



## Early removal of a Maverick disc prosthesis : surgical findings and morphological changes

Jens FRANÇOIS, Ronald COESSENS, Philippe LAUWERYS

*From the University Hospital, Leuven and the A.Z. Jan Palfijn, Gent, Belgium*

We report the case of a patient who underwent explantation of a Maverick total disc prosthesis at the L5S1 level because of severe persisting pain one year after initial implantation. Dynamic radiographic imaging studies showed good position and size of the prosthesis and no evidence of loosening. Intraoperatively residual mobility at the proximal bone-prosthesis interface was detected, as well as gross metallosis around the articulation of the total disc prosthesis. A safe and straightforward technique for the extraction of a Maverick prosthesis using a hooked instrument to hook-on the keel of the device is reported. After removal of the device, an anterior lumbar interbody fusion with subsequent posterior pedicle screw fixation and posterior bone grafting with autologous iliac bone was performed (360° fusion). During this posterior procedure, severe L5S1 facet joint arthrosis was observed. Early clinical and radiographic results were good with excellent patient satisfaction.

**Keywords** : total disc replacement ; prosthesis ; lumbar spine.

### INTRODUCTION

Despite growing experience with lumbar total disc replacement (TDR), few reports have emphasised the complications and revision strategies for the different artificial disc designs (7, 9). In particular, the problem of severe back pain after a lumbar TDR is poorly understood. This case report

describes a patient with severe pain after implantation of a Maverick TDR. Technical investigations showed no gross abnormalities. Surgical exploration revealed a “pseudarthrosis” of the cranial endplate of the prosthesis, metallic debris around the prosthesis, and facet joint arthrosis and osteonecrosis. The extraction technique and conversion to a fusion are discussed.

### CASE REPORT

A 36-year-old female teacher suffering from low back pain for several years, failed to improve with conservative treatment by means of physical therapy and pain medication.

An MRI scan showed monosegmental disc degeneration at the L5S1 level (fig 1). CT and MRI

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■ Jens François, MD, Orthopaedic Surgeon, Fellow Spine Surgery.

■ Philippe Lauweryns, MD, PhD, Orthopaedic Surgeon.  
*Department of Orthopaedic Surgery, University Hospital, Leuven, Belgium.*

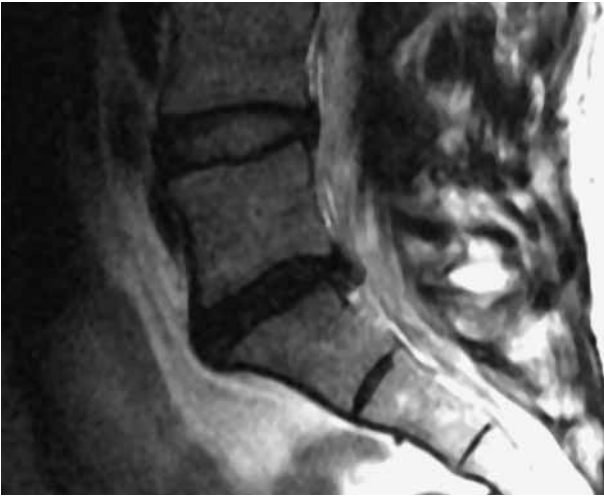
■ Ronald Coessens, MD, General Surgeon.  
*Department of Spinal Surgery, A.Z. Jan Palfijn, Gent, Belgium.*

Correspondence : Philippe Lauweryns, Department of Orthopaedic Surgery, University Hospital Leuven, 1 Weligerveld, 3212 Leuven, Belgium.

E-mail : philippe.lauweryns@uz.kuleuven.ac.be.

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*Fig. 1.* — Sagittal T2 weighed image of the lower lumbar spine, showing isolated discopathy at the L5/S1 level.

scan confirmed the absence of facet joint degeneration (fig 2).

A Maverick metal-on-metal TDR was implanted at the L5/S1 level through a left retroperitoneal approach in another institution. The operation was performed in September 2004 by a surgeon experienced in disc arthroplasty.

The position of the Maverick TDR on post-operative radiographs was in accordance with the criteria reported in the literature (4) : it was well centered on the AP radiographs (i.e. the keel projected 0 to 9% from the midline) and on the lateral films it was within 7 mm of the posterior edge of the inferior vertebral body of the segment (fig 3).

Post-operatively the patient continued to experience low back pain. Epidural injections, facet joint infiltrations and radiofrequency treatment of the lower lumbar ganglia were performed, but the pain progressively increased.

Therefore 9 months after the index operation, she consulted our department. Clinical evaluation revealed pain at the lumbo-sacral level upon palpation and mobilisation in all directions. Neurological examination was normal. As mentioned earlier, radiographic imaging showed a correct position and size of the prosthesis. Conservative treatment consisting of symptomatic pain therapy and physiotherapy was advised.

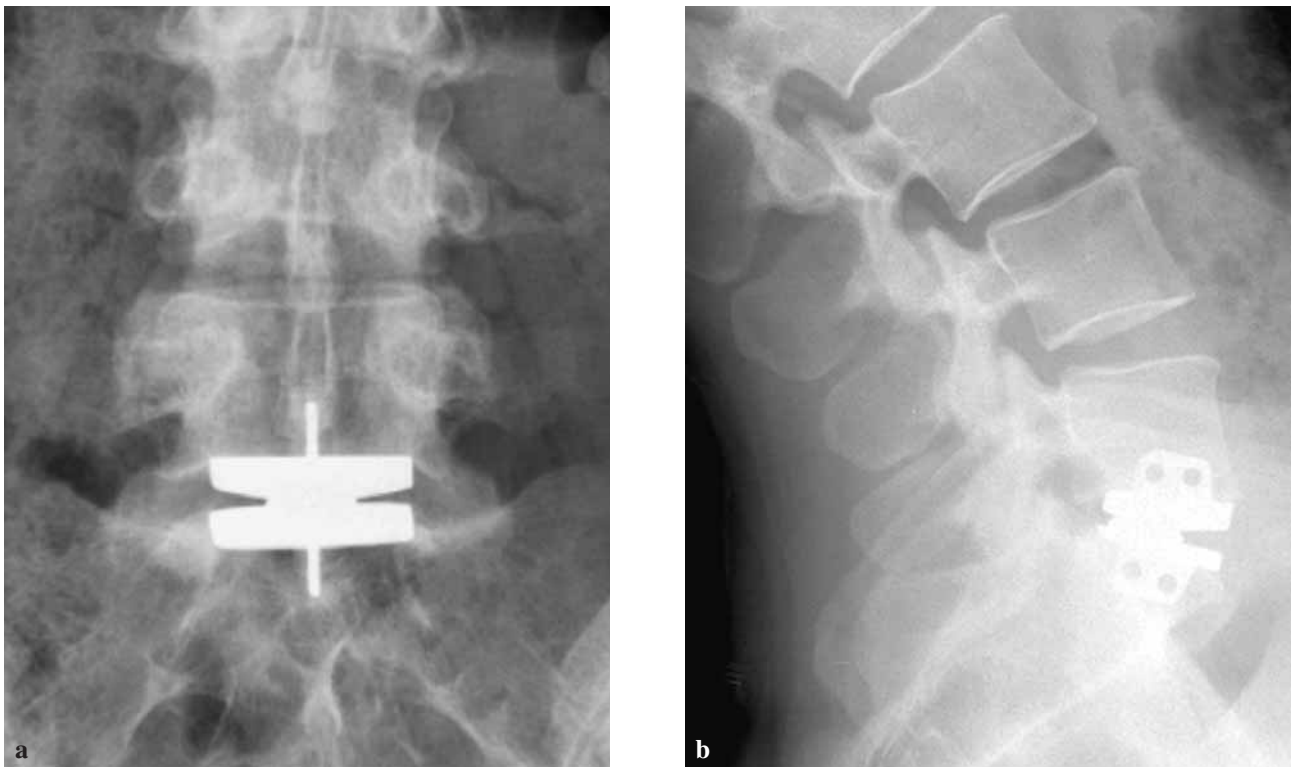


*Fig. 2.* — Axial MRI image at the L5/S1 level showing normal facet joints and some fatty infiltration of the posterior muscles.

After 3 months she returned to our clinic without any improvement of the pain. Subsequently brace therapy with a lumbosacral orthosis with a thigh extension was instituted. This resulted in considerable pain relief, allowing her to stop using analgesics. Although the use of bracing as a predictor for outcome in lumbar fusion surgery remains debated, in the authors' opinion a positive response to the immobilisation by bracing can be interpreted as an indication for a possible mechanical cause of the pain.

Although loosening or abnormal movement of the prosthesis were not apparent on dynamic radiographic examination, a revision procedure was proposed based on the former findings. The patient consented to a new operation with the intention to explore the TDR for signs of loosening and possibly to remove the total disc prosthesis and perform a 360° arthrodesis of the L5/S1 segment.

On December 1, 2005 she was operated in our department. The patient was installed supine on a Jackson operating table and prepared for anterior spinal surgery. A transperitoneal approach was elected considering the former left retroperitoneal approach. The prosthesis was identified and exposed without any vascular or visceral compromise. Clear movement at the superior vertebral endplate-prosthesis interface could be elicited,



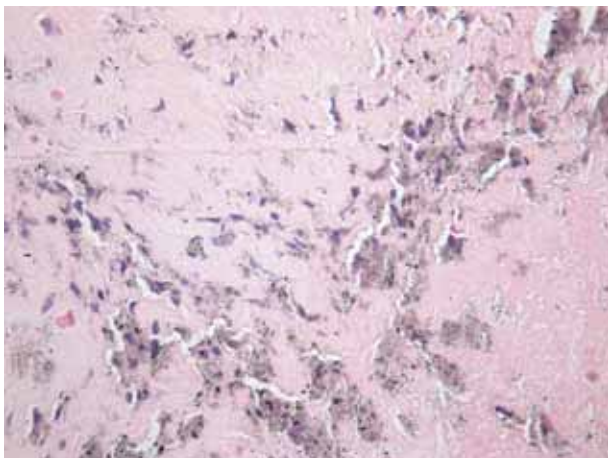
**Fig. 3.** — Dynamic radiographs of the lumbar spine in AP (a) and lateral (b) projection. Flexion/extension images show a good size and position of the Maverick total disc prosthesis, as well as a good mobility. There is no evidence of loosening or motion at the bone-prosthesis junction.

while no movement could be detected at the S1 end plate junction. In between both prosthesis components (i.e. around the ball-and-socket joint) a dark coloured, fibrous tissue was found, which was removed for biopsy. The microscopic examination showed metallosis (fig 4).

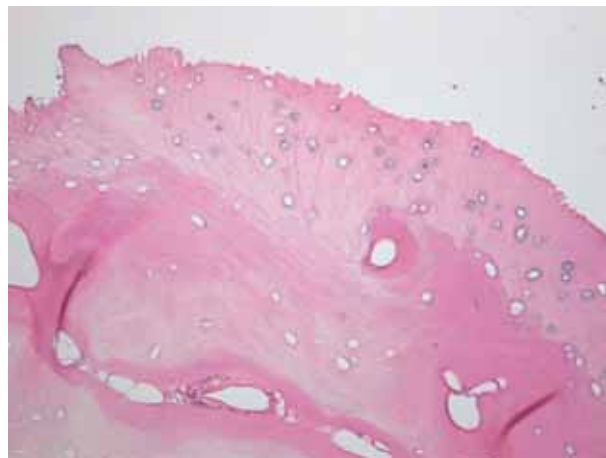
In order to remove the proximal component, a small cortical window centered over the keel of the prosthesis was made on the anterior L5 vertebral surface. Additionally a small amount of cancellous bone was removed as well, exposing the anterior part of the keel. Using a hooked cement extraction instrument (Protek, Münsingen-Berne, Switzerland), the keel could be “hooked on” through the anterior hole and the proximal component was removed easily. There were no signs of bony ingrowth at the prosthesis endplate. The distal prosthetic endplate was separated from the bone by use of small chisels and was removed uneventfully.

After removal of the prosthesis, a carbon-fibre reinforced ALIF cage (Co-Ligne, Zurich, Switzerland) measuring 15 mm in height and incorporating 11 degrees of lordosis, filled with autologous bone graft harvested from the anterior iliac crest, was introduced. Minor irregularities in the end plate – cage interface were filled up using loose cancellous bone grafts. Cage positioning and stability were very satisfactory.

Subsequently, after routine anterior wound closure, the patient was turned over into the prone position and draped for posterior stabilisation with pedicle screws and bone grafting (using autologous bone grafts that were harvested from the iliac crest during the anterior procedure). During this uneventful procedure, both L5-S1 facet joints were noted to show significant arthrosis. Microscopic examination of these facet joints confirmed major cartilage damage, exposure of



**Fig. 4.** — Microscopic image ( $\times 20$ ) of fibrous tissue surrounding the ball-and-socket joint of the total disc prosthesis : scar tissue with deposits of black pigment : metallosis.



**Fig. 5.** — Microscopic (b) ( $\times 20$ ) image of the inferior L5 facet joint, showing gross cartilage defects and microscopically confirmed focal bone necrosis.

subchondral bone and evidence of subchondral osteonecrosis (fig 5).

The post-operative radiographs are illustrated in figure 6.

There were no postoperative complications and 10 days later the patient was discharged from hospital using standard post-operative analgesics. She was advised to continue wearing an LSO brace with thigh extension for the next 3 months. During this first 3-months follow-up period, she experienced significant pain relief and she was very happy with the (preliminary) clinical result.

## DISCUSSION

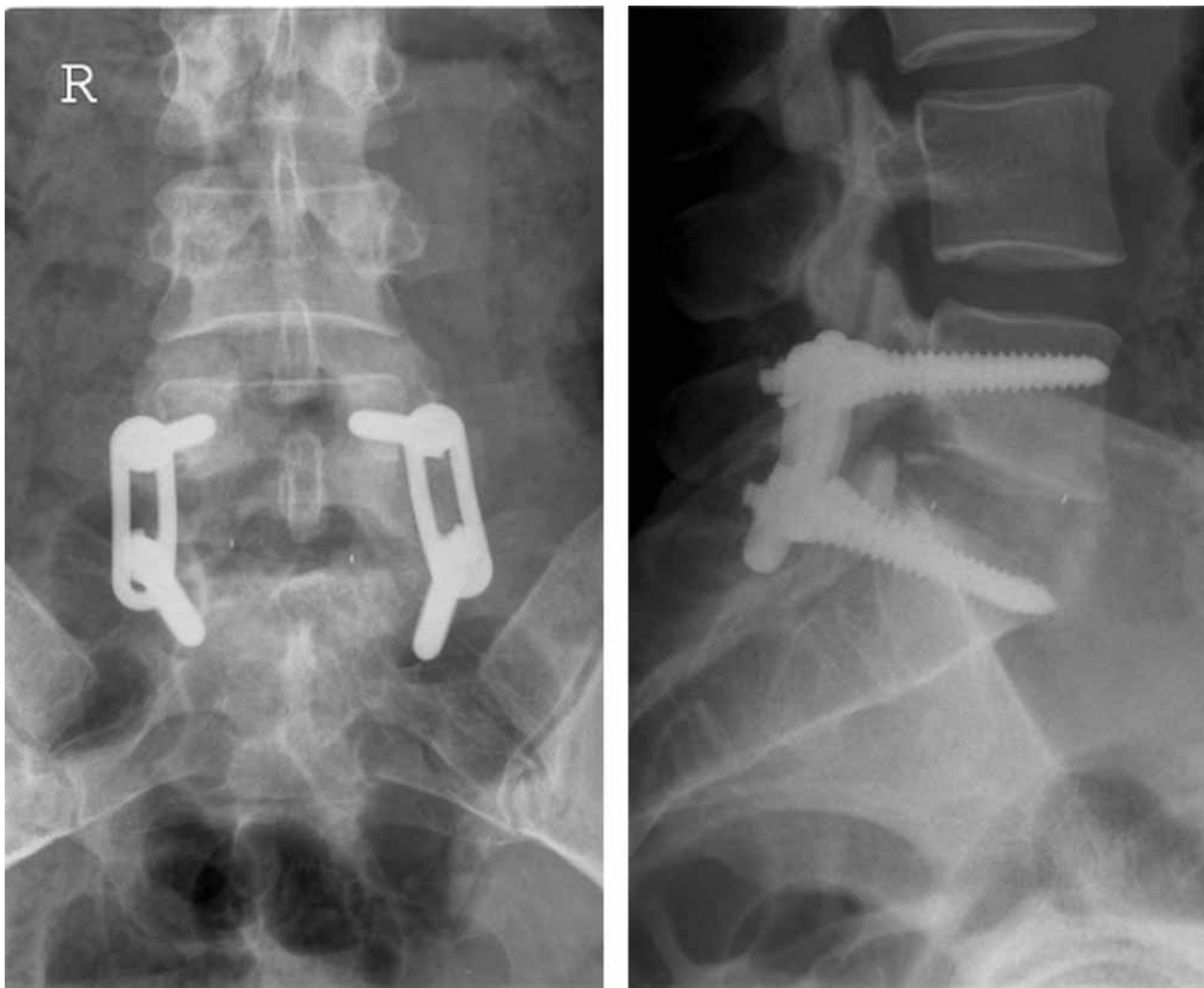
Revision surgery with explantation of a lumbar TDR carries great risk to the major anterior vessels and is a potentially life-threatening procedure (8). Therefore most lumbar TDR explantations are only performed for major complications such as dislocation, loosening or subsidence of the prosthesis (3). Arthrodesis of the lumbar segment (ALIF with or without posterior stabilisation) seems to be a good solution in these cases (1, 7, 8). Some authors reported the technical feasibility of inserting a new prosthesis (2, 7). Others recommend to leave the prosthesis in place if this is acceptable, and to stabilise the segment with pedicle screws (1). This

does however not treat the problem associated with the prosthesis, and the clinical improvement is often moderate or poor (5, 9).

Even in patients, who have been carefully selected and operated, continuing low back pain after TDR can occur and pose a significant problem to both the patient and the surgeon. In a number of these cases there is no evident reason for the poor clinical outcome. This is partly due to the limitations of the post-operative imaging modalities.

This case report illustrates that surgical exploration can detect technical problems after lumbar TDR such as insufficient ingrowth at the end plate junction and residual mobility at the bone-prosthesis interface. The following surgical findings were recorded by the authors :

1. Despite correct implant positioning in this young and healthy, non-smoking patient, there appeared to be a "pseudarthrosis" between L5 and the proximal end plate of the TDR. This was shown by clear movement between the proximal vertebra and the device with the prosthesis *in situ*, as well as by the absence of bony ongrowth onto the prosthesis end plate. This loosening was not visible on dynamic radiographic imaging studies.



**Fig. 6.** — Postoperative radiographs illustrating pedicle screw fixation and good position and size of ALIF carbon-fibre reinforced cage, filled with autologous bone grafts.

2. The presence of gross metallosis in the short term period of one year probably reflects the instability at the bone-prosthesis interface, rather than an intrinsic design problem. Safety studies of the Maverick TDR have demonstrated that the production of wear debris is low and without epidural reaction (6). Its presence in this case should be emphasised as a manifestation of a biomechanical problem and it cannot be detected by any current imaging technique. Metallic wear debris has been described on a polyethylene inlay after migration of a Prodisc

II prosthesis (8), but this is the first report of metallosis concerning a metal-on-metal TDR such as the Maverick prosthesis.

3. The macroscopic and microscopic findings at the facet joints were striking. Despite normal facet joints pre-operatively on CT and MRI scan, severe arthrosis and osteonecrosis had developed over the course of one year after TDR. Facet joint arthrosis has previously been identified as a predictor of clinical outcome after lumbar TDR (4), but there are no published data available concerning the onset or increase

of facet joint degeneration after TDR. It is believed that a posterior center of rotation (such as in the Maverick disc prosthesis) can reduce the loads on the facet joints (4). However, this case illustrates that this might not always be the case. Perhaps the fact that not all individual variations in facet joint morphology can be addressed by one prosthetic design and a small number of prosthetic sizes, may be responsible for this phenomenon.

To our knowledge this is the first report describing the findings and the technique of explantation of a Maverick disc prosthesis. The anterior approach should be carefully selected according to the approach used in the index operation : it is safe to consider an alternative approach (transperitoneal versus retroperitoneal or a retroperitoneal approach through the contralateral side) (8).

### CONCLUSION

Although removal of a lumbar total disc prosthesis remains a potentially life-threatening procedure, it may sometimes be considered in cases of persistent and incapacitating pain, even in the absence of obvious complications. The authors found that a cement extraction instrument can be used to hook on the keel of the Maverick total disc prosthesis in order to facilitate removal. Surgical exploration in this case showed loosening of one of both prosthetic components, gross metallic debris and dramatic

degeneration of the facet joints. The Maverick TDR was converted into a 360° fusion with relief of symptoms and a good early clinical result.

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