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Research article

CONVENTIONAL RADIOGRAPHIC EVALUATIONS OF CERVICAL SPONDYLOSIS IN UNIVERSITY OF UYO TEACHING HOSPITAL, UYO, NIGERIA.

[1]DR EDUWEM, D U., [1]DR UDUMA, F U., [2]DR EKE, B., [3]DR INYANG C., [4]DR NWASHIDI, A

1-Department of Radiology, University of Uyo teaching hospital, Uyo, Nigeria

2-Neurology Unit, Department of Medicine, University of Uyo teaching hospital, Uyo, Nigeria

3-Department of Trauma and Orthopedics, University of Uyo teaching hospital, Uyo, Nigeria.

4-Department of maxilllo-facial surgery, University of Uyo teaching hospital, Uyo, Nigeria.

CORRESPONDENCE: Dr. Felix U. Uduma

E-mail: felixuduma@yahoo.com

ABSTRACT

BACKGROUND

Cervical spondylosis (CS) is an age-related disc degenerative disease of the cervical vertebrae. It affects not only the cervical inter-vertebral discs but also the two facet joints and two uncovertebral joints of Luschka.

AIM

Evaluating the radiographic components of cervical spondylosis in University of Uyo teaching hospital (UUTH), Uyo, Nigeria.

METHODOLOGY

The study took place between 27th June, 2012 and 31st October, 2013. Consecutive patients who came to Radiology Department of UUTH for cervical spine radiographs on any account were prospectively studied. For

each patient, anterior-posterior(AP) and lateral cervical spine radiographs were taken according to standard protocols after extraction of demographic factors.

Features of CS like disc space narrowing, osteophytosis, endplate sclerosis and vacuum phenomenon were sought for at each vertebral level and disc space.

Exclusion criteria included non-optimal radiographs. Results were analyzed using SPSS 13.0 for Windows software package (SPSS, Chicago, Ill).

RESULTS

A total of 140 patients were studied (82 males and 58 females) with age range of 10 to 89years.

47.14% (n- 66) patients had CS with 63.64% of males and 36.36% of females giving a male to female ratio of 1.75:1. CS was predominant from 5th decade of life to 7th. No CS was seen before 19years.

The commonest radiographic features of CS in UUTH is osteophytosis (100% of CS patients). This is followed by disc space narrowing (48.48%, M:F ratio of 1.7:1). Then end-plate sclerosis 6.06%, (M:F ratio of 0:4). Vacuum phenomenon was not observed in any patient.

The atlas vertebra was never involved in CS. CS started from axis vertebra and the frequency increases down the vertebral level peaking at C5, thereafter declining to C7.

Disc space narrowing started at C3/C4 peaking at C4/C5 and declining to C6/C7.

The commonest pattern of osteophytosis in CS is anterior osteophytosis (n=173), followed by posterior osteophytosis (n-12). No marginal osteophytosis was seen. 10.60% of patients with radiographic features of CS had osteophytic detachment. This was confined to anterior osteophytosis, males and vertebral levels of C4-C7 with the commonest site being C6 (42.85%).

CONCLUSIONS

The commonest component of cervical spondylosis in Uyo is osteophytosis with anterior osteophytosis being the most predominant and the most detached. Vacuum phenomenon is not a common variable of cervical spondylosis in Uyo. Unlike other studies, the commonest site of cervical spondylosis in Uyo is C4/C5.

KEY WORDS: Cervical spondylosis, disc, osteophytes, radioculopathy, myelopathy.

INTRODUCTION

Spondylosis is a broad term used for degenerative changes of the axial spine [1,2]. Specifically, cervical spondylosis (CS) is characterized by degeneration of the cervical inter-vertebral discs and the four joints of the cervical motion segment namely the two facet joints and two uncovertebral joints of Luschka) [2]. Degenerations are also known to affect ligaments and connective tissue of the cervical vertebrae [2,3,4].

CS is part of the normal aging process of the vertebral column [2,5]. Consequently, it is commonly seen in individuals after the age of 40 years with male predominance [2,5]. Its sites of predilection are C5/C6 followed by C6/C7. These are locations that are most liable to flexion and extension in the subaxial spine [2]. Aetiological factors of CS are poorly understood but multi-factorial. They include age, abnormal posture, anxiety, depression, neck strain, occupational activities (like heavy labour, lifting), excessive driving, smoking and dystonic cerebral palsy affecting cervical muscles [2,3,4,6]. Others are significant trauma, congenitally narrow vertebral canal and atheletic endeavours like soccer, rugby and horse riding . Lifestyles of Africans and other developing nations may contribute to the risk as axial strain of load-carrying on the head exacerbates CS [5]. Genetic predispositions also occur. An example is Down syndrome as 70 percent of patients with Down syndrome have an increased incidence of spondylosis by 50 years of age[4].

CS could be asymptomatic even with severe degenerative changes [2,6]. But it can develop insidiously presenting as three clinical syndromes. These syndromes are axial neck pain (discogenic neck pain), cervical radiculopathy and cervical spondylotic myelopathy(CSM) [2,3,4,5,6,7]. Radiculopathy arose from intervertebral foraminal narrowing with pain confined to a stereotypical dermatomal distribution [3,4] Nerve root compression is caused by foraminal spondylotic changes

secondary to chondrosseous spurs of facet and uncovertebral joints [2] The most commonly involved nerve roots in cervical radiculopathy are the 6^{th} and 7^{th} due to C5-C6 or C6-C7 spondylosis. [4] Similarly, spinal canal narrowing with attendant spinal cord compression is the basis of CSM [3] Osteophytic overgrowth ventrally and buckling of the ligamentum flavum dorsally can cause direct compression of the spinal cord resulting in CSM[3,4]. CSM is actually the consequence of direct spinal cord compression, ischaemic compression of related vascular structures, repeated spinal cord local trauma from physiological movements in the presence of osteophytic bars and compression from degenerative kyphosis/ subluxation [5,8]. This is worse during neck extension [2]. Symptoms develop in CSM when the spinal cord has been reduced by at least 30 percent or canal diameter being less than 13mm (normal is 17mm [4]. CSM is the commonest cause of non-traumatic parapariesis and quadripariesis in older persons [3.4].

CS is characterized radiologically by the presence of disk space narrowing, osteophytes, end-plate sclerosis, vacuum phenomenon and degenerative changes of uncovertebral and facet joints [1,2,7].

MRI could be the modality of choice as it is multi-planar and has good display of disc degeneration, myelomalacia, foraminal/canal stenosis [2,4]. However, CT may give a more accurate assessment of the degree of canal compromise as it is superior to MRI in evaluating bones (osteophytes). [4]. Myelography provides useful information on surgical planning [4] . CT myelography replaces MRI in patients with pacemaker [2]. Plain radiography alone is therefore of little benefit as an initial diagnostic tool especially when it is necessary to correlate cervical spondylotic changes with identifiable sensorimotor abnormalities [4]. Despite all these, plain radiography remains very vital as a simple , cheap and readily available radiological tool in diagnosis of spondylosis. This underlies its exploit in this study. In this study we are only employing anterior-posterior and lateral radiographs for simple identification of radiographic features of cervical spondylosis. Otherwise, additional radiographic views llke oblique view which is important for foraminal stenosis assessment and flexion and extension views important for angular or translational instability would have been used [2]. This would invariably add to cost and radiation dose, thus we excluded additional views from the scope of our study.

AIMS

To identify the commonest radiographic components of cervical spondylosis in University of Uyo teaching hospital, Uyo, Nigeria using cervical conventional radiographs.

MATERIALS AND METHODS

This study took place between 27^{th} June, 2012 and 31^{st} October, 2013. Consecutive patients who came to Radiology Department, University of Uyo teaching hospital (UUTH), Uyo, Akwa Ibom State, Nigeria for cervical spine radiographs on any account were prospectively studied. Their clinical and demographic data were extracted and patients' consents were sought prior to radiographic examinations. For each patient, anterior-posterior(AP) and lateral cervical spine radiographs were taken according to standard protocols.

In AP position, the patient lies supine in the centre of X-ray couch with the back of the head rested on the couch top. It is ensured that the head is not rotated through immobilization using sandbags. Then the chin is elevated to the point that the lower border of the mandible is 90^{o} to the detail screen cassette. Marker is applied, beam collimated and protection also applied. Centring point is 5cm above the supra-sternal notch and in the midline. The central ray is directed vertically with the tube angled 15^{o} cephalad. Exposure is done under arrested respiration

In the lateral position, patient stands or sit in the true lateral position. against the erect cassette holder. The chin is raised such that the angle of the mandible is clear of cervical vertebrae. The shoulder is depressed as low as possible. The tip of the shoulder is rested on the lower border of cassette. Head is immobilized, marker applied, beam collimated and protection applied. Centring point is 2.5cm posterior to the angle of the mandible. The

central ray is directed horizontally at 90^{o} to the cassette. Exposure is done under arrested respiration. The 7th cervical vertebra is shown with the arm in weight bearing. Focal film distance applied is 150cm to make up for the large object- film distance.

In some cases, anterior-posterior open mouth view was also done to properly show cervical vertebrae 1-3.

Features of spondylosis like disc space narrowing, osteophytosis, endplate sclerosis and vacuum phenomenon were sought for at each vertebral level and disc space.

Exclusion criteria included non-optimal radiographs, non-standardized radiographs and patients without complete bio-data. Results were analyzed using SPSS 13.0 for Windows software package (SPSS, Chicago, Ill).

RESULTS

A total of 140 patients were studied with 82 males and 58 females giving a male to female ratio of 1.4:1. Age range was between 10 and 89years of life. The largest male population was 15.71 percent (n=22) in the 30-39 age range while the largest female population was 17.14 percent (n=24) in the 50-59 age range.

66 patients had cervical spondylosis with a percentage of 47.14. Males were 42 (63.64%) in number whereas females were 24 (36.36%) giving a male to female ratio of 1.75:1. The commonest radiographic features of cervical spondylosis in UUTH is osteophytosis (n=66 with male to female ratio of 2.3:1). This is followed by disc space narrowing(n=32, M:F ratio of 1.7:1). Then end-plate sclerosis (n=4 with male to female ratio of 0:4). Vacuum phenomenon was not observed in any patient.

The predominance of cervical spondylosis was seen from 5th decade of life to 7th decade. No cervical spondylosis was seen from 0-19 years.

In terms of vertebral level involvement, it started from axis vertebra and the frequency increased down the vertebral level peaking at C5, thereafter the frequency started declining to C7. The atlas vertebra was never involved in cervical spondylosis.

The commonest pattern of osteophytosis in cervical spondylosis is anterior osteophytosis (n=173, M:F ratio of 2.7:1). This is followed by posterior osteophytosis of 12 with M:F ratio of 1:1. No marginal osteophytosis was seen.

10.60% of patients with radiographic features of cervical spondylosis had anterior osteophytic detachment. This constituted 23.33% of all patients with anterior osteophytosis. Detachment of anterior osteophytes were only seen in males and only at vertebral levels of C4-C7 . The commonest site of detachment was C6 seen in 42.85% of patients with detachment. Multiple anterior osteophytic detachments

(C4-C6) was seen in one patient who was 89years old.

C1/C2 and C2/C3 were spared of disc space narrowing. Disc space narrowing started at C3/C4 peaking at C4/C5 and then decline to C6/C7.

Table 1: Showing age distribution of studied population

AGE RANGE	MALES	FEMALES	TOTAL
0-9	0	0	0
10-19	0	4	4
20-29	10	8	18
30-39	22	6	28
40-49	10	10	20
50-59	14	24	38

60-69	12	4	16
70-79	8	0	8
80-89	6	2	8
TOTAL	82	58	140

Table 2: showing the distribution of the various cervical spondylosis component with age.

Age	OST		DISC		VAC		END		NOR		
	M	F	M	F	M	F	M	F	M	F	
0-9											
10-19										4	
20-29	2		2						8	8	
30-39		2							20	6	
40-49	2	4		2					10	6	
50-59	16	10		8					2	6	
60-69	14	2	10				2			6	
70-79	8		8				2				
80-89	4	2		2							
90-99											
TOT	46	20	20	12	0	0	4		40	38	

(OST-Osteophyte, DISC-Disc space narrowing, VAC-Vacuum phenomenon, END-Endplate sclerosis, NOR-Normal)

Table 3: showing the distribution of different sub-types of osteophytosis according to cervical segmental level.

vert	marg		ant		post		nor		
	M	F	M	F	M	F	M	F	tot
C1	0	0	0	0	0	0	0	0	0
C2	0	0	2	0	0	0	0	0	2
C3	0	0	12	10	0	0	0	0	22
C4	0	0	32	9	2	0	0	0	33
C5	0	0	36	18	2	4	0	0	60
C6	0	0	34	8	2	2	0	0	46

C7	0	0	10	2	0	0	0	0	12
tot	0	0	126	47	6	6	0	0	

(vert-vertebrae, mag-marginal osteophytes, ant-anterior osteophytes, post-posterior osteophytes, nor-normal, tot-total)

Table 4: showing the distribution of different components of cervical spondylosis according to cervical segmental levels.

LEV	DISC		END		VAC		NOR		
	M	F	M	F	M	F	M	F	
C1/C2	0	0	0	0	0	0	0	0	
C2/C3	0	0	0	0	0	0	0	0	
C3/C4	6	6	0	0	0	0	0	0	
C4/C5	10	8							
C5/C6	4	4	1						
C6/C7	2	2	1						
TOT	22	20	2	0	0	0	0	0	

(LEV-Level, DISC-Disc space narrowing, END-Endplate sclerosis, VAC-Vacuum phenomenon, NOR-Normal)

DISCUSSIONS

Cervical spondylosis (CS) was seen in 47.14% of our studied population. This value reflects how common CS is on this anatomic region of the vertebral column. Presumably, higher frequency rate would have been obtained if we had applied strict sample bias as CS is known to be the consequence of the natural aging process of the spine (see table 1) [2,4]. CS is commonest among people aged above 40 [2,4]. This is reflected in our study as over 90% of all positive cases of CS were seen in patients aged 40 years and above (see table 2). This is not unconnected with mechanical factors and demineralization of disc cartilage accompanying aging [2,3,7]. Similarly, no one aged between 70-80 years was exempted from CS in this study. This is a higher value when compared to 70% of patients with CS obtained in another but similar study on those aged 70 years of age [2].

CS is also known to advance with age [9]. In our study, no case of CS was seen below 19years, 11.11% had CS at 20-29, 93.75% of patients 60 years and above had CS. This is in agreement with another radiological study on asymptomatic individuals that showed that spondylotic changes increase with each decade of life [5] 5-10% of their patients aged 20-30 years had CS, >50% by age 45 years, and >90% by 60 years of age [5]. Chronic disc degenerations result in increased mechanical stressors passing through the cervical spinal column as one ages and consequently ends up as CS [3].

CS has being seen to be more common in men than women [2,3]. Our study also showed such male predominance with a male to female ratio of 1.75:1. But this ratio is less than 3:2 seen in another study [3]. This is still due to our all inclusive study.

Multi-level involvement (75%) in this study is more than single level involvement . Also multi-level involvement increased with age as 85% of patients aged 60 years and above had multi-level involvement.

Another study of asymptomatic adults showed significant degenerative changes at 1 or more levels in 70% of women and 95% of men at age 65 and 60 [3].

Osteophytosis in this study is the commonest radiographic feature of CS (see table 3) . Osteophytes also known as bone spurs are known to pathogenetically developed from margins of end-plate and stabilize adjacent vertebrae whose hypermobility is caused by the degeneration of the disc [4,5]. Osteophytes increase the weight-bearing surface of the end plates and, therefore, decrease the effective force being placed on them [4]. In other words, osteophytes are buttressing mechanism to compensate for the increasing axial load on the vertebra following loss of tensile strength seen in degenerating disc. However this advantage is short-changed by possible symptomatic effect arising from the presence of these osteophytes.

Its anatomic nearness to neural formina and spinal canal inadvertently incite radiculopathy and cervical spondylotic myelopathy respectively. These are all due to extrinsic compression of contiguous structures by these chondro-osseus spurs. While posterior osteophytes are the worst in causing myelopathy, marginal osteophytes are known to cause radiculopathy and anterior osteophytes cause dysphagia and soft tissue injury. Interestingly the frequency of osteophytosis in this study in decreasing order is anterior-posterior-marginal osteophytosis. In fact no case of marginal osteophytosis was observed. This may be partly due to sub-optimal films seen in anterior-posterior view of cervical spine resulting from technical factors or poor patients' compliance to instructions during X-ray exposure.

Multi-segmental level osteophytosis in this study was found to be three times commoner than single level. This probably may be due to same effect of degeneration affecting all discs simultaneously. The distribution of osteophytosis in blacks is different from whites; osteophytes appear to affect either the vertebral body or apophysial joint/ facets in the cervical vertebrae of the blacks[5]. On the other hand, both sites are often affected on the same vertebra in whites, which in life may result in a pincer-like entrapment of the spinal nerve root or vertebral artery [5]. This was attributable to carrying of objects on the head by Africans [5].

Osteophytic detachments may follow osteophytosis and these were restricted to anterior osteophytosis . This might suggest relative mobility of these osteophytes since it is adjacent to soft tissue structures of retropharyngeal and prevertebral spaces.

In CS, degenerative changes start in the intervertebral discs [6]. Disc space narrowing seen in every spondylosis is due to disc degeneration, disc dessication, disc bulging, disc hernaition and finally loss of disc height, [2] In this study, disc space narrowing is the second commonest radiographic component of CS. One would have ordinarily expected this component to be the commonest since it is the initiator of the cascade of spondylosis, hence the alternate name degenerative disc disease. This reduction in frequency of occurrence may either be due to patient positioning on x-ray exposure or the anatomic peculiarity of cervical spine. However, the impact of gravity on these disc is exemplified in this study by the increasing frequency of disc space narrowing from C3/C4 peaking at C4/C5 and then declining to C6/C7. This is unlike the commonest level of disc space narrowing being C5/C6 greater than C6/C7 and C4-5 seen in other studies [2,3]. These localizations arose because these levels are the most flexed and extended in the subaxial spine [2,3].

Dessication and degeneration put greater stress on the articular cartilages of the vertebrae and their respective end plates [4]. This leads to a process called endplate sclerosis. Endplate sclerosis is the eburnation that protects the specific vertebra from the increasing weight occasioned by the disc degeneration. This sclerosis understandably is worst with lower vertebrae, likely due to same reason of increasing axial weight. End-plate sclerosis was the third commonest findings in this study.

Vacuum phenomenon was not observed in our study (see table 4). "Vacuum phenomena" relate to the accumulation of gas, principally nitrogen, in crevices within the degenerating nucleus pulposus of intervertebral disc or vertebra [10,11]. This has been described since 1980 [11]. Vacuum phenomenon can be demonstrated in conventional radiography, CT and MRI [11]. Its absence in our study may not be surprising as vacuum phenomenon is commonly seen in lumbar spondylosis [11]. A pocket of gas may be seen within the spinal canal through the fissures or cracks that reach the annulus ligament complex [10,11]. This was not seen in our study. Vacuum phenomenon appearance does not uniformly indicate degenerative disc disease as gaseous collections may be associated with vertebral osteomyelitis, Schmorl node formation, spondylosis deformans and vertebral collapse with osteonecrosis .

There are different options for managing the clinical problem of cervical spondylosis, this can broadly be divided into conservative and surgical methods. Conservative method is for milder clinical conditions and those who cannot tolerate surgery. Non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, antidepressants, anticonvulsants, exercise, manipulation, and mobilization, are frequently used in non-operative management of these conditions [6,7]. Non- responsive patients to the medical treatments, intractable pain, a lesser transverse area of spinal cord progressive disease and those with disabling neurological syndromes are treated surgically [5,12].

Differential Diagnosis of Cervical Spondylosis include

other non-specific neck pain lesion like acute neck strain, postural neck ache, whiplash, fibromyalgia, disc prolapse, diffuse idiopathic skeletal hyperostosis, Inflammatory disease like rheumatoid arthritis, ankylosing spondylitis, or polymyalgia rheumatic. Others are metabolic disease like Paget's disease, osteoporosis, gout, or pseudo-gout. Infections (osteomyelitis or tuberculosis) or malignancies like myeloma or secondaries are further differentials [7].

The significance of this study is the need to highlight components of spondylosis for easy recognition by radiologists, rheumatologists, orthopaedic surgeons and neurologist. This is so as cervical spondylosis can marauder as shoulder joint pains, dysphagia, jaw pains, paraesthesia or even upper limb parapariesis with attendant effect on productivity.

The limitation of this study is that it is a hospital based study without age bias nor any consideration of symptoms. Cervical spondylosis is known to increase with age therefore age limitations would have naturally been expected to raise the frequency of cervical spondylotic components in this study.

CONCLUSION

The commonest component of cervical spondylosis in Uyo is osteophytosis with anterior osteophytosis being the most predominant and the most detached. Multi-segmental level osteophytosis is commoner than single level osteophytosis.

Vacuum phenomenon is not a common variable in cervical spondylosis in Uyo.

Cervical spondylosis is rare before second decade of life but over 90% is seen in those 40years and above with male preponderance.

Unlike other studies, the commonest site of cervical spondylosis is C4/C5 in Uyo.

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