



Full Length Research Paper

Cervical Spine MRI Findings in Patients Presenting With Neck Pain and Radiculopathy

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ABSTRACT

The peculiar position and functions of the cervical spine and its intervertebral discs in the human body make it prone to degenerative changes and other functional disorders and Magnetic Resonance Imaging (MRI) is the gold standard in adequately depicting these changes. This retrospective study aimed at showing the type and distribution of pathological changes and abnormalities in the cervical spines of patients who presented with symptoms of neck pain and radiculopathy. Data of 170 patients who had an MRI of the cervical spine over a 60 month period were retrieved and reviewed from the MRI database. Excluded from this study were patients whose symptoms were not neck pain or radiculopathy. Twenty-one patients did not meet these criteria by symptoms. The images were acquired in axial, sagittal and coronal planes using T1 weighted (T1W), T2 weighted (T2W) sequences and evaluated from C1/C2 to C7/T1 by signal intensity, posterior and anterior disc protrusion. The data were analyzed using SPSS version 16. The results show that cervical spondylosis occurred as a single finding in 44.4% of patients and in combination with disc prolapse in 41.9%, making it the most frequent finding overall. Patients aged 45-54 years were the highest imaged though the percentage of abnormal findings increased linearly with age. The most affected disc level was at C4/C5 (27.7%). Fourteen (9.4%) patients had a normal MRI result. Cervical spondylosis and degenerative disc disease are common in this locality.

Keywords: Cervical spine, MRI, Intervertebral disc prolapse, spondylosis

INTRODUCTION

MRI is now widely acknowledged as the imaging modality of choice to demonstrate diseases and abnormalities of the spinal column and the intervertebral discs. Its superior soft tissue differentiation and ability to visualize and detect lesions within the bone marrow, the spinal cord and the intervertebral disc (IVD) give it this advantage over other imaging modalities (Herring, 2007). It is non-invasive, gives detailed information about the morphology and integrity of the IVD, vertebrae, intervertebral foramina, facet joints and ligaments on both T1W and T2W images, especially sagittal plane images (Ryan et al., 2011).

The cervical spine has the most spinal mobility with as much as 600 movements per hour in a normal

individual, thus its high susceptibility to degenerative changes (Hashemi et al., 2002; Bland., 1989). Neck pain and cervical radiculopathy are common reasons for requests of MRI of the cervical spine, however as well as requests for the evaluation of spondylitis, trauma and less frequently neoplastic disease processes of the neck in order to achieve better patient outcome (Basak et al., 2003). Overall, MRI has a high diagnostic accuracy in differentiating these various disease processes.

Cervical spondylosis is a degenerative process of the spine with a gradual onset which alone or in combination with other factors may result in narrowing of the central spinal and root canals. It is a very common cause of spinal cord dysfunctions with progressing age and some

researchers have documented that by the 7th decade, it would have reached a prevalence of 95% in many subjects and may manifest with long periods of disability which worsens progressively, (Malcolm., 2002; Maccormick et al., 2003). Although degenerative changes are noted much earlier in life.

Degenerative disc disease and its sequelae are main causes of neck pain, thus suspicion of it is a strong indication for an MRI investigation, which will aid in the diagnosis of severe disease as well as identify reversible and thus treatable causes, although this modality has also been shown to demonstrate degenerative changes in both symptomatic and asymptomatic patients (Matsumoto et al., 1998). Without MRI, it is virtually impossible to detect and accurately diagnose many causes of neck pain such as disk prolapse, nerve entrapment and spinal cord compression which cannot be identified on conventional radiographs (Ryan et al, 2011).

The objectives of this study are to evaluate the role of MRI in the diagnosis of causes of neck pain and to document the pattern of findings seen in patients who presented with neck pain and radiculopathy in a university teaching hospital, and to compare our findings with those of others and pave the way for further research on the spine in this locality.

MATERIALS AND METHODS

This retrospective study was conducted at the diagnostic unit of the Department of Radiology, University of Maiduguri Teaching Hospital (UMTH) using data of patients who had an MRI of the cervical spine between May 2007 and April 2013.

The information of a total number of one hundred and seventy (170) patients were extracted from the UMTH MRI departmental record book and reviewed, out of which 21 patients whose requests were not neck pain or radiculopathy were excluded from the study. All the examinations were performed using an open type Magnetom Concerto MR Syngo, Version 2004A (SIEMENS) with a magnetic field strength of 0.2 Tesla, using a neck spine array volume coil (medium and large size). A data capture sheet designed to include patients' age, sex, indications and MRI findings was used.

Images were acquired in sagittal, coronal and axial planes in T1W spin echo, repetition time (TR)/Echo Time (TE) 358/13; field of view (FOV) 280mm; matrix size 205x256; slice thickness 4mm; no slice gap and T2W turbo spin echo, TR/TE 3940/120; FOV 280mm; slice thickness 4mm; no slice gap; matrix 192x256 sequences Short Tau Inversion Recovery (STIR) sequences were

done to better demonstrate the integrity of the vertebral marrow in some cases. Gadolinium-based contrast medium (Magnevist) was not administered routinely, but only to assess suspected infectious or demyelinating diseases.

All MRI images were interpreted by three radiologists comprised of two younger and one senior radiologist who was the most experienced with reporting MRIs. In the very few instances of inter rater differences, a Professor of Radiology gave the final review. A departmental grading system was agreed on for evaluating the images. Cervical spondylosis (which for the purpose of this study) was defined as the reduction in signal intensity of the disk material on T2W images with or without a decrease in disk height. We classified all forms and severities of disc bulging, herniation and migration simply as disc prolapse.

The data were analyzed using SPSS, (IL, Chicago, USA version 16). The results were presented as tables and figures as appropriate.

Limitations encountered included incomplete patient information from the record book.

RESULTS

A total of 170 MRI examinations of the cervical spine were carried out during the period under review, out of which 149 were included in this study. There were 98 (65.8%) males and 51 (34.2%) females (male: female 1.9:1). The mean age was 49.4±13.6 (range is 15-83 years).

Fourteen patients (9.4%) had normal findings, whilst degenerative diseases were found in 117 (78.5%) patients (Table 1).

In patients with degenerative findings, cervical spondylosis alone was seen in 52 patients (34.9%) while it occurred in combination with disc prolapse in 49 (32.9%), which is the second most frequent finding. The percentage of abnormal findings per age group increases linearly with age (Table 2). Males were mostly affected with spondylosis (37.8%), whilst females were mostly affected with spondylosis plus disc prolapse (33.3%) as shown in Figure 1.

Tuberculosis (TB) was diagnosed in five patients; two (40%) had features of tuberculous spondylitis alone, another two (40%) had features of TB and cervical spondylosis and one patient (20%) had tuberculous spondylitis associated with a retropharyngeal abscess (figure 5).

Degenerative disc disease was seen most frequently at C4/C5 level (spondylosis & disc prolapse 79%; spondylosis 75%), followed by C3/C4 level (spondylosis & disc prolapse 75.5%, spondylosis 69%) shown in figure 2.

Table 1: MRI Findings among the study group

Findings	Frequency	Percent
Normal	14	9.4
Others	13	8.7
Prolapse	16	10.7
Spondylosis & Prolapse	49	32.9
Spondylosis	52	34.9
TB	5	3.4
Total	149	100.0

Table 2: Percentage of Abnormalities per Age Group

AGE	PTS	Findings					N	Total%
		Spondylosis	Disc Prolapse	Spondylosis & Disc Prolapse	TB	Others		
15-24	5	0	0	2	0	1	2	60
25-34	19	5	3	2	2	3	4	79
35-44	26	11	1	6	2	3	3	88
45-54	42	13	9	12	0	4	4	90.5
55-64	37	15	2	17	0	2	1	97
65-74	15	4	1	10	0	0	0	100
75-83	5	4	0	0	1	0	0	100

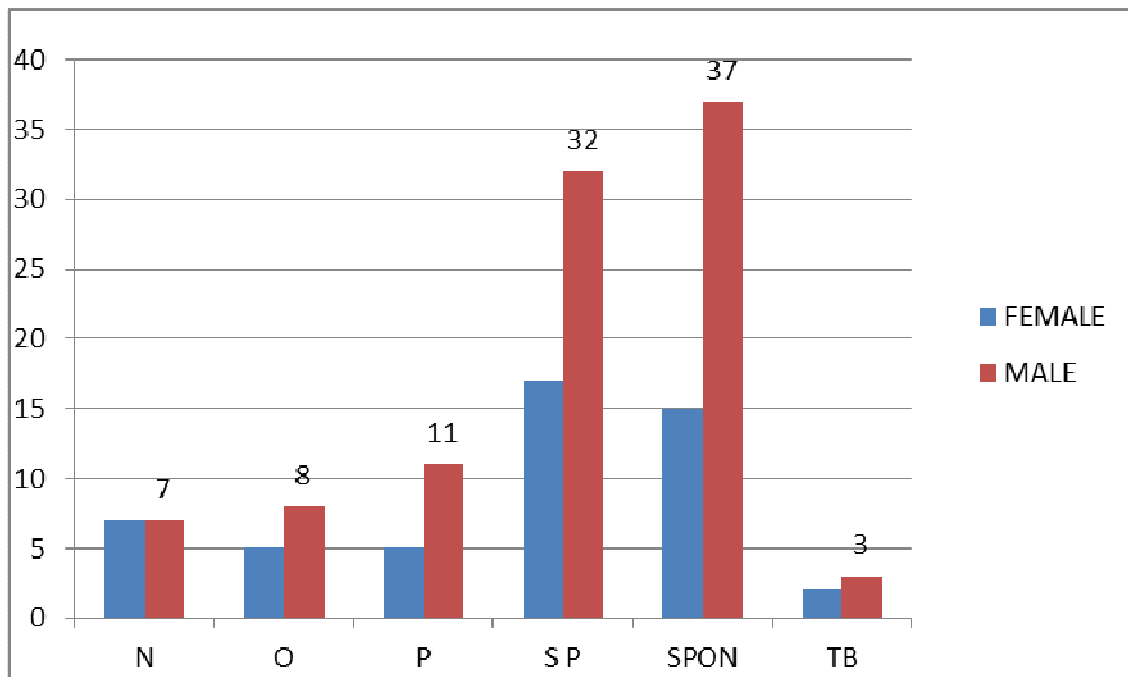


Figure 1: Gender distribution in relation to findings

LEGEND: O = Others, P = Prolapse, SP = Spondylosis & Disc prolapse, N = Normal
 SPON = Spondylosis, TB = Tuberculosis.

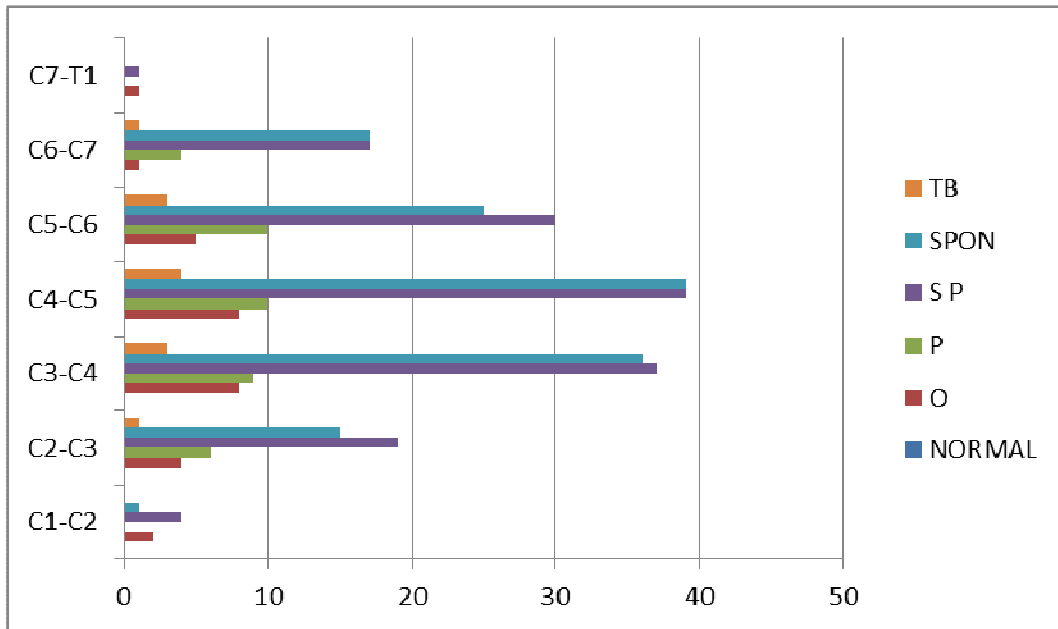


Figure 2: Findings and affected disk level
LEGEND: O = Others, P = Prolapse, SP = Spondylosis & Disc prolapse, SPON = Spondylosis, TB = Tuberculosis.

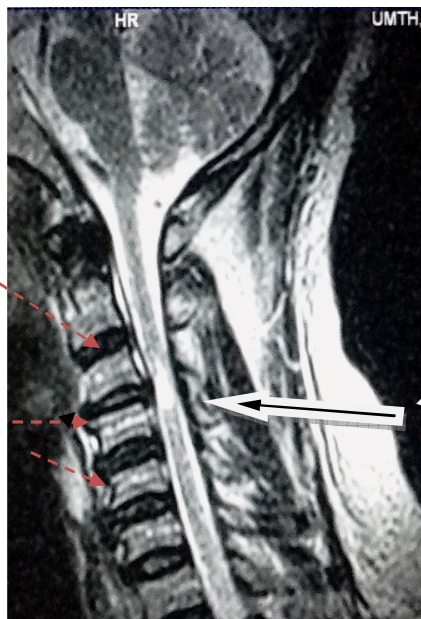


Figure 3. T2W sagittal Image of a 59 year old male patient, showing multiple levels of anterior osteophytes and reduced disc height. (red arrows) The black arrow points to Syringomyelia

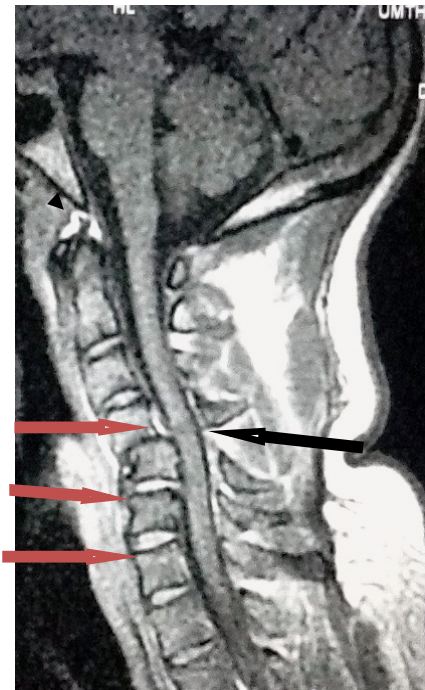


Figure 4: T1W sagittal image of a 42 year old female patient. Black arrow show reversal of cervical curvature at C4/C5, slight cord compression and Grade I Cervical Spondylolisthesis. Red arrows show multiple levels of osteophytes and reduced disc height

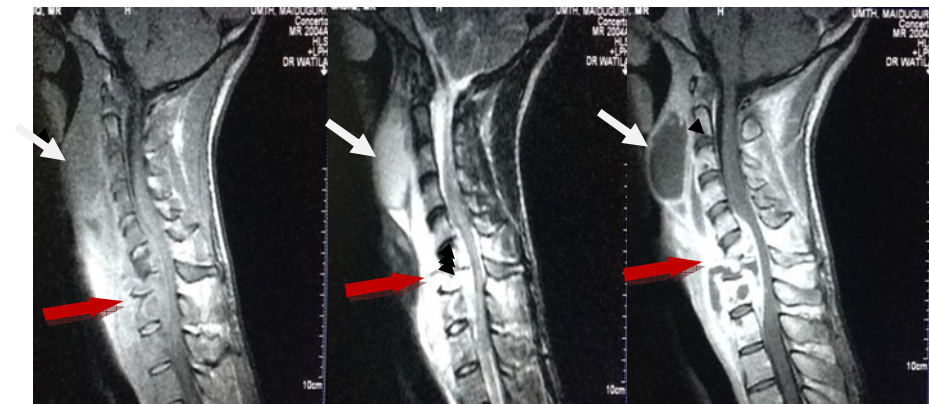


Figure 5: a) T1W sagittal
b) T2W sagittal
c) T1W sagittal post Magnevist.

Note: white arrows indicate retropharyngeal abscess and red arrows areas of cervical disc destruction in pott's disease (TB Spine).

DISCUSSION

A handful of studies we reviewed made no reference to gender variation (Hong et al., 2009; Feller., 2002; Rojas et al.), although some studies have shown results in keeping with ours, while some others showed no gender

variation. (Hashemi et al.,2002; Islam et al., 2009; Okada et al., 2010; 2007; Mann et al., 2011; Sinan et al., 2004). All the patients in this study were symptomatic.

Disc height reduction occurs as a result of dehydration of the inner nucleus pulposus. Associated degeneration of the outer annulus fibrosus of the disc

material leads to osteophytosis. Disc prolapse occurs as a result of the already compromised annulus fibrosus permitting the degenerating nucleus pulposus to migrate and this can be seen as bulging of the disk material in its mildest form to migration in severe cases (Herring., 2007). With all these processes occurring simultaneously and progressively, there may be an exacerbation of the symptoms of neck pain and findings of spinal cord and nerve compression. Our results showing cervical spondylosis as the most frequent finding is in keeping with findings in other studies (Hashemi et al., 2002; Islam et al., 2009; Sinan et al., 2004). We found a linear increase in the percentage of abnormal findings from 60% in the least affected age group of 15-24 years to 100% in the 75-84 year age range. Studies carried out on symptomatic as well as asymptomatic subjects also observed a similar relationship (Hashemi et al., 2002; Matsumoto et al., 1998; Islam et al., 2009). On the whole, increasing age and past history of neck trauma have been shown to favor a diagnosis of degenerative disc changes.

Cervical spines 3 – 7 are considered to be the motion segments of the C-spine with mobility being maximal at C5/C6 levels and it is the most frequently affected by disc prolapse. We found disk prolapse occurring at C4/C5 most frequently, followed by C3/C4 and same has been documented in other studies (Herring., 2007; Matsumoto et al., 1998; Sinan et al., 2004). (See figures 3 & 4 above)

Tuberculosis (TB) of the spine is perhaps the most important of all the extra pulmonary forms of TB. This is because early diagnosis and treatment will spare many patients spinal deformities and debilitating and often irreversible neurological damage (Jain et al., 1993; Patankar et al., 2000). Tuberculous spondylitis most commonly affects the thoracolumbar spine, followed by the thoracic spine, but is rare in the cervical region and comprises only 2-3% of all cases of TB spine (Ogah et al., 2012;). This study reports five cases of tuberculous spondylitis in the cervical region, all presenting with neck pain and a few with radiculopathy and neurological disorders. Two of these patients also showed associated features of spondylosis whilst one had a retropharyngeal abscess which is an extremely rare association. (See Figure 5)

We classified syringomyelia, spondylolisthesis and congenital findings as 'others' because these were the only three non-degenerative, non-infective findings we documented. We recorded five, three and five of the cases, respectively. Syringomyelia occurs secondary to many disease processes and is often seen as a fluid-filled cavity extending along the spinal cord in a longitudinal direction (Butteriss et al., 2009). Causes range from intramedullary spinal tumors, arachnoiditis and less commonly acute trauma with spinal fracture and acute disk prolapse. Its association with cervical

spondylosis is less common and poorly understood, as was the case in the 5 patients seen in our study. It is advised that such cases should be thoroughly investigated to exclude other acute and more treatable cases (Butteriss et al., 2009).

A total of 14 patients (9.4%) had normal results despite having a complaint of neck pain. A study carried out on 342 symptomatic patients in Iran showed 73 (21.3%) to have normal results (Hashemi et al., 2002). In a contrasting study of 497 asymptomatic subjects carried out in Japan to evaluate the cervical IVD, it was found that the degenerative changes were very common and increased linearly with age from as low as 12% in the 3rd decade to as high as 89% in the 7th decade with it occurring at a higher incidence in men than in women (Okada et al., 2010;). Aside from the two stated examples, there is a wealth of research which supports the hypothesis that degenerative changes are probably a normal aging process, though few researchers believe that the technical or inherent faults or shortcomings of an MRI scanner may be responsible for inability to detect some structural changes, thus documenting these cases as normal (Herring., 2007; Hashemi et al., 2002; Islam et al., 2009; Mann et al., 2011).

CONCLUSION

Magnetic resonance imaging is the most reliable method of evaluating the spine and spinal cord and remains the gold standard. Degenerative changes are common in this locality and were shown by this study to increase linearly with age and affect multiple intervertebral disk levels. Our study also found a significant number of normal subjects manifesting with neck pain.

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