Proposal of a new anatomical landmark to identify the disc space in endoscopic lumbar discectomy

ABSTRACT

Introduction: In endoscopic lumbar discectomy for posterolateral disc herniation, we determined some anatomical landmarks for improved disc space access. These landmarks are based on the beginning of the insertion of the ligamentum flavum (LF) to vertebral lamina.

Materials and Methods: In 978 patients operated by posterolateral disc herniation, we measured prospectively the distance between the beginning of the insertion of the LF and space disc rostrally.

Results: The distance between the beginning of the insertion of the LF and space disc was broader at the level of L3–L4, with an average of 14 mm. At L4–L5, the average distance was 13.5. At L5–S1, the average distance was 12 mm.

Conclusion: Knowing the accurate distance between the insertion of LF and disc space contributes to reducing the average duration of the surgical procedure to avoid empirical search of disc space by a surgeon and avoiding unnecessary and excessive LF and bone removal.

Keywords: Degenerative diseases of the lumbar spine, endoscopic lumbar discectomy, low back pain, radiculopathy, sciatica

INTRODUCTION

In endoscopic lumbar discectomy, we have made a habit of starting removal of a part of overlying laminae to identify the beginning of the insertion of the ligamentum flavum (LF). This approach helps us to remove most accurately and millimeter by millimeter the LF and reduces the risk of cerebrospinal fluid leakage. The removal continues caudally until we detect the disc space. Sometimes, for various reasons, including anatomic variation of shape of the vertebral laminae, arthrosic process in elderly patients, bleeding which reduces the field of vision in endoscopy surgery, and particularly, restricted operating field in this type of surgery, identification of disc space is difficult. Therefore, the latter must be accurately targeted. Achieving more than 1500 endoscopic lumbar discectomy incited us to determine some anatomical landmarks for improved disc space access by surgeons. These landmarks are based on the beginning of the insertion of the LF to vertebral lamina.

ANATOMICAL BASE

The LF joins two contiguous laminae at the posterior side of the dura mater and plays an important role as protector of dura mater. Intervertebral space is covered posteriorly by two flaps of LF symmetrically. LF is extended from the

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articular processes to the base of the spinous processes, and with its contralateral counterpart, they form an obtuse angle anteriorly at the midline. LF is separated anteriorly from dura mater by a venous plexus. The superior edge of LF is a concave bevel and is attached to anterior side of lamina.\[1-14\]

**SURGICAL TECHNIQUE**

In posterolateral endoscopic excision for lumbar disc herniation, we start the procedure by interlaminar space identification. We begin then to open the overlying lamina (L3 Lamina for L3–L4 disc herniation, L4 lamina for L4–L5 disc herniation, and L5 lamina for L5–S1 disc herniation). This hemilaminotomy extends upward until we identify the beginning of the insertion of the LF.\[10\] This technique gives us the opportunity to visualize well the dura mater and slip the hook on the underside of LF to examine the degree of adhesion of LF to the dura mater. Thus, we can remove the LF securely by a kerrison forceps while slipping gently the latter below the LF. We continue LF removal caudally toward disc space.

**MATERIALS AND METHODS**

In 978 patients operated by posterolateral disc herniation, we measured prospectively the distance between the beginning of the insertion of the LF and space disc rostrally. Table 1 demonstrates the results of these measures based on the operated level.

The distance between the beginning of the insertion of the LF and space disc was broader at the level of L3–L4 between 16 and 12 mm with an average of 14 mm. At L4–L5, the average distance was 13.5 with a low of 11.5 and a high of 14. At L5–S1, the average distance was 12 mm with a low of 10 and a high of 13.5.

**DISCUSSION**

Knowing the accurate distance between the insertion of LF and disc space contributes to maximizing the following benefits:

1. Reducing the average duration of the surgical procedure to avoid empirical search of DISC space by the surgeon
2. Avoiding unnecessary and excessive LF and bone removal.

Since the creation of these anatomical landmarks and its systematic use by authors, we operated 338 patients for lumbar disc herniation using these landmarks. We include a comparison group of 338 patient operated for lumbar disc herniation without these landmarks in our study. In patients operated with landmarks, the average duration of the surgery decreased by 10 min. Table 2 demonstrates the duration of surgery in different levels in patients operated with and without our landmarks.

The best results obtained in L3–L4 discectomy for a shorter duration of 6 min and 24 s. In L4–L5 discectomy, the procedure was in average shorter than 4 min and 46 s. L5–S1 discectomy using the landmarks took in average 4 min and 20 s fewer than procedure without using procedure. The authors believe that reduction in the time of surgery is mainly attributable to decreasing average time of LF removal. A further factor is the ease of disc space finding, in particular when bleeding affects vision in endoscopic procedure.

In patients who underwent discectomy without using landmarks, we had three cerebrospinal fluid leakages versus 0 in patients operated using the landmarks. The following question will inevitably be raised: is not the reduction in procedure time in conjunction with the experience rise of the authors? This technique is used by the corresponding author for many years (2012). Since then, more than 1500 patients have been operated by this technique, while the proposed landmarks have been only tested in 489 patients since 2 years. Consequently, the patients who benefited from this method have not been operated during authors’ learning process. However, to reduce biasing effect to a maximum, we chose the control group to compare outputs between two groups more clearly.

**CONCLUSION**

The measurement of the distance between the beginning of the insertion of the LF and space disc in endoscopic lumbar discectomy gave us the anatomical details and allowed us to:
to define some anatomical landmarks to make this surgery faster and safer.

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Conflicts of interest
There are no conflicts of interest.

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