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A "rising" transpedicular access to anterior vertebral body: A case report

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ABSTRACT

INTRODUCTION: The transpedicular access is a common and effective procedure used to reach anterior vertebral body without passing through critical structures. after a transpedicular instrumentation, it is difficult to reach the anterior vertebral body because screws are placed in the way. We assume that an innovative transdiscal route could be used in patients with previous instrumentation, in order to perform a vertebroplasty or biopsy.

PRESENTATION OF CASE: We report the case of a 65-years-old woman who came to our Department complaining low back pain. Neurological examination showed a stable L4 wedge fracture under a previous lumbar L3–L4 posterolateral fusion performed 2 years before.

DISCUSSION: In order to perform a vertebroplasty and a biopsy of the collapsed L4 anterior vertebral body we had to deal with transpedicular screws, which prevent any standard transpedicular pproach.

CONCLUSION: In order to reach the L4 collapsed body we used an ascending transpedicular approach. We performed a biopsy and a subsequent vertebroplasty. Two days after surgery the patient reported a complete pain remission and was allowed to walk.

1. Introduction

Nowadays, an increasing number of vertebral injuries and spinal pathologies can be treated with surgery, thanks to new devices and new surgical techniques.

At the same time, patient's life expectancy is increasing and surgical components are becoming more wear-resistant and reliable, therefore it will be necessary to study alternative accesses to reach stabilized areas in order to treat a spine once again with minimally invasive methods [1–3].

In Europe, pedicular fixation devices have become the gold standard to treat an unstable spine because it is a simple way to correct deformity and to perform spinal fusion [4,5].

The presence of pedicle screws makes traditional transpedicular approaches to vertebral body difficult or even impossible to perform.

Degeneration of the intervertebral disc results in initial relative instability and hypermobility of the facet joints. This can lead to hypertrophy of the facet joint, particularly the superior articular process, resulting in reduced spinal canal dimensions and compressed neural elements [6,7]. Decompressive laminectomy and instrumented stabilization are the best surgical solution.

Vertebral fractures are an indicator for osteoporosis and/or osteopenia [8]. Vertebral body collapse can occur after instrumented fusion or due to osteoporosis. Vertebroplasty has been proved to be an effective new procedure in osteoporotic vertebral collapse fracture with debilitating pain [9]. Cement augmentation (vertebroplasty of kyphoplasty) helps stabilize painful osteoporotic vertebral fracture (OVF) refractory to medical treatment. This stabilization is thought to improve pain and functional outcome. Vertebroplasty is the injection of Poly (methyl methacrylate) (PPMA) into a fractured vertebra using a percutaneous transpedicular approach [10].

Also, several proliferative processes may be localized in the anterior portion of vertebral body, necessitating a biopsy of the involved structures.

We describe a case of percutaneous vertebroplasty performed in a 65-years-old woman with an L4 unknown anterior vertebral body lesion who underwent to previous lumbar L3–L4 fusion and a history of breast cancer 5 years before. We used a percutaneous modified posterolateral approach with an ascending angulation of the trocar introduced through L5 pedicles to reach L4 anterior body.

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The presented case has been reported in line with the SCARE criteria (Agha et al., 2016) [11].

2. Presentation of case

The patient was a 65-years-old woman with a history of breast cancer who underwent to L3–L4 posterolateral fusion 2 years before. After two years she felt a sudden lower back pain after a flexion of the spine. The walking perimeter was reduced to 50 m. The neurological examination was normal with no alteration of the inferior reflexes. A physical examination revealed pain during percussion over spinous processes of L4 and L5, bilateral contraction of paravertebral muscles and inability to maintain standing position up to 2 min. X-ray exam showed diffuse osteoporosis and a stable L4-wedge fracture without loosening of the pedicle screws.

We decided to perform a L4 biopsy and a percutaneous vertebroplasty in order to strengthen the collapsed vertebral body and considering her breast cancer history.

The percutaneous procedure required an accurate fluoroscopic imaging of the vertebral anatomy and a radiolucent operating table. The C-arms was oriented in AP direction on the lower interested vertebral pedicle and X-Ray beam had to be co-linear with the sagittal pedicle angle visible on the lateral view of the vertebral body.

On initial AP view, a radio-opaque instrument was placed on the skin to mark the levels and positions of vertebral pedicles, then local anaesthesia was obtained by injection of mepivacaine 2% near the pedicles of the inferior vertebra passing through the soft tissues and reaching the periosteum at the bony entry point.

A small skin incision was made at the interested level to allow a 11 G Jamshidi needle to reach the pedicle (Fig. 1).

With the needle placed on the inferior-lateral border of the X-ray pedicle appearance, a slight pressure was done to permit initial entry.

Needle was gently tapped 1–2 mm into the bone using a mallet with 45° caudo-cranial degrees and 25° latero-medial degrees of direction. Lateral fluoroscopy was necessary to give superior and inferior trajectory of the needle, whereas AP view gave medial and lateral trajectory. Repeated AP and lateral images were taken to follow the needle and to confirm accurate positioning (Fig. 2).

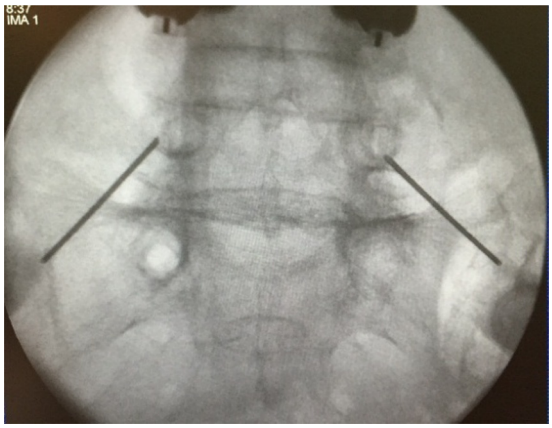

Fig. 1. Entry point of the trocar at the inferior-lateral border of the X-ray pedicle appearance.

To prevent excessive traumatic damage to L5 superior body wall, to the intervertebral disc and to L4 inferior body wall, a K wire inserted into the cannula was used to create the gateway (Fig. 3).

Once the trocar passed through the intervertebral space and entered the body, the needle was pulled out.

A10-ml syringe was then attached at the bottom of the trocar to create a negative pressure in order to drag biopsy tissue, while a rotating movement of the cannula simplified this operation.

The contralateral trocar was inserted using the same method.

Under lateral fluoroscopy, 3 ml of Polymethylmethacrylate (PMMA) was slowly injected from both trocar into the anterior part of the L4 vertebral body, then they were gently removed.

AP and lateral X-rays controls 3 days later shown cement in the correct area without leakage (Fig. 4).

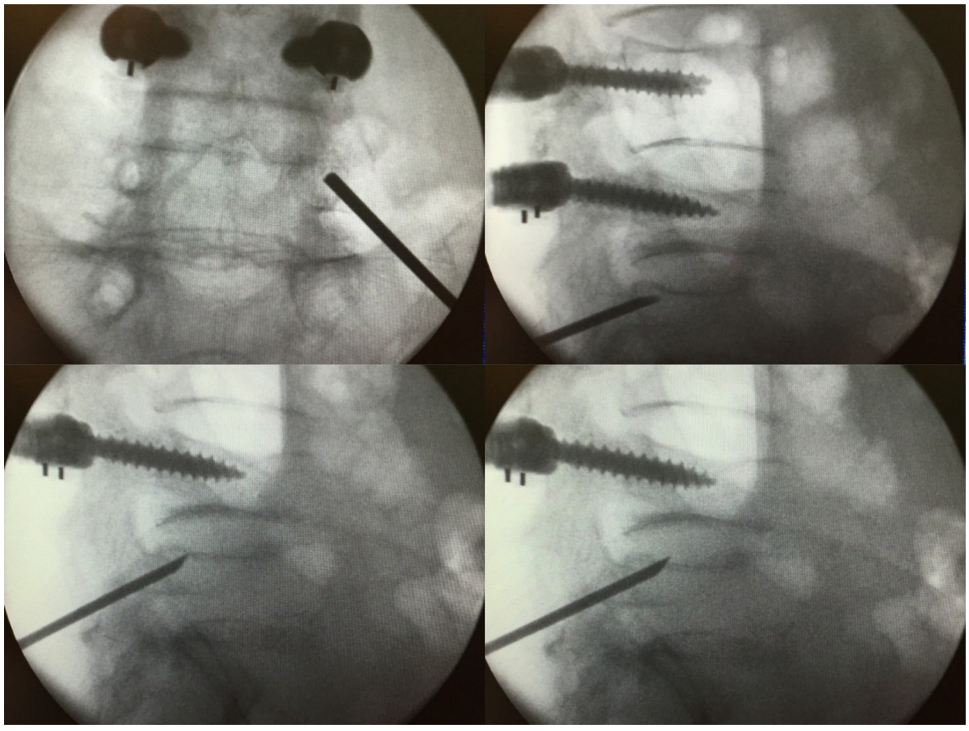

Fig. 2. Sequence of AP and lateral x-ray views during introduction of the needle through pedicle.

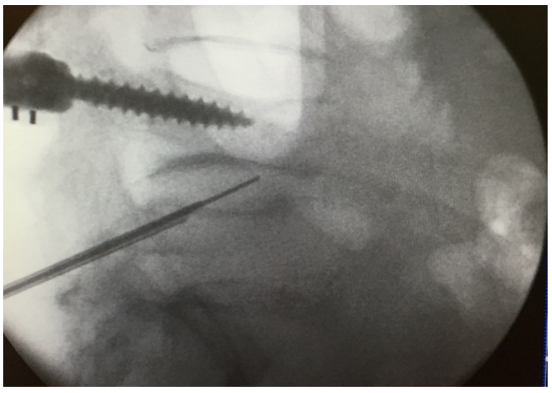

Fig. 3. A K wire creating the gateway through intervertebral disc.

The clinical evaluation 3 days later showed pain relief evaluated to 50% using visual analogue scale (VAS) and the patient started to walk without a stick.

The histologic examination of the biopsy revealed no cancer-related disease.

3. Discussion

Vertebroplasty is a procedure that allows to obtain a quick and good improvement for aged patients with acute OVF [12].

Sometimes spine fusion devices require a vertebroplasty as an extension to primary surgical treatment because of osteoporotic fractures occurred.

A regular transpedicular approach for vertebroplasty can be difficult or impossible due to the presence of pedicular screws used for spine fusion instrumentation and because of vulnerability of the nearby structures.

We decided to avoid the use of an extrapedicular access to anterior vertebral body in order not to damage “noble” structures such as peritoneum along the lumbar tract, pleura along the thoracic tract and segmental artery.

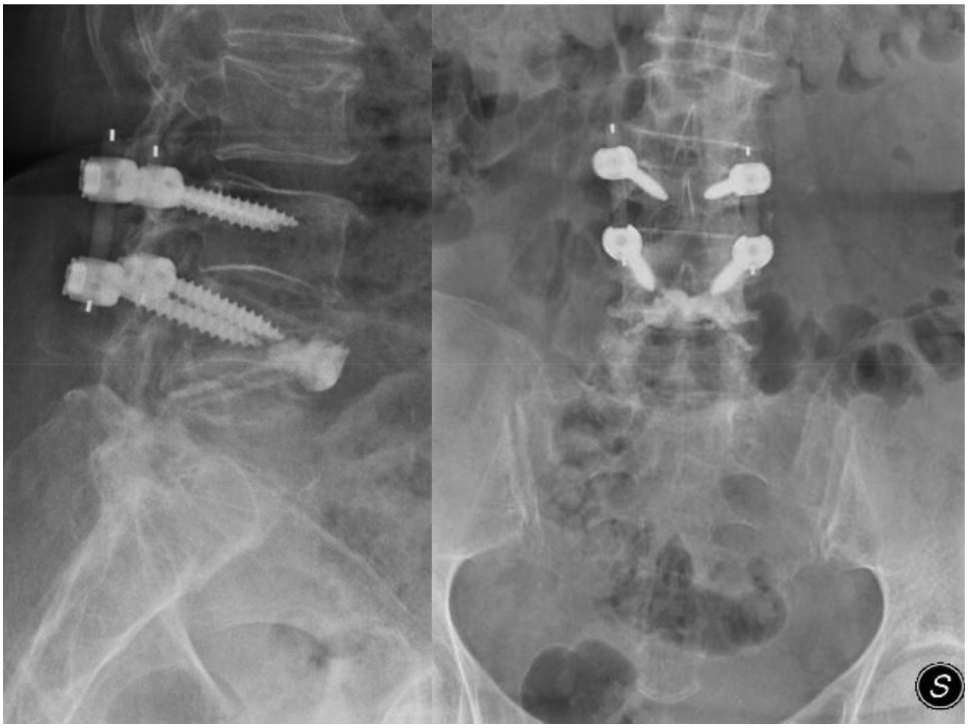

Fig. 4. Post-operative x-ray control at 3 days later.

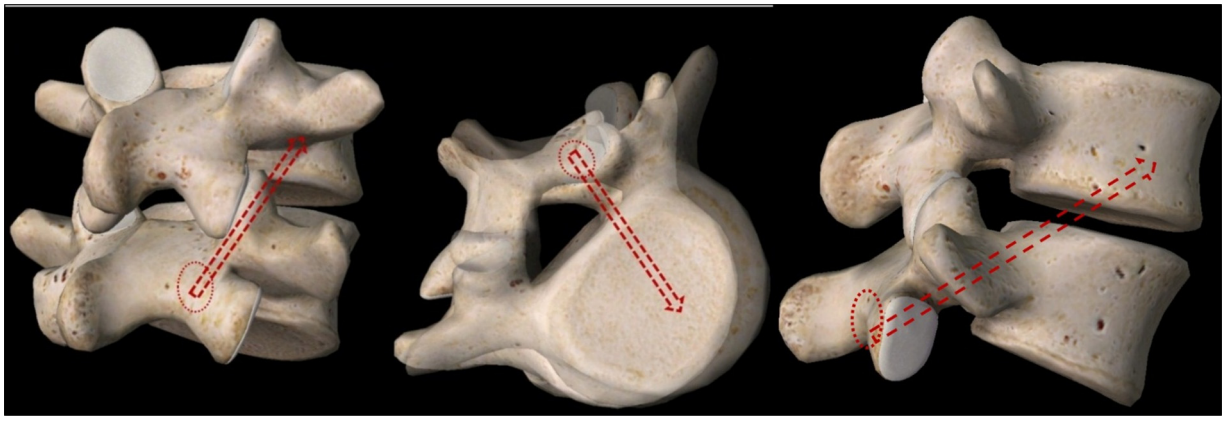

Fig. 5. A tridimensional view of needle route from inferior pedicle to superior vertebral body (red arrows).

The lumbar extrapedicular approach uses an oblique trajectory, anterior to the transverse process, at the level of the pedicles. An accurate fluoroscopic visualization of the vertebra with a true AP and lateral views is crucial. After the surgeon marks a bipedicular line on the skin, an entry point is flagged 8 cm at L1 to 12 cm at L4, lateral to midline. Then a spinal needle is advanced with 60° angulation to the vertical plane along the bipedicular line, passing anterior to the transverse process, up to the junction of the ipsilateral pedicle and the posterior vertebral body at their lateral walls. After periosteal anaesthesia, the spinal needle is withdrawn and the 11-gauge Jamshidi is advanced along the same trajectory to the same entry point [13].

It's necessary to say that in L5 the access may be difficult because of the iliac crest, the extreme medial angulation of the L5 pedicles and the largeness of the vertebral body.

In the thoracic spine is not possible to perform a lateral entry point just like in the lumbar tract, because of the ribs and pleura. Therefore, the access will be between the rib head, transverse process and pedicle.

Along the lumbar spine, an extrapedicular access with a too ventral trajectory of the needle may accidentally pass through retro-peritoneum, posteriorly to ileo-psoas, with elevated risk of bacterial diffusion or metastatic dissemination from biopsied site.

The risks for an extrapedicular approach along the thoracic spine are bacterial diffusion or metastatic dissemination into the pleural space, pneumothorax and/or haemothorax.

In both spine tracts, the extrapedicular approach may result in an injury to a nerve root or a spinal segmental artery. Nerve root injury can be easily monitored during vertebroplasty because percutaneous vertebroplasty is usually performed under local anaesthesia and any neural irritation would present with radiating radicular pain. Therefore, a nerve root injury may be prevented during the procedure. However, we suggest that injury to the spinal segmental artery may be difficult to monitor and to detect during vertebroplasty. A lumbar segmental artery injury results in a retroperitoneal hematoma, which can induce irritation of the nerve root and may potentially lead to systemic hypovolemic shock [14].

In this case, an oblique ascending transpedicular approach of L5–L4 (Fig. 5) was preferred.

4. Conclusion

This new surgical access route lets surgeon to reach two contiguous vertebral levels using a "one-act" injection in order to perform a double-level vertebroplasty or a biopsy on different structures only changing the trajectory of the needle.

The surgeon can reach the anterior vertebral body avoiding critical structures such as arteries or nerve root sleeve, or passing through pleura or peritoneum. This new surgical approach broadens the possibility for surgeons to move through vertebral structures during spinal surgery. In our debated case, an access from L4 pedicle was not possible because of the screws implanted during previous stabilization. We chose to use the descripted ascending route to execute an anterior vertebral body biopsy and subsequently to inject cement, thus reinforcing the collapsed and altered vertebral body.

The outcome of the patient was promising. The patient was able to walk without any help 3 days after surgery with pain relief up to 50% compared to precedent condition.

We suggest that this new surgical transpedicular approach could be a valid option in spine surgery to reach anterior vertebral body especially when osteosynthesis components from a previous treatment prevent classical procedures.

Spine revision surgery revision surgery is always a demanding task for the surgeons because of modifications in anatomical structures and presence of fixation devices. Surgeons have to be familiar with different surgical approaches in order to reach bone structures and to prevent iatrogenic damages. The ascending transpedicular approach from lower vertebra may be a valid and secure option to reach anterior vertebral body in order to perform a biopsy or vertebroplasty, especially when osteosynthesis components make other more used accesses difficult.

Submission declaration

The authors declare: that the work described has not been published previously, that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright holder.

Conflict of interest

Nothing to declare.

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Ethical approval

An ethical approval was not required.

Consent

Written and signed consent was obtained from the patient.

Authors contribution

E.C. and L.P. data analysis and interpretation, writing the paper.
G.C image preparation and study design.
A.M. data analysis.
C.D. overall responsibility, data analysis and interpretation, writing the paper.

Guarantor

Professor Carlo Doria.

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