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Correlation Analysis of Extensive Foraminotomy of Lumbar Foramina Stenosis Patients to Improvement of Visual Analogue Scale (VAS) And Oswestry Disabilty Index (ODI)

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Abstract

Background: Lumbar foramina stenosis is one of the causes due to lumbar disc herniation occurs in 40% of the population in the United States with peak incidence at the age of the third and fourth decades which are in the productive ages. This disorder is the cause of the most common non-traumatic disability and disruption of activity and often has significant socioeconomic impacts. Extensive foraminotomy is an invasive procedure by expanding the intervertebral foramen to remove the foramina stenosis thus reducing the compression of the neural roots. The purpose of this study was to identify the correlation of extensive foraminotomy techniques on lumbar foramina stenosis to its improvement using VAS (Visual Analogue Scale) and ODI (Oswestry Disabilty Index).

Method: This study was a cross sectional study to identify correlation using retrospective data collection method with consecutive sampling in 30 cases of lumbar foramina stenosis treated and performed extensive foraminotomy at Department of Neurosurgery Dr. Hasan Sadikin General Hospital Bandung during January 2016 - December 2016 period. Surgical procedure was started in a safer extraforaminal area compared to a more risky intraforaminal area. Then the foraminal decompression is done by using burr and Kerrison punch. Follow up until 3 months and assessed using VAS and ODI.

Results: Based on the Mann-Whitney correlation test, there is a statistically significant association between VAS for inferior limb pain that improved from baseline score of 6.57 to 1.73 in 3 months postoperatively (P = 0.000 <0.05). While for ODI also showing improvement from baseline index of 47 at first month post operation to 17,33 at 3 months post operation (P = 0,000 <0,05).

Conclusion: Extensive foraminotomy could be an efficacious surgical procedure for the treatment of lumbar foramina stenosis. This result is expected to be a consideration for spine neurosurgeons in determining effective surgical procedures because it provides safe and promising results, especially in elderly patients or with other medical morbidities.

Keywords: Extensive Foraminotomy; Lumbar Foramina Stenosis; VAS; ODI

Abbreviations: ODI: Oswestry Disability Index; HNP: Hernia Nucleus Pulposus; VAS: Visual Analogue Scale; WHO: World Health Organization; CI: Confidential Interval

Introduction

Lower back pain is a common problem in all classes of society. Lower back pain is pain that is felt in the lower back, may be local pain or radicular pain or both caused by irritation or compression of the roots in one or more lumbosacral roots which may be accompanied by motor weakness or sensory impairment. One of the most common causes of back pain is Hernia Nucleus Pulposus (HNP). HNP is a rupture of the nucleus pulposus. 90% lumbar HNP is on intervertebral disc L4-L5 and L5-S1. Based on lumbar disc herniation, HNP is classified into central canal zone, subarticular zone, foraminal zone, extraforaminal zone (far lateral zone). Various radiological modalities for knowing and evaluating HNP such as MRI and CT Scan. MRI is a standard for HNP examination, in addition MRI can detect soft tissue abnormalities (muscles, tendons, ligaments and discs) and edema that occur around HNP and detect other serious disorders such as tumors and infections. The degeneration process of the intervertebral discs is easily recognized, in which isointens at T1 becomes hypointens on T2. Normally hyperintens on T2, so if there is prolapse / disc herniation, it is easy to diagnose because of the compression on the dural sac as well as the suppression of the spinal cord and the root. In general, CT Scan examination of the vertebrae will give an overview of multiple pieces of axial, coronal and sagittal to the axis of the spinal columns. The distance between pieces can be adjusted according to the inspector's needs and toolability.

The most commonly used instrument for measuring pain subjectively is Visual Analogue Scale (VAS) by asking patients about the degree of pain represented by the number 0 (no pain) to 10 (severe pain). In accordance with the criteria of Borges et al. the degree of pain based on the VAS scale is divided into several categories: 0.5-1.9: Very mild degree; 2.0-2.9: Lightweight; 3.0-4.9: Medium; 5,0-6,9: Strong; 7.0-9.9: Very strong; 10: Very powerful (Figure 1). Disability is defined as the inability to engage in important useful activities because of physical and mental limitations and may result in death or has been ongoing or is expected to last for a period of not less than 12 months. World Health Organization (WHO) provides a definition of disability as a state of limited ability to perform activities within the limits considered normal by humans. Three conditions that must be met to declare that there is disability: the duration of time, the absence of useful activities, and the existence of medical limitations can be determined. Oswestry Disability Index (ODI) is an instrument used to assess patients with permanent functional disability. This test is considered standard for assessing functional disability outcomes in back pain and inferior extremities [1] (Table 1). Conventional surgery techniques in foraminal type lumbar HNP patients include a total facetectomy with or without fusion. With the action of the roots of the nerve can be completely decompressed but in many patients resulted in disturbance of the segmental stability of the spine resulting in increased spinal pain [1,2].

Table 1: Assessment of Oswestry Disability Index (ODI) (Greenberg, 2010).

Score	Interpretation
0-2%	Minimal Disability: Can cope with most daily activities
21-40%	Moderate Disability: Pain and difficulty with sitting, lifting and standing. The patient may be disabled from work
41-60%	Severe Disability: Pain is the main problem, but other areas are affected
61-80%	Crippled: Back pain impinges on all aspects of the patient's life
81-100%	These patients are either bed-bound or else exaggerating their symptoms

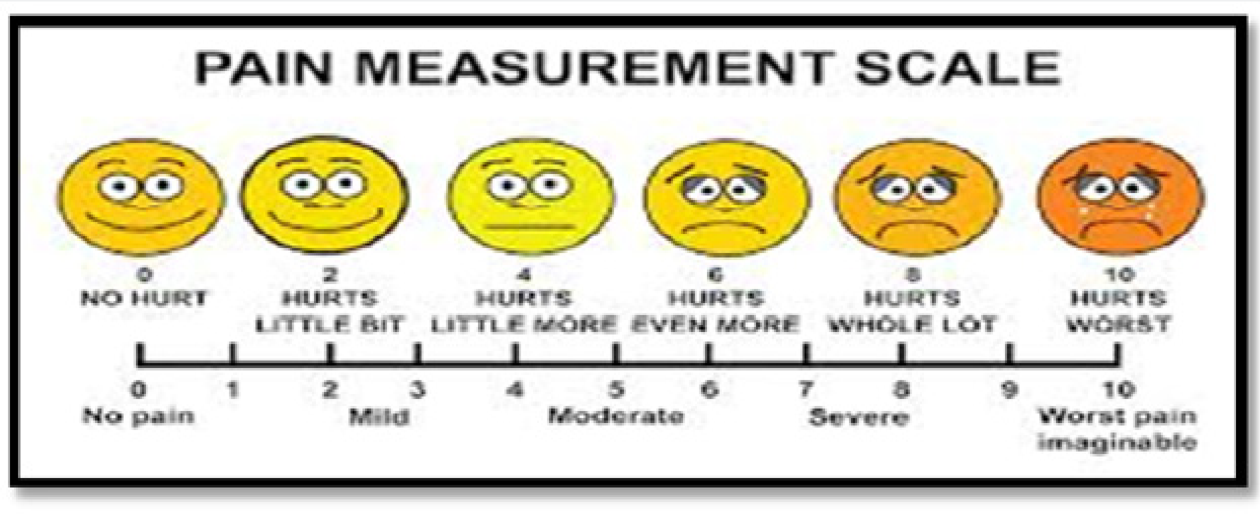

Figure 1: VAS assessment.

Over time this technique is modified by a spine neurosurgeon, where surgery is performed by direct access to the intervertebral foramen, with very minimal destruction of the facet joint. And the success rate of this action is 72% - 83%. And this action is regarded as the best choice in foraminal type lumbar HNP patients. Some patients are still complained of pain spread to the inferior extremity after this action [4]. Yong Ahn et al. in 2014 reported that of the 35 patients who performed foraminotomy measures had a success rate of 72% -83%, previously Chang et al in 2011 reported that foraminotomy had a success rate of 83% of 39 patients. In an extensive foraminotomy the spine neurosurgeon will take > 50% of the lateral portion of the lamina, and half of the medial facet joint, without damage to the facet joint itself, and herniated disc will be under went discectomy [5-8] (Figure 2). It is expected that extensive foraminotomy will be performed on patients with foraminal type lumbar HNP who have a higher success rate than foraminotomy. The purpose of this study was to identify the correlation of extensive foraminotomy techniques on lumbar foramina stenosis against outcome of clinical outcome [9-12].

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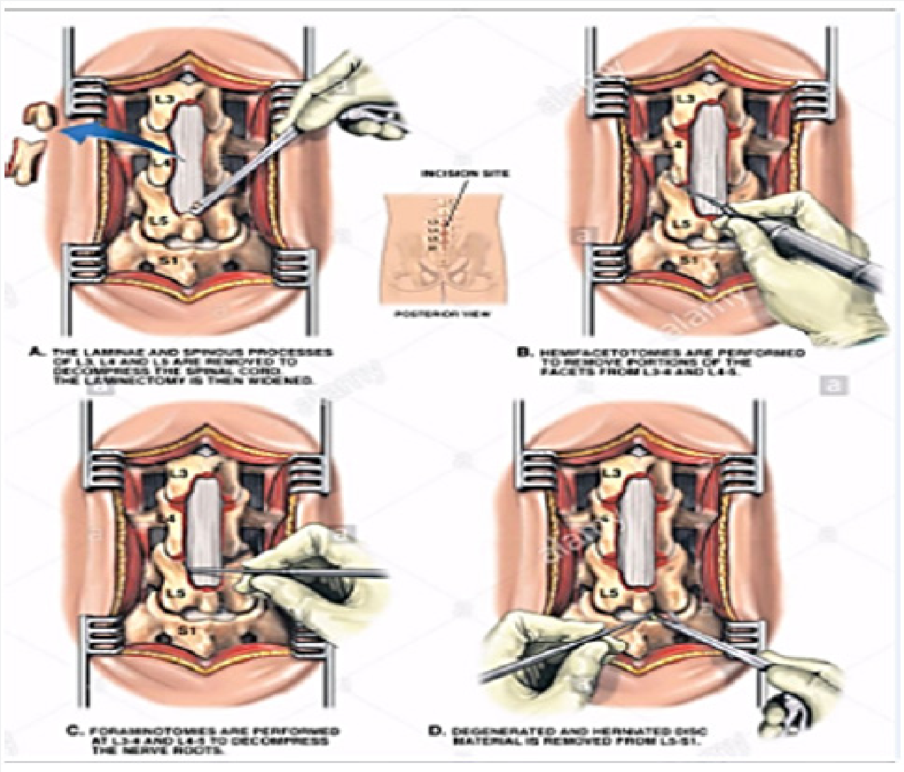

Figure 2: : Illustration of L3-L4, L4-L5 Laminectomy, Facetectomy, Foraminotomy and Discectomy (Benzel, 2012).

Methods

Data source and variables studied

The study subjects were all patients, with foraminal type lumbar HNP performed by extensive foraminotomy in the Department of Neurosurgery Dr. Hasan Sadikin General Hospital Bandung in the period of January 2016 - December 2016. The inclusion criteria used were all foraminal type lumbar HNP patients, aged 20-60 years with appropriate clinical and radiological features of preoperative MRI and failed conservative therapy for 6 months, then underwent extensive foraminotomy at the Department of Neurosurgery Dr. Hasan Sadikin General Hospital Bandung. Subsequent clinical outcome assessments were performed using VAS and ODI in the first and third months post operation. The exclusion criteria used were patients with history of surgery on the lumbar vertebra, history of spinal injury, infection, congenital abnormalities or previous lumbar vertebral neoplasms. Patients who did not agree to be the subject of the study were also included in the exclusion criteria in this study.

Study design and statistical analysis

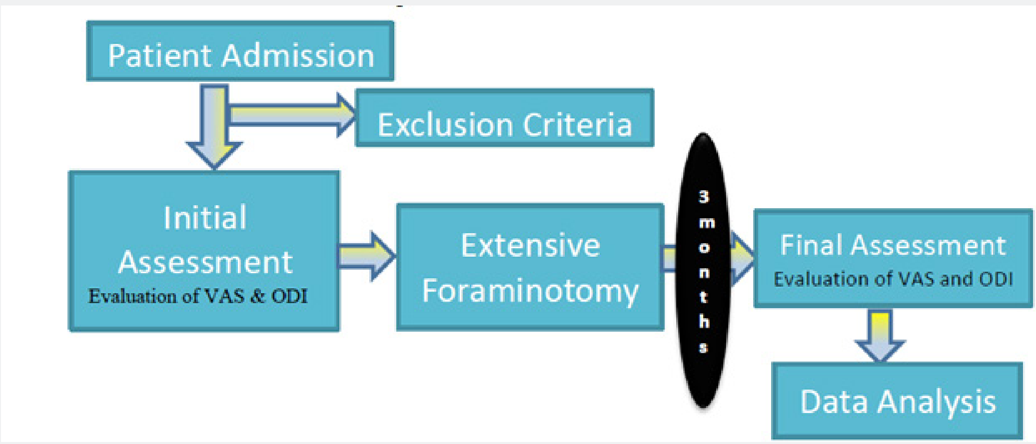

Figure 3: Design of Study.

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The study design used was correlation analysis to identify the correlation of extensive foraminotomy technique on lumbar foramina stenosis to its clinical improvement using VAS (Visual Analogue Scale) and ODI (Oswestry Disabilty Index) in Department of Neurosurgery Dr. Hasan Sadikin General Hospital Bandung. The independent variables in this study were age, sex and prognosis of VAS and ODI values. The dependent variable in this study is the extensive foraminotomy techniques. Samples fulfilling the inclusion criteria were recorded, all the data based on medical records and then measured pain scale using VAS and ODI at the time of preoperative, 1 month post operation and 3 months post operation. Data analysis is tailored to the research objectives, using computer statistics program. The data is tabulated on each variable and each research variable will be presented in the form of descriptive statistic consisting of average, smallest value, largest value and standard deviation. The statistical analysis used in this study is parametric correlation analysis (Shapiro-Wilk) if the normal data distribution is continued with non parametric analysis (Kruskall-Wallis and Mann-Whitney) to find correlation between multiple free variables and dependent variables. Statistical analysis using SPSS for Window version 21. Meaning is determined based on P Value, that is <0,05 and confidencial interval (CI) equal to 95% (Figure 3).

Results

Patient characteristics

Study has been done in Department of Neurosurgery Dr. Hasan Sadikin General Hospital Bandung in January 2016 until December 2016 with subjects of lumbar foramina stenosis patients who meet inclusion and exclusion criteria. From Table 2 above shows the total number of samples of 30 patients with women as many as 16 people (53.3%). It is also known that almost half of the study sample was more than 50 years old (46.7%), between 41-50 years as many as 30% and at least aged <21 years only 3.3%.

Table 2: Patient Characteristics by Sex and Age.

(n=30)		Frequency (n=30)	Percentage (%)
Sex	Male	14	46,7%
	Female	16	53,3%
	Total	30	100%
Age	<21 years	1	3,3%
	21-30 years	2	6,7%
	31-40 years	4	13,3%
	41- 50 years	9	30,0%
	>50 years	14	46,7%
	Total	30	100%

Descriptive analysis of research data

The following descriptive statistical analysis is provided with the help of SPSS v21 Software which consists of average value, standard deviation, smallest value and largest value based on foramen height, foramen width, VAS and ODI before and after operation. Based on Table 3 above, it is known that the highest VAS value before operation is 4.0 with the lowest value reaching 9.0, while the average VAS value before operation of 30 research samples is 6.57 with standard deviation 1.25. For the highest 1 month postoperative VAS score was 4.0 with the lowest score of 9.0, while the mean VAS score after 1 month post operation was 6.17 with standard deviation 1.29. The highest 3 month postoperative VAS score was 1.0 with the lowest score reaching 3.0 while the mean value of postoperative VAS 3 months was 1.73 with standard deviation 0.69. From the SPSS results it is seen that VAS value of 3 months postoperative tends to increase compared to 1 month post operation but not significant difference between VAS value 1 month post operation with VAS value before operation with difference of average from 30 responder only 0,40.

Table 3: VAS Description Before and After Operation.

	N	Minimum	Maximum	Mean	Standard Deviation
VAS (Pre-Op)	30	4,00	9,00	6,57	1,25
VAS 1 month	30	4,00	9,00	6,17	1,29
VAS 3 months	30	1,00	3,00	1,73	0,69
Valid N (Listwise)	30				

Based on Table 4 above, it is known that the highest ODI value before operation is 30.0 with the lowest value reaching 80.0, whereas the average of ODI value before operation of 30 research samples is 47,0 with standard deviation [12-15]. For the highest 1 month postoperative ODI value was 20.0 with the lowest score reaching 70.0, while the mean ODI value after 1 month post operation was 37,67 with standard deviation 13,31. The highest 3 months postoperative ODI score was 10.0 with the lowest score reaching 40.0 while the average ODI 3 months postoperative value was 17.33 with standard deviation of 7.40. From the results of SPSS it is seen that the value of ODI 3 months postoperative tends to increase compared to 1 month postoperative and before surgery.

Table 4: ODI Description Before and After Operation

	N	Minimum	Maximum	Mean	Standard Deviation
ODI (Pre-Op)	30	30,00	80,00	47,00	15,12
ODI 1 month	30	20,00	70,00	37,67	13,31
VAS 3 months	30	10,00	40,00	17,33	7,40
ODI 3 months	30				

Correlation analysis of research data

The following is presented comparative analysis before and after the operation both VAS and ODI using statistical tests with the help of SPSS Software v21 Table 5 a&b and the Further Test above explain the difference of VAS before and after operation with a distance of 1 to 3 months with non-parametric statistical approach Kruskall-Wallis because there are some data that

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is not normally distributed. From the table it is known that P Value is 0,000 <0,05 so it can be concluded that overall there is a significant difference between before and after operation on VAS assessment. Meanwhile, if it is seen from Further Test, VAS values of 3 months postoperative tends to be much smaller than 1 month post operation with significant differences as well as VAS 3 postoperative with preoperative, while the difference between 1 month post op with pre-surgery not significantly different (0.300> 0.05) also seen from the difference in mean values on both treatments (6.57 and 6.17) by the difference of 0.40. Table 6 a &b and Further Test above explain the difference of ODI before and after operation with a distance of 1 to 3 months with non-parametric statistical approach Kruskall-Wallis because there are some data that is not normally distributed. From the table it is known that P Value is 0,000 <0,05 so it can be concluded that overall there are significant differences between before and after operation on ODI assessment. Whereas from the Further Test, 3 months postoperative ODI values tend to be greater than 1 month postoperatively as well as with preoperative ODI values, as well as VAS values.

Table 5a: VAS Comparison Before and After Operation.

VAS	Average	P value
Before Operation	6,57	0,000[b]
1 month post operation	6,17[a]	
3 months post operation	1,73[a]	

Description: a) Data not normally distributed sig. (Shapiro-Wilk) <0.05

b) P value using Kruskall-Wallis test

Table 5b: Further test.

VAS	Average	P Value
Before Operation X 1 month post operation	6,57 X 6,17	0,300[a]
Before Operation X 3 months post operation	6,57 X 1,73	0,000[a]
1 month post operation X 3 months post operation	6,17 X 1,73	0,000[a]

Description: a) P Value using Mann-Whitney test of Further Test of Kruskall-Wallis.

Table 6a: ODI Comparison Before and After Operation..

ODI	Average	P value
Before Operation	47,00[a]	0,000[b]
1 month post operation	37,67[a]	
3 months post operation	17,33[a]	

Description: a) Data not normally distributed sig. (Shapiro-Wilk) <0.05

b) P value using Kruskall-Wallis test

Table 6b: Further test.

VAS	Average	P Value
Before Operation X 1 month post operation	47,00 X 37,67	0,014
Before Operation X 3 months post operation	47,00 X 17,33	0,000
1 month post operation X 3 months post operation	37,67 X 17,33	0,000

Description: a) P Value using Mann-Whitney test of Further Test of Kruskall-Wallis

Conclusions and Recommendations

This study shows a significant straight-line correlation between extensive foraminotomy techniques on lumbar foramina stenosis to clinical outcome results using VAS and ODI. There was a statistically significant difference between the VAS values before and 3 months postoperatively, but there was no significant difference between before surgery and 1 month postoperatively. There was a statistically significant difference between ODI values before and after 1 and 3 months of operation Based on the above data analysis and conclusions it can be concluded that extensive foraminotomy should be used as operational standards for the treatment of lumbar formina stenosis patients.

References

1. Fairbank JC (2000) The Oswestry Disability Index. Spine 25(22): 2940-2953.
2. Kunogi J, Hasue M (1991) Diagnosis and operative treatment of intraforaminal and extraforaminal nerve root compression. Spine (Phila Pa 1976) 16(11): 1312-1320.
3. Donaldson WF III, Star MJ, Thome RP (1993) Surgical Treatment for the far lateral herniated lumbar spine disc. Spine (Phila Pa 1976) 18(10): 1263-1267.
4. Wilco C (2010) Surgery versus conservative management of sciatica due to a lumbar herniated disc: a systematic review. Department of Neurosurgery, Leiden University Medical Center.
5. Ahn Y, Lee SH, Park WM, Lee HY (2003) Posterolateral percutaneous endoscopic lumbar foraminotomy for L5-S1 foraminal or lateral exit zone stenosis. Technical note. J Neurosurg 99(Suppl 3): 320-323.
6. Benzel EC (2012) Edwarrd CB (Eds) In: Spine Surgery. Technique, complication avoidance and management (3rd edn) Philadelphia, PA: Elsevier, USA.
7. Youmans JR, Winn HR, Youmans (2011) Neurological Surgery: Elsevier-Health Sciences Division.
8. Faske S, Greenberg S (2003) Degenerative and compressive structural disorder in: textbook clinical neurology. Second edition. USA. Elsevier Saunders Pp: 583-588.
9. Snell R (2006) Clinical Anatomy for Medical Students. Lippincott & Wilkins, pp: 881.
10. Epstein NE (2002) Foraminal and far lateral lumbar disc herniations: Surgical alternatives and outcome measures. Spinal Cord 40(10): 491-500.
11. WHO Scientific Group (2003) WHO Technical Group Series 919. The Burden of Musculoskeletal Conditions at The Start of The New Millenium. Geneva, Switzerland.

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12. Ma D, Liang Y, Wang D, Liu Z, Zhang W, et al. (2013) Trend of incidence of lumbar disc herniation: Decreasing with aging in the elderly. Clin Interv Aging 8: 1047-1050.

13. Baba H, Uchida K, Maezawa Y, Furusawa N, Okumura Y, et al. (1996) Microsurgical nerve root canal widening without fusion for lumbosacral intervertebral foraminal stenosis: Technical notes and early results. Spinal Cord 34(11): 644-650.

14. Block JDC (2001) Surgery and Herniated Nucleus Pulposus.

15. Autio R (2006) MRI of Herniated Nucleus Pulposus. Oulu University Press, Finland Pp.17.

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