

BILATERAL FRACTURE OF L5 PEDICLES IN A PATIENT WITH TOTAL DISC REPLACEMENT OF L5-S1: A CASE REPORT

FRATURA BILATERAL DE PEDÍCULOS L5 EM PACIENTE COM PRÓTESE DE DISCO L5-S1:
RELATO DE CASO

FRACTURA BILATERAL DE PEDÍCULOS L5 EN PACIENTE CON PRÓTESIS DE DISCO L5-S1:
REPORTE DE CASO

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ABSTRACT

Report of a rare complication - fracture of the pedicles – in a patient with total disc replacement of L5-S1, a surgical resolution, and a biomechanical explanation. To the authors' knowledge, there is only one previous report of bilateral fracture of the pedicles in the literature, as a complication in total disc replacement of the lumbar spine. In this case, no direct repair was made to the fracture site; instead intersomatic fusion was performed by the anterior approach. A 40-year-old male, a martial arts practitioner who had undergone L5-S1 (ProDisc®) disc replacement nine months earlier, with complete resolution of the preoperative symptoms and no complications, sudden pain during physical activity, without neurological symptoms. Computed axial tomography showed a fracture of the L5 pedicles and anterior luxation of the polyethylene insert. Surgery was performed by the posterior approach, with direct repair of the fractures and posterolateral fusion of L5-S1 with transpedicular screws (Schanz) and USS® internal fixator. A follow-up axial CT scan at 6 months after surgery showed complete consolidation of the fractures, and the patient was asymptomatic. Due to the alteration in weight transmission through the anterior part of the spine in the total replacement of the lumbar disc, which preserves the movement but not the absorption of forces, the pedicle becomes more susceptible to fracture. It is important to bear this complication in patients submitted to this procedure.

Keywords: Intervertebral disc; Spine; Spinal fusion; Bone screws.

RESUMO

Relato de uma complicação rara – fratura de pedículos – em paciente com prótese de disco L5-S1, sua resolução cirúrgica e uma explicação biomecânica. Até onde os autores sabem, existe na literatura apenas um relato anterior de fratura bilateral de pedículos como complicação de substituição total de disco lombar; neste caso, não se realizou reparo direto da fratura, e sim, fusão intersomática por acesso anterior. Paciente do sexo masculino, com 40 anos de idade, praticante de artes marciais e com antecedente de prótese de disco L5-S1 (ProDisc®) há nove meses, atinge melhora completa dos sintomas pré-operatórios sem complicações, apresenta dor súbita ao realizar atividade física sem intercorrências neurológicas. Na tomografia axial computadorizada, observa-se fratura de pedículos L5 e luxação anterior do inerto de polietileno. Realiza-se cirurgia por acesso posterior com reparo direto das fraturas e fusão posterolateral de L5-S1 com parafusos transpediculares tipo Schanz e fixador interno USS®. A TC axial de acompanhamento 6 meses depois da cirurgia mostra consolidação completa das fraturas, e o paciente está assintomático. Devido à alteração da transmissão de cargas através da parte anterior da coluna vertebral na substituição total de disco lombar, que preserva o movimento, mas não a absorção de forças, o pedículo fica mais suscetível à fratura, e é preciso considerar essa complicação em pacientes submetidos a esse procedimento.

Descritores: Disco intervertebral; Coluna vertebral; Fusão vertebral; Parafusos ósseos.

RESUMEN

Reporte de una rara complicación, fractura de pedículos, en un paciente con prótesis de disco L5-S1, la resolución quirúrgica y una explicación biomecánica. En el conocimiento de los autores, solo existe un reporte previo en la literatura de una fractura bilateral de pedículos como complicación de un reemplazo total de disco lumbar; en dicho caso no se realizó una reparación directa de la fractura, sino una fusión intersomática por vía anterior. Paciente masculino de 40 años de edad, practicante de artes marciales, con antecedente de prótesis de disco L5-S1 L nueve meses atrás, alcanza mejoría total de los síntomas preoperatorios sin complicaciones, presenta dolor súbito al realizar actividad física sin datos neurológicos. En la TAC se observa fractura de pedículos L5 y luxación anterior del inserto de polietileno. Se realiza cirugía por vía posterior con reparación directa de las fracturas y fusión posterolateral L5-S1 mediante tornillos transpediculares tipo Schanz y fijador interno USS®. La TAC de seguimiento a 6 meses de la cirugía muestra una consolidación completa de las fracturas y el paciente se encuentra asintomático. Debido a la alteración en la transmisión de las cargas a través de la porción anterior de la columna vertebral en el reemplazo total de disco lumbar, ya que este preserva el movimiento pero no la absorción de fuerzas, el pedículo es más susceptible a la fractura, es por ello que se debe tener en cuenta esta complicación en pacientes sometidos a dicho procedimiento.

Descriptores: Disco intervertebral; Columna vertebral; Fusión vertebral; Tornillos óseos.

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INTRODUCTION

The intervertebral disc is an important component of the functional unit of the spine, and degeneration of or injury to it can produce direct pain or spinal imbalance and cause a number of painful pathologies.

The disc prosthesis has been developed over the last 40 years as an alternative to arthrodesis for the management of degenerative disc disease, and current manufacturing advances make it an excellent treatment option for the management of disc disease in selected patients. It has the unique advantage of preserving the intervertebral space and the movement of the segment, thereby preventing changes in spinal mechanics and the premature degeneration of adjacent segments. Today, excellent results are achieved in 80% of patients who have received implants, with 70% of them even returning to high performance and physically demanding activities.

In this report, we discuss a rare complication in a patient with a lumbar disc prosthesis that we found described in only one published report.

Case history

Male, 41 years of age, professional, practitioner of martial arts, with a history of coronary malformation treated by catheterization, athletic build, with weight of 73 kg and height of 1.75 m.

At the end of March, 2010, he had a sudden attack of very intense, extremely debilitating low back pain, radiating to both lower limbs and down to the ankles. A physical examination showed significant limitation in movements of the trunk, with difficulty in toe-to-heel walking, weakness of the gastrocnemius muscles, reduced bilateral Achilles reflexes, and bilateral Lasègue of 40 degrees. An MRI was performed and revealed discopathy and herniation of the L5-S1 disc, which was managed surgically with a Prodisc lumbar disc prosthesis without complications.

The patient evolved adequately, with complete recovery of radicular function and complete cessation of pain for a period of 9 months, but the patient reported the onset of sudden intense low back pain when performing physical exercise, without radiation to the lower limbs or neurological involvement. This pain was difficult to manage with medication, and was closely related to physical activity and mobilization of the trunk.

Imaging studies (simple and dynamic radiographies, as well as CT of the lumbar spine) were performed in the emergency room (Figure 1). An anterior dislocation of the prosthetic insert with partial reduction of the disc space, a mild anterolisthesis of L5, and a bilateral fracture of the L5 pedicles were observed.

It was decided that the fracture would be handled using posterior instrumentation and posterolateral fusion.

Surgical technique

A Synthes transpedicular internal fixation instrumentation system was used, with the placement of 4 titanium Schanz screws in the L5 and S1 pedicles, taking special care to place them as perpendicularly as possible to the line of the fracture of the L5 pedicles, and being sure to pass the screw all the way through the anterior fragment with the idea of providing adequate interfragmentary compression. Two titanium bars and four locknuts were also used. Once the pedicular fracture line was completely closed, the bars were adjusted and an allograft of previously demineralized bone matrix was placed in the prepared posterolateral bone bed. The patient presented favorable evolution with cessation of pain and improved function, and is currently asymptomatic. Almost three years after the procedure, a CT of the lumbar spine was performed (Figure 1) which showed complete primary consolidation of both pedicles with proper integration of the bone graft.

Biomechanical Explanation

Load distribution (Figure 2a) is absorbed mainly by the intervertebral disc in the anterior segment. In the posterior segment, the load passes through the facet joints (dotted arrows) and is distributed

among the posterior elements (pars articularis, laminae, pedicles), the pars being the most susceptible to injury, followed by the pedicle.

In total disc replacement (Figure 2b) where, besides the loads described for the intact posterior elements, the loads not absorbed by the disc (dotted arrows) are added and distributed among the vertebral platforms, the implant-bone interface, and into the posterior elements, coming together in the pedicle and significantly increasing the level of stress on it.

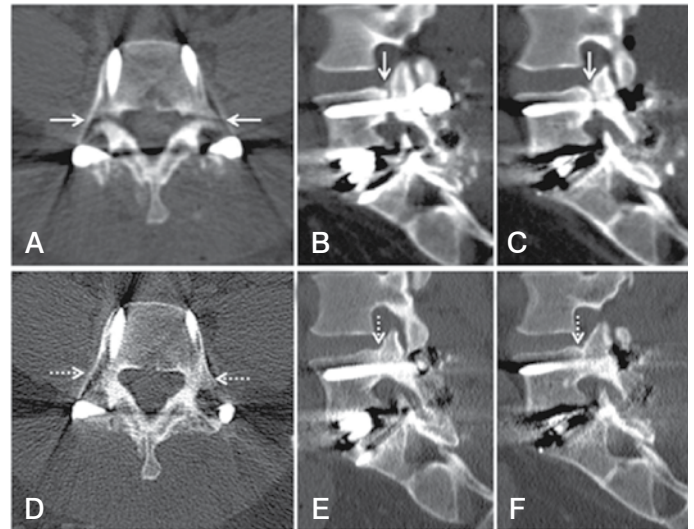


Figure 1. Immediate post-operative CT. A) Axial section; B) Right pedicle, sagittal view; C) Left pedicle, sagittal view. The solid arrows show the gap in the fracture. The images show the CT six months after surgery; D) Axial section; E) Right pedicle, sagittal view; F) Left pedicle, sagittal view. The dotted arrows show consolidation of the fracture lines.

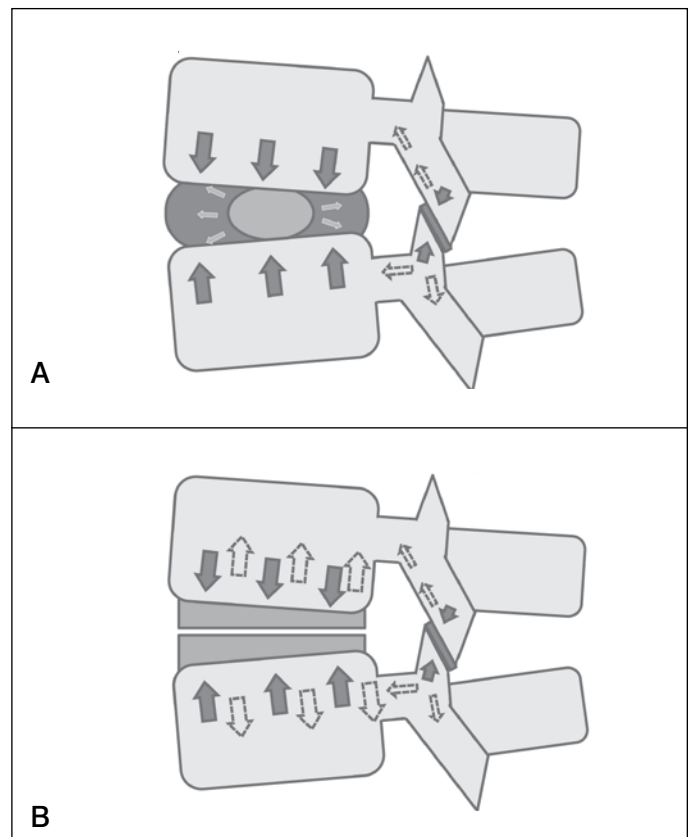


Figure 2. Diagram of intact anatomy and normal load distribution (A) and the changes in a patient with a disc prosthesis (B).

DISCUSSION

Cyron et al.¹ demonstrated that the pars interarticularis is the weakest part of the neural arch, followed by the pedicle, and that L5-S1 is the segment most susceptible to injury because of the transition from the mobile spine to the stable pelvis, and because of the tilt of the sacral platform. The pedicles are submitted to increased mechanical demands following spinal surgery, especially after fusion.²⁻⁶ Traugher and Havlina⁷ reported the first case of a bilateral pedicle stress fracture. Gunzburg and Fraser⁸ introduced the term pediculosis in 1991. Sadiq⁹ reports a case of a bilateral stress fracture of the L2 pedicles in a sedentary 36-year-old woman treated conservatively. Hari et al.¹⁰ published a case of a bilateral fracture of the L5 pedicles in a young athletic patient treated surgically with 360° anterior and posterior fusion following the failure of conservative management. Rami et al.¹¹ reported a case of a bilateral fracture of the L5 pedicles in a patient whose 10 years of conservative treatment was based on bisphosphonates. There are also three reports of bilateral pedicle fracture in patients with instrumented posterolateral arthrodesis of the lumbar spine.¹² These last three suggest that the predisposing factor is solid posterolateral fusion that includes the pars interarticular, leaving the pedicle as the weakest structure of the neural arch, combined with persistent movement between the intervertebral discs.

The only previously reported case of a bilateral pedicle fracture associated with total disc replacement is of a 30-year-old man with chronic low back pain who underwent total replacement of the L5-

S1 lumbar disc and who presented dislocation of the polyethylene insert and a bilateral fracture of the L5 pedicles, which was resolved through the placement of a stand-alone cage via anterior approach with good results.¹³

A biomechanical trial of Prodisc L states that the functional spinal segment absorbs more energy with a total disc replacement than in anatomically intact specimens, and this energy is distributed across the subjacent platforms, the prosthesis-bone interface, and the other anatomical vertebral structures, including the pedicle.¹⁴

Among the most common complications of total disc replacement reported in the literature¹⁵ are retrograde ejaculation, sympathectomy associated with dysesthesia, infection of the surgical wound, deep vein thrombosis and pulmonary thromboembolism, extraforaminal protrusions, neuropathies, etc. But risk of pedicle fracture secondary to overload of the bone structures following total disc replacement has not been reported.

Due to changes in load transmission through the anterior portion of the spine in total lumbar disc replacement, which preserves the movement but not the absorption of forces, the pedicle is more susceptible to fracture. This complication should be taken into account in patients undergoing this procedure.

All authors declare no potential conflict of interest concerning this article.

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