



## Unilateral transforaminal lumbar interbody fusion (TLIF) using a single cage for treatment of low grade lytic spondylolisthesis

Mohamed Adel EL MASRY, Hisham KHAYAL, HOSSAM SALAH

From Cairo University Teaching Hospitals, Cairo, Egypt, and Ali Omar Askar Neurospinal Centre, Libya

The authors conducted a prospective study on 30 patients with low grade lytic spondylolisthesis, who underwent unilateral transforaminal lumbar interbody fusion (TLIF) using a single cage with adjunctive pedicular fixation. There were 17 males and 13 females with a mean age of 39.5 years. The mean follow-up period was 32 months. The overall clinical results were excellent or good in 90% of the patients. Fusion was solid or probable in 91%. Three patients presented initially with a motor deficit ; one of them did not recover.

According to the literature this technique yields a shorter operative time, less blood loss, less need for intensive care, shorter hospital stay, lower hospital cost and less complications than other techniques for interbody fusion. It is safe and reliable in patients with low grade lytic spondylolisthesis.

**Keywords :** transforaminal ; unilateral ; interbody fusion ; single cage ; spondylolisthesis.

The initial management of the condition is conservative. When this is deemed to have failed, surgery is considered.

Posterolateral fusion has long been considered the “gold standard” for surgical treatment of adult spondylolisthesis. Superior results have subsequently been reported with interbody fusion with cages and posterior instrumentation (3). Transforaminal lumbar interbody fusion (TLIF) is an alternative technique which avoids the ventral approach ; theoretically it prevents typical complications, such as those seen in anterior and posterior lumbar interbody fusion (8). Unilateral TLIF with adjunctive pedicular fixation is one variation of the interbody fusion technique that requires less dissection and minimizes nerve root manipulation compared with other interbody fusion methods (4).

The purpose of this study was to prospectively evaluate the clinical and radiological results of a

### INTRODUCTION

Lytic spondylolisthesis is a common condition, which occurs most frequently in the lower lumbar spine. The extent of the slip is usually graded using the Meyerding classification (10) in which the displacement of one vertebral body on another is divided into four equal parts. Grades I and II, which represent up to 25% and 50% displacement respectively and which cover the majority of cases, are referred to as low-grade slips.

■ Mohamed A. El Masry, Assistant Professor of Trauma and Orthopaedic Surgery.

■ Hossam Salah, Assistant Professor of Trauma and Orthopaedic Surgery.

*Cairo University Teaching Hospitals, Cairo, Egypt.*

■ Hisham Khayal, Consultant Neurosurgeon.

*Ali Omar Askar Neurospinal Centre, Libya.*

Correspondence : Mohamed Adel El Masry, 64 Mosadek Street, Dokki, Giza, Egypt.

E-mail : drmedoelmasry@yahoo.co.uk

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**Fig. 1.** — Preoperative MRI showing a low grade lytic spondylolisthesis L4L5.

unilateral TLIF using a single cage with adjunctive pedicular fixation in the management of low grade lytic spondylolisthesis.

### MATERIALS AND METHODS

This is a prospective study of 30 consecutive adult patients with a low-grade lytic spondylolisthesis (fig 1) who underwent a unilateral TLIF (fig 2a,2b), using a single obliquely seated cage with adjunctive pedicular fixation, between 2003 and 2005. There were 13 females and 17 males. The average age at surgery was 39.5 years (range 27 to 51 years). The mean follow-up was 32 months (range 26 – 38 months). Twenty-seven patients had a single-level and 3 a two-level TLIF. A total of 33 levels were treated : 20 out of 33 at the L4/L5 level, 11 at the L5/S1 level, and 2 at the L3/L4 level.

All patients were assessed with a full history and detailed clinical evaluation ; all had plain radiographs and MRI of the lumbar spine. Every patient had persist-

ent complaints of low back and leg pain since at least six months despite conservative treatment. In addition, three patients (10%) presented with a motor deficit. Patients were excluded from the study if they had had previous lumbar spine surgery, were involved in medicolegal claims or had other spine or hip pathology which might have contributed to their symptoms.

All patients underwent general anaesthesia with endotracheal intubation. They were positioned in the prone position on a Montreal frame. A standard midline posterior exposure was performed. Pedicle screws were inserted at the desired levels in the routine fashion. By excising the distal part of the superior facet above the level of the pedicle and the lateral part of the ligamentum flavum, the intervertebral foramen became widely exposed. The loose posterior element was removed in toto. The exiting nerve root was then identified, and protected. A unilateral posterior annulotomy was performed gaining access to the interior of the disk space. Various disk spreaders allowed distraction of the disk space to regain disk height. Distraction was then maintained by a distractor across the pedicle screws. Using a variety of instruments the disk space was totally cleared of disk material down to the bony end plates. Bone grafts, taken from the posterior elements, fashioned into small pieces and augmented with synthetic bone grafts, were then inserted into the disk space with a specially designed graft delivery tube. The grafts were then carefully impacted into the disk space along the anterior and lateral aspects of the annulus fibrosus. A single Peek cage (Capstone, Medtronic, Minneapolis, Minnesota, USA) of appropriate size was mounted on the introducer and gently pushed into the disk space with a light mallet at an angle of 45 degrees. Final reduction was achieved by tightening the reduction screws over the rods. An element of compression over the cage was added at the final tightening. Intertransverse grafting was also performed (fig 2). Closure was finally performed in layers in the routine fashion over a suction drain.

All patients had prophylactic antibiotic cover for 24 h. The drains were removed at 48 h. All patients were mobilized in a lumbosacral orthosis. They were routinely discharged from hospital one week postoperatively, and reassessed in the clinic at 6 weeks. They were routinely reviewed and radiographically checked at 3 months, 6 months and 12 months postoperatively.

### Clinical outcome

All patients completed a visual analogue scale (VAS) (7) at their initial visit before surgery and again at the



Fig. 2. — Unilateral transforaminal lumbar interbody fusion (TLIF). a : Anteroposterior view ; b : lateral view

latest follow-up after surgery. Use of pain medication before and after surgery was compared. Return to work was evaluated as a percent of working capacity (at the latest follow-up evaluation) of the premorbid occupation as estimated by the patient (100%, 75%, 50%, 25%, 0%). For ladies who were not employed, the ability to perform house work was used to assess their functional outcome postoperatively.

Results were classified into three categories (excellent and good, fair, and poor) using the Parker *et al* criteria (12). A good or excellent result means a VAS less than or equal to 4, no medication or NSAID only, and return to more than 75% of premorbid work capacity. A fair result means that VAS is more than 4 and less than or equal to 6, occasional use of narcotics, and more than 50% of previous work capacity. A poor result means a VAS above 6, daily narcotics, and less than 25% of previous work capacity.

#### Radiographic fusion

Radiographic fusion at the interbody levels was assessed and graded into five grades according to the cri-

teria described by Brantigan and Steffee (1): Grade 1 means obvious radiographic pseudarthrosis; grade 2: probable radiographic pseudarthrosis; grade 3: radiographic status uncertain; grade 4: probable radiographic fusion; grade 5: radiographic fusion.

#### RESULTS

There were no intraoperative problems. One patient developed a superficial wound infection which resolved after débridement and treatment with antibiotics. Another patient complained of transient paraesthesiae along the L4 root, but they completely resolved one month after surgery. Three patients presented initially with a motor deficit. At the latest follow-up, two of them had complete recovery, while the third showed no recovery.

The overall clinical outcome according to the Parker *et al* (12) scale was as follows:

27 patients (90%) were rated as excellent or good, while 3 patients (10%) were rated as fair. No

patient was rated as poor. The radiological outcome, according to the criteria of Brantigan and Steffee (1) was as follows : 14 out of 33 levels, or 42.5%, were rated as grade 5 ; 16 or 48.5% as grade 4 ; and 3 or 9% as grade 3.

## DISCUSSION

The advantage of anterior column support and fusion in addition to pedicle fixation in patients with degenerative spinal disorders has become more and more clear. With the increase in popularity of this treatment, a variety of techniques has been developed (9,14). Anterior Lumbar Interbody Fusion (ALIF), Posterior Lumbar Interbody Fusion (PLIF), and combined anterior-posterior spinal procedures are gaining wide acceptance for the treatment of selected patients with segmental spinal instability and spondylolisthesis (4).

TLIF is an alternative technique which avoids the ventral approach ; it can theoretically prevent typical disadvantages, such as those seen in anterior and posterior lumbar interbody fusion (8). Whitecloud *et al* (15) and Hee *et al* (5) compared TLIF with combined anterior and posterior fusion. They found that TLIF patients had a shorter operative time, less blood loss, lower need for blood transfusion, lower need for postoperative intensive care, shorter hospital stay and lower hospital cost compared to single stage anterior and posterior fusion. Humphreys *et al* (6) compared Posterior Lumbar Interbody Fusion (PLIF) and TLIF. They concluded that TLIF had a much lower complication rate than PLIF. Brislin and Vaccaro (2) have reported upon the lower risk of nerve tethering in TLIF compared to the more traditional PLIF.

The results of TLIF have been widely described in the literature. Rosenberg and Mummaneni (13) reported on a series of 22 patients, with a good and excellent outcome in 21 and with minimal complications. Moskowitz (11) particularly stressed the early mobilization and short hospital stay following the procedure. The unilateral TLIF procedure with adjunctive pedicular fixation is one variation of an interbody fusion technique that requires less dissection and minimizes nerve root manipulation compared with other interbody fusion methods (4).

Lowe *et al* (9) reported upon 40 patients who underwent a unilateral portal TLIF using two cages ; they noted 85% good and excellent clinical results, with 90% radiological fusion. To the best of the authors' knowledge, this is the first series to report upon both the clinical and radiological results of a unilateral TLIF using a single cage with adjunctive pedicular fixation in the management of low grade lytic spondylolisthesis. The overall clinical outcome achieved in this study was 90% excellent or good results. The fusion was solid or probable in 91% of the patients, with minimal complications. These results are comparable to the results of PLIF and TLIF using single or double portals of access to the disc space. By using a unilateral transforaminal access with the insertion of a single cage it was possible to achieve restoration of disc space height, segmental lordosis, and reduction of spondylolisthesis with its biomechanical advantages. These were achieved with less dural retraction and less trauma to the spinal canal. Another advantage of a single cage is that it allows to insert more bone grafts into the disc space outside the cage, which may theoretically increase the grafting area resulting in a higher fusion rate.

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