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Etiologies of Recurrent Low Back Pain after Laminectomy with Emphasis on Segmental Instability

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Laminectomy is a surgical treatment for lumbar stenosis. In some patients, however, back pain may recur after this operation. This study was performed to determine underlying causes of recurrent back pain after laminectomy and examine the possibility of an association between axial rotation and segmental instability after laminectomy. A total of 35 patients with previous laminectomy with and without discectomy and recurrent back pain were recruited. Etiologies of recurrent back pain were investigated. An axially rotated lumbar vertebra was reported, when at extreme parasagittal sections the posterior borders of two successive vertebral bodies were not aligned. The frequency of this image finding was compared before and after laminectomy. An axially rotated lumbar vertebra was present in two patients before operation and in four patients after it. Only two new cases with axial vertebral rotation were identified after laminectomy ($p = 0.50$). The underlying causes of recurrent low back pain after laminectomy were disc reherniation (57.1%), spondylolisthesis (20%), scarring (8.6%), new axial rotation (5.7%), ligamentum flavum hypertrophy (5.7%) and diastematomyelia (2.9%). According to these findings, recurrent disc herniation and spondylolisthesis are two major causes of recurrent back pain after laminectomy. Axial lumbar vertebral rotation is not associated with instability.

Key words: Axial rotation, lumbar vertebra, segmental instability, laminectomy

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INTRODUCTION

The spinal column in human being is the main axial load-bearing structure in the skeleton, which acts as a supporter for the whole body, as well as a efficient protector of central nervous system against external forces while, it remains flexible for motion in various directions (Banczerowski *et al*., 2009; Yang *et al*., 2011; Feiz *et al*., 2012; Daghighi *et al*., 2013; Pouriesa *et al*., 2013).

Lumbar spinal stenosis is a common condition in which, the vital organs inside the spinal canal including the cord and originating nerves undergo pressure with varying degree. There are several surgical ways to obviate this pressure including discectomy, facetectomy, laminotomy and laminectomy that could be performed alone or in combination based on the patient's condition and the surgeon's preference. Laminectomy, however, is a very common method because compared to other mentioned techniques, it is less along with segmental instability. Although, this is a relatively safe operation in certain patients of symptoms associated with lumbar spinal stenosis may recur due to various causes (Quint *et al*., 1998).

As mentioned earlier, segmental instability is one of the underlying causes of recurrent back pain after laminectomy. It is thought that accelerated degenerative changes in the intervertebral disc may also occur after laminectomy (Kirkaldy-Willis and Farfan, 1982).

Segmental instability, as it is known in the literature, is a dynamic condition, i.e., it can be usually detected in Magnetic Resonance (MR) image only after appropriate external forces are employed on the involved segment (Haughton *et al*., 2002).

According to the present experience, however, a condition inwhich a fixed abnormal axial rotation may also exist in the lumbar vertebrae of some patients, it is not known whether this condition is also associated with laminectomy or not. This study aimed to firstly investigate etiologies of recurrent back pain after laminectomy and secondly, to examine possible association between fixed axial lumbar vertebral rotation and laminectomy.

MATERIALS AND METHODS

In this prospective, a total of 35 patients with recurrent low back pain after laminectomy with or without discectomy were examined by MR imaging in Tabriz Imam Reza Teaching hospital from April 2012 to May 2014. This study was approved by the ethics committee of Tabriz University of Medical Sciences and informed consents were obtained from the patients.

Cases with infectious spondylitis, spinal tumors and preoperative spondylolisthesis were excluded. All the patients underwent thorough physical and neurological examination by a skilled neurologist. Contrast-enhanced MR images of the lumbar spine were obtained at sagittal and axial T1 and T2 weighted sections using a 1.5 Tesla scanner (MAGNETOM Avanto 1.5 Tesla MRI system; Siemens, Erlangen, Germany). Two skilled radiologists, unaware of the results of physical examinations, reviewed the images individually and in case of any discrepancy, a third radiologist interfered. Pre and post-operational MR images were examined randomly.

Axial rotation was present when the posterior borders of two adjacent lumbar/lumbosacral vertebrae were not aligned in extreme parasagittal views by MR imaging unilaterally or bilaterally in opposite directions (Fig. 1).

In addition to axial rotation, the condition of the endplates (normal appearance, abnormal appearance

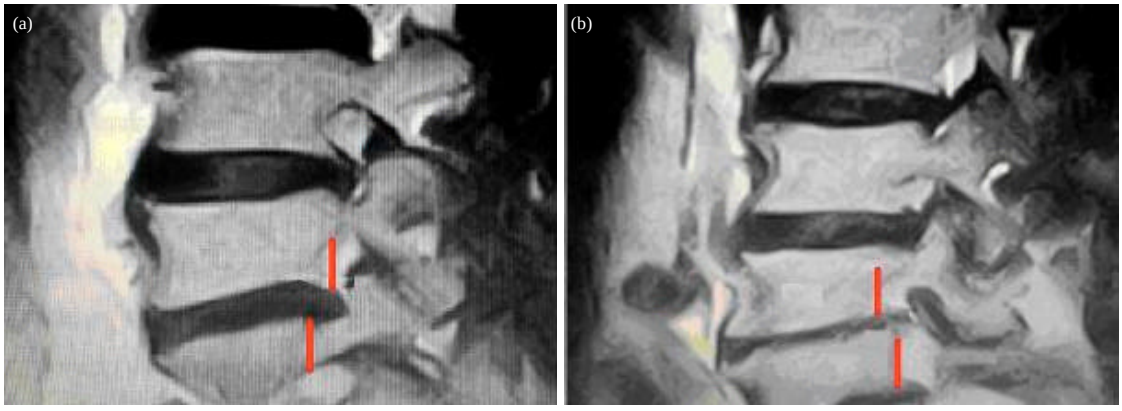

Fig. 1(a-b): Axial rotations of the fifth lumbar vertebra (a) Anticlockwise and (b) Clockwise

containing decreased signal at T1+increased signal at T2, increased signal at both T1 and T2 or decreased signal at both T1 and T2) and the intervertebral disc (normal, abnormal including bulging, protrusion, extrusion, sequestration, disc dehydration, presence of osteophyte) was also reported.

The final etiology of recurrent low-back pain was reported according to a consensus reached by two radiologists and the neurologist with a high rate of agreement (>95%) between the three physicians.

Statistical analysis: The SPSS software version 16 was used for statistical analysis. McNemar test was employed to compare frequencies of variables before and after laminectomy. A significance level of $p \leq 0.05$ was used.

RESULTS

A total of 35 cases with previous laminectomy-discectomy, including 18 males (51.4%) and 17 females (48.6%) with a mean age of 50.23±12.56 years (min-max: 22-75) were enrolled in this study.

The mean time gap between laminectomy and recurrence of low back pain was 3.27±2.45 years (min-max: 1-10) (Fig. 2).

While before operation, axial rotation was evident in 2 MR images (5.7%), after operation the frequency increased to 4 (11.4%) with two new cases developed after laminectomy. This change was not statistically significant (McNemar test $p = 0.50$).

The two new cases were a male (age: 46 years, level: L4-5, laminectomy from recurrent back pain: 1 year) and a female (age: 56 years, level: L4-5, laminectomy from recurrent back pain: 7 years).

Before operation, abnormal endplates adjacent to the rotated vertebrae were present in 20 patients (57.1%), which increased to 31 cases (88.6%) after laminectomy. This increase was statistically significant (McNemar test $p = 0.01$).

After laminectomy, abnormal intervertebral discs were present in 33 cases (92.3%) and osteophytes were spotted in 9 cases (25.7%). Dehydrated disc was present in 31 patients (88.6%).

The underlying causes of recurrent low back pain after laminectomy were reherniation in 20 cases, spondylolisthesis in 7 cases, scarring in 3 cases, axial rotation in 2 cases, ligamentum flavum hypertrophy in 2 cases and diastematomyelia in 1 patient (Fig. 3).

DISCUSSION

In the present study, the most common cause of recurrent back pain after laminectomy with or without discectomy was reherniation (57.1%), followed by spondylolisthesis (20%), scarring (8.6%), new axial rotation (5.7%), ligamentum flavum hypertrophy (5.7%) and diastematomyelia (2.9%).

In line with these results, Slipman *et al.* (2002) reported the most frequent causes of failed back surgery syndrome as disc reherniation/retention, spinal canal stenosis and fibrosis.

In another report by Rodrigues *et al.* (2006), the most frequent causes of recurrent back pain after hemilaminectomy with discectomy, laminectomy and/or foraminotomy in 26 patients were recurrent disc herniation followed by lumbar stenosis. These findings are similar to present results.

In another series by Waguespack *et al.* (2002), the most common causes of recurrent low back pain after back

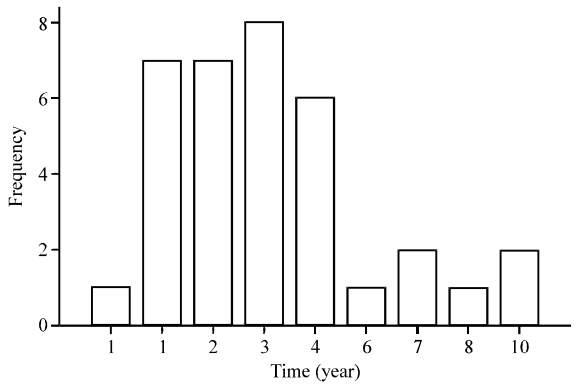

Fig. 2: Frequency of time gap between laminectomy and the emergence of recurrent low back pain

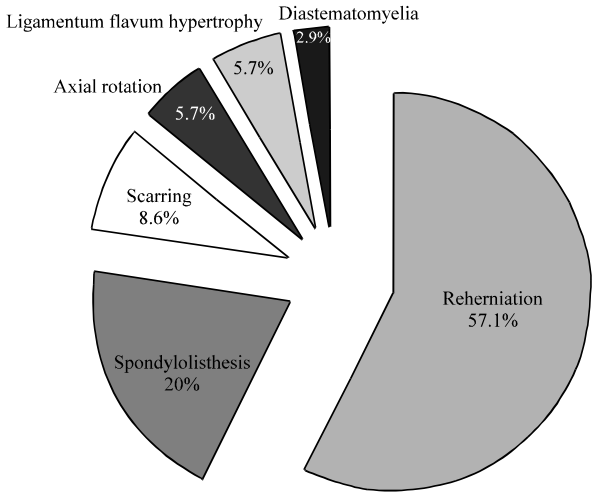

Fig. 3: Underlying etiologies of recurrent low back pain after laminectomy

surgery were stenosis (29%), disc problems (17%), pseudarthrosis (14%), neuropathic pain (9%), segmental instability (5%) and psychological problems (3%).

It should be noted that the axial rotation investigated in present study is a novel entity and completely differs from segmental instability known in the literature. Unlike segmental instability, which is evident only after exertion of external forces on the involved vertebra (Haughton *et al*., 1999), the novel axial rotation, introduced in this study, is an evident finding in neutral position.

The association between conventional segmental instability and recurrent low back pain after lumbar surgery is not new in the literature (Zander *et al*., 2003).

For example, in a study by Haughton *et al*. (2002), patients with laminectomy underwent application of external forces on the operated segment. In comparison with controls, they found that the amount of axial rotation was significantly higher after laminectomy in comparison with the intact lumbar segments.

In another similar study by Lee and Teo (2004), it was found that such laxity was not limited to axial rotation and found to be multidirectional after laminectomy.

The results of the present study indicate that the axial rotation introduced in this study is probably different from that which is associated with instability and other underlying factors may be involved. Further studies are recommended in this regard.

Another important finding in the present study was the high incidence of degenerative changes in the operated lumbar segments (over 90%) after laminectomy. This finding confirms the previous report indicating a potent role of laminectomy in inducing degenerative changes in the disc and associated anatomical structures (Lee and Teo, 2004).

CONCLUSION

The most frequent causes of recurrent low back pain after laminectomy are disc reherniation and spondylolisthesis. Also, axial rotation may contribute to this syndrome, instability is not a probable cause of such rotations.

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