


Review Article

Corresponding Author

Takeshi Hara

 <https://orcid.org/0000-0002-5124-5329>

Department of Neurosurgery, Juntendo
University, 2-1-1 Hongo, Bunkyo-ku,
Tokyo 113-0033, Japan
Email: tkhara@juntendo.ac.jp

Received: January 15, 2023

Revised: March 2, 2023

Accepted: March 2, 2023



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Perioperative Management for Full-Endoscopic Lumbar Discectomy: Consideration From the Perspective of Preventing Complication

Takeshi Hara^{1,2}, Yukoh Ohara^{1,2}

¹Spine and Spinal Cord Center, Juntendo University, Tokyo, Japan

²Department of Neurosurgery, Juntendo University, Tokyo, Japan

In recent years, full-endoscopic discectomy (FED) has expanded its range of indications with the development of devices and various techniques. The advantage of FED over conventional surgery is that it is a minimally invasive procedure. However, intraoperative and postoperative precautions must be taken to prevent complications. It is necessary to avoid complications that could compromise the outcome of the procedure. Effective perioperative management is necessary to avoid complications; however, there is no set view for perioperative management in FED. In this study, we perform a literature review to examine the effectiveness of perioperative management methods for FED. The key to ensuring the efficacy and minimal invasiveness of FED is prevention of complications. Based on the result and literature review, we believe that the most manageable postoperative management after FED is prevention of recurrent disc herniation and hematoma formation. A drain should be placed to prevent postoperative hematoma formation. It is advisable to evaluate the patient's symptoms and monitor C-reactive protein and erythrocyte sedimentation rate levels during the first week after surgery. Postoperative antibiotics were administered for 1 day.

Keywords: Full-endoscopic lumbar discectomy Recurrent disc herniation, Perioperative management, Hematoma

INTRODUCTION

In recent years, full-endoscopic discectomy (FED) has expanded its range of indications with the development of devices and various techniques. The advantage of FED over conventional surgery is that it is a minimally invasive procedure. However, intraoperative and postoperative precautions must be taken to prevent complications. The minimally invasiveness of FED is one of its advantages; therefore, it is necessary to avoid complications that could compromise the outcome of the procedure. Effective perioperative management is necessary to avoid complications; however, there is no set view for perioperative management in FED, which is left to the discretion of each institution and surgeon.

In this study, we perform a literature review to examine the

effectiveness of perioperative management methods for FED.

COMPLICATION OF FED

The key to ensuring the efficacy and minimal invasiveness of FED is prevention of complications. Perioperative management and special care should be taken during surgery to prevent complications. There is a paucity of literature describing the perioperative management of FED in detail.

The major complications of FED are (1) postoperative hematoma, (2) dural tear, (3) infection, (4) nerve root injury, (5) recurrent disc herniation, and (6) intracranial hypertension.

1. Postoperative Hematoma

FED is characterized by a limited surgical field because it does

not invade the muscles or soft tissues, and bone removal is limited to a small area. This is the reason why FED is a minimally invasive treatment. However, because of this limited space, even a small amount of hematoma can easily compress and damage the nerves.¹ The causes of hematoma formation include bleeding from soft tissues and removed bone, antiplatelet and anticoagulation medications, and segmental artery injury due to puncture manipulation.^{2,3} Intraoperative meticulous hemostasis is important to prevent its occurrence. The use of a gelatin-thrombin matrix sealant (FloSeal, Baxter, Deerfield, IL, USA) may also prevent the occurrence of postoperative epidural hematomas.⁴ There is no consensus on whether or not a drainage tube should be placed after FED. Patients considered at high risk for hematoma formation, such as those with underlying medical problems or previous operative scarring, should have a drainage tube placed postoperatively. When drain was placed postoperatively, drainage was performed for 1–2 days. Even a small amount of hematoma formation could easily become symptomatic; therefore, continued drainage requires indwelling.

There are 2 types of postoperative hematoma: epidural hematoma and retroperitoneal hematoma. Ahn et al.³ reported that retroperitoneal hematoma occurred in 4 of 412 patients who underwent FED. Retroperitoneal hematoma is thought to be caused by puncture beyond the posterior vertebral line during the approach and damage to the terminal branch of the segmental artery. Coagulopathy and abnormal vascular motion have also been reported to be involved in the occurrence of this disease.

Great care should be exercised to avoid hemorrhagic complications in patients with medical problems, and an adequate technique for the transforaminal approach should be used.

2. Dural Tear

Intraoperative dural tears have been reported to occur at a frequency of 0.6%–6.9%.⁵ This can be caused by intraoperative drilling, epidural fat removal at the pituitary forceps, or inadvertent manipulation during the use of the Kerrison punch.⁶

If a dural injury can be recognized intraoperatively, it can be repaired on the spot; however, it may not be recognized intraoperatively and may be recognized several days after surgery as intractable radicular pain.

This may be due to the fact that a minor intraoperative dural tear may expand over time, causing root herniation and delayed appearance of symptoms. If symptoms improve immediately after surgery but worsen a few days later and magnetic resonance imaging (MRI) shows no evidence of recurrent disc herniation,

a dural tear should be considered. Therefore, changes in symptoms should be monitored several days after surgery.⁷

The gold standard method for repairing a dural tear is to perform open conversion followed by direct repair.⁷ If a dural tear occurs on the ventral side of the dura mater, repair by a transdural approach may be necessary. However, the change from endoscopic surgery under local anesthesia to open surgery to general anesthesia is disconcerting. Therefore, several endoscopic repair methods have been reported.^{8,9} Shin et al.⁸ reported a method of performing a primary suture repair during endoscopic lumbar spinal surgery. A double-arm needle was used to thread through the dura. After a single knotting of the suture thread outside the endoscope, an endoscopic curette was used to push the knotted thread in and close the dura.

Park et al.⁶ described a dural tear management algorithm for biportal endoscopic spinal surgery. Dural tears smaller than 4 mm were followed up with bed rest for 24 hours. A hard sealant was applied to the dural tears between 4 mm and 12 mm, and the patient was kept in the hospital for 24 hours for observation. For dural tears > 12 mm, the algorithm depends on the location of the dural tear. If the dural tear is located in the dural sac (zone 2) or in the descending root (zone 3) with a regular margin, repair is performed using a nonpenetrating clip, the patient is hospitalized for 48 hours of observation, and external lumbar drainage is considered. If the lesion is in the emerging root armpit (zone 1) or in zones 2 or 3 with an irregular margin, it is converted to open surgery and primary repair is performed.

When neurological deficits due to dural tears occur, they may be permanent if not treated at the appropriate time. If neurological deficit develops after surgery, it should be evaluated and managed appropriately.

3. Infection

In FED, the skin incision is small, a sterile environment is easily maintained, and potential sources of infection are eliminated, thus reducing the possibility of infection. Postoperative infection is rare.^{5,10}

Ahn and Lee¹¹ reported that postoperative spondylodiscitis occurred in 12 of 9,821 patients (0.12%) who underwent FED with a transforaminal approach. Laboratory markers, such as erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) levels, were found to be elevated in postoperative spondylodiscitis cases. But early-stage MRI, which was performed before the 5th postoperative day, did not show definite evidence of spondylodiscitis. The causes of spondylodiscitis include inappropriate intraoperative techniques (repeated needling, nee-

dle insertion at a steep angle, and frequent in-and-out movements of the endoscope instruments with a long operation). From the viewpoint of early response to complications, we believe that evaluation of postoperative symptoms is important, and if infection is suspected, measurement of CRP and ESR would allow for early recognition.

4. Nerve Root Injury

The frequency of worsening neurological symptoms (motor deficit, dysesthesia, and paresthesia) after FED has been reported to be 0.7%–3.1%.^{2,12–14} It occurs mainly during FED via a transforaminal approach. Neuropathy after FED is distinguished as nerve root injury or irritation² and is caused by improper manipulation of the sheath during surgery in the transforaminal approach. Intraoperative sheath manipulation causes pressure on the exiting nerve root, resulting in injury. In the transforaminal approach, if the surgical field is narrow, that is, if Kambin's triangle is small, the sheath may cause nerve sheath injury. Therefore, it is necessary to prevent the sheath from being subjected to nerve compression. Therefore, it is effective to perform surgery with a wider surgical field by partially drilling the facet to prevent complications.^{2,15}

Choi et al.¹⁶ measured the shortest distance between the root and facet surface at the lower disc margin level on a preoperative MRI and compared the results between groups in which extending nerve root injury occurred (the shortest distance between the root and facet surface at the lower disc margin level was 4.4 ± 0.8 mm for group A and 6.4 ± 1.5 mm for group B, with a significant difference between groups A and B). The authors recommend preoperative measurement of the exiting nerve root and facet surface at the lower disc margin level, and if they are short, switching to other surgical methods should be performed instead of FED. Ju¹⁵ also mentioned the need to change the approach angle and skin incision site depending on disc morphology. Thus, a detailed evaluation of preoperative images can help prevent complications.

If the exiting nerve root is close to the superior articular process, consider adding a foraminoplasty to prevent exiting nerve root injury due to sheath manipulation. Similarly, in the interlamina approach, it is necessary to consider methods to prevent root injury when the width of the interlamina is narrow.

If the herniated disc is located further away from the interlamina window, the cranial laminotomy for a shoulder type and upward migration or caudal laminotomy for downward migration. By performing bone removal until the lateral aspect of the traversing nerve can be seen, pressure on the root can be mini-

mized. Recently, a newly designed endoscope for lumbar spinal stenosis has been reported, which has a 5.7-mm working channel and is effective for bone removal, especially when the interlamina space is less than 8 mm.^{17,18}

Xie et al.¹³ reported that 15 of 479 patients who underwent full-endoscopic interlaminar lumbar discectomy and experienced postoperative paresthesia were treated with pregabalin, which significantly improved their symptoms at 8 weeks postoperatively. This led to the conclusion that postoperative paresthesia is a neuropathic pain, and it is reasonable to treat any occurrence of nerve root irritation as neuropathic pain.

5. Recurrent Disc Herniation

The frequency of disc herniation recurrence after FED has been reported to be approximately 3.6%,¹⁹ and care to prevent postoperative disc herniation recurrence is important to improve the postoperative outcomes.

Unlike microdiscectomy, FED does not require laminectomy. Therefore, the posterior elements were retained postoperatively. This is believed to prevent postoperative pressure buffering of the disc.²⁰

Risk factors for postoperative disc herniation recurrence in FED include old age (> 50 years), obesity (body mass index > 25 kg/m²), upper disc (L1/2, L2/3, and L3/4),¹⁹ male sex, heavy work, facet joint degeneration, and early ambulation.^{21,22} Qin et al.²² reported a significantly higher recurrence rate in early ambulation patients who were ambulated within 24 hours after FED, and the importance of time to first ambulation as a factor in postoperative recurrence.

Hao et al.²³ reported that patients with preoperative MRI showing moderate changes between the affected vertebrae had a higher frequency of recurrent disc herniation after FED surgery due to endplate degeneration, which causes the cartilaginous endplate to detach and protrude from the hernia.

Miller et al.²⁴ reported that in lumbar discectomy cases, recurrence of symptoms and reoperation are more common when the annular defect is 6 mm or larger.

Based on the association between annular defect size and symptom recurrence, Chen et al.¹⁷ proposed that if the annular defect is less than 6 mm, sequestrectomy with fragmentectomy is suitable without increasing the risk of recurrent disc herniation.

The annular sealing method is used to prevent recurrence by coagulating and shrinking the area around annular fissure with a bipolar coagulator and sealing the annular defect.^{17,25}

Wang et al.²¹ found that the average time to ambulation was significantly shorter in recurrent cases (17 days in the recurrent

Table 1. Summary of perioperative management in full-endoscopic discectomy

Preoperative	Intraoperative	Postoperative
Evaluation of preoperative imaging	1–2 Days of drain placement	• Bed rest for 24 hours
Determine the extent of bone removal to prevent nerve root injury.	Dural tear occurrence • Dural repair using endoscopy • Convert open surgery and direct repair	• Lumbar brace for 1 month • Weight control • Avoidance of heavy work and activity Consider MRI imaging and CRP and ESR monitors when postoperative symptoms worsen.

MRI, magnetic resonance imaging; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate.

group vs. 24 days in the normal group) and emphasized the importance of limiting postoperative upright activity. It is believed that external stress on the lumbar region and incorrect postoperative rehabilitation may influence recurrence, and weight control, avoidance of heavy work, and strengthening rehabilitation are recommended.

Patients with a risk factor for recurrent disc herniation or those who have undergone a Modic change require careful postoperative management.

CONCLUSION

Based on the above, we believe that the most manageable postoperative management after FED is prevention of recurrent disc herniation and hematoma formation. A drain should be placed to prevent postoperative hematoma formation. It is advisable to evaluate the patient's symptoms and monitor CRP and ESR levels during the first week after surgery. Postoperative antibiotics were administered for 1 day. Postoperative FED patients are allowed bed rest for 24 hours after surgery and then allowed to leave the bed with a lumbar brace. The lumbar brace was kept in place for 1 month after surgery (Table 1).

NOTES

Conflict of Interest: The authors have nothing to disclose.

Funding/Support: This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contribution: Writing - original draft: TH; Writing - review & editing: TH, YO.

ORCID

Takeshi Hara: 0000-0002-5124-5329

Yukoh Ohara: 0000-0002-1816-0219

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