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Long-term Titanium mesh cage implant failure after total en bloc spondylectomy due to spinal chondrosarcoma. Case report and literature review

Rotura a largo plazo de celda titanio después de una espondilectomía total en bloque debido a condrosarcoma espinal. Reporte de caso y revisión de la literatura

Fracasso a longo prazo do caixa lombar em titânio após espondilectomia total em bloco devido a condrossarcoma espinhal. Relato de caso e revisão da literatura

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CONCEPTOS CLAVE:

Qué se sabe sobre el tema.

El condrosarcoma de localización lumbar es una condición infrecuente. El estandat de oro del tratamiento es la espondilectomía total en bloque seguido de la instrumentación del segmento para mantener estabilidad mecánica.

Qué aporta este trabajo.

Se presenta una complicación sumamente infrecuente cómo lo es la rotura de la celda de titanio, siendo aún más infrecuente su aparición a los 10 años de la cirugía índice. Se remarca el descarte obligatorio de la recurrencia tumoral local y se enfatiza realizar un seguimiento continuo y prolongado para prevenir esta falla de instrumentación.

Divulgación

El condrosarcoma de la columna vertebral es una afección infrecuente. La resección tumoral seguida de la instrumentación del segmento vertebral afectado se considera el estándar de oro en términos de tratamiento, y las complicaciones asociadas con el fallo de la instrumentación a largo plazo son poco comunes y escasamente reportadas en la literatura.

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Abstract

Keywords:
chondrosarcoma; prosthesis and implants; low back pain; prosthesis failure.

Objective. To report an unusual titanium mesh cage failure after ten years of follow-up. **Clinical case.** A 40-year-old woman diagnosed with low-grade spinal chondrosarcoma underwent a total en-bloc spondylenctomy (TES) surgery. This technique required a wide resection, anterior reconstruction with a titanium mesh cage (TMC), and posterior stabilization. For several years a favorable clinical outcome was achieved. After 10 years of follow-up, the patient developed acute non-traumatic low back pain without neurological repercussions. The images confirmed a rupture of the titanium cage. After ruling out tumor recurrence, the patient went through spinal instrumentation revision. **Conclusion.** Isolated TMC rupture is a rare event scarcely reported in the literature. There is a strong recommendation to instrument two levels proximal and distal to the bone defect in 360° reconstructions after a TES. Stability had likely been lost over the years due to the slow resorption of the bone graft. We consider necessary studies with a higher casuistry and level of evidence to analyze the contributing factors for the event of TMC rupture.

Rotura a largo plazo de celda titanio después de una espondilectomía total en bloque debido a condrosarcoma espinal. Reporte de caso y revisión de la literatura

Resumen

Palabras clave:
condrosarcoma; prótesis e implantes; dolor de la región lumbar; falla de prótesis.

Objetivo. Reportar una complicación muy inusual, la rotura de una celda mesh de titanio luego de diez años de seguimiento. **Caso clínico**. Mujer de 40 años diagnosticada con condrosarcoma espinal de bajo grado que se sometió a una cirugía de espondilectomía total en bloque (ETEB). Esta técnica requirió una resección amplia, reconstrucción anterior con una celda mesh de titanio (CMT) y estabilización posterior. Durante varios años se logró un resultado clínico favorable. Después de 10 años de seguimiento, la paciente desarrolló dolor agudo no traumático en la parte baja de la espalda sin repercusión neurológica. Las imágenes confirmaron la rotura de la celda de titanio. Después de descartar la recurrencia del tumor, la paciente se sometió a una revisión de la instrumentación espinal. **Conclusión.** La rotura aislada de la CMT es un evento muy infrecuente y apenas reportado en la literatura. Existe una fuerte recomendación de instrumentar dos niveles proximales y distales al defecto óseo en reconstrucciones de 360° después de una ETEB. La estabilidad probablemente se perdió con el tiempo debido a la lenta reabsorción del injerto óseo. Consideramos necesarios estudios con una casuística y nivel de evidencia mayor para analizar los factores contribuyentes al evento de rotura de la CMT.

Fracasso a longo prazo do caixa lombar em titânio após espondilectomia total em bloco devido a condrossarcoma espinhal. Relato de caso e revisão da literatura

Resumo

Palavras-chave:
condrossarcoma; próteses e implantes; dor lombar; falha de prótese.

Objetivo. Relatar um raro caso de falha em uma gaiola de malha de titânio após dez anos de acompanhamento. **Caso clínico.** Mulher de 40 anos diagnosticada com condrossarcoma espinhal de baixo grau foi submetida a uma cirurgia de espondilectomia total em bloco (TES). Essa técnica envolveu uma ressecção extensa, reconstrução anterior com uma caixa lombar em titânio (TMC) e estabilização posterior. Durante vários anos, obteve-se um resultado clínico favorável. Após 10 anos de acompanhamento, a paciente desenvolveu dor aguda na região lombar, não relacionada a trauma, sem repercussões neurológicas. As imagens confirmaram a ruptura da gaiola de titânio. Após descartar a recorrência do tumor, a paciente passou por uma revisão da instrumentação espinhal. **Conclusão.** A ruptura isolada da TMC é um evento raro e pouco relatado na literatura. Há uma forte recomendação para instrumentar dois níveis proximais e distais ao defeito ósseo em reconstruções de 360° após uma TES. A estabilidade provavelmente foi perdida ao longo do tempo devido à lenta reabsorção do enxerto ósseo. Consideramos necessários estudos com uma casuística e nível de evidência mais elevados para analisar os fatores contribuintes para o evento de ruptura da TMC.

Introduction

Chondrosarcomas are primary malignant tumors with an estimated incidence of 0.5 per 100,000 patient-years. Axial lesions such as the spine only represent 20% of the cases, with the lumbar the less commonly affected region[1]. Total en-bloc spondylectomy (TES) is the most suitable procedure to provide local control, lower recurrence rate, and overall survival[2]. After corpectomy is performed, titanium mesh cage (TMC) anterior reconstruction together with posterior column instrumentation, is the best option to achieve immediate mechanical stability of the segment, with favorable clinical outcomes[2]. Despite this, it is considered a complex surgery with high risk OF complications[3]. We describe an unusual case of spinal chondrosarcoma treated with TES that developed a titanium mesh cage failure after ten years of the index surgery.

Clinical Case

A 40-year-old female patient with non- traumatic low back pain during 4 weeks and irradiated radiculopathy in the anterior aspect of the right thigh presented to the clinic. The patient's medical record revealed no history of cancer, and physical examination ruled out neurological deficit. Imaging studies of the region were requested, showing a lytic lesion at the L2 vertebral body (Fig. 1).

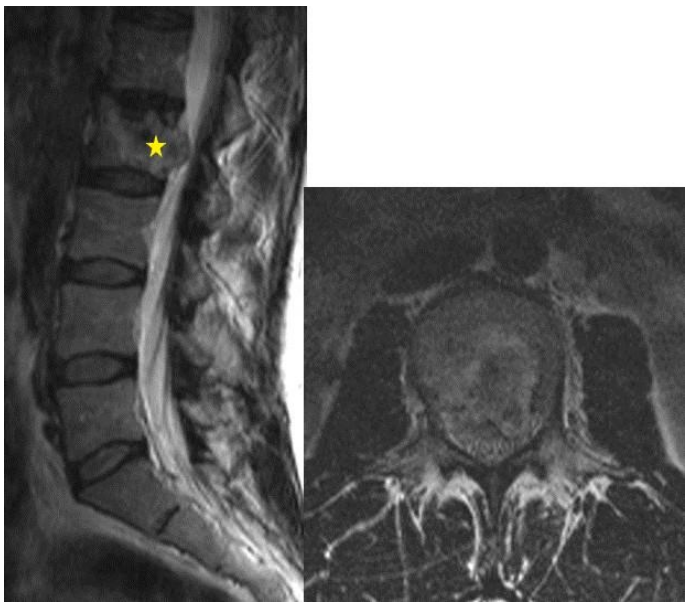

Figure N° 1. Preoperative mid-sagittal and axial MRI on T2-sequence showed an expansive tumoral lesion arising from the L2 vertebral body with epidural extension and displacement of the epidural sac.

Once local or distant metastases were dismissed, bone biopsy was performed, confirming the diagnosis of low-grade extracompartmental chondrosarcoma (Enneking 1B). TES was conducted through simultaneous posterior anterior approaches, with posterior fixation and placement of a TMC with cadaveric bone graft as an anterior support (Fig. 2).

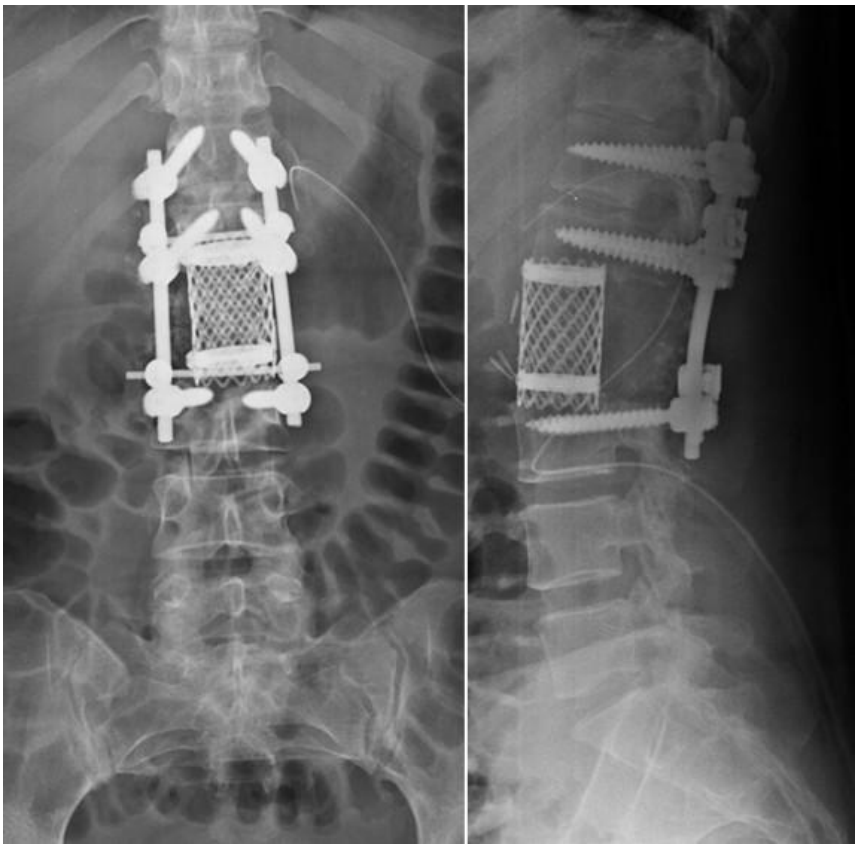

Figure N° 2. Postoperative x-rays showed the L2 spondylectomy and 360° T12-L3 instrumented arthrodesis.

Histological results confirmed a low-grade chondrosarcoma with tumor-free margins. During the following years, the patient's symptoms and quality of life improved, and the radiographic and tomographic controls remained practically unchanged (Fig. 3).

Figure N° 3. Eight-year follow-up sagittal and coronal CT images revealed minimal subsidence of the TMC and partial resorption of bone graft.

Results

After a ten years follow-up period, the patient presented a non-traumatic acute onset of low back pain without neurological symptoms, and x-rays showed an isolated rupture of the TMC (Fig. 4).

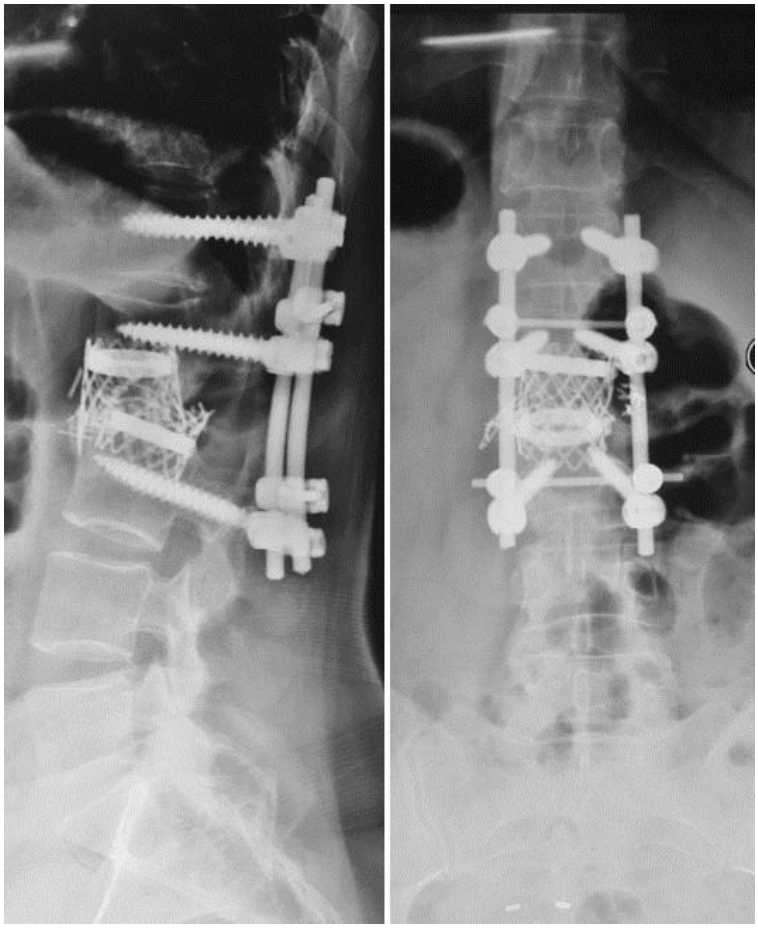

Figure N° 4. Radiographic follow-up ten years postoperatively demonstrates TMC fracture and collapse with consequent segmental kyphosis.

Revision surgery was performed, and new anatomopathological samples were taken, ruling out tumor recurrence. The procedure involved fusion extention to L4, rod exchange, addition of two extra rods connected by rod-to-rod connectors in order to increase rigidity and endurance of the construction, L3-L4 transforaminal interbody fusion (TLIF) and posterolateral arthrodesis with iliac bone graft. No anterior procedure was performed. One-year post-operative follow-up X-rays show no mechanical complication and the patient remains symptom free. (Fig. 5).

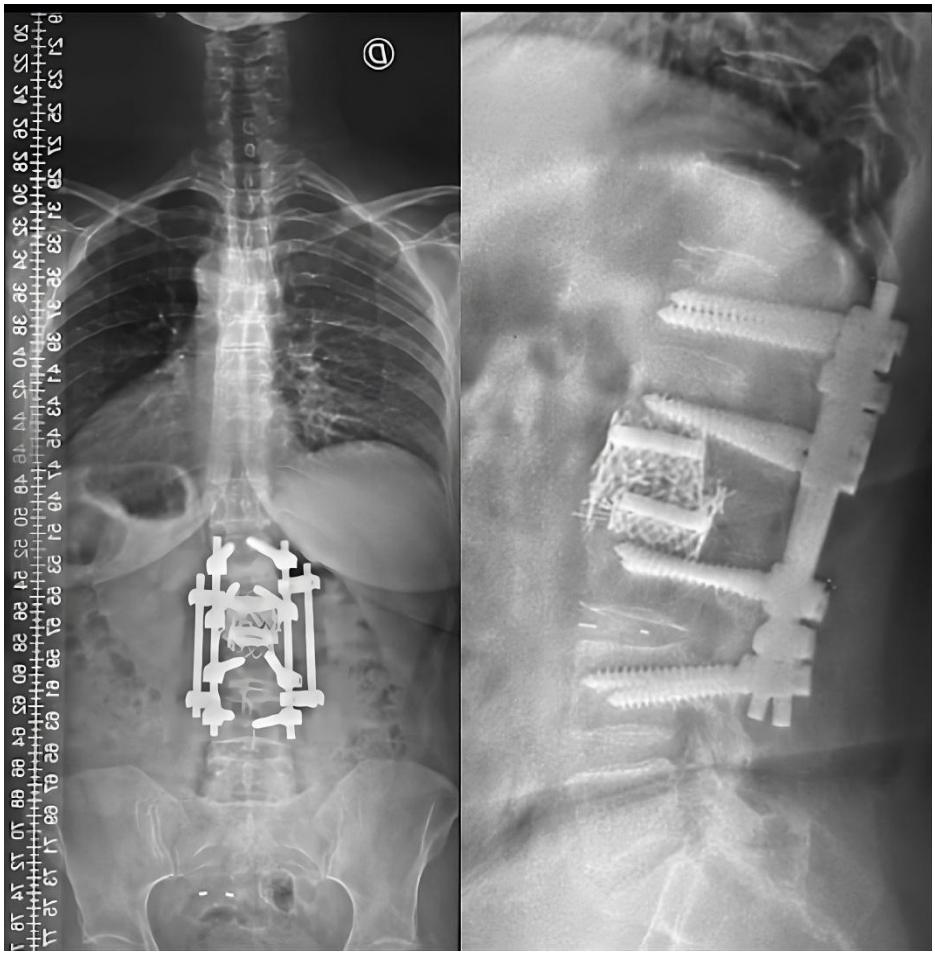

Figure N° 5. 1-year postoperative anterior-posterior and latera lumbosacral X-ray showing revision surgery and no related mechanical complications.

Discussion

Although various reconstruction techniques have been described, and there is limited evidence regarding which option is superior[4], the ultimate goal is to achieve segment fusion with long-term mechanical stability. The fusion rate reported in the literature after vertebrectomy secondary to a neoplastic process varies from 36% to 100%, and implant failure for the same procedure rises to 40%[5-7]. Despite the heterogeneity of the techniques used to reconstruct the anterior column described in the literature (polymethylmethacrylate, bone graft, or expandable cages), TMC was among the most

frequently used devices[3,5,6,8]. The principal function of these interbody implants is to provide mechanical support while the biological fusion process is developing. There are few reports in the literature evaluating risk factors for implant failure after TES[3,5,6,8]; TMC subsidence, number of instrumented levels, history of prior radiotherapy, and lumbar segment TES have been indicated as the main risk factors for instrumentation material fatigue. However, only one of these studies evaluated the degree of fusion achieved before implant failure[3,8]. Implant failure is commonly reported in posterior instrumentation, whereas isolated TMC fracture is scarcely reported in the literature[9-13] (Table 1). The most common complications associated with this device are endplate subsidence, which can lead to uneven axial load distribution and an overload of the posterior instrumentation system, non-union, instability, and fatigue of the entire construct. Even though mild subsidence is tolerated and might prevent further implant displacement[14], some authors consider a subsidence greater than 5 mm as a risk factor for implant failure[5]. Furthermore, although there is insufficient high-quality evidence regarding the length of the instrumentation needed to reduce the risk of implant failure, many authors strongly recommend implementing two levels above and below the anterior column deficit in 360° reconstructions[3,4]. However, increased instrumentation length has been reported to be an independent risk factor for pseudoarthrosis[15].

Table N° 1: Titanium Mesh-Cage fracture Reports

Authors	Diagnosis	Procedure	Bone graft type	Follow-Up (months)
Dvorak et al. (2003)	L1 burst fracture	VB + TMC + Anterior plate stabilization	Autologous	-
Robertson et al (2004)	-	VB + TMC	-	48
Bierry et al (2006)	L3 lytic lesion	TES. TMC + posterior fixation of L2–L5		48
Klezl et al (2007)	L4 burst fracture	1° Stage: LL and LD. Posterior fixation of L3-L5 2° Stage: VB + TMC	Autologous	13
Wang et al (2015)	L4 burst fracture	VB + TMC + one level posterior fixation	Autologous	42

VB. Vertebrectomy. TMC. Titanium mesh cage. TES. Total en bloc spondylectomy. LL. Lumbar laminectomy. LD. Lumbar decompression.

Conclusion

Isolated TMC rupture is a rare event scarcely reported in the literature. There is a strong recommendation to instrument two levels proximal and distal to the bone defect in 360° reconstructions after a TES. Stability had likely been lost over the years due to the slow resorption of the bone graft. We consider necessary studies with a higher casuistry and level of evidence to analyze the contributing factors for the event of TMC rupture.

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La responsabilidad del trabajo es exclusivamente de quienes colaboraron en la elaboración del mismo.

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