Journal of Clinical Neuroscience 21 (2014) 431–435

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical Study

Disc herniation in the thoracolumbar junction treated by minimally invasive transforaminal interbody fusion surgery

Jian Wang *, Yue Zhou, Zheng Feng Zhang, Chang Qing Li, Wen Jie Zheng, Bo Huang

Department of Orthopaedic Surgery, Affiliated Xinqiao Hospital, The Third Military Medical University, 2 Xinqiao Street, Shapingba District, Chongqing 400037, People's Republic of China

ARTICLE INFO

Article history:
Received 24 December 2012
Accepted 13 April 2013

Keywords:
Disc herniation
Minimally invasive spine surgery
Thoracolumbar junction
Transforaminal lumbar interbody fusion

ABSTRACT

Minimally invasive surgery-transforaminal lumbar interbody fusion (MIS-TLIF) has demonstrated efficacy in the treatment of lumbar degenerative diseases. Use of this procedure for thoracolumbar junction disc herniation remains challenging. Reports concerning MIS-TLIF at the thoracolumbar junction are rare. Thus, we performed a retrospective analysis of the clinical outcomes of 10 patients with thoracolumbar junction disc herniation treated by MIS-TLIF between December 2007 and October 2010. The purpose of this study was to investigate the efficacy and safety of MIS-TLIF for disc herniation in the thoracolumbar junction. Clinical and radiological data were collected and analyzed. Fusion levels included T12–L1 (two patients), L1–L2 (four patients) and L2–L3 (four patients). Clinical outcome was assessed using the Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI). The average follow-up period was 39.2 months, with a minimum of 24 months. The mean ± standard error of the mean of the operative time, intraoperative blood loss, and x-ray exposure were 128 ± 36 minutes, 204 ± 35 mL, and 43 ± 12 seconds, respectively. The VAS for back and leg pain decreased significantly postoperatively from 6.4 ± 2.7 to 1.5 ± 0.6 ($p < 0.01$), and from 7.1 ± 2.4 to 1.3 ± 0.4 ($p < 0.01$) respectively, as did the ODI from 39.3 ± 11.2 to 16.5 ± 4.7 ($p < 0.01$). Bone fusion was observed in eight patients. There were no other major complications at last follow-up. MIS-TIF is a safe and effective procedure for disc herniation in the thoracolumbar junction. Occurrence of non-union is relatively high compared to previous findings.

1. Introduction

The minimally invasive surgery-transforaminal lumbar interbody fusion (MIS-TLIF) technique has been reported to reduce the iatrogenic soft tissue injury that occurs with muscle stripping and retraction during routine posterior spinal exposure [1–5]. The potential advantages of minimally invasive surgical procedures include less soft tissue injury, decreased blood loss, decreased hospital length of stay, and earlier recovery while resulting in clinical outcomes similar to the equivalent open procedure. The efficacy of MIS-TLIF techniques in patients with disc herniation of the thoracolumbar junction requires further investigation.

Disc herniations at the T12–L1, L1–L2 and L2–L3 levels constitute less than 5% of all lumbar disc herniations [6–8] and the outcomes at these levels are less satisfactory than those recorded for the lower lumbar spine [9]. The conventional posterior approach requires extensive resection of the facet joint to obtain adequate exposure of the herniated disc fragment, which may result in instability, predisposing the patient to sustained back pain and a high risk of neural injury [10]. The anterolateral retroperitoneal approach with or without fusion is still associated with many complications [11]. To our knowledge, no study on the treatment of thoracolumbar junction disc herniation using MIS-TLIF has been reported.

2. Materials and methods

From December 2007 to October 2010, 10 consecutive patients with a mean age of 45.1 years (range, 27–61) with disc herniation of the thoracolumbar junction were treated with the Quadrant retractor system and Sextant pedicle screw system (Medtronic Sofamor Danek, Memphis, TN, USA). These patients with high level disc herniation presented with back pain and varying degrees of radiating pain, neurological deficits, or a combination of these. Patients complained of pain in the buttocks (n = 3), posterior and posterolateral thigh (n = 3), anterior aspect of the thigh (n = 2), anterolateral aspect of the thigh (n = 2), calf (n = 1), and foot dorsum (n = 1). No sphincter dysfunction occurred in this series. Fusion levels included T12–L1 in two patients, L1–L2 in four patients and L2–L3 in four patients. Patients with significant

* Corresponding author. Tel.: +86 023 6877 4082.
E-mail address: tonywjxq@yahoo.com.cn (J. Wang).

0967-5868/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.jocn.2013.04.029

spondylosis or ossification of the ligamentum flavum or large, central, broad based and calcified disc herniations were excluded from this study. All MIS-TLIF procedures were performed by the first author. The patients' demographic characteristics and the procedure performed are listed in Table 1.

2.1. Surgical technique

After induction of general anesthesia, patients were positioned prone on a radiolucent frame. A 3 cm longitudinal incision was made for placement of the Quadrant retractor system. The level of disc to be operated was checked by intraoperative fluoroscopy. The facet joint was removed from lateral to medial aspects of the intervertebral foramina using a punch. Complete resection of the zygapophyseal joints and partial laminectomy were performed in order to gain sufficient exposure of the discs and avoid retraction of the dural sac. After identifying the lateral border of the dural sac and exiting nerve root, a discectomy was performed using instrumentation including curettes, pituitary rongeurs and Kerrison rongeurs without retraction of the dural sac. Care was taken to prevent compression or injury to the cranial wad of soft tissue containing the exiting nerve root. Interbody distractors were introduced in the disc space. Autologous bone graft obtained from the removed facet and lamina, or allograft (if needed) was packed in the anterior disc space. A single PEEK cage (Capstone; Medtronic Sofamor Danek) was inserted obliquely across the disc space. If the disc space was too narrow, no cage was inserted. Unilateral full facetectomy was chosen on the symptomatic side. No patients presented bilateral leg pain or numbness in this study.

After the Quadrant system was removed, the pedicle entry point was able to be palpated with the surgeon's index finger within the same incision. A modified cannulated needle (used for percutaneous verterbroplasty) was advanced through the pedicle into the vertebral body under fluoroscopic guidance, followed by insertion of a blunt-tipped guide wire into the ventral third of the vertebral body and tapping of the screw path. Using the percutaneous pedicle screw system, the appropriately sized cannulated M-8 pedicle screws were placed along the guide wire into the pedicle under fluoroscopic guidance. A representative procedure is shown in Fig. 1.

2.2. Clinical and radiological evaluation

Operative time, intraoperative blood loss and x-ray exposure time were collected. Patients underwent postoperative radiographs prior to discharge. They were followed up at 1, 3, and 12 months, and then annually. In addition to radiographic analysis, the postoperative follow-up evaluation included a telephone interview with the first author of this study and a visit to the outpatient clinic.

Back and leg pain was quantified by Visual Analog Scale (VAS) scores collected from the patients preoperatively and at last follow-up. Version 2.0 of the Oswestry Disability Index (ODI) was used both before and after surgery to inform the surgeon about the effect of leg or back symptoms on the ability to manage in everyday life. The question regarding sex (Section 8) is unacceptable in our culture, and most patients are reluctant to answer this section; therefore, it was omitted in this study. Thus the total possible score was 45.

Preoperative radiological evaluation included anteroposterior and lateral plain radiographs, CT scans and MRI. Fusion rates were assessed by an independent radiologist using 1 mm thin-slice CT scans at last follow-up. Definitive fusion was identified by formation of trabecular bony bridges between contiguous vertebral bodies at the instrumented levels.

Table 1
Demographic data and clinical presentation of 10 patients who underwent minimally invasive surgery-transforaminal lumbar interbody fusion

Patients (n)	10
Mean age ± standard deviation (years)	45.1 ± 13.6
Male:Female (% male)	4:6 (40.0)
Symptoms and signs [n (%)]	
Back pain	10 (100.0)
Radicular pain	8 (80.0)
Leg numbness	2 (20.0)
Motor or sensory deficit	7 (70.0)
Knee reflex change	5 (50.0)
Positive femoral stretch test	9 (90.0)
Level of fusion [n (%)]	
T12–L1	2 (20.0)
L1–L2	4 (40.0)
L2–L3	4 (40.0)

2.3. Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS, Chicago, IL, USA). Data are shown as mean ± standard error of the mean. Student's *t*-test was used for the comparison of continuous variables. p values below 0.05 were accepted as significant.

3. Results

Ten patients who had undergone MIS-TLIF in our department were analyzed. The study included four men and six women with a mean age of 45.1 years (range, 27–61 years). Average follow-up time was 39.2 months (range, 24–55 months). The mean operative time, intraoperative blood loss, and x-ray exposure time were 128 ± 36 minutes, 204 ± 35 mL, and 43 ± 12 seconds, respectively. At the time of last follow-up, the VAS for back pain and leg pain decreased from 7.1 ± 2.2 to 1.6 ± 0.5 and from 7.1 ± 2.4 to 1.3 ± 0.4, respectively, as did the ODI scores from 40.3 ± 8.7 to 13.9 ± 5.3. The differences in these preoperative and postoperative outcome variables were statistically significant ($p < 0.01$). The preoperative and postoperative clinical outcomes are shown in Table 2. All 10 patients had postoperative CT scans and eight showed bridging fusion. Both patients who did not demonstrate bridging fusion refused revision surgery because they had no back or leg pain. There were no other major complications related to the surgery, including pedicle screw malpositioning, spinal cord or nerve root injury, dural tear or infection.

4. Discussion

The goal of minimally invasive spinal surgery is to achieve the same objectives as the comparable open procedure via a less traumatic approach. Although lessening the approach-related morbidity is a primary aim of minimally invasive spine surgery, this must be accomplished without compromising the efficacy of the procedure or increasing the risk of the complications. MIS-TLIF is a relatively new technique attracting increased interest among less invasive surgical fusion techniques [1–4]. We have previously reported a clinical comparative study on MIS-TLIF for lower back degenerative diseases as primary and revision surgery [12,13]. MIS-TLIF is a safe and effective procedure for treatment of spondylolisthesis (less than grade 2) and selected revision procedures in patients previously treated by open surgery with some potential advantages. To our knowledge, however, no reports have been published on using MIS-TLIF for disc herniation of the thoracolumbar junction. The decreased visualization and requirement of