



Intraspinal metalloma causing lumbar stenosis after interbody fusion with cylindrical titanium cages

Nicomedes FERNÁNDEZ-BAÍLLO, José Miguel SÁNCHEZ MÁRQUEZ, Esther CONDE GALLEGO, Ana MARTÍN ESTEBAN

From the University Hospital Madrid Sanchinarro, Madrid, Spain

Intraspinal metallomas are rare. The authors present a case after implantation of two titanium threaded interbody cages at the L4L5 level, without posterior instrumentation. To their knowledge this is the first case due to intervertebral cages. The lack of additional instrumentation had probably allowed the cages to make contact. Subsequently, friction generated wear debris, which led to the formation of a granuloma, responsible for compression of the dural sac. Intraspinal metallosis should be kept in mind as an infrequent cause of delayed neurological symptoms after spinal surgery with metallic instrumentation.

Keywords: metallosis ; metalloma ; spinal stenosis ; interbody cages.

INTRODUCTION

There is a great deal of clinical experience with permanent and temporary metal implants in orthopaedic surgery. The biocompatibility of these implants with the surrounding tissues has always been a concern. The implant, or wear debris generated from it, may release chemically active metal ions (7). These ions may stay in place, and cause local problems, such as metallosis, bone resorption or mechanical compression of important soft tissues (3). They may also diffuse to the bloodstream and the lymphatics and, hence, to remote organs (9) with unclear consequences. These problems are well known in the field of arthroplasty (5,8,13), but

the increasing use of spinal instrumentation has led to similar concerns.

CASE REPORT

A 46 year-old male patient was referred because of low back pain with ambulation and neurogenic claudication. Eight years before he had undergone a microdiscectomy L4L5 for a disc herniation, in an other hospital. However, after a few months the complaints recurred. MRI demonstrated a decreased cross-sectional area of the spinal canal, secondary to a disc hernia L4L5, and bilateral lateral recess stenosis at the same level. The next step, 4 years before referral, consisted of open discectomy, bilateral flavectomy and posterior lumbar interbody fusion L4L5 with two threaded cylindrical titanium cages. Neither posterior instrumentation nor posterolateral fusion were added.

- Nicomedes Fernández-Baíllo, MD, Orthopaedic Consultant.
- José Miguel Sánchez Márquez, MD, Orthop. Consultant.
- Esther Conde Gallego, MD, Pathologist Consultant.
- Ana Martín Estéban, Practising Nurse.

Hospital Madrid Universitario Sanchinarro, Madrid, Spain.

Correspondence : J.M. Sánchez Márquez, Secretaría de Cirugía Ortopédica y Traumatología, Hospital Madrid Universitario Sanchinarro, Calle Oña nº 10, 28050 Madrid, Spain.

E-mail : jm.sanchez.marquez@gmail.com

© 2012, Acta Orthopædica Belgica.

No benefits or funds were received in support of this study. The authors report no conflict of interests.

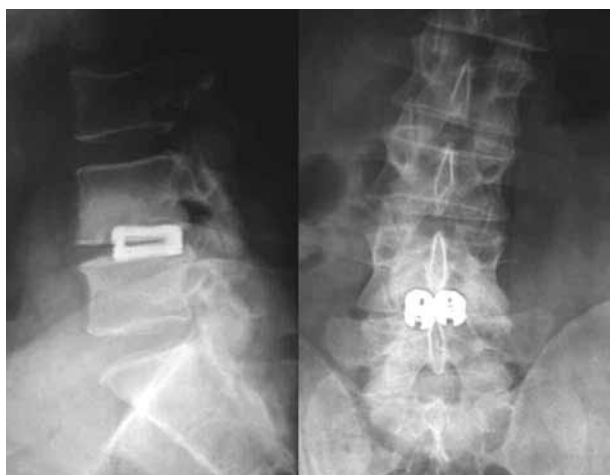


Fig. 1. — Preoperative plain radiographs showing the cylindrical interbody cages, making contact with each other.

The patient was referred to the authors' hospital, 8 years after the first operation. The neurogenic claudication was now extreme. Symptoms were relieved with flexion of the lumbar spine, hips and knees. There was no neurological deficit. The biochemistry was normal. Radiographs showed contact between the cages, and a slight subsidence (Fig. 1). CT and MRI (Fig. 2) showed a mass at the L4L5 level, displacing the dural sac posteriorly. No metallic artifacts were noted.

An L4L5 decompression was performed, the mass was excised, and the cages were removed. The cages were in contact and loose, the brightness of the metal was lost, and wear was noted in the friction area (Fig. 3). The mass consisted of dark gray granulation tissue. All metallic débris were removed, and tissue samples were obtained for microbiological and pathological examination. A circumferential L4L5 fusion was performed with four pedicle screws (Malibu®, SeaSpine, USA) and a 13 mm Olys® PEEK interbody cage (Biorad-Medisys Pvt. Ltd.). Local bone grafts, augmented with Vitoss® bone graft substitute (Orthovita, Malvern, PA, USA), were added.

No microorganisms were identified in the removed material. Haematoxylin-eosin stained sections (Fig. 4) of the paraffin-embedded material showed dead bone trabeculae adjacent to dense

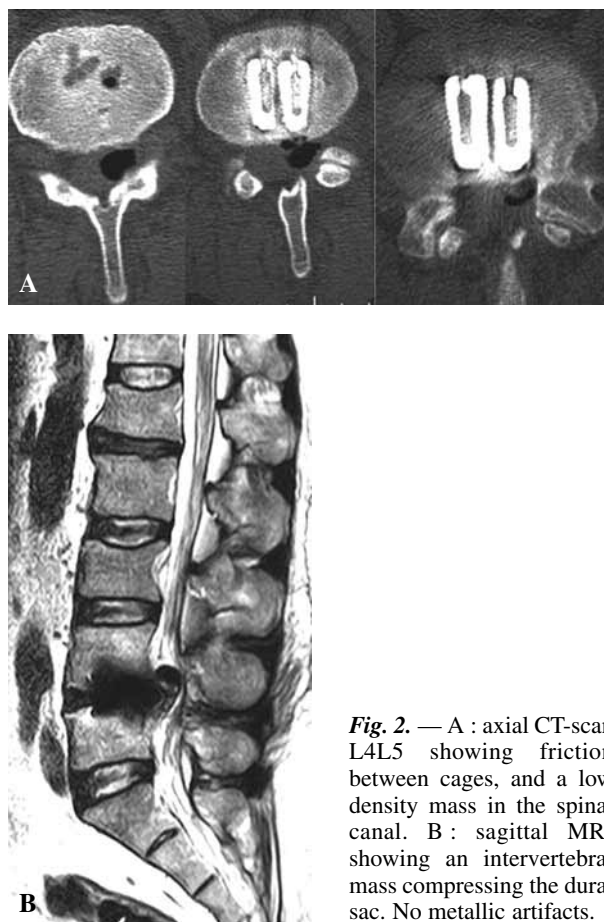


Fig. 2. — A : axial CT-scan L4L5 showing friction between cages, and a low density mass in the spinal canal. B : sagittal MRI showing an intervertebral mass compressing the dural sac. No metallic artifacts.

fibrotic tissue, heavily stained with predominantly extracellular black metal débris. There were numerous macrophages heavily laden with the same débris.

The postoperative course was uneventful, and the patient was symptom free three months later.

DISCUSSION

Rarity of spinal metallomas

There are few reports about metallosis in the field of spinal instrumentation. Guyer *et al* (6) and François *et al* (2) found metallosis after failure of metal-on-metal lumbar and cervical total disc replacement ; explantation and spinal fusion were necessary. Takahashi *et al* (11) and Tezer *et al* (12)

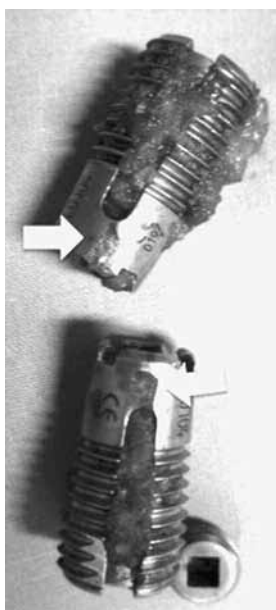


Fig. 3. — Titanium threaded cages after removal. Wear in the friction area (arrows). Loss of brightness.

reported on 3 cases of intraspinal metalloma causing neurological symptoms in patients who underwent posterior stabilization of the lumbar spine with hooks and rods. Granulation tissue had formed in the spinal canal adjacent to a metallic device. Months to years later, neurologic impairment developed.

Intraspinal metallosis, caused by metallic interbody cages, as described here, has not yet been reported, to the authors' knowledge. They hypothesize that abnormal implant motion with friction, generating metallic débris, and chemical stimuli by metal particles, were both responsible for the formation of the growing metalloma around the implants, causing a progressive lumbar stenosis.

Pathogenesis of spinal metallomas

Motion at a bone-metal interface generates metal wear. If, moreover, there is motion between two metal pieces, wear and corrosion at the interface are accelerated, which in turn leads to rapid release of metal particles into the interstitial fluid. Phagocytosis of these particles initiates a series of inflammatory reactions (7,11), which may cause fur-

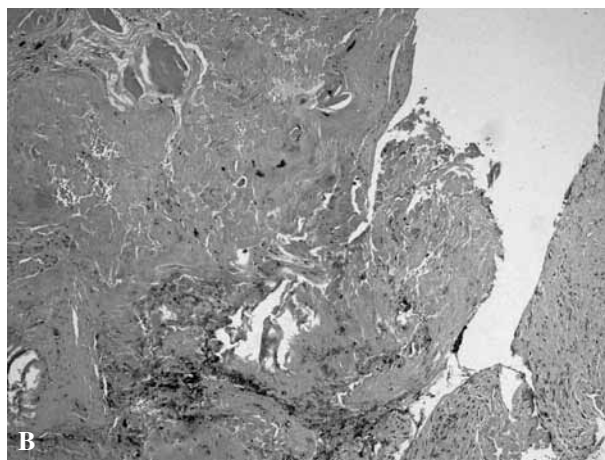
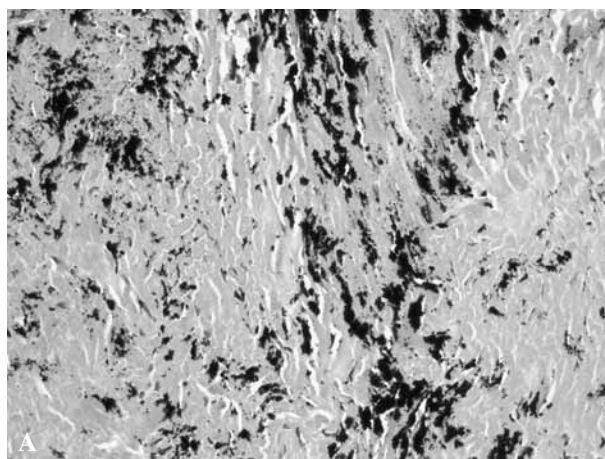


Fig. 4. — Histological sections. A : abundant black metal wear debris, predominantly extracellularly, and macrophages heavily laden with the same débris (hematoxylin-eosin, $\times 400$). B : dead bone trabeculae adjacent to fibrous tissue (above); necrosis and metallic wear debris (below) (hematoxylin-eosin, $\times 100$).

ther acceleration of the metal degradation, leading to a vicious circle. The inflammatory granulation tissue or metalloma may lead to compression of the cauda equina.

In the case reported, no additional instrumentation had been used, besides the two cages. This might have caused the collision, and subsequently the friction, of the cages. Indeed, the use of titanium threaded cages as stand-alone devices (not supplemented with some form of posterior fixation) has been questioned (1). Fuji *et al* (4) conducted a study to evaluate the bony union obtained through

posterior lumbar interbody fusion using Ray's threaded fusion cages without other instrumentation, such as pedicle screws. They noted, with a mean follow-up of 44 months, a nonunion rate of 72%. Shetty *et al* (10) compared interbody fusion with 1 : cages only, 2 : cages supplemented with posterolateral bone grafts, and 3 : cages supplemented with posterolateral pedicle screw fixation. They found that subsidence was more common in the groups without pedicle screw fixation. They suggested that pedicle screw fixation should be added to the cages when operating at levels above L5S1.

CONCLUSION

The authors wish to warn against placing interbody metallic devices too close to one another in disk surgery, more specifically if no additional instrumentation is used, so facilitating friction. Ideally, posterior instrumentation should be added. Intraspinal metallosis should be kept in mind as one of the late complications associated with spinal instrumentation.

REFERENCES

1. **Blumenthal SL, Ohnmeiss DD.** Intervertebral cages for degenerative spinal diseases *Spine J* 2003 ; 3 : 301-309.
2. **François J, Coessens R, Lauweryns P.** Early removal of a Maverick disc prosthesis : surgical findings and morphological changes. *Acta Orthop Belg* 2007 ; 73 : 122-127.
3. **Friedman RJ, Black J, Galante JO, Jacobs JJ, Skinner HB.** Current concepts in orthopaedic biomaterials and implant fixation. *J Bone Joint Surg* 1993 ; 75-A : 1086-1109.
4. **Fuji T, Oda T, Kato Y, Fujita S, Tanaka M.** Posterior lumbar interbody fusion using titanium cylindrical threaded cages : is optimal interbody fusion possible without other instrumentation ? *J Orthop Sci* 2003 ; 8 : 142-147.
5. **Fujishiro T, Hayashi S, Kanzaki N et al.** Retroperitoneal abscess following infected bipolar hemiarthroplasty diagnosed by metallosis : a case report. *Hip Int* 2010 ; 20 : 338-339.
6. **Guyer RD, Shellock J, MacLennan B et al.** Early failure of metal-on-metal artificial disc prostheses associated with lymphocytic reaction : diagnosis and treatment experience in four cases. *Spine* 2011 ; 36 : E492-E497.
7. **Jacobs JJ, Gilberte JL, Urban RM.** Corrosion of metal orthopaedic implants. *J Bone Joint Surg* 1998 ; 80-A : 268-282.
8. **Korovessis P, Ptsinis G, Repanti M, Repantis T.** Metallosis after contemporary metal-on-metal total hip arthroplasty. Five to nine-year follow-up. *J Bone Joint Surg* 2006 ; 88-A : 1183-1191.
9. **Richardson TD, Pineda SJ, Streng KB et al.** Serum titanium levels after instrumented spinal arthrodesis. *Spine* 2008 ; 33 : 792-796.
10. **Shetty AP, Osti OL, Abraham G et al.** Cylindrical threaded cages for lumbar degenerative disc disease. A prospective long term radiological study. *Paper presented at the meeting of the International Society for the Study of the Lumbar Spine* ; April 2000, Adelaide, Australia.
11. **Takahashi S, Delécrin J, Passuti N.** Intraspinal metallosis causing delayed neurologic symptoms after spinal instrumentation surgery. *Spine* 2001 ; 26 : 1495-1499.
12. **Tezer M, Kuzgun U, Hamzaoglu A et al.** Intraspinal metalloma resulting in late paraparesis. *Arch Orthop Trauma Surg* 2005 ; 125 : 417-421.
13. **Willis-Owen CA, Keene GC, Oakeshott RD.** Early metallosis-related failure after total knee replacement : a report of 15 cases. *J Bone Joint Surg* 2011 ; 93-B : 205-209.