the ipsilateral bridging veins prone to injury but also the contralateral veins [7]. There have also been reports of ruptured arachnoid cysts resulting in ipsilateral subdural cerebrospinal fluid collections without haemorrhage [8,9], and it has been proposed that the resulting sudden collapse of the cyst could result in tearing of bridging veins on the contralateral side and subsequent contralateral subdural haemorrhage [7].

This case demonstrates that although arachnoid cysts are usually benign, complications can occur. In this case, the initial CT scan did not demonstrate the tear in the arachnoid membrane but was better delineated with MRI. It is important to identify and be aware of the possible progression of this injury in order to ensure that patients are followed up appropriately.

Conflicts of Interest/Disclosures

The authors declare that they have no financial or other conflicts of interest in relation to this research and its publication.

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References

[1] Osborn AG, Preece MT. Intracranial cysts: radiologic-pathologic correlation and imaging approach 1. Radiology 2006;239:650–64.
[2] Burger P, Scheithauer B, Vogel F. Intracranial meninges. In: Scheithauer BW, Vogel FS, editors. Surgical pathology of the brain and its coverings. Philadelphia, Pa: Churchill Livingstone; 2002. p. 89–93.
[3] Gosalakkal JA. Intracranial arachnoid cysts in children: a review of pathogenesis, clinical features, and management. Pediatr Neurol 2002;26:93–8.
[4] Iaconetta G, Esposito M, Maiuri F, et al. Arachnoid cyst with intracystic haemorrhage and subdural haematoma: case report and literature review. Neurol Sci 2006;26:451–5.
[5] Wester K, Helland CA. How often do chronic extra-cerebral haematomas occur in patients with intracranial arachnoid cysts? J Neurol Neurosurg Psychiatry 2008;79:72–5.
[6] Patel AP, Oliverio PJ, Kurtom KH, et al. Spontaneous subdural hematoma and intracystic hemorrhage in an arachnoid cyst. Radiol Case Rep 2009;4.
[7] Pillai P, Menon SK, Manjooran RP, et al. Temporal fossa arachnoid cyst presenting with bilateral subdural hematoma following trauma: two case reports. J Med Case Rep 2009;3:17.
[8] Nuri Sener R. Arachnoid cysts associated with post-traumatic and spontaneous rupture into the subdural space. Comput Med Imaging Graph 1997;21:341–4.
[9] Gelabert-González M, Fernández-Villa J, Cutrín-Prieto J, et al. Arachnoid cyst rupture with subdural hygroma: report of three cases and literature review. Childs Nerv Syst 2002;18:609–13.

Cortical screw trajectory for instrumentation and fusion in the setting of osteopathic compression fracture allows for percutaneous kyphoplasty for adjacent level compression fractures

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Spinal fixation in the osteoporotic patient can be challenging due to the poor trabecular bone quality of the vertebral body. Patients with osteoporotic vertebral body compression fractures are at risk for future compression fractures at adjacent levels, especially after cement augmentation. The purpose of this technical report is to describe the utilization of a cortical screw trajectory along with kyphoplasty for a patient with an osteoporotic compression fracture as well as degenerative spinal disease. This trajectory allows for the possibility of percutaneous pedicle access in the event of future compression fractures. Our patient underwent a decompressive laminectomy and kyphoplasty at the level of an osteoporotic compression fracture. The fracture was stabilized with cortical screw instrumentation and fusion at a level above and a level below the fracture. Subsequently the patient developed an adjacent level fracture within the fusion construct. Due to the utilization of a cortical screw trajectory for the initial fusion, the traditional pedicle trajectory was still accessible. As a result, the new fracture was treated with a percutaneous kyphoplasty through a standard pedicle trajectory. In conclusion, the use of a cortical screw trajectory for stabilization of osteoporotic compression fractures provides for a stronger bone screw interface and avoids osteoporotic trabecular vertebral body bone. At the same time this trajectory allows for future percutaneous pedicular access in the event that the patient suffers future compression fractures.

1. Introduction

Approximately 10 million people in the USA currently suffer from osteoporosis with an estimated additional 34 million people at risk of low bone density. Osteoporosis is responsible for an estimated 2 million fractures, of which approximately 550,000 are vertebral fractures [1,2]. With an aging population worldwide, specifically those individuals over 65 years of age, there will be an increased need to treat degenerative spinal conditions in patients suffering from osteoporosis [2,3]. In many cases, patients will likely experience a combination of degenerative disease as well as osteoporotic fractures. Unfortunately, surgical treatment of vertebral compression fractures and other spinal disease in patients with osteoporosis is challenging, as many of the bony changes that make people with osteoporosis prone to spinal degeneration also interfere with stable spinal fixation [3–7]. Complications of spinal fixation in these patients include screw loosening and hardware failure from poor fixation in osteoporotic

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bone, vertebral fractures after instrumentation, and pseudoarthrosis [8–13].

Currently, the main surgical treatment for symptomatic vertebral compression fractures involves cement augmentation either through vertebroplasty or kyphoplasty. The natural history of osteoporosis-related compression fractures is that approximately 19% of patients will develop radiographic evidence of a subsequent compression fracture within 1 year [14]. Treatment with cement augmentation has been shown to increase the incidence of subsequent vertebral fractures, which occur in 12–52% of patients, with the majority occurring in the first 3 months [15–17]. It is postulated that the presence of cement increases the stress on the adjacent end plates resulting in an increased rate of adjacent segment fracture [18]. Multiple studies have demonstrated that the incidence of adjacent level fracture is greater in kyphoplasty (22–75%) than vertebroplasty (0–16%) [15–17,19].

Fig. 1. Preoperative sagittal CT scan of the lumbar spine.

Vertebral body compression fractures may also be treated with spinal instrumentation and fusion techniques. Pedicle screw systems help correct alignment, maintain stability, and achieve stable bony fusion in patients with vertebral compression fractures [13]. The stability of these systems depends largely on the pedicle screw purchase in the trabecular bone. The decreased density in osteoporotic bone reduces the number of sites of contact between the screw and bone compared with normal bone, which compromises the maximum strength and rigidity obtained at the screw–bone interface. Additionally, the decreased connectivity in the trabecular network and higher susceptibility to microfracture in osteoporotic bone increases the risk of the screw shearing away from adjacent bone [6,10,20]. These mechanisms lead to increased screw loosening and instrumentation failure. Osteoporotic bone also takes longer to fuse compared with normal bone. This means that the instrumentation designed to provide temporary support during fusion experiences longer stress loading, which further increases the risk of instrumentation failure [8]. These complications have led to the investigation of ways to improve spinal fixation by altering the surgical insertion technique, the type of implant used, the bone density, or augmenting with bone cement [7,20].

One method proposed to improve spinal fixation is to alter the pedicle screw trajectory so that it experiences higher density bone. The more traditional trajectory is the transpedicular path, in which the screw passes through both cortical and trabecular bone. The new trajectory allows the screw to experience cortical bone without passing through trabecular bone. As cortical bone is denser and less effected by the degenerative changes of osteoporosis, this maximizes screw purchase at the screw–bone interface by providing greater contact between the screw and the bone. A biomechanical study by Santoni et al. demonstrated that this new cortical trajectory provides a 30% increase in failure load in screw pullout, which suggests that this trajectory may be useful in patients with osteoporosis who have poor trabecular bone quality [3,20].

We present a case report of a patient with a combination of osteoporotic compression fracture and spondylosis who underwent decompression, kyphoplasty, and cortical bone screw instrumentation and fusion. She subsequently developed an adjacent segment compression fracture within the spinal fixation construct.

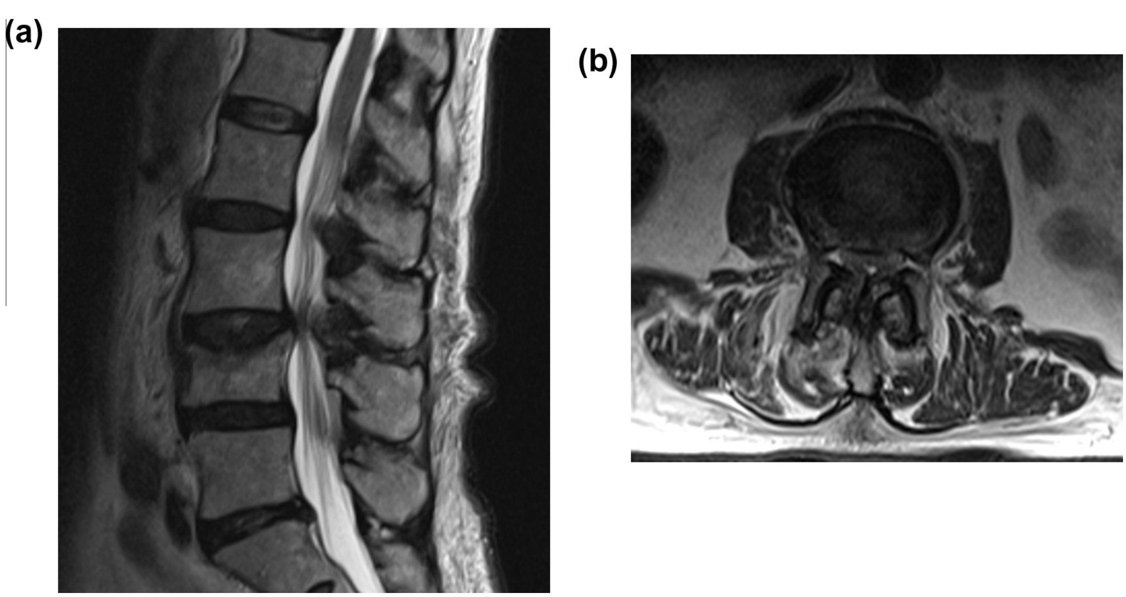

Fig. 2. Preoperative (a) sagittal and (b) axial T2-weighted MRI of the lumber spine.