

Comparison of 50 vertebral compression fractures treated with surgical (kyphoplasty) or non surgical approach

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Summary

The presence of a vertebral fracture increases the risk of a new fracture within a year by at least five times and the risk further increases in case of recurrent fractures (domino effect).

The pain and fracture kyphosis can compromise respiratory function. Many patients sustain serious cardiovascular, musculoskeletal, metabolic, and immune complications related to immobility and bedrest. This study is a clinical and radiological assessment of a consecutive cohort of 50 patients with vertebral fractures. We made comparison of 25 vertebral compression fractures treated with surgical (kyphoplasty) or non surgical approach.

Systematic reviews of this procedure have shown significantly improved back pain and quality of life compared to conservative therapy. When performed by a well-trained practitioner in appropriately selected patients, kyphoplasty is a safe and effective treatment for fresh vertebral compression fractures.

KEY WORDS: osteoporosis; vertebral compression fracture (VCFs); kyphoplasty; social cost.

Introduction

Osteoporosis affects more than the 55% of women older than 55 years and it is characterized by decreased bone mineral density resulting in increased bone fragility and a higher susceptibility to fracture (1-4). In the United States, osteoporosis leads to over 700,000 vertebral compression fractures (VCFs) per year and affects women twice as often as men (5).

The increased risk of falling associated with aging leads to fractures of the wrist, spine and hip. The risk of falling, in turn, is increased by impaired eyesight due to any cause (e.g. glauco-

ma, macular degeneration), balance disorder, movement disorders (e.g. Parkinson's disease) and dementia. Collapse (transient loss of postural tone with or without loss of consciousness) leads to a significant risk of falls; causes of syncope are manifold but may include cardiac arrhythmias (irregular heart beat), vasovagal syncope, orthostatic hypotension (abnormal drop in blood pressure on standing up) and seizures.

The form of osteoporosis most common in women after menopause is referred to as primary type 1 or postmenopausal osteoporosis. Primary type 2 osteoporosis or senile osteoporosis occurs after age 75 and is seen in both females and males at a ratio of 2:1. Finally, secondary osteoporosis may arise at any age and affects men and women equally. This form of osteoporosis results from chronic predisposing medical problems or disease, or prolonged use of medications such as glucocorticoids, when the disease is called steroid- or glucocorticoid-induced osteoporosis.

Vertebral fractures are the most common in osteoporosis. Decreased bone mineral density acts particularly on the cancellous bone. Cancellous bone being the responsible for 70% of vertebral strength, which explains the frequency of VCFs in osteoporosis.

Initial treatment of VCF includes rest in bed, activity modification and analgesic medications. The clinical manifestation of a VCF can lead to chronic pain, deformity, and disability.

The presence of a vertebral fracture increases the risk of a new fracture within a year by at least five times and the risk further increases in case of recurrent fractures (domino effect) (6).

The pain and fracture kyphosis can compromise respiratory function. Many patients sustain serious cardiovascular, musculoskeletal, metabolic, and immune complications related to immobility and bedrest.

Patients typically affected by VCF often cannot tolerate the complications of nonoperative care. It is not uncommon for a patient to be admitted to a hospital for treatment, discharged, and readmitted to treat complications with medical resources used at each stage. The result can be a downward-spiral of complications, functional decline, and a higher risk of death as a result of the VCF. Treatment that accelerates the return of patient function can potentially reduce both the medical risks of VCF as well as the economic burden of the disease. Techniques of vertebral augmentation have been developed to treat VCFs refractory to nonoperative care. Percutaneous vertebroplasty was introduced in 1987 initially as a treatment for aggressive vertebral hemangiomas and was later modified as kyphoplasty (7, 8).

Both involve pedicle cannulation and injection of polymethylmethacrylate (PMMA) bone cement into the fracture. In kyphoplasty, an inflatable bone tamp is used to prepare a confined space for PMMA injection. With kyphoplasty we put cement low pressure and we can reduce the fracture. Both techniques reportedly relieve fracture pain and improve functional outcome at both short- and long-term follow up. The procedure is not without risk, however. Cement extrusion from the vertebra reported in up to 30% of vertebroplasty has been improved to 0-8.6% by using the bone tamp in kyphoplasty (Figure 1).

Additionally, the initial cost of kyphoplasty may be higher than nonoperative care (including implanted PMMA and disposable instrumentation), but may be offset by reduced use of medical resources after hospital discharge.



Figure 1 - Post operative x-ray of L1 fracture.

Materials and methods

This study is a clinical and radiological assessment of a consecutive cohort of 50 patients with vertebral fractures.

25 patients were treated with kyphoplasty and 25 patients were treated with rest and orthoses.

The mean follow up period is 12 months (range, 6 to 24 months). All patients were operated by the senior author at one center between June 2004 and May 2009.

The average age of the surgical patients was 69 years (range, 44 to 83 years) at the time of the operation. 17 patients were female and 8 were male.

The average age of the non-surgical patients was 78 years (range, 44 to 83 years) at the time of the operation. 14 patients were female and 11 were male.

Both groups of patients were treated with bisphosphonates.

The standard procedure for assessing the patient's profile and suitability for a kyphoplasty procedure during the preoperative phase consisted of a clinical examination, X-rays, CT.

CT, before procedure, evaluates the integrity of the posterior somatic wall and helps to assess the eventual posterior displacement of fragments. Furthermore, CT allows measurement of the pedicular diameter, which may influence the size of the needle chosen for puncture, especially in the more slender thoracic vertebral pedicles (Figure 2).

According to the Italian law, Ethical approval for this study was not



Figure 2 - CT scan evaluates the integrity of the posterior somatic wall.



Figure 3 - Intraoperative procedure shows trochar advanced through the pedicle.

required because it involved only routine clinical follow up and radiographic examination.

The procedure was performed under local anaesthesia in the prone position on a fluoroscopy table through a 22- G spinal needle both at the skin level and deep to include the periosteum of the pedicle. Biplanar fluoroscopy was mandatory for this procedure to be performed under fluoroscopic guidance. Needles with connection tubing and cement injection syringes (11-13 G) were used. Bilateral approach was performed. Trochar advanced through the pedicle, sloping anteriorly, medially and caudally (Figure 3). A poly(methyl methacrylate) (PMMA) mixture was injected into the vertebral body (mean 2.5 ml) after careful imaging to confirm location of the trochar in the anteromedial portion of vertebral body; cement injection was executed on lateral view with continuous fluoroscopic monitoring, with close attention at the posterior margin of the vertebral body and at the epidural space. During cement deposition, frequent fluoroscopic controls in both planes were required to ensure that the material remained within the vertebral body without migrating into the surrounding venous plexus. Injection was terminated when adequate filling of the vertebral body was obtained.

Results

In the conservative cases we had a 35% increase of loss height

in the first 4 months and 20% of cases there was a new fracture during the two years following the first injury. Cases treated with kyphoplasty have achieved a 80% reduction of the fracture with partial somatic repair of the height. The reported complications for hospital treatment of VCFs was 4 cases of asymptomatic migration of the cement, only 8% of the cases recorded a new fracture during the two years following the first injury. The pain resolution took place after 48 hh after treatment.

Discussion

Systematic reviews of this procedure have shown significantly improved back pain and quality of life compared to conservative therapy. Additionally, the initial cost of kyphoplasty may be higher than nonoperative care (including implanted PMMA and disposable instrumentation), but may be offset by reduced use of medical resources after hospital discharge (9, 10). Fracture reduction was best achieved in acute fractures. The evidence for increased risk of adjacent level fracture after this procedure compared to conservative treatment is inconclusive (11). When performed by a well-trained practitioner in appropriately selected patients, kyphoplasty is a safe and effective treatment for fresh vertebral compression fractures.

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