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CLINICAL CASE

How to deal with this complication: Intraoperative anterior cage migration in L5-S1 resolved with a lumbar hybrid fusion technique

Cómo afrontar esta complicación: migración intraoperatoria de la caja anterior en L5-S1 resuelta con una técnica de fusión lumbar híbrida

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Abstract

Anterior cage migration is the most infrequent and dangerous complication seen in posterior lumbar interbody fusion (PLIF) procedures. We report the case of a 74-year-old woman who underwent PLIF at the L5-S1 level. During the surgery, one of the PLIF-cages dislodged anteriorly into the abdominal cavity without vascular injury. An anterior retroperitoneal approach to remove the cage and complete the fusion was made. The patient was discharged 2 weeks later with encouraging clinical results. In a patient hemodynamically stable, removing the cage by a vascular surgeon, and complete the Anterior Lumbar Interbody Fusion could be a feasible option at L5-S1.

Key words: *Anterior lumbar interbody fusion. Cage migration. Complications. Posterior lumbar interbody fusion. Spine surgery.*

Resumen

La migración anterior del implante para fusión lumbar es la complicación más infrecuente y peligrosa asociada a la fusión intersomática posterior (PLIF). Reportamos el caso de un paciente femenino de 74 años, operada de PLIF en L5-S1. Durante la cirugía, una de las cajas usadas migró a la cavidad abdominal, sin ocasionar lesión vascular. Para remover el implante y completar la fusión lumbar un abordaje retroperitoneal anterior fue realizado. La paciente fue egresada 2 semanas después con éxito. En un paciente hemodinamicamente estable, este abordaje puede ser una opción para revertir la complicación y completar la fusión lumbar vía anterior.

Palabras clave: *Cirugía de columna. Complicaciones. Fusión intersomática lumbar anterior, Fusión intersomática lumbar posterior. Migración del implante.*

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Introduction

Posterior lumbar interbody fusion (PLIF) is a technique widely used by spine surgeons for treating several spinal diseases. This technique provides support and stabilization of the spine[1]. There have been reports of high morbidity and mortality rates related to complications associated with cage placement, especially anterior migration with vascular injury[1-3]. Most of the cage displacements are posterior, and anterior cage migration is extremely rare[4]. We report the case of a cage migrated intraoperatively into the retroperitoneal space during a PLIF procedure, but we focus on how this dangerous complication was resolved in our patient.

Case presentation

Written informed consent was obtained from the patient for publication of this case report and the accompanying images. A 74-year-old woman with a history of lumbar spinal fusion and cortical screw fixation at L4-L5, 2 years before. She complained of severe low-back pain (visual analog scale [VAS] 9/10) aggravated by walking, sitting, and position changes. Conservative treatment was done for at least 6 months, with no symptomatic relief. The patient had no neurological deficits. Radiographs and magnetic resonance imaging studies showed grade I degenerative spondylolisthesis, degenerative disc disease, and bilateral facet joint arthrosis at L5-S1 (Figs. 1A and B). The patient underwent bilateral facet joint blocks at L5-S1 relieving 70% of her pain for few days. Therefore, a PLIF at L5-S1 and the replacement of cortical screws by transpedicular screw fixation at L4-L5-S1 were planned. During surgery, after pedicle screw insertion and posterior decompression, discectomy was done and endplates were prepared with proper shavers. Then, a titanium bullet-tip cage filled with autologous bone graft mixed with demineralized matrix was placed into the intervertebral space on the right side without complications. The surgeon introduced the second cage on the left side into the intervertebral space but tapped it to an excessive depth damaging the anterior annulus and anterior longitudinal ligament (ALL). Consequently, intraoperative C-arm fluoroscopy showed the cage migrated into the abdominal cavity retroperitoneally, far from the L5 vertebral body (Fig. 1C). The patient´s vital signs remained stable, hence, we decided to remove the interbody device via an anterior approach based on the location of the migrated cage. Posterior rod fixation was done and wound closed with skin suture and patient made supine. Concomitantly, the vascular surgeon was called to the operating room for removing the cage. Anterior approach to L5-S1 through a Pfannenstiel-type incision was performed and the peritoneum was laterally retracted to access the retroperitoneal space. The cage was identified easily and perforation of the ALL observed (Fig. 1D). The anterior surface of the L5-S1 level was exposed and no anterior vessel injury was observed, therefore, anterior lumbar stabilization and fusion (Anterior Lumbar Interbody Fusion [ALIF]) were completed. The ALL and annulus were cut on the left side at the previous perforation site and a titanium mesh cage filled with autologous bone graft was placed into the intervertebral space (Fig. 1E). During the anterior annulotomy, we observed an ALL with degenerative changes, soft and friable. Intraoperative fluoroscopy views showed proper location of the mesh cage (Fig. 1F). There were no adverse events during the anterior approach. Two weeks later the patient was discharged walking comfortably without assistance, and her lower back pain improved almost totally (VAS 2/10). No associated complications were seen after the anterior retroperitoneal approach. Solid bone fusion of PLIF/ALIF segment was confirmed by a lumbar CT scan 6 months postoperatively (Fig. 2).

Discussion

PLIF is widely used for the treatment of mechanical low back pain, degenerative disc disease, recurrent disc herniation, and low-grade spondylolisthesis (grades I and II) with acceptable outcomes[2,5]. However, certain complications such as nerve root damage, dural tear, epidural fibrosis or arachnoiditis, cage subsidence, and migration have been reported[5]. Concerning specifically to complications associated with the interbody device, most cage migrations are posterior due to misplacements or subsidence, but the anterior movement is very unusual[4,6]. Murase et al. reported an incidence of 0.26% for anterior cage dislodgement in 4625 patients who underwent PLIF, with the injury of anterior lumbar vessels being the most dangerous intraoperative complication which has < 0.01% incidence[3]. L4-L5 is the lumbar segment with the highest risk of vascular injury and the right common iliac artery, the most frequently injured vessel. The mortality rate associated with both is 10-56%[1]. The lower incidence of the ALL injury at L5-S1 owing to the considerable thickness (1.9-mm) and the

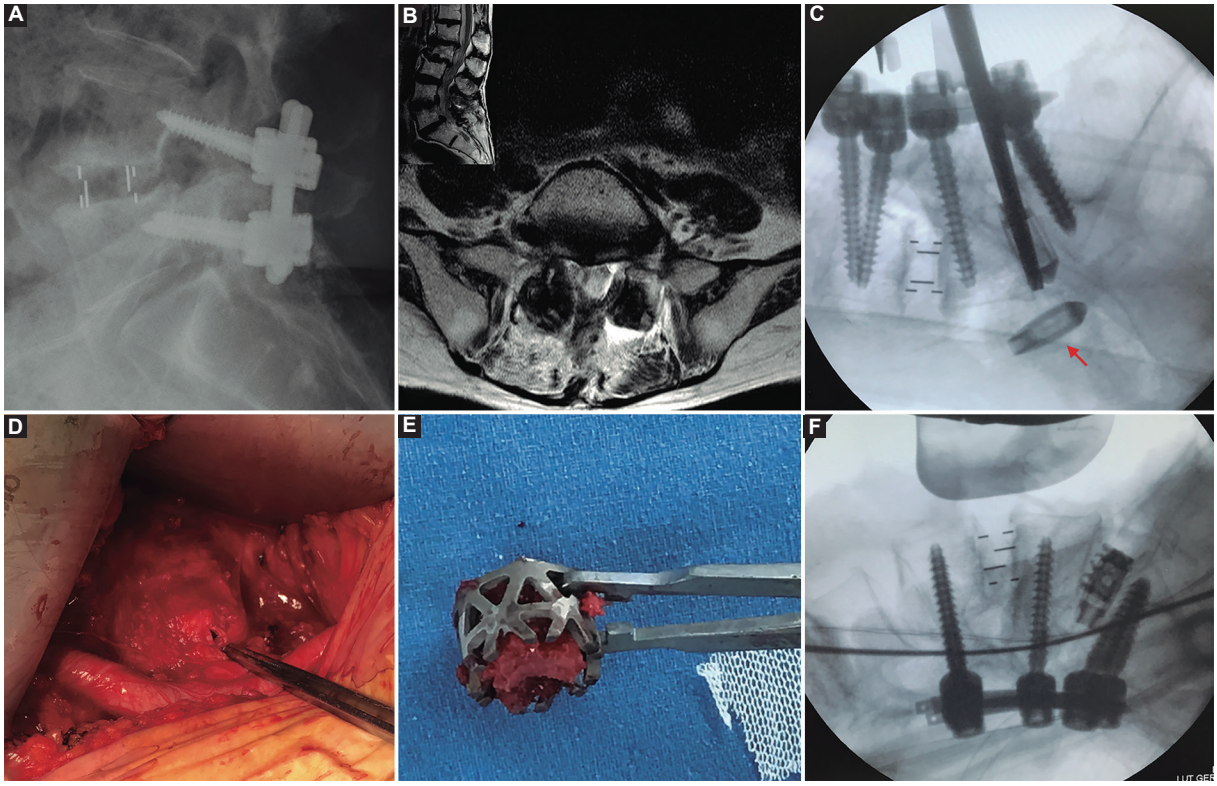

Figure 1. A: *preoperative lumbar radiograph in lateral projection shows low-grade spondylolisthesis at L5-S1.* **B:** *preoperative T2-weighted magnetic resonance imaging (MRI) on axial view shows facet arthrosis at L5-S1.* **C:** *anterior cage migration is observed (red arrow) in the intraoperative fluoroscopy with the C-arm on the lateral view.* **D:** *intraoperative image from the surgical field showing a perforation in the anterior longitudinal ligament* **E:** *a mesh filled with bone replaced the migrated cage.* **F:** *intraoperative fluoroscopy image on lateral view with proper location of the mesh cage at L5-S1.*

significant tensile strength; that is why in female patients, it is possible to perform sacrocolpopexy fixed to ALL at L5-S1[7].

Iatrogenic perforation of ALL during L5-S1 discectomy with the collateral damage of abdominal viscera such as bowel and the left common iliac artery and vein, with fatal prognosis, has been reported in the literature[8,9].

The latter is important because the leading cause of anterior cage migration during PLIF is iatrogenic perforation of ALL, and the excessive cage impaction is the most common cause for it[4]. Other technical errors have been seen such as anatomical disorientation of the surgical field, especially in patients with vertebral rotation in degenerative scoliosis, and the lack of use of intraoperative fluoroscopy during throughout cage delivery. In our patient, the anterior cage dislodgment was caused by excessive impaction over an ALL degenerated.

We think that placing a small-size cage into the intervertebral space can result in a minor friction of the cage-endplate interface, and an excessive impaction could lead to perforate the anterior annulus and ALL. Thus, the shape and dimensions of the cage are factors to consider preoperatively to avoid anterior dislodgment. We highly encouraged to measure the disc height by CT or radiographs preoperatively since, on the other hand, an oversized cage could disrupt the ALL and lead an anterior migration of the implant.

From the four cases of anterior dislodgment of a cage during PLIF at L5-S1 reported previously, only one was operated 13 days after the complication via transperitoneal approach[4,6]. However, what could we do if the primary goals of the surgery have not been reached? In our manuscript, we explained how we dealt with the complication. The rationale for stabilizing the anterior spine through an alternative approach was the high risk of coronal imbalance, and pseudoarthrosis since the first cage inserted on the right side of L5-S1 was placed too lateral. That was the reason to perform a hybrid

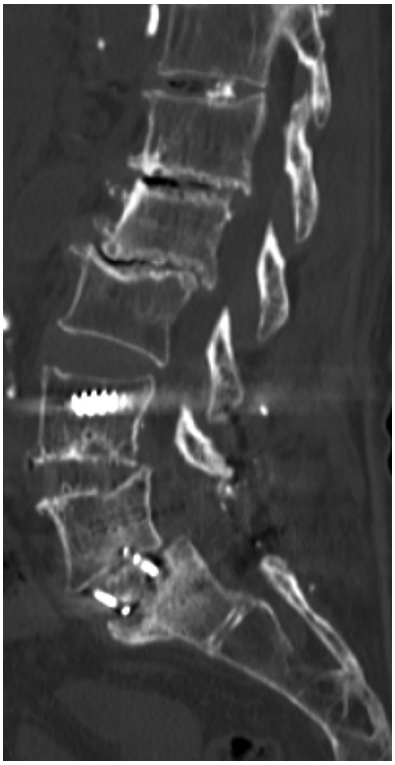

Figure 2. *Lumbar computed tomography scan on mid-sagittal view showing bone fusion at L5-S1 at 6 months post-operatively.*

fusion technique (PLIF/ALIF) after removing the cage from the retroperitoneal space successfully and confirming no vascular injury by a vascular surgeon.

The interbody cage migrated to the abdominal cavity is usually filled with different allografts such as demineralized matrix or even morphogenetic protein. The latter is relevant because it is still unclear why the implant produces an inflammatory process around it, which can result in deep vein thrombosis or other vascular injuries, moreover the legal implications that may exist[10-12].

In summary, the following recommendations could prevent anterior cage migration during a posterior interbody fusion procedure. (1) Preoperative planning that includes the measurement of the intervertebral space, to consider the cage height during the surgery. (2) The use of intraoperative lateral and anteroposterior views with the C-arm during insertion of the cage. (3) Avoid taping the interbody device with excessive strength. (4) A meticulous evaluation case-by-case based on degenerative changes at the L5-S1 level to evaluate the risk of this complication.

Conclusion

Cage dislodgement into the abdominal cavity during a posterior interbody fusion procedure is a rare but dangerous complication caused mostly by improper surgical technique. If the patient is hemodynamically stable, removing the cage by a vascular surgeon is recommended. ALIF was a reasonable option to aim fusion and stabilization of the L5-S1 level in our patient correctly.

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Conflicts of interests

1. The authors declare that the article has not been partially or completely published in other journals.
2. That the article is not under review in other magazines.
3. That none of the authors reports any conflicts of interest related to the process of reviewing, editing, or publishing this manuscript.
4. That the completion of the manuscript is not associated with any public, commercial, or other economic benefit.
5. That all authors have contributed in the same way in the preparation of the manuscript.
6. That none of the authors has an affiliation with the industry in relation to this manuscript**.**

Ethical responsibilities

Protection of people and animals. The authors declare that the procedures followed were in accordance with the ethical standards of the responsible human experimentation committee and in accordance with the World Medical Association and the Declaration of Helsinki.

Confidentiality of the data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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