Femoral nerve stretch test predicts radiological features of lumbar spondylosis in Nigerians with low back pain

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Abstract

Background: Lumbar spondylosis is one of the most common cause of low back pain. The diagnosis of lumbar spondylosis often depends on radiodiagnostic evaluations which are not readily available in primary healthcare centers. This study examined the ability of clinical test to diagnose radiographic lumbar spondylosis compared to x-rays in subjects with low back pain.

Methods: This was a secondary analysis of data from the 2016 Jos COPCORD study. The data on subjects with low back pain who had complete clinical and radiological examinations were analyzed to determine clinical factors that were independently associated with radographic lumbar spondylosis. A P value of <0.05 was considered significant for all statistical test.

Results: The data of 187 subjects with a mean age of 46±15 years were analyzed. There were 38.5% males and 61.5% females. Age (χ^2=75.91, P <0.001), marital status (χ^2 29.85, <0.001), education (χ^2 11.34, P = 0.01), occupation (χ^2=18.44, P <0.001) BMI (χ^2 =10.79, P = 0.02) hypertension (χ^2=9.20, P = 0.002), SLR (χ^2 =9.37, P=0.002) and FNST (χ^2 =50.49, P<0.001) were statistically correlated with radiographic lumbar spondylosis. On logistic regression, age ≥ 45years, marital status, education, occupation, hypertension, SLR and FNST remained significantly associated with radiographic lumbar spondylosis. A positive SLR had a sensitivity of 26.32%, specificity of 91.78% and an ROC Area of 0.59, while a positive FNST had a sensitivity of 85.96%, specificity of 64.38% and ROC Area of 0.75 in predicting radiographic lumbar spondylosis.

Conclusion: A positive FNST was more discriminatory in predicting the occurrence of radiographic lumbar spondylosis compared to SLR. Therefore, it can be used acceptably in the diagnosis of Lumbar spondylosis in centers where there are no X-ray facilities.

Keywords: Low back pain, Lumbar spondylosis, Femoral nerve stretch test, Nigerians.

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Introduction

Low back pain (LBP) is the one of the most common pain disorders and the most common reason for seeing a doctor globally [1-3]. LBP affects all ages with a lifetime prevalence of 60-70% in industrialized countries and 62% in Africa[2-3]. LBP is ranked as the greatest contributor to years lived with disability (YLDs) globally, resulting in 149 million lost workdays annually, over $90 billion in excessive and inappropriate use of diagnostic and therapeutic services as well as over $28 billion loss in productivity cost. [4-6]

Most low back pains are mechanical and lumbar spondylosis is arguably the most common known cause of low back pain[7]. The diagnosis of lumbar spondylosis is highly dependent on the radiographic findings of osteoarthritic changes such as disc or joint space narrowing, subchondral sclerosis and osteophyte formation[6]. However, a specific cause cannot be identified in up to 85% of patients with low back pain and about 10% of these are chronic.[6] It may be difficult to clinically distinguish lumbar spondylosis from other degenerative causes of low back pain. [6] Most primary health care centers in Nigeria do not have access to radiological diagnostic facilities, therefore, there is a need to have a clinical test that closely correlates with radiological findings in the diagnosis of lumbar spondylosis.

This study set out to evaluate two of the specialized clinical tests (SLR and FNST) that are used in the evaluation of patient with low back pain, with a view to determine which of them can be used as a surrogate for the diagnosis of radiographic lumbar spondylosis where X-rays are not available.

Methods

Study Population

The study population comprised of all subjects who were investigated for low back pain among participants of the 2016 house to house Community Oriented Program for the Control of Rheumatic Disease (COPCORD) survey in Katon Rikkos, Jos.[8] The Jos COPCORD study, was a cross-sectional survey of 2454 residents of Katon Rikkos, Jos North Local government area of Plateau state Nigeria, who were 15 years or older, for musculoskeletal diseases. A questionnaire was used to

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collect data about family, social and medical history as well as the presence or absence of musculoskeletal symptoms including back pain. Subjects reporting positive musculoskeletal symptoms were further evaluated at the Jos University Teaching Hospital where specific diagnoses were made. Subjects with low back pain were evaluated using straight leg raise test (SLR), femoral nerve stretch test (FNST) and lumbo-sacral x-rays for the diagnosis of lumbar spondylosis.

Straight leg raise test also known as Lasegue test is performed with the patient lying supine and the leg is raised while the knee remains straight. The test is positive if the patient's pain is reproduced by the raising of the leg. It is primarily used to assess sciatic nerve root compromise due to lumbar disc herniation, lumbar radiculopathy and facet joint hypertrophy.[9,10] On the other hand, the femoral nerve stretch test is performed by the patient lying prone and the knee maximally dorsiflexed and the hip joint extended. The test is positive if the patients experience pain in the groin and thigh area when the knee is dorsiflexed and the hip joint extended. It is also frequently used in the evaluation of low back pain with radiculopathy which is attributed to lumbar disc protrusion, lumbar vertebrae osteophytes, lumbar facet joint and ligamentum flavum hypertrophy.[11]

The diagnosis of diabetes mellitus was based on a history of doctor diagnosed diabetes mellitus, treatment for diabetes mellitus and/or a fasting blood sugar ≥ 7.0mmol/l. Similarly, the diagnosis of hypertenson was based on a history of doctor diagnosed hypertension, treatment of hypertension and an average blood pressure measruement of ≥ 140mmhg systolic and ≥ 90mmhg diastolic blood pressure.

The study was approved by the Human Research Ethics Committee of the Jos University Teaching Hospital (JUTH) and permission was obtained from the community head of Katon Rikkos community [8].

Data Management

We reviewed the 2016 Jos COPCORD study data base, for patients who reported low back pain and had complete record of clinical history, physical examination, and radiological investigation. Radiographic lumbar spondylosis was defined as the presence of joint space narrowing, subchondral sclerosis and/or osteophytes on anteroposterior and lateral lumbosacral X-rays.[12] The data was analyzed using Stata statistical software release 14 (College station, TX: Stata Corp LP).

Results were presented in tabular form using frequency and percentages. Chi square test was used to compare the characteristics of low back pain subjects with and without radiographic lumbar spondylosis. Logistic regression was used to identify factors that were independently associated with radiographic lumbar spondylosis. The ability of each of the clinical test to diagnose radiographic lumbar spondylosis compared to x-ray was determined using the 2x2 tabulation and the roctab functions of Stata. An area under the receiver operating characteristic curve of <0.7 was considered nondiscriminatory, 0.7 – 0.8 was considered acceptable, 0.8-0.9 was considered excellent and >0.9 was considered outstanding.[13] A P value of <0.05 was considered significant for all statistical test.

Results

Two hundred and seven subjects had a history of low back pain, giving a point prevalence of 8.4% in the general population. Of these, 187 went through the whole process of clinical and radiological examination and thus form the population in this study as shown in Figure1 The mean age of the study population was 46±15, with 72 (38.5%) males and 115 (61.5%) females. Other sociodemographic characteristics of the study population is as shown in Table 1.

Table 1. characteristics of subjects with and with xray features of lumbar spondylosis

Variables	Spondylotic features on xray		χ^2	P value
	Yes, n (%)	No, n (%)		
Age (years)			75.91*	<0.001
15-24	2 (22.22)	7 (77.78)		
25-34	3 (8.11)	34 (91.89)		
35-44	27 (58.70)	19 (41.30)		
45-54	33 (80.49)	8 (19.51)		
55-64	27 (90.0)	3 (10.0)		
≥65	22 (91.67)	2 (8.33)		
Sex			0.42	0.51
Female	68 (59.13)	47 (40.87)		
Male	46 (63.89)	26 (36.11)		
Marital Status			29.85*	<0.001
Single	5 (18.52)	22 (81.48)		
Married	92 (64.79)	50 (35.21)		
Divorced	13 (92.86)	1 (7.14)		
Widowed	4 (100.0))	0 (0.0)		
Education			11.34	0.01
None	24 (77.42)	7 (22.58)		
Primary	32 (72.73)	12 (27.27)		
Secondary	24 (46.15)	28 (53.85)		
Tertiary	34 (56.67)	26 (43.33)		
Occupation			18.44*	<0.001
Unemployed	3 (17.65)	14 (82.35)		
Informal	85 (63.91)	48 (36.09)		
Formal	19 (63.33)	11 (36.67)		
Retired	7 (100.0)	0 (0.0)		

Table 1. Contd

Variables	Spondylotic features on xray		χ^2	P value
	Yes, n (%)	No, n (%)		
Habits				
Ever drank alcohol	17 (70.83)	7 (29.17)	1.12	0.28
Currently drinking	7 (63.64)	4 (36.36)	0.03*	0.85
Ever smoked	7 (87.50)	1 (12.50)	2.47*	0.11
Currently smoking	3 (75.00)	1 (25.00)	0.33*	0.56
BMI			10.79*	0.02
Underweight	0 (0.0)	2 (100.0)		
Normal	40 (54.79)	33 (45.21)		
Overweight	33 (56.90)	25 (43.10)		
Obesity	32 (72.73)	12 (27.27)		
Morbid obesity	9 (90.00)	1 (10.00)		
Hypertension	32 (82.05)	7 (17.95)	9.20	0.002
Diabetes	8 (88.89)	1 (11.11)	3.09*	0.07
Positive SLR test	30 (83.33)	6 (16.67)	9.37	0.002
Positive FNST	98 (79.03)	26 (20.97)	50.49	<0.001

*Fishers exact test

Straight Leg Raise (SLR) was positive in 36 (19.3%), while Femoral Nerve Stretch Test (FNST) was positive in 124 (66.3%) of subjects. Features of lumbar spondylosis on X-ray were present in 114 (61%) of subjects with low back pain. Other clinical characteristics of the study population is as shown Table 1.

On univariate analysis, increasing age (χ^2=75.91, P <0.001), marital status (χ^2=29.85, P<0.001), educational attainment (χ^2=11.34, P = 0.01), occupation (χ^2=18.44, P <0.001), higher body mass index (χ^2=10.79, P = 0.02) hypertension (χ^2 =9.20, P = 0.002), positive straight leg raise (χ^2 =9.37, P=0.002) and positive femoral nerve stretch test (χ^2 =50.49, P<0.001) were statistically correlated with radiographic lumbar spondylosis. This is shown in Table 1. Logistic regression was used to assess for factors that were independently associated with radiographic lumbar spondylosis. All eight variables with a P value of <0.05 on univariate analysis were included in the model, however, the widowed category of marital status and the retired category of occupation were dropped from the analysis because all the subjects in those categories had radiographic lumbar spondylosis and as such there was no basis for comparison. ≥45years, marital status, post primary education, occupation, hypertension, a positive straight leg raise (SLR) test, and a positive femoral nerve stretch test (FNST) were found to be independently associated with radiographic lumbar spondylosis as shown in Table 2.

Table 2. Logistic regression of factors associated with radiographic lumbar spondyosis

Variable	Odds ratio	95% confidence interval	P value
Age groups in years			
15-24	1		
25-34	0.30	0.04 - 2.20	0.24
35-44	4.97	0.92 - 26.61	0.06
45-54	14.43	2.50 - 83.16	0.003
55-64	31.49	4.38 - 226.52	0.001
≥65	38.49	4.54 - 326.10	0.001
Marital Status			
Single	1		
Married	8.09	2.88 - 22.68	<0.001
Divorced	57.19	6.00 - 544.79	<0.001
Education			
None	1		
Primary	0.77	0.26 - 2.27	0.64
Secondary	0.25	0.09 - 0.68	0.007
Tertiary	0.38	0.14 -1.02	0.05
Occupation			
Unemployed	1		
Informal	8.26	2.26 - 30.20	0.001
Formal	8.06	1.88 - 34.40	0.005
BMI			
Normal	1		
Overweight	1.08	0.54 - 2.18	0.81
Obesity	2.20	0.98 - 4.93	0.05
Morbid obesity	7.42	0.89 - 61.65	0.06
Hypertension	3.67	1.52 - 8.86	0.004
Diabetes	5.43	0.66 - 44.38	0.11
Positive SLR	3.98	1.56 - 10.14	0.004
Positive FNST	11.07	5.42 - 22.59	<0.001

*Retired in occupation and widowed in marital status were dropped from the logistic model

A 2x2 table analysis showed that a positive straight leg raise test had a sensitivity of 26.32%, specificity of 91.78% and an ROC Area of 0.59, while a positive FNST had a sensitivity of 85.96%, a specificity of 64.38% and an ROC Area of 0.75 in the diagnosis of radiographic lumbar spondylosis. This is shown in Table 3, Figure 2 and Figure 3

Table 3. roctab analysis of clinical test in the diagnosis of radiographic lumbar spondylosis

Clinical test	Radiographic spondylosis		Sensitivity	Specificty	PPV	NPV
	Yes	No				
SLR			26.32	91.78	83.33	44.37
Negative	67	84				
Positive	6	30				
FNST			85.96	64.38	79.03	74.60
Negative	47	16				
Positive	26	98				

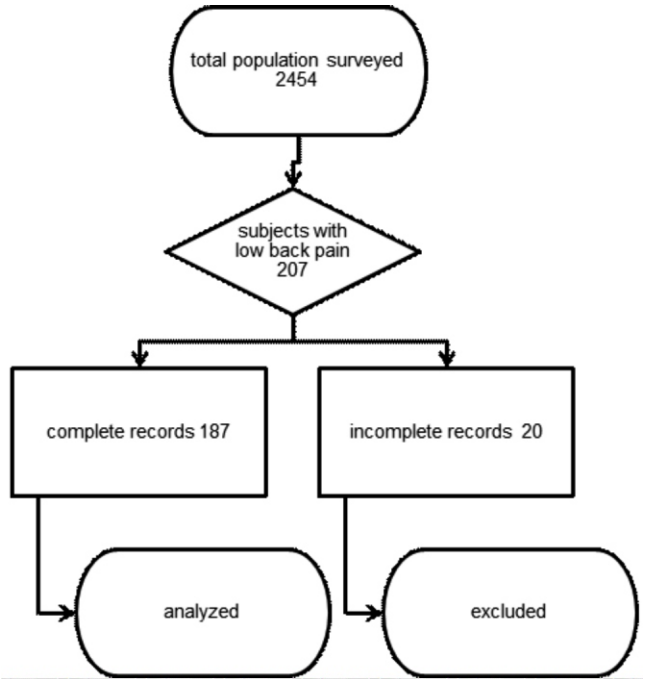

Figure 1 Selection of subjects

Discussion

Lumbar spondylosis is a common cause of low back pain in our community; however, diagnosis often requires lumbosacral X-ray which is not readily available in most primary health care settings in Nigeria. Two specialized clinical tests commonly used in the evaluation of patients with low back pain; straight leg raise test and femoral nerve stretch test, were evaluated for their correlation with radiological features of lumbar spondylosis. Some authors have argued that a positive SLR was of minimal value in differentiating patients with herniated disc from other patients with low back pain and sciatic, the findings of this study tend to agree with that assertion.[14] Even though a positive SLR was independently associated with radiographic lumbar spondylosis and had a very high specificity in its diagnostic assessment, the sensitivity was very low and the ROC area was non-discriminatory and therefore may not be useful in the absence of radiological assessment in the diagnosis of radiographic lumbar spondylosis. In this study, we also tested the ability of FNST to predict the findings of spondylotic changes on lumbosacral X-ray. FNST performed acceptably well in its ability to detect lumbar spondylosis using Xray as gold standard. It had a high sensitivity, specificity, negative and positive predictive values as well as a high area under the ROC. This finding agrees with that of a systematic literature review of 12 studies that found a mean sensitivity of 1.00 (95% CI 0.40-1.00) and specificity of 0.83 (95%CI 0.52-0.98) in the ability of FNST to detect nerve root impingement using Magnetic Resonance Imaging (MRI) as gold standard.[15] This means that in primary health care settings where X-rays are not readily available, FNST can be relied upon clinically to make a reasonable diagnosis of lumbar spondylosis and treatment can be instituted accordingly. This is of utmost importance in low resource settings like Nigeria especially in our rural areas where it is almost impossible to find health centers with

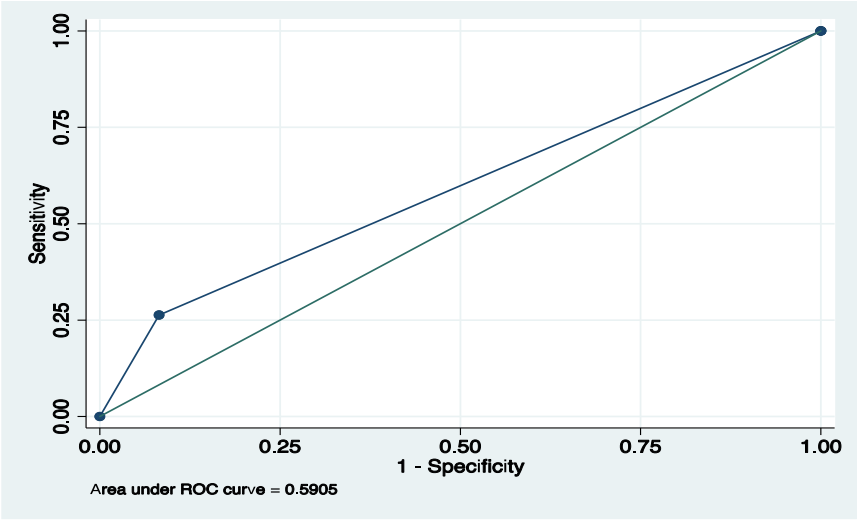

Figure 2 Straight Leg Raise test

X-ray facilities and yet the population are most at risk of lumbar spondylosis. The health care practitioner can make the diagnosis of lumbar spondylosis with reasonable confidence in the presence of a positive FNST. This also calls on rheumatologists and orthopedic surgeons to ensure that medical students and other health care workers who pass through our training institutions are well grounded in this clinical skill so as to reduce the disabilities that results from undiagnosed and inadequately treated low back pain due to lumbar spondylosis

This study found a point prevalence of 8.4% for LBP in this population which is similar to the pooled point prevalence of LBP in Africa as reported by Lou et al[3] in a systematic review of 27 epidemiological studies across Africa. The prevalence of LBP in our study is lower than the 33% reported by Omokhodion et al[16] in South West Nigeria. Their study was conducted in a rural population unlike our study that was conducted in a semi urban population. Difference in prevalence rate may be attributable to differences in demography; as most people in rural Nigeria are likely to be engaged in farming, which is likely to increase the risk of low back pain compared to semi urban population where more than half of the population surveyed had secondary and tertiary education and were involved in different kinds of occupation.

We could not find any previous community-based studies on lumbar spondylosis in Nigeria. However, the prevalence of lumbar spondylosis among patients with low back pain in this study is similar to the 59% and 66% reported by Rayoffor et al[17] and Uduma et al[12], both from tertiary health centers in South-South Nigeria, but higher than the 44% reported by Edomwonyi et al[18]in a South-West tertiary center in Nigeria. The lower prevalence reported by Edomwonyi et al[18] may be attributable to the fact that not all their patients had radiological diagnosis. It is possible that some cases of lumbar spondylosis may have been missed, unlike the study by Rayoffor et al[17]and our study in which everyone included in the analysis had radiological evaluation.

Similar to previous studies, this study also showed increasing prevalence of lumbar spondylosis with age and age $\geq$ 45years was independently associated with radiographic lumbar spondylosis in subjects with low back pain. [12,19,20] We also found an inverse relationship between educational attainment and radiographic lumbar spondylosis. This is similar to the findings of Igbinedion et al[21] in south west Nigeria in which they reported that age and educational level correlated with osteophytosis, even though they did not perform regression analysis on their population.

The limitations of this study may include the fact that the use of X-ray may have limited the sensitivity and specificity of FNST in this study, as MRI may have diagnosed earlier degenerative changes that could not be captured on X-ray. The study also may not have considered some confounders that may have influenced the finding of a positive FNST such as knee pain or hamstring spasm that may not necessarily be from lumbar spondylosis.

Conclusion:

Femoral nerve stretch test is an important clinical test with an acceptably high diagnostic accuracy in identifying patients with low back pain, who are like to also have radiological features of lumbar spondylosis. All health workers who care for patients with low back should therefore be conversant with the performance and interpretation of this test.

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