Microsurgical Posterolateral Foraminotomy on Patients with Adult Isthmic Spondylolisthesis

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■ BACKGROUND: **The standard surgical treatment for adult isthmic spondylolisthesis consists of various techniques of arthrodesis supplemented with instrumentation. However, the superiority of this strategy has not been irrefutably proved. Considering the risk associated with the instrumentation surgery, examining a less invasive approach is justified.**

■ METHODS: **We describe a series of 9 patients with adult isthmic spondylolisthesis, in whom we microsurgically decompressed the responsible nerve root in the intervertebral foramen through the posterolateral intermuscular approach. Technical details specific to isthmic spondylolisthesis were reviewed. The 2-year outcome was assessed with Short Form 36 and visual analog scale scores.**

■ RESULTS: **The mean age of the patients was 68 ± 7 years (standard deviation [SD]). The mean slip rate of spondylolisthesis measured on the preoperative lumbar radiography was 20% ± 12% (SD). All patients successfully underwent the procedure without complications. All the examined scores remained significantly better than the preoperative values 2 years after surgery; the mean visual analog scale score decreased from 7.8 ± 2.8 (SD) preoperatively to 2.8 ± 1.4 (SD) at 2 years ($P = 0.008$), average physical score of Short Form 36 improved from 33.1 ± 9.7 to 52.5 ± 9.4 ($P = 0.001$), and the bodily pain score improved from 28.0 ± 13.5 to 55.1 ± 9.7 ($P = 0.001$).**

■ CONCLUSIONS: **Microsurgical decompression through the posterolateral intermuscular approach was effective in producing good 2-year outcome in patients with adult isthmic spondylolisthesis. This procedure may be considered as a less invasive alternative in the surgical treatment of adult isthmic spondylolisthesis.**

INTRODUCTION

The standard surgical treatment for adult isthmic spondylolisthesis consists of arthrodesis with instrumentation using various surgical approaches.[1,2] The purpose of the arthrodesis is to improve the long-term outcome by preventing the slip progression. However, evidence supporting this strategy is obscure. There has not been a randomized controlled trial comparing microsurgical decompression and lumbar fusion. As to the role of instrumentation, 4 previous randomized controlled trials including cases of isthmic spondylolisthesis did not show significant improvement of outcome by instrumentation.[3-6] In addition, complex instrumentation procedures may occasionally be associated with significant complications.[1,7-9] In this situation, it is justifiable to examine whether there is a less invasive alternative.

In isthmic spondylolisthesis, the symptom is usually caused by a nerve root compressed by the fibrocartilaginous tissue in the intervertebral foramen.[2,10] Therefore, the goal of less invasive surgery is to decompress the nerve root, preserving spinal stability. Historically, Gill[11] and Osterman et al.[12] reported removal of the loose lamina with relatively good outcome, but this procedure has not been widely accepted. Recently, endoscopic foraminal decompression has been reported, with promising results.[13,14] Further evidence needs to be accumulated to assess the feasibility of the less invasive approach.

Key words
- Adult isthmic spondylolisthesis
- Decompression
- Foraminal stenosis
- Microsurgery

Abbreviations and Acronyms
CT: Computed tomography
MRI: Magnetic resonance imaging
SD: Standard deviation
SF-36: Short Form 36
VAS: Visual analog scale

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Citation: World Neurosurg. (2017) 100:434-439.
http://dx.doi.org/10.1016/j.wneu.2017.01.040

*Journal homepage: **www.WORLDNEUROSURGERY.org***

*Available online: **www.sciencedirect.com***

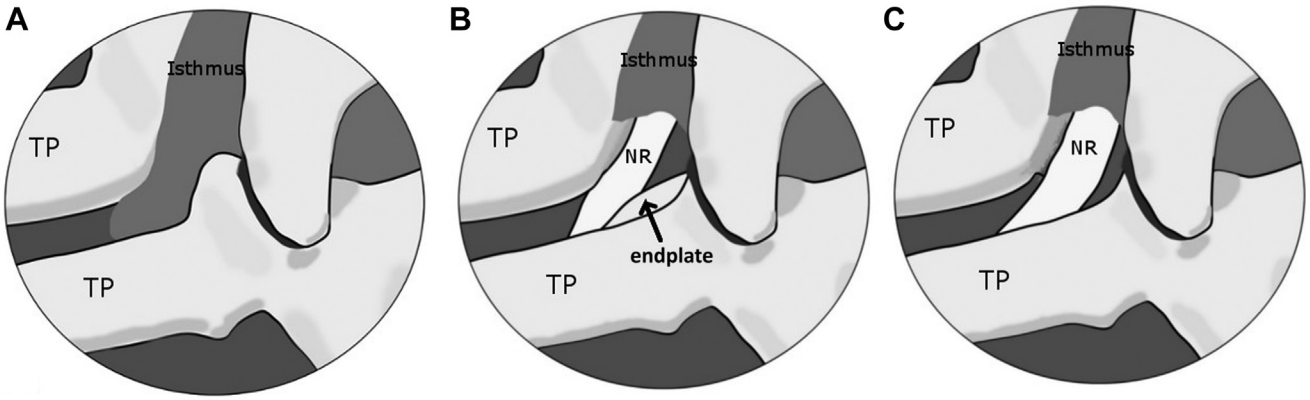

Figure 1. Schematic drawings showing the surgical procedure of microsurgical posterolateral foraminotomy. A left-sided approach is shown. (**A**) Exposure of the posterolateral aspect of the isthmus through the posterolateral intermuscular approach. (**B**) After resection of the tip of the superior facet and the fibrocartilaginous tissue in the isthmic bone defect. The nerve root is identified on the medial side of the medial aspect of the pedicle. Often, the nerve root is clamped between the pedicle and the superior end plate of the lower vertebra as shown in the figure. (**C**) After partial resection of the superior end plate and decompression of the nerve root. NR, nerve root; TP, transverse process.

In this article, we describe a series of 9 patients with adult isthmic spondylolisthesis who underwent microsurgical foraminal decompression through the posterolateral intermuscular approach. Specific technical problems were reviewed, and the 2-year outcome was assessed with the Short Form 36 (SF-36) and visual analog scale (VAS).

METHODS

Description of the Series

This study is a retrospective cohort study with prospectively acquired data and was approved by the institutional review board. During the period from 2005 to 2014, we performed 537 operations on patients with lumbar degenerative diseases. Among these patients, there were 9 with adult isthmic spondylolisthesis. These 9 patients comprise a consecutive series because no patient with isthmic spondylolisthesis underwent other procedures such as lumbar fusion during this period. All 9 patients had unilateral symptoms and were treated with microsurgical decompression of the foramen without arthrodesis, which we call microsurgical posterolateral foraminotomy; the details are described in the following sections.

Preoperatively, the patients underwent standard neurologic examinations, standing lumbar radiography, lumbar spine computed tomography (CT), and lumbar spine magnetic resonance imaging (MRI). Six patients had undergone nerve root block to confirm the responsible nerve root. Electromyography was not used in any patient. The slip rate of spondylolisthesis was measured on standing lateral lumbar radiography with the Taillard method.[15]

Surgical Technique

The technique was a modification of the microsurgical foraminal decompression that we described previously.[16] With a small skin incision 4 cm off the midline, the appropriate foramen was approached through the plane between the multifidus and the longissimus muscle. The small operative field was secured with retractors with 2-cm blades. The pertinent transverse processes were identified (Figure 1A). The approach to the lateral orifice of

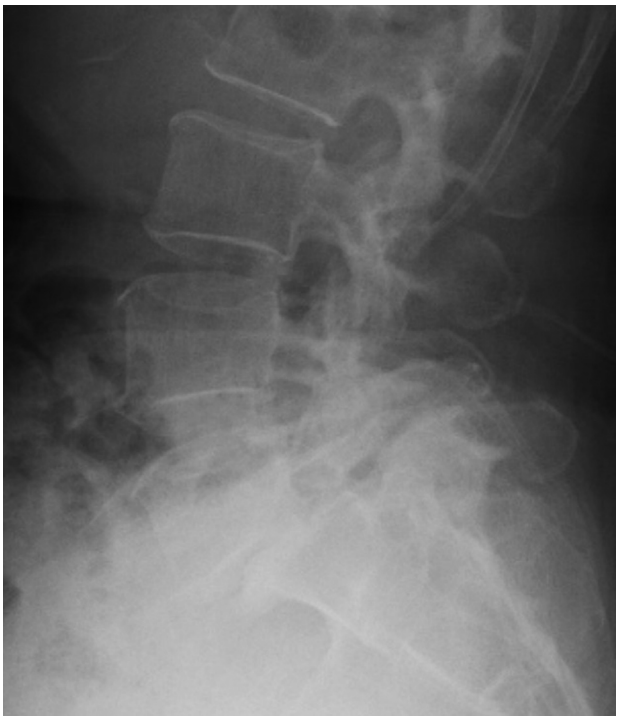

Figure 2. Preoperative standing lumbar spine radiograph (lateral view) of the presented case. Isthmic spondylolisthesis is noted with a slip rate of 30%.