Original Article

Diagnostic efficacy of clinical tests for lumbar spinal instability

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Abstract

Background: Although various clinical tests are utilized to assess lumbar spine instability (LSI), few have documented diagnostic efficacy. We assessed the diagnostic efficacy of four clinical and one radiographic test for LSI in patients with degenerative lumbar disease.

Methods: A cohort of 52 patients with pain attributed to lumbar spine stenosis and degenerative spondylolisthesis were prospectively evaluated utilizing dynamic X-rays, the passive lumbar extension (PLE) test, instability catch sign, painful catch sign, and the apprehension sign. The results of these preoperative tests were compared with spinal surgeons' intraoperative documentation of spinal instability considered in this study as the "gold" standard.

Results: Intraoperatively, 33 patients demonstrated instability (63.5%) whereas 28 had motion documented on preoperative dynamic radiography. The sensitivity, specificity, positive, and negative predictive value and accuracy of dynamic radiography were 84.8%, 100%, 100%, 79.1%, and 90.4%, respectively. The diagnostic efficiency of PLE was higher than other additional studies – sensitivity 78.8%, specificity 94.7%, positive predictive value 96.3%, negative predictive value 72%, and accuracy rate 84.6%.

Conclusion: Dynamic radiography was more reliable than any of the clinical tests in diagnosing LSI. Among the latter, PLE had the highest diagnostic value for establishing LSI.

Key Words: Clinical test, diagnostic efficacy, dynamic radiography, instability, spine

INTRODUCTION

Lumbar spinal instability (LSI) is a common cause of nonspecific low back pain (LBP).[1] At present, flexion-extension X-rays are the standard method for measuring anteroposterior translation[2,4] but have several shortcomings.[2] There are several clinical tests for diagnosing LSI,[1-3,5] however, none have been previously proven to be effective measures for LSI.

We investigated the diagnostic efficacy of dynamic X-rays and four clinical tests to assess LSI: (a) passive lumbar extension (PLE) test, (b) instability catch sign, (c) painful catch sign, and (d) apprehension sign utilized to establish the diagnosis of LSI. Furthermore, patients were followed 6 months postoperatively with dynamic X-rays to determine if they became unstable.

MATERIALS AND METHODS

Clinical data
The 52 patients included in this prospective study met the following inclusion criteria: (1) back/radicular leg pain, (2) age between 50 and 70 years, (3) diagnostic studies showing degenerative lumbar spine disease, (4) patients who underwent laminectomy for lumbar spine stenosis and/or degenerative spondylolisthesis [Table 1].

Imaging assessment
Preoperatively, all patients had dynamic radiographs and MRI [Table 2]. The need for fusion after laminectomy/decompression was based on intraoperative documentation of active translation of >4 mm or rotation of >10 degrees at the level of listhesis. All

images were reviewed by three independent specialists: one radiologist, an orthopedic, and a neurological spine surgeon [Table 3]. Prior to surgery, the two spine surgeons used the JOA score and four clinical examinations to confirm LSI: the passive lumbar extension (PLE) test, the instability catch sign, the painful catch sign, and the apprehension sign [Table 4].

Intervention
Patients underwent decompression by the two attending surgeons who could see the images but were not informed of the outcome of the clinical tests. They could independently judge whether patients had LSI and required fusion or not. In addition, patients underwent dynamic X-rays 6 months postoperatively to see if they developed LSI.

Lumbar canal stenosis was present in 35 patients, whereas stenosis/degenerative spondylolisthesis was found in 17. The average age of patients was 56.7 years.

Statistical analysis
The independent samples *t*-test (quantitative) and Chi-square test (qualitative) were utilized to compare data between patients with/without LSI. The qualitative data were compared using Pierson's or Spearman's correlation test using SPSS software (version 15.0). $P > 0.05$ while the sensitivity, specificity, accuracy, positive and negative predictive values of dynamic radiography and clinical tests were calculated.

RESULTS

Although preoperative dynamic X-rays showed LSI in 28 patients, 33 patients were unstable intraoperatively (63.5%). The sensitivity, specificity, PPV, NPV, and accuracy of dynamic radiography in establishing the diagnosis of LSI were uniformly high [Tables 3 and 4]. Even though the PLE test had the highest efficacy in diagnosing LSI, there was no significant correlation with neurologic symptoms ($P = 0.65$) [Table 4].

DISCUSSION

Intraoperative documentation of LSI best correlated with preoperative dynamic X-ray evidence of instability. Similar to Kasai *et al.*,[6] our findings confirmed that the PLE test had the highest diagnostic efficacy among all the clinical

Table 1: Comparing the age, gender and duration of symptoms between stable and unstable patients

Group	Stable (*n*=19)	Unstable (*n*=33)	*P*
Age (y)	54.7±14	57.9±10.3	0.358
Gender			
Male	9 (47.4%)	8 (24.4%)	0.087
Female	10 (52.6%)	25 (75.6%)	
Duration of symptoms (m)	31.8±23.6	33.3±23.8	0.829

y: Year, m: Month

Table 2: Comparing the radiographic and intraoperative findings

Dynamic radiography operation	Stable	Unstable	Total
Stable	19	0	19
Unstable	5	28	33
Total	24	28	52

Table 3: Showing our material briefly

Lumbar stenosis	Stenosis + lysthesis	Age/average
35	17	56.7 year

Table 4: Comparing the outcomes of clinical tests and intraoperative findings

	PLET		ICST		PCST		AST	
	Stable	Unstable	Stable	Unstable	Stable	Unstable	Stable	Unstable
Intraoperative findings								
Stable	18	1	9	10	10	9	13	6
Unstable	7	26	14	19	13	20	21	12

PLET: Passive lumbar extension test, ICST: Instability catch sign test, PCST: Painful catch sign test, AST: Apprehension sign test

Table 5: Diagnostic efficacy of clinical tests

Clinical test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
PLET	78.8	94.7	96.3	72	84.6
ICST	57.6	47.4	65.5	39.1	53.8
PCST	60.6	52.6	68.9	43.5	57.7
AST	36.3	68.4	66.6	38.2	48.1

PLET: Passive lumbar extension test, ICST: Instability catch sign test, PCST: Painful catch sign test, AST: Apprehension sign test, PPV: positive predictive value, NPV: Negative predictive value

measures with a sensitivity of 78.8% and specificity of 94.7% [Table 5].

Limitations

Although two expert spine surgeons evaluated the presence of intraoperative LSI, there may still be nonreproducible intraoperative surgeon-bias constituting a flaw in the study design. Another shortcoming of this study is the relatively low number of cases included.

CONCLUSION

Preoperative dynamic X-rays best predicated the chance of intraoperative documentation of LSI as performed by two spine surgeons. Among the clinical tests for assessing preoperative LSI, the PLE had the highest predictive value.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Alqarni AM, Schneiders AG, Hendrick PA. Clinical tests to diagnose lumbar segmental instability: A systematic review. J Orthop Sports Phys Ther 2011;41:130-40.
2. Alyazedi FM, Lohman EB, Wesley Swen R, Bahjri K. The inter-rater reliability of clinical tests that best predict the subclassification of lumbar segmental instability: Structural, functional and combined instability. J Man Manip Ther 2015;23:197-204.
3. Denteneer L, Stassijns G, De Hertogh W, Truijen S, Van Daele U. Inter- and Intrarater Reliability of Clinical Tests Associated With Functional Lumbar Segmental Instability and Motor Control Impairment in Patients With Low Back Pain: A Systematic Review. Arch Phys Med Rehabil 2017;98:151-64.e6.
4. Hammouri QM, Haims AH, Simpson AK, Alqaqa A, Grauer JN. The utility of dynamic flexion-extension radiographs in the initial evaluation of the degenerative lumbar spine. Spine (Phila Pa 1976) 2007;32:2361-4.
5. Hicks GE, Fritz JM, Delitto A, Mishock J. Interrater reliability of clinical examination measures for identification of lumbar segmental instability. Arch Phys Med Rehabil 2003;84:1858-64.
6. Kasai Y, Morishita K, Kawakita E, Kondo T, Uchida A. A new evaluation method for lumbar spinal instability: Passive Lumbar Extension Test. Phys Ther 2006;86:1661-7.