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Efficacy of Percutaneous Endoscopic Lumbar Foraminotomy in Treating Foraminal Stenosis: A Prospective Study

Yaqoob Ur Rehman[1], Afaq Uddin[2], Riaz Muhammad[3], Akbar Ali Safi[4]

[1]Assistant Professor Orthopedic Nowshera Medical College
[2]Assistant Professor Orthopedic Nowshera Medical College
[3]Specialist Registrar Orthopedic Nowshera Medical College
[4]Assistant Professor Orthopedic Nowshera Medical College

Corresponding Author:
Akbar Ali Safi
Email ID: akbarsafi135@gmail.com

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ABSTRACT

Background: Foraminal stenosis is a disorder in which the opining of the spine (neural foramina) becomes narrow and compresses the nerves that leave the spinal cord. The regions supplied by the affected nerves may experience pain, tingling, numbness, or weakness as a result of this constriction. So early treatment is crucial in this case. One of the effective approaches to treat lumbar foraminal stenosis is PELF.

Objective: The aim of this study was to find out the efficacy of Percutaneous Endoscopic Lumbar Foraminotomy in Treating Foraminal Stenosis

Material and methods: The current Prospective Study was carried out at the orthopaedic department, Nowshera Medical College and Qazi Hussain Ahmad Medical Complex Nowshera. The study duration was six months from January 2024 to June 2024 after taking approval from the ethical committee of the hospital. A total of 37 individuals with lumber stenosis who had performed Percutaneous Endoscopic Lumbar foraminotomy were enrolled in this study. Chart reviews, patient-based outcome questionnaires, and phone interviews were used to collect data. The visual analogue scale (VAS) score was used to measure the individuals' degrees of radicular leg pain and back pain. The Oswestry Disability Index was used to evaluate functional status. The modified MacNab criteria were also used for assessing the clinical results. A paired t test with the Bonferroni approach for multiple comparison correction and repeated-measures analysis of variance were used to compare the clinical outcomes in pain and functional status before and after surgery. P-values of.05 were considered significant.

Results: A total of 37 individuals were included in this study out of which 20 were females and 17 were males. The mean age of the study participants was 65.3 years with a range of 17 to 81 years. For back pain, the mean before surgery VAS score were SD = 2.05. At six weeks, six months, 1 year, & 2 years after surgery, this score improved to SD = 1.77 (P value less than 0.001)**.** Preoperative leg pain had a mean VAS score of SD = 1.33. At six weeks, 6 months, one year, & two years after surgery, this score improved (P value less than 0.001). At six weeks, six months, one year, and two years after surgery, the mean postoperative ODI score were improved. The modified MacNab criteria were graded as follows at the final follow-up review: 31.8% had an excellent rating, 40.5% had a good, 32.4% had a fair, and 5.4% had a poor score. Consequently, 81.0% had excellent or good outcomes, and 35 out of 37 participants (94.5%) had an improvement in their symptoms.

Conclusion: The present study concluded that percutaneous endoscopic lumbar foraminotomy in treating foraminal Stenosis is very effective and this surgical procedure has grown more standardized and useful.

Keywords: *Efficacy; Percutaneous Endoscopic Lumbar Foraminotomy; Foraminal Stenosis*

1. INTRODUCTION

Foraminal stenosis is a disorder in which the opining of the spine (neural foramina) become narrow and compress the nerves that leave the spinal cord. The regions supplied by the affected nerves may experience pain, tingling, numbness, or weakness as a result of this constriction. It is an example of spinal stenosis, and although many people have no symptoms, the severity and location of the constriction might affect the symptoms that do appear. One of the most prominent causes of this disease is disc degeneration and disc height reduction, which eventually disrupt facet joint biomechanics, motion, and anatomical anomalies (i.e., hypertrophy).[1] The levels of the spine involved, however, identify the specific clinical presentation.[2] For example, lumbar foraminal stenosis (may lead to weakness, radiculopathy, paresthesia, back pain, and leg pain at rest. These symptoms can all result in a lower quality of life as well as diminished capacity for activity.[3-4] Conservative therapies such non-steroidal anti-inflammatory medications or surgical management, particularly for individuals who are not responsive to the former, can be used to treat these symptoms.[5] Several surgical techniques, including foraminotomy and decompression with lumbar fusion, are used to treat lumbar foraminal stenosis.[6] one of the effective approach to treat lumbar foraminal stenosis, a minimally invasive surgical technique called percutaneous endoscopic lumbar foraminotomy (PELF) is performed. With the use of an endoscope, the affected nerve root is visualized and decompressed by removing thicker ligaments, bone spurs, or other structures that are causing the constriction. This method seeks to alleviate nerve compression-related leg pain, numbness, or tingling.[7] Percutaneous endoscopic foraminal discectomy and/or foraminoplasty have been used by some authors.[8] However, only foraminal soft disc herniation or associated mild foraminal stenosis have been treated with these minimally invasive techniques. A study described the L5-S1 level percutaneous endoscopic lumbar foraminotomy (ELF) technique.[10] A systematic decompression procedure for hard bone stenosis has been hard to attain, and a safe access to the stenotic foramen is still challenging. In contrast to the method described in previous research, we have created a more useful version of this methodology and adapted it to lumbar levels .[10] the present study was carried out to find out the Efficacy of Percutaneous Endoscopic Lumbar Foraminotomy in Treating Foraminal Stenosis

2. MATERIAL AND METHODS

The current Prospective Study was carried out at the orthopaedic department, Nowshera Medical College and Qazi Hussain Ahmad Medical Complex Nowshera. The study duration was six months from January 2024 to June 2024 after taking approval from the ethical committee of the hospital. A total of 37 individuals with lumber stenosis who had performed Percutaneous Endoscopic Lumbar foraminotomy were enrolled in this study. Individuals who have had more than six weeks of conservative therapy and still suffered from lumbar foraminal stenosis without any disc herniation conformed by CT and MRI were included while individuals with Intra-canalicular stenosis or concurrent clinical diseases such acute inflammation, infection, or tumor were excluded. Chart reviews, patient-based outcome questionnaires, and phone interviews were used to collect data. Participants filled out questionnaires showing their level of discomfort and functional status at each follow-up. The visual analogue scale (VAS) score was used to measure the individuals' degrees of radicular leg pain and back pain. The Oswestry Disability Index was used to evaluate functional status. The modified MacNab criteria were also used for assessing the clinical results. A paired t test with the Bonferroni approach for multiple comparison correction and repeated-measures analysis of variance were used to compare the clinical outcomes in pain and functional status before and after surgery. P-values of.05 were considered significant.

3. RESULTS

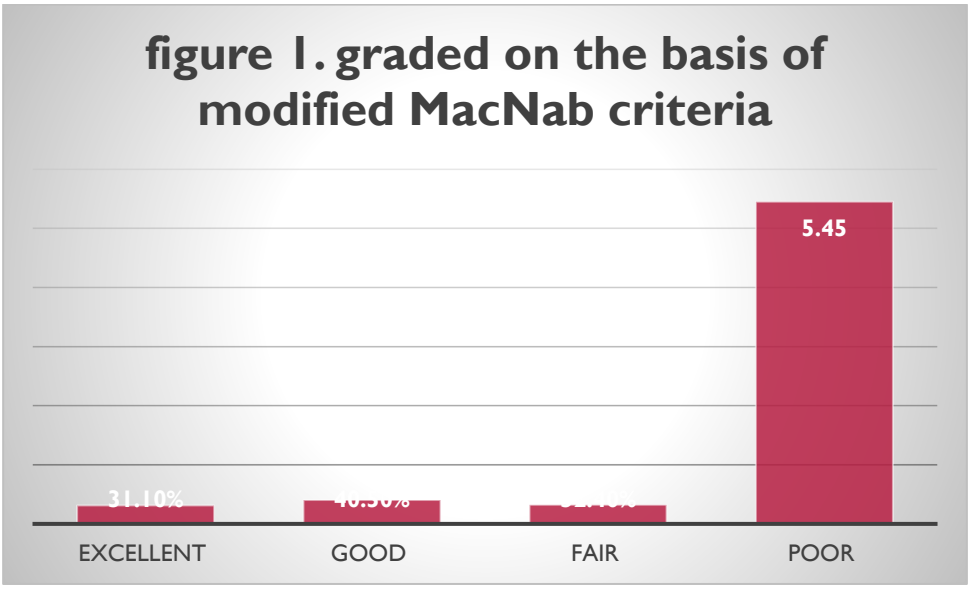
A total of 37 individuals were included in this study out of which 20 were females and 17 were males. The mean age of the study participants was 65.3 years with a range of 17 to 81 years. Three individuals underwent surgery at L2-3, 9 underwent L3-4, 16 underwent L4-5, and 12 underwent L5-S1. 13 patients had previously undergone lumbar surgery; 7 of them had open discectomies at the same level, 3 had open discectomies at separate levels, and 3 had fusions at nearby levels. Neurological deficiencies in the form of muscle weakness or sensory deficiencies in the affected nerve root's distribution were present in 20 out of 37 individuals. Per level, the average operating time was 56.5 mins (SD = 18.3 minutes; range: 35-120 minutes). Following the procedure, the average length of stay in the hospital was 1.35 days (SD equates to 0.64 days; range: 1-4 days) as presented in **table 1.** For back pain, the mean before surgery VAS score were 6.35 (SD = 2.05). At six weeks, six months, 1 year, & 2 years after surgery, this score improved to 4.10, 3.50, 2.11, and at last, 2.08 (SD = 1.77), respectively (**P value less than 0.001**) as presented in **table 2.** Preoperative leg pain had a mean VAS score of 9.35 (SD = 1.33). At six weeks, 6 months, one year, & two years after surgery, this score decreased to 4.01, 3.20, 2.05, & lastly 1.88 (SD = 1.86), respectively (**P value less than 0.001**) as presented in **table 3.** 66.1% was the mean ODI score (SD = 16.9%) before surgery. At six weeks, six months, one year, and two years after surgery, the mean postoperative ODI score were 30.0%, 27.1%, 18.5%, and 18.02% (SD = 16.7%), correspondingly (value of p less than 0.001) as shown in **table 4.** The modified MacNab criteria were graded as follows at the final follow-up review: fourteen individuals (31.8%) had an excellent rating, 15 individuals (40.5%) had a good, five individuals (32.4%) had a fair, and 2 patients (5.4%) had a poor score. Consequently, 31 out of the 37 participants (81.0%) had excellent or good outcomes, and 35 out of 37 participants (94.5%) had an improvement in their symptoms as described in **figure 1**.

Table .Demographic features of the study participants	
Features	**Frequency**
Sex	
Male	**17**
Female	**20**
Age in years	65.3 years(SD) Range (17 to 81)
neurological deficits	
Muscle weakness	20
history of lumbar surgery	13
Operative time in minutes per level	56.5 SD = 18.3 minutes; range, 35-120 minutes)
Hospital stay	1.35 days (SD = 0.64 days; range, 1-4 days

	Table 2.preoperative and post-operative VAS score for backpain	
Vas score		**P value**
Preoperative	**6.35 (SD =2.05).**	**P value Less than 0.001**
Postoperative		
6 weeks	**4.10**	
6 months	**3.50**	
1 years	**2.11**	
2 years	**2.08**	

	Table 3.preoperative and post-operative VAS score for leg pain	
Vas score		**P value**
Preoperative	**9.35 (SD =133).**	**P value less than 0.001**
Postoperative		
6 weeks	**4.01**	
6 months	**3.20**	
1 years	**2.05**	
2 years	**1.88**	

Table 4.preoperative and post-operative ODI Score		
ODI		P value
Preoperative	**66.1% (SD = 16.9%)**	**P value less than 0.001**
Postoperative		
6 weeks	**30.0%**	
6 months	**27.1%**	
1 years	**18.5%**	
2 years	**18.20%**	



4. DISCUSSION

A number of researchers have created percutaneous endoscopic methods for foraminal decompression since Sampson first proposed the idea of posterolateral percutaneous lumbar disc decompression.[11] In order to treat different foraminal nerve root entrapment diseases, Knight et al. developed laser foraminoplasty.[11] They compressed the departing nerve root by ablation of soft tissues including osteophytes and foraminal ligaments using a side-firing laser. We presented an ELF method that uses a laser and bone reamer.[12] Additionally, Schubert and Hoogland documented the use of a bone reamer for foraminoplasty in migrated disc herniation cases. However, the prior methods' use in definitive foraminal decompression is restricted. Only neural entrapment brought on by soft tissue or delicate osteophytes can be successfully treated with a laser. Regretfully, for severe bony stenosis, the laser may be not as effective and need more time.[13] The hypertrophied bone can be quickly sliced using bone reamers. However, there is an inherent drawback to using bone reamers: because it is a blind procedure, it does not allow direct control by sight. A percutaneous endoscopic method for foraminal/extraforaminal disc herniation has been described by several publications.[14] The hypertrophied bone can be quickly sliced using bone reamers. However, there is an inherent drawback to using bone reamers: because it is a blind procedure, it does not allow direct control by sight. A percutaneous endoscopic method for foraminal/extraforaminal disc herniation has been described by several publications.[15] In the current study A total of 37 individuals with lumber stenosis who had performed Percutaneous Endoscopic Lumbar foraminotomy were studied . our findings revealed that for both back and leg pain, the mean VAS score after surgery was improved at six weeks, six months, 1 year, & 2 years respectively (P value less than 0.001) These results demonstrate the effectiveness of this approach in decompressing the departing nerve root, and the effect continued during a follow-up period of two years. Our findings are similar to previous study .[16] At six weeks, six months, one year, and two years after surgery, the mean postoperative ODI score were (SD = 16.7%), correspondingly (value of p less than 0.001).our study results are

similar to the study conducted by Ostelo et l.[17] A 20% or greater drop in the ODI score is regarded as clinically significant.[17] As a result, our series demonstrated functional improvement at clinically meaningful levels. Our study had an overall success rate of 81.0% and a symptomatic improvement of 94.5% based on the modified MacNab criteria. These results are similar to those of other reported patient series including open decompression surgery in a study conducted by Epstein.[18] In the present study, individuals under local anesthesia underwent ELF operations for an average of 56.5 minutes. Consequently, as compared to open decompression surgery, our surgical results show a comparatively shorter operating time. Additionally, our results are similar to those of other minimally invasive or endoscopic decompression methods.[12-19] The case series' total success rates varied from 73% to 100%. Since the nature and severity of foraminal disorders may vary slightly, we believe it is challenging to make direct comparisons between those studies. Yet it would be beneficial to influence the development of minimally invasive foraminal decompression methods in the future. Less trauma and a decreased risk of complications are generally the main benefits of endoscopic spine surgeries.[19] Regarding tissue trauma, our endoscopic foraminotomy surgical findings and clinical results showed significant advantages. There are several limitations even though this method offers the advantages of full-scale foraminal decompression with minimal stress. First, this new method can have a learning curve. Most spine surgeons have never used a drill & punches under endoscopic control. Second, the ELF approach would still be difficult to apply in situations of severe far lateral stenosis brought on by hypertrophied sacral ala at the L5-S1 level. To remove the sacral ala, an alternative angle and endoscope rotation should be necessary.

5. CONCLUSION

The present study concluded that percutaneous endoscopic lumbar foraminotomy in treating foraminal Stenosis is very effective and this surgical procedure has grown more standardized and useful.

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