and Nigeria on patients with neck pain that undergo cervical spine MRI evaluation showing degenerative changes such as intervertebral disc desiccation and bulge to have increased prevalence with age. [10, 15] On the other hand, this pattern of abnormal degenerative findings was also seen in asymptomatic patients where there was a higher incidence in association with advanced age as shown in studies done by Teresi et al, and Okada et al. [26, 27] This may show that degenerative MRI findings in patients with neck pain may suggest age related changes and may only partially explain the patients' symptoms, even though this explanation may need correlation with detailed patient background history such as psychosocial and socioeconomic factors as well as post interventional outcome correlations.

IVD herniation was seen in 18(11.2%) patients with the highest number of patients seen in the 5th decade (38.9%) followed by the 3rd decade (27.8%). The C5-C6 level was the most commonly affected level (56.5%) and single level involvement was more common than multiple level involvements. Similar epidemiologic finding was seen in a previous study that included 750 symptomatic patients and showed 159 patients to have disc herniations and C5-C6 level as the most common involved level. Multiple level involvement was seen only in 23 patients.[10] Disc herniation was found to be exclusively found in symptomatic patients versus asymptomatic patients in a comparative study while other degenerative disc changes were equally prevalent among both symptomatic and asymptomatic patients.[28]

Other degenerative findings include ligamentous degeneration (ligamentum flavum and/ posterior longitudinal ligament) seen in 49(30.6%) patients and facet and/uncovertebral joint degeneration seen in 13 (8.1%) patients. The role of facet joint in the development of cervical spondylosis and its implication in patients' symptoms such as neck pain and radiculopathy is described by Steilen et al. in their paper about chronic neck pain and cervical instability. [17]

Neural foramina and spinal canal stenoses were seen in 117(73.1%) and 110(68.8%) patients respectively. A higher prevalence as compared to a study by *Olarinoye-Akorede, et al* in which exit foramina stenosis was in 39.2% of patients (out of 130 patients). [16] This difference may be due to difference of epidemiology and/ or operational definitions.

Non degenerative abnormalities were not common findings. They were seen in 10(6.3%) patients. Karki DB, et al and *Olarinoye-Akorede, et al* in their study on patients with neck pain found non-degenerative pathologies in 12.1% and 35.5% respectively.[18,16] The relative less percentage of non-degenerative pathologies in our study may be explained by the exclusion of patients with neck trauma, as majority of patients with non-degenerative findings seen in the above mentioned studies represent trauma related findings.

MRI is said to be the modality of choice for imaging spine infections with several imaging findings, such as disc space sparing, multilevel subligamentous spread, and large abscesses, can suggest the diagnosis of tuberculous over pyogenic infection, the two most common spine infections. [19] In this study imaging findings suggesting infections were detected in 3(1.9%) patients which is a similar prevalence to a previous study. [18] Imaging findings were suggestive of tuberculous infections in all the three patients seen in our study. Despite Ethiopia's high prevalence of tuberculosis infection, the number of cases seen in this study is low. One explanation could be that cervical spine is a less common site for tuberculous infection as compared thoracic or lumbar spine. [20, 21] The other explanation could be the exclusion of patients with symptoms other than neck pain with or with radiculopathy such as paraplegic patients in our study.

Imaging findings suggesting neoplasm were seen in three (1.9%) patients, two intramedullary neoplasm suggesting glioma and one vertebral metastasis with similar prevalence to previous studies.[16, 25]

Three cases of Chiari I malformation, two of which associated with syrinx and one case of congenital block vertebra were seen and categorized under miscellaneous cases.

Out of the 160 patients in this study, 23(14.4%) patients had no remarkable cervical spine MRI findings. The absence of abnormal imaging findings in these patients may be related to different nonstructural factors such as patient background situations including psychosocial, demographic and socioeconomic factors as many previous studies tried to link up and explain neck pain with different perspectives. [2, 11] Other possible explanation are technical factors related to imaging technique and, resolution power of current imaging modalities to detect micro level pathologic changes such as micro level intervertebral disc degeneration which could have resulted in less detection of abnormalities, but these needs to be confirmed with studies.

This study has a number of limitations. This study didn't also follow the treatment given to see patient response, especially those patients with degenerative findings. Control group would have been a good input to compare patterns of degenerative spine changes, especially in relation to

advancing age. Detailed clinical backgrounds of patients such as socioeconomic and psychosocial factors were not considered in this study which would have been useful to assess these factors in relation to the pattern of imaging findings among study individuals.

CONCLUSION

Degenerative cervical spine findings were the most common MRI patterns seen in symptomatic patients in this study showing increasing prevalence with age. Cervical spine MRI in patients with neck pain with or without radiculopathy can strongly suggest underlying serious abnormalities as demonstrated in our study, such as infections or neoplasms, which could definitely affect patient management plan.

RECOMMENATIONS

- Future population based studies are recommended to really assess the prevalence of neck pain and its disability burden in Ethiopia.
- An institution based prospective study is recommended to come up with the significance of cervical spine MR imaging findings in patients with neck pain and/or radiculopathy.
- Interdepartmental discussion and cooperation is needed to clearly standardize clinical guidelines for stepwise indication of different imaging modalities for assessment of neck pain.

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ANNEX: QUESTIONNAIRE

ADDIS ABEBBA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF RADIOLOGY

CERVICAL SPINE MRI PATTERNS IN NECK PAIN PATIENTS

1. Id

2. Age in years

3. Age group in years

1. < 21
2. 21-30
3. 31-40
4. 41-50
5. 51-60
6. 61-70
7. >70

4. Gender

1. Male
2. Female

5. Clinical data

1. Neck pain
2. Neck pain with radiculopathy

6. Vertebral bone degenerative changes

1. Posterior marginal osteophytes
2. Loss of vertebral body height
3. Both osteophytes and loss of vertebral body height

4. No sign of vertebral bone degenerative change
7. Facet joint and/ uncovertebral joint degenerative change/arthropathy
 1. Facet joint degeneration
 2. Uncovertebral joint degeneration
 3. Both facet and uncovertebral joint degenerative change
 4. No sign of facet or uncovertebral joint degenerative change
8. Intervertebral disc degenerative changes
 1. Desiccation/dehydration
 2. Loss of height
 3. Both desiccation and loss of height
 4. Disc-osteophyte complex
 5. Desiccation / loss of height and disc-osteophyte complex
 6. No sign of intervertebral disc degenerative change
9. Intervertebral disc herniation(Isolated from disc-osteophyte complex)
 1. Yes
 1. Single level
 2. Multiple levels
 2. No
10. Ligamentous change (hypertrophy-thickening)
 1. Posterior longitudinal ligament thickening
 2. Ligamentum flavum thickening
 3. Both posterior longitudinal ligament and ligamentum flavum thickening
 4. No sign of ligamentous thickening
11. Imaging findings suggestive of spine infection
 1. Tb spondylodiscitis
 2. Pyogenic spondylodiscitis

3. Others
4. No sign of infection
12. Imaging findings suggestive of neoplasm
 1. Intramedullary
 2. Intradural-extramedullary
 3. Extradural
 4. No sign of neoplasm
13. Cervical spine alignment
 1. Straightened
 2. Exaggerated lordosis
 3. Reversed
 4. Scoliotic
 5. Anatomic
14. Spinal canal stenosis
 1. Yes
 2. No
15. Neural foramina stenosis
 1. Yes
 2. No
16. Spinal cord compression
 1. Yes; with signal change
 2. Yes; without signal change
 3. No sign of spinal cord compression
17. Spondylolisthesis
 1. Yes

2. No

18. Final imaging impression

1. Degenerative disease
2. Infection
3. Neoplasm
4. Miscellaneous
5. Unremarkable/normal

