Realizable Minimally Invasive 1-Day Lumbar Interbody Fusion Surgery: No General Anesthesia, No Hemovac Insertion, No Skin Suture Surgery, and Early Ambulation

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Objective: The lumbar interbody fusion surgery, patients commonly have severe pain, requiring adequate bed rest for a long time. We performed a 1-day minimally invasive spine (MIS) lumbar interbody fusion that required no hemovac insertion and no skin suture and led to early ambulation. Here, we report the surgical procedure and results. Methods: This study was designed as a retrospective review. From January 2013 to August 2014, 49 patients who received the MIS TLIF for 1-day MIS lumbar interbody fusion surgery were included in this study. The surgical procedures performed were as follows: (1) epidural catheter insertion; (2) midline subdermal dissection procedure; (3) MIS TLIF; (4) bleeding control procedure; (5) percutaneous transpedicular screwing; (6) tight subdermal plan suture; (7) skin sealing procedures. Postoperatively, wound dressing was not needed. Epidural catheter was removed on the second day after the operation. Results: Average intraoperative bleeding was 128.6 mL per level. The average operation time was 78.9 min. per level. An average midline skin incision was 2.8 cm per level. The possible ambulation time was 0.94 ±0.88 day. The discharge time after antibiotic injection for 3 days was 4.88±1.51 days. In the corresponding order of preoperative and immediate postoperative, 3-month, 6-month, and final follow-up, Postoperative VAS (back), VAS (leg) and ODI improved significantly immediate postoperatively (p<0.0001). Postoperatively, there was no cases of revision due to hematoma. Conclusion: The results indicated good clinical results of the 1-day minimally invasive lumbar interbody fusion surgery, without any serious complications.

Key Words: Minimally invasive, Transforaminal, Lumbar interbody fusion, 1-day surgery

INTRODUCTION

The incidence of degenerative spinal diseases that require lumbar interbody fusion surgery has increased with an increase in the elderly population. However, following lumbar interbody fusion surgery, patients commonly have severe pain and require long periods of adequate bed rest. Moreover, associated complications can occur, leading to a delay in rehabilitation.

An extensive body of research supports Minimally Invasive Surgical (MIS) techniques as effective in decreasing postsurgical morbidity and improving postoperative recovery."
care signified that the patients were not completely discharged from the hospital.

Ambulation is a critical aspect of rehabilitation and positively affects patients’ recovery. In fact, the main reasons patients stay in hospital are as follows: (1) postoperative pain management, (2) management and removal of any drainage tubes, and (3) postoperative wound care. Thus, if these procedures were unnecessary, true 1-day fusion surgery would be possible.

We performed a 1-day MIS lumbar interbody fusion that did not require Hemovac insertion or postoperative sutures and allowed early ambulation. Here, we report the surgical procedure and results.

**MATERIALS AND METHODS**

This study was designed as a retrospective review of clinical and surgical parameters. From January 2013 to August 2014, 49 patients who underwent 1-day MIS transforaminal lumbar interbody fusion (TLIF) surgery were included in this study.

All patients underwent MIS TLIF using an MIS retractor system (Tubular/Caspar/Taylor) and MIS decompression technique (unilateral decompression/bilateral decompression/unilateral approach bilateral decompression). Two cases were being treated for foraminal stenosis, one for recurrent Herniated Nucleus Pulposus (HNP), 13 for spinal stenosis, and 33 for spondylolisthesis.

1. Patients

This study examined surgeries conducted between January 2013 and August 2014 by reviewing the medical charts of 49 patients. Patients with spinal stenosis, spondylolisthesis, foraminal stenosis, or recurrent HNP were included in this study, all of which were in need of decompression, as well as pedicle screw fixation and fusion.

2. Operative techniques

Decompression was performed using the basic MIS TLIF procedure as described below.

3. Technique for MIS TLIF

The MIS TLIF procedure was performed on the symptomatic side. C-arm guidance was used to determine the disc space and to draw the lateral pedicle line in the fluoroscopic anterior posterior view. After a vertical skin incision in line with the lateral pedicle, after a complete facetectomy, the ligamentum flavum was removed to expose the lateral border of the ipsilateral nerve root. The retractor was angled medially. The patient was tilted laterally to decompress the contralateral side. Extensive decompression was performed, which included decompression of the central stenosis and contralateral side. A discectomy was also performed. A single, banana-shaped polyetheretherketone interbody cage filled with only autologous local bone was inserted. After interbody fusion, the retractor was removed, and the same procedure was repeated for each segment. Ipsilateral percutaneous pedicle screws were inserted through the same skin incision. Contralateral percutaneous pedicle screws were placed using a mirror incision under fluoroscopic guidance.

Additional surgical procedures performed were as follows:

1. Epidural catheter insertion for anesthesia and postoperative pain control: this allowed the procedure to be performed without general anesthesia and controls postoperative pain effectively such that patients can ambulate shortly after surgery.

2. Midline subdermal dissection procedure: this procedure can reduce the size of the skin incision, and the tension of the skin can reduce the risk of postoperative hematoma. Although it is a midline incision, dissection is performed at the subdermal level, and TLIF, decompression are performed via the paraspinus plane, PLIF, which comes in contact with the midline structure, can induce central accumulation of blood and eventually cause a postoperative hematoma (Fig. 1).

In addition, advances in MIS techniques for TLIF have reduced the incidence of complications and morbidity associated with conventional TLIF.

3. MIS TLIF procedure (unilateral/bilateral) (Fig. 2).
4. Percutaneous transpedicular screw insertion under the subdermal dissection plane (Fig. 3).
5. Blood loss control procedure: limiting blood loss is the most crucial step, as hemostasis is a key aspect in 1-day fusion surgery. Our procedures included the following: (A) meticulous bleeding control; (B) fibrinogen/thrombin-based collagen fleece bleeding control; (C) fluid-type anti-adhesive agent, which can stop venous bleeding using hydrostatic pressure; and (D) Gelfoam® covering, which acts as a barrier that stops bleeding that occurred outside the spinal canal, i.e., from the muscle, from coming into the canal (Fig. 4).
6. Tight subdermal plane suture (conjoined suture of split fascia and subdermal skin) (Fig. 5).
RESULTS

We examined surgery-related results, the intraoperative and postoperative conditions, postoperative complications, and clinical results by using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) immediately (1-2 days), and 1 month, 3 months, 6 months, and 12 months postoperatively.

1. Demographics

The mean age was 65.27±9.57 years, and the sex ratio was 20:29 (male:female). The average follow-up period was 26.04±7.25 months.

Regarding the number of segments involved in the operation, 33 patients underwent one segment; 13 patients, 2 segment; and 3 three patients, 3 segment operation (average: 1.39±0.61 segment).

2. Clinical outcomes

Average intraoperative bleeding was 178.47±73.70 mL (per level: 128.60 mL). The average operation time was 109.49±32.71 min (per level: 78.90 min). Average midline skin incision length was 3.90±1.18 cm (per level: 2.80 cm).

The possible ambulation time was 0.94±0.88 day. The discharge time after 3 days’ antibiotic administration was 4.88±1.51 days.

The VAS (back) were as follows: 6.33±0.94, 3.14±1.12, 2.47±0.58, 2.29±0.65, and 2.31±0.77; VAS (leg): 7.37±0.70, 2.69±0.85, 2.29±0.46, 2.14±0.58, and 2.24±0.80; and ODI: 39.37±3.05, 29.29±5.78, 22.59±2.99, 20.27±2.59, and 18.63±3.13 for the preoperative, immediate postoperative, and 3-month, 6-month, and 12-month follow-up values, respectively. Postoperative VAS (back), VAS (leg), and ODI improved significantly immediately postsurgery (p<0.0001) (Table 1).

In terms of postoperative complications, there were two cases of transient motor weakness (both cases recovered sufficiently after the follow-up period), four requiring wound suture due to avulsion of the surgical field (all cases healed completely after the follow-up period), one of dural tear, and two of cage subsidence or implant failure. No cases required revision due to hematoma.

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<th>Table 1. Patient clinical outcomes</th>
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7) Skin sealing procedures: secure skin and zip surgical skin closure systems (Fig. 6).

A postoperative wound dressing was not needed. The wounds were checked every 3-4 days. The epidural catheter was removed on the second day after the operation. Intravenous antibiotics were administered for 3 days after the operation.

Epidural catheter insertion enables additional pain control. Even if an IV PCA is used, patients experience the most severe pain during the first two days post-operatively, which can be controlled continuously via the epidural catheter.

Fig. 3. Percutaneous transpedicular screw insertion.

Fig. 4. Blood loss control procedure (fibrinogen fleece, fluid type antiadhesive agent, Gelform barrier).

Fig. 5. Conjoined suture of fascia and subdermal skin.

Fig. 6. Skin and zip surgical skin closure systems.
3. CASE

56-year-old male who visited the hospital for severe, radiating low back pain and neurogenic claudication present for more than a few months. The 1-day postoperative MRI showed sufficient decompression with MIS TLIF. The patient was capable of walking by the afternoon on the day of surgery. He was capable of discharge after 1 postoperative day (Fig. 7-12).
ultimately, postoperative complications are minimized, leading to effective rehabilitation. National Health Insurance systems differ for each country, so there would be practical differences, but minimally invasive procedures should be studied to develop such surgical techniques.

Many physicians consider Gelfoam® as a foreign body and worry about mass effect and infection from leaving Gelfoam at the laminectomy site. Although there were no postoperative infections in the present study, the possibility of other issues that may be revealed in a larger number of cases should be noted.

Furthermore, this study did not distinguish patients using anticoagulants, thus did not develop a separate protocol: this should be addressed in the future as well. In addition, preoperative assessment items for 1-day fusion surgery should also be elaborated.

**CONCLUSION**

The results indicated good clinical results for the 1-day minimally invasive lumbar interbody fusion surgery without any serious complications. With the development of an effective infection control system for the lumbar interbody fusion surgery, an effective true 1-day lumbar interbody fusion surgery will be possible.

**REFERENCES**