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Accuracy of Clinical Examination, Lumbosacral Radiography, and Electrodiagnosis in Suspected Patients With Lumbar Herniated Nucleus Pulposus

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ABSTRACT

Low back pain is a common health problem often complained around the world with prevalence of 12% -35%[2]. Low back pain is the second causes of patient consult in United State of America and become the etiology of patient under 45 years old disability.[3] Apart from a number of strategies recommended for the causes of low back pain, the initial diagnosis and correct diagnosis of the pain location is of clinical importance. In Indonesia, diagnostic test for lumbosacral radiography, EDX and neurological clinic examination that might help to diagnose HNP have never been compared to MRI as gold standard. Many studies have tried to find diagnostic alternatives using other modalities to help with HNP screening such as myelographic CT scans, conventional myelography or discography, but those tests are invasive. Common test that is expected to help in screening is clinical neurological examination because it is easy to do, requires no fees, can be carried out by a neurology resident supervised by a neurologist and a neurologist himself, and can be done anywhere. The accuracy of neurological clinical examinations, along with lumbosacral radiography and electrodiagnosis in assessing signs of lumbar HNP as a screening method is compared to gold standard MRI. The study is a diagnostic study with a cross sectional approach. This research was conducted at the Department of Neurology, Dr. Mohammad Hoesin Hospital Palembang in the period of 6 months from February to July 2018. The study population were patients who were suspected of having lumbar HNP. Samples were patients with suspected lumbar HNP who came to Dr. RSUP. Mohammad Hoesin Palembang and conducted a Lumbosacral MRI examination and according to the research acceptance criteria (inclusion and exclusion criteria). We find that ischialgia history, lumbosacral radiographs, upright AP projections, electroneuromyograph (ENMG) and neurological clinical examinations can be used as a screening modality in diagnosing lumbar HNP and have an accuracy that approaches the gold standard examination, namely MRI.

Key Words: Low Back pain, HNP, MRI, CT, EMG. EDX, EMNG, Imaging

1. Introduction

Low back pain (LBP) is a symptom experienced by patients worldwide. In a global scale, 40% of people in their life felt back pain, and 80% of those number is in developing countries. Apart from a number of strategies recommended for identifying the causes of low back pain, the initial diagnosis and correct diagnosis of the pain location is of importance.
Radiculopathy can be diagnosed by history, and physical examination, imagin tests like MRI and EMNG can lead to confusion of differential diagnostic if the clinical data is inconsistent or inadequate. Electrodiagnostics (EDX) like EMG is the one of many methode that can be used beside MRI. Although the EMG can detect physiological abnormalities like radiculopathy, it can not correctly detect the location of its etiology. Magnetic Resonance Imaging (MRI) is the best imaging option to show the disc morphology and it is the gold standard to diagnose HNP. [11] The weakness of MRI is the high price and many hospital in Indonesia does not have it. Diagnostic test for lumbosacral using radiography, EDX and neurological clinic examination that might help to diagnose HNP has never been compared with MRI. Even though it is not sensitive, it has high specificity. In Cipto Mangunkusumo Hospital (RSCM) Jakarta 2013, Amelia Putri had examined the sensitivity and specificity of lumbosacral radiography compared to MRI to detect secondary signs of HNP in a diagnostic test with the conclusion that it is viable as a screening modalities in diagnosing secondary signs of HNP.[14] At the RSUP dr. Mohammad Hoesin Palembang in 2013 Nur Amaliah Verbty has examined the suitability of electroneuromyography and MRI imaging tests in lumbosacral radiculopathy which concluded that there was a match between the EMG and MRI images.[15] Many studies have tried to find diagnostic alternatives using other modalities to help with HNP screening such as myelographic CT scans, conventional myelography or discography, but such examination is invasive.

2. Method

The study design was a diagnostic study with a cross sectional approach to determine the accuracy of neurological clinical assessment, lumbosacral radiography and electrodiagnoses in assessing the signs of lumbar HNP compared to Lumbosacral MRI examination as a gold standard examination. It is conducted at the Department of Neurology, Dr. Mohammad Hoesin Hospital Palembang in the period of 6 months from February to July 2018.
The study population were patients with suspected lumbar HNP. Affordable population are patients with suspected lumbar HNP that came to Dr. RSUP. Mohammad Hoesin Palembang. Of those patients, samples were recruited from patients with suspected lumbar HNP who conducted a Lumbosacral MRI examination and are according to the research acceptance criteria (inclusion and exclusion criteria). Samples are collect by the consecutive method, all subjects who met the inclusion and exclusion criteria were selected and included in the study until the required number of samples were met. Measurements of diagnostic accuracy are done with blinding method by making each test's examiner unaware of the results of other examinations.[39]

3. Results

Table 1. Table Area Under The Curve (AUC)

Area Under the Curve (AUC)

Variables	Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
Demography + Anamnesa + Penunjang	0,985	0,015	0,001	0,955	1,000
Age >50 years	0,880	0,052	0,012	0,778	0,982
Anamnesa Ischialgia	0,690	0,159	0,209	0,379	1.000
Radiografi lumbosakral	0,900	0,046	0,008	0,810	0,990
`ENMG	0,940	0,033	0,004	0,874	1,000
Clinical Examination	0,725	0,132	0,137	0,466	0,984

The demographic AUC value coupled with supporting examinations has the highest value (98.5%) followed by electrodematical examination (ENMG) (94%), lumbosacral radiographic examination (90%), neurological clinical examination (72.5%) and the last isamialgia history is 69%. Thus, demographic data in the form of age> 50 years plus clinical ischialgia coupled with lumbosacral radiographic examination support, ENMG and clinical examination are accurate enough to establish a diagnosis of lumbar HNP.

Table 2. AUC value from several obtained models

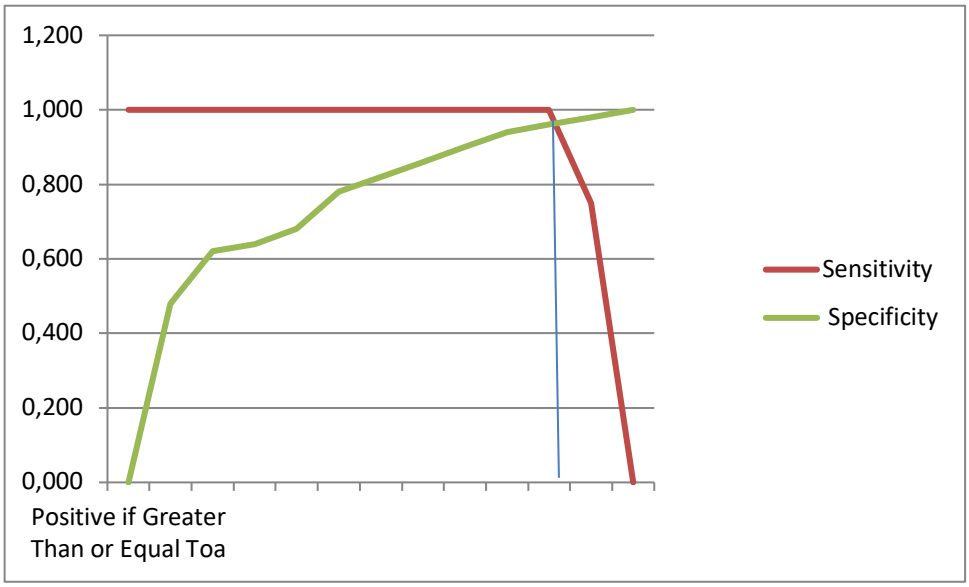
Diagnostic Model	AUC Value
Demography + anamnesis + Workup	98,5%
Demography + ischialgia anamnesis	90%
Demography + ischialgia anamnesis + imaging	97%
Demography + ischialgia anamnesis + ENMG	98,5%
Demography + ischialgia anamnesa + physical examination	93,5%
Age > 50 years	88%
Ischialgia Anamensis	69%
Lumbosacral imaging	90%
Electrodiagnosis (ENMG)	94%
Neurologic Physical Examination	72,5%

Table 3.Table Study Cut Off Point

Coordinates of the Curve

Test Result Variable(s): Demography + Anamnesa + Penunjang

No	Positive if Greater Than or Equal To[a]	Sensitivity	Specificity	
1	0,0000000	1,000	0,000	1,000
2	,0000000	1,000	0,480	,520
3	,0000000	1,000	0,620	,380
4	,0000000	1,000	0,640	,360
5	,0000000	1,000	0,680	,320
6	,0000000	1,000	0,780	,220
7	,0000000	1,000	0,820	,180
8	,0000000	1,000	0,860	,140
9	,0000000	1,000	0,900	,100
10	,0000000	1,000	0,940	,060
11	,2500000	1,000	0,960	,040
12	,6250000	,750	0,980	,020
13	1,0000000	0,000	1,000	0,000



Graph 1. Cut off point curve on Multivariate Analysis Result

The curve above is the sensitivity and specificity curve. The intersection point is the value at which the sensitivity curve and the specificity curve intersect. To find the point of intersection, we draw a vertical line from the point of intersection. The optimal cut-off point is between 10 and 11. It is concluded that the cutoff point of the lumbar HNP score is ≥0.25. This means that patients who score ≥0.25 will be diagnosed as patients suffering from lumbar HNP.

4. Discussion

This Research was conducted at Neurology Department of Mohammad Hoesin General Hospital. Data were obtained from the radiology department, ENMG laboratory and Neurology outpatient clinic at Dr. Mohammad Hoesin General Hospital Palembang between 1 February 2018- 31 July 2018. Within 6 months there are some patients who come to neurology outpatient clinic due to degenerative processes, clinically varying in the form of back pain, ischialgia, canal stenosis, compression and irritation of the roots, spondylolisthesis, and suspicious lumbar Hernia nucleus pulposus. Research samples that comply the inclusion and exclusion criteria and dropped out of all patients were 54 subjects which already exceeds the minimum sample calculation count of 45 subjects. Women are slightly more numerous than men.

According to Rovner et al women have higher activity than men despite suffering from chronic pain in various areas of the body including low back pain.[44] In addition, women also tend to have more complaints about lower back pain than men. Researchers suspect this is what might bring more female patients to seek treatment at the neurology outpatient clinic. Job is an important factor in the incidence of lumbar HNP. Work that has a risk of recurrence of this disease is heavy work, in the sense of work that requires a lot of physical strength and energy such as lifting, turning, bending, and work that affects vibrations throughout the body, covering more than 50% of workers in cars (drivers) and workers who use heavy equipment such as field workers.[42] In this study, it was found that most subjects were employed by civil servants (PNS) and housewives with a percentage of 31.5%, respectively 17 people. Work as a civil servant can be associated with ergonomic factors when working, the possibility of poor posture during work. But further research is needed to find out what factors influence lumbar HNP in civil servants.

In this study, most subjects have normal BMI (18.5-24.9). This is different from research conducted by Meredith et al entitled obesity increases the recurrence of lumbar HNP where researchers find that obesity is one of the strong predictors and free of recurrence in lumbar HNP.[45] Lumbar vertebrae support the most body pressure compared to other vertebrae. Pain scale measurement in this study uses the NPRS (Numeric Pain Rating Scale)[49] that is, mild (1-3), moderate (4-6) and severe (7-10) where the most common are subjects with moderate NPRS. This is similar to Lee's study using the Visual Analog Scale (VAS), which means that for low back pain (LBP) moderate VAS results are obtained, whereas in ischialgia severe VAS results are obtained.[8]

The MRI sequences used in the T1WI and T2WI lumbosacral MRI examination are axial and sagittal cuts. The T2WI sequence shows a very good picture because the annulus which is rich in connective tissue will give a picture of hypointense while the nucleus pulposus that is rich in water looks hyperintense. The disadvantages of radiographic examination include not being able to show the soft tissue using radiation

The results of this study indicate that lumbosacral radiographs in upright lateral projections provide a fairly good sensitivity of 80% with 100% specificity.

On electrodiagnoses examination (EDX) namely electroneuromyography

(ENMG) a good sensitivity of 88% with 100% specificity is shown. The ENMG showed a statistically significant test for lumbosacral MRI in diagnosing lumbar HNP.

Clinicians must be aware that lumbosacral MRI can give false positive results in finding nerve compression.[53]In this study the neurological clinical examination gave an poor sensitivity and specificity of 70% and 75%. Statistical tests did not show a significant difference between neurological clinical examinations and the gold standard that is lumbar MRI. Interestingly in this study there were quite a number of subjects with a negative but positive SLR test and Cross SLR test on a lumbosacral MRI examination. Researchers did not conduct clinical, radiological, ENMG and lumbosacral MRI concordance tests. The modalities of supporting examinations and clinical examinations are not elaborated in more detail in the form of provocative maneuvers, motor examinations, sensory examinations that are in accordance with dermatomes and other reflexes correlated with the gold standard. Researchers do not assess how long the patient has experienced pain and the consumption of pain-relieving drugs so that the impact on neurological clinical examination results is not good. Researchers did not elaborate on the etiology of causes of patients not diagnosed with lumbar HNP and further interventions for the subjects studied.

5. Conclusion

Demographic data in the form of age above 50 years old, ischialgia history, lumbosacral radiographs, upright AP projections, electroneuromyograph (ENMG) and neurological clinical examinations can be used as a screening modality in diagnosing lumbar HNP and have an accuracy that approaches the gold standard examination, namely MRI. The level of accuracy, sensitivity and specificity of lumbosacral radiography in diagnosing patients with lumbar HNP are 81.4%, 80% and 100%. The accuracy, sensitivity and specificity of neurological clinical examinations in diagnosing patients with lumbar HNP are 70.3%, 70% and 75%.

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