Percutaneous Treatment of Lumbar Compression Fracture with Canal Stenosis and Neurogenic Intermittent Claudication: Combining Kyphoplasty and Interspinous Spacer

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ABSTRACT

Vertebral compression fractures (VCFs) can cause symptomatic spinal canal stenosis secondary to posterior wall retropulsion. This report describes four patients with VCF and lumbar stenosis secondary to posterior wall retropulsion who were treated with combined kyphoplasty and percutaneous interspinous spacer (IS) placement. Clinical and imaging follow-up ranged from 12–36 months. Outcomes were favorable. Combined kyphoplasty and percutaneous IS implant represents a minimally invasive, safe, and efficient option to treat VCF with symptomatic spinal stenosis.

ABBREVIATIONS

BKP = balloon kyphoplasty, INC = intermittent neurogenic claudication, IS = interspinous spacer, VCF = vertebral compression fracture

Vertebroplasty and balloon kyphoplasty (BKP) are widely used for minimally invasive treatment of pain associated with vertebral compression fractures (VCFs) (1–4). Use of interspinous spacers (ISs) has proven effective in increasing the size of the spinal canal and intervertebral foramina in patients with symptomatic lumbar stenosis (5,6), reducing or eliminating symptoms of intermittent neurogenic claudication (INC) (7,8). Some VCFs can be complicated by retropulsion of the posterior vertebral wall, causing central canal stenosis, and INC. According to Miller and Nader (9), combining BKP and IS placement is a therapeutic option for patients with pain from osteoporotic VCF and INC, obviating the need for bracing, immobilization, and more invasive decompressive laminectomy and foraminotomy. We applied a similarly combined approach, but entirely percutaneous and minimally invasive, in four patients presenting with back pain and INC from a lumbar VCF with vertebral body retropulsion and central canal stenosis.

MATERIALS AND METHODS

The description of this case series was authorized by our local ethical committee. Data on patients, treatment, and follow-up are summarized in the **Table**. Details of procedures in two patients are provided in **Figs 1a–e** and 2**a–d**.

Procedure and Instrumentation

Percutaneous BKP (Kyphon Balloon Kyphoplasty; Kyphon Medtronic, Minneapolis, Minnesota) was performed with the patient in the prone position, with bolsters under the abdomen and chest to hyperextend the spine segment, in an attempt to achieve partial reduction of the VCF, under biplane fluoroscopy guidance. Using a bilateral transpedicular approach, a bone curet was operated coaxially before tamp inflation, to allow the desired balloon inflation in a cranial and midline direction. In all cases, two 20-mm balloons were inflated inside each vertebral body. To decrease the risk of recollapse of the vertebral body after balloon deflation and before cement injection, only one balloon was deflated at a time, while standard Kyphon polymethyl methacrylate was injected ipsilaterally. Solidified cement is not adhesive and cannot adhere to an inflated balloon. Although occasionally a balloon left inflated dur-

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Table. Patient Characteristics, Treatment, and Follow-up

Patient	Sex/ Age (y)	VCF	Treatment	Concurrent BKP/IS	Clinical Follow-up	Imaging Follow-up	Imaging Results	Additional Notes
1	F/60	L4	BKP L4; IS L3-L4	No	36 mo	36 mo	↑ CC	Steroid-induced osteoporosis
2	F/79	L3, L4	BKP L3, L4; IS L3-L4	No	18 mo	None	N/A	L4 VCF responsible for CC stenosis
3	M/82	L4	BKP L4; IS L3-L4, L4-L5	Yes	32 mo	32 mo	↑ CC L4-L5	Multilevel congenital and degenerative CC stenosis. Spinoplasty L3, L4, L5
4	F/67	L4	BKP L4; IS L3-L4	Yes	12 mo	12 mo	↔ CC	Degenerative spondylolisthesis L3-L4

BKP = balloon kyphoplasty, CC = central canal caliber, IS = interspinous spacer, N/A = not applicable, VCF = vertebral compression fracture, ↑ = increased, ↔ = unchanged.

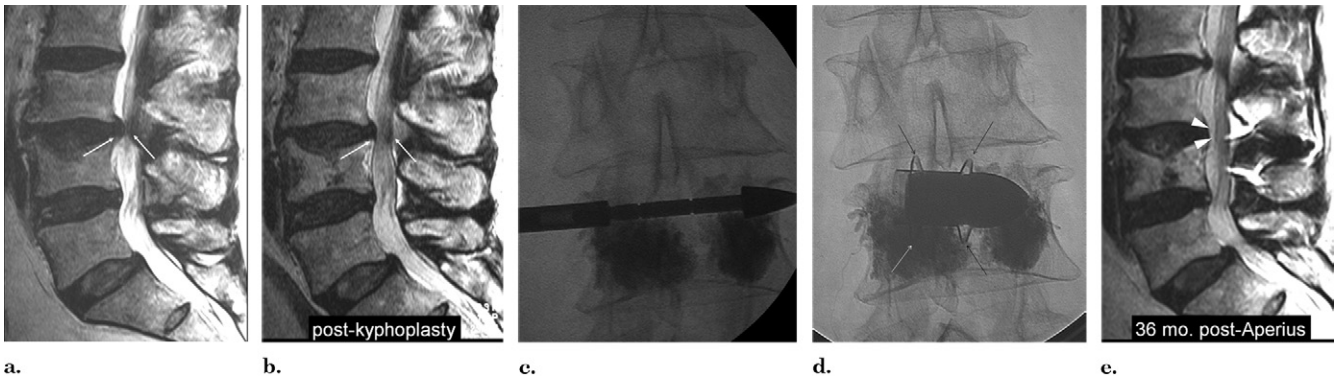

Figure 1. Patient 1. **(a)** Midsagittal T2 fast spin echo MR image shows L4 compression fracture, mild retropulsion of the superior corner of the posterior wall, and disk protrusion, resulting in severe central canal stenosis at L3-L4 (arrows). Short tau inversion recovery images (not shown) showed bone marrow edema in the fractured vertebral body. **(b)** Corresponding midsagittal T2 fast spin echo MR image after L4 kyphoplasty shows significant reduction of the segmental stenosis (arrows). **(c)** Anteroposterior fluoroscopic image during percutaneous interspinous dilator insertion. **(d)** Through the path created by the dilator, the Aperius IS device is percutaneously inserted between the spinous processes and released; four little wings (arrows) are opened, which, with the intact supraspinous ligament, secure the device in place. **(e)** MR imaging midsagittal T2 fast spin echo obtained at 36 months' follow-up shows further significant reduction of the spinal stenosis, with patency of the subarachnoid space and decompression of the roots of the cauda equina (arrowheads).

ing contralateral injection of cement can rupture, this did not happen in any of these cases.

Percutaneous IS device (Aperius PercLID system; Kyphon Medtronic) placement was performed using biplane fluoroscopic guidance, with the patient in the prone position and mild flexion of the lumbar spine, obtained by the use of bolsters of different thickness under the abdomen. A 15-mm paravertebral skin incision was made 6 cm from the midline. Through the incision, an 8-mm dilator with a sharp tip was inserted and pushed, under lateral fluoroscopic control, in a ventromedial direction toward the ventral part of the interspinous space, immediately behind the lamina, and deep to the supraspinous ligament. Under anteroposterior fluoroscopic control, the sharp dilator was inserted through the interspinous ligament, about 2 cm beyond the midline (**Fig 1c**). The described lateral approach respects the integrity of the supraspinous ligament. The dilator was retrieved, and blunt dilators of increasing size (10 mm, 12 mm, 14 mm) were easily inserted through the already opened pathway. The correct size of the implant was determined by evaluating the physical resistance to introduction and retrieval and observing under fluoroscopy the widening of the disk space and foramina. The chosen device was introduced in the same way. Once in place across midline, the IS was compressed and shortened by turning a knob with consequent opening of the lateral wings (**Fig 1d**). At this point, a second knob unscrewed a retention thread and allowed final release of the IS device. All interventions were performed under intravenous conscious sedation. Postoperative mobilization and full weight bearing were allowed the same day after the procedure, without any bracing.

CASE REPORTS

Case 1

The patient presented with sudden onset of severe acute lumbar pain while lifting a light weight. Magnetic resonance (MR) imaging showed a VCF of L4 with bone