Percutaneous Vertebroplasty in Osteoporotic Vertebral Fractures

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25.1 Terminology

The term vertebroplasty describes the internal augmentation of a fractured vertebra through the direct intraosseous injection of bone cement into the vertebral body in order to reduce pain and provide stability.

25.2 Surgical Principle

A large-caliber trocar needle is percutaneously inserted into the vertebral body via a transpedicular or an extrapedicular approach under fluoroscopic guidance. The bone cement (usually polymethylmethacrylate; PMMA) is injected slowly under image guidance and continuous monitoring of the vital parameters. Most procedures are performed with the use of fluoroscopic guidance; the use of computed tomography has also been described. Reduction of a kyphotic deformity is performed before the injection by manual traction and hyperlordotic positioning of the patient. The intervention can be performed under general anesthesia or conscious sedation and local anesthesia.

25.3 History

Vertebroplasty has become one of the fastest emerging techniques in spine surgery in the last 5 years. Deramond and Galibert, interventional radiologists at the university of Amiens, France, first performed the technique in 1984 as a treatment for an aggressive vertebral hemangioma of C2 and named it percutaneous vertebroplasty [11].

Later the indication was extended to the treatment of other osteolytic lesions with painful involvement of the spine [10], as well as to the treatment of osteoporotic vertebral fractures [20]. The first series in the United States was reported in 1997 [18]. In the late 1990s vertebroplasty was “reimported” to Europe, gained widespread popularity, and became the treatment of choice for fresh, painful osteoporotic vertebral compression fractures (VCFs).

25.4 Advantages

The reasons for the popularity of percutaneous vertebroplasty are its excellent results in pain relief, combined with a low morbidity of the procedure and the possibility of performing it in an outpatient setting. Vertebroplasty is also a low cost procedure, as no expensive implants or single-use devices are required.

But its major advantage is that it closes the gap between conservative therapy with bed rest, bracing, and analgesics, and “real” surgery with a multilevel instrumentation and stabilization. Vertebroplasty offers a treatment to a group of patients who, until then, only had very limited therapeutic alternatives [8].

25.5 Disadvantages

Due to the lack of alternative treatment options, percutaneous vertebroplasty has no major disadvantages. However, it is a technically demanding procedure, especially in severe osteoporotic cases and even more so in metastatic VCFs. Spine surgeons used to direct visual control might experience difficulties in relying on fluoroscopic guidance alone, and interventional radiologists might have more problems selecting the correct patients, handling stability issues, and identifying the limitations of the procedure.

25.6 Indications

Patient selection is the key to a successful outcome for most surgical interventions. The indication for percutaneous vertebroplasty in osteoporotic VCFs is usually based on:
The presence of a VCF, which is not old or healed (a fresh or “chronic fresh” fracture should be shown by MRI; “chronic fresh” fractures are old, obviously not healing osteoporotic fractures which present the same MRI features as fresh fractures; see 25.6.1)

- The presence of pain corresponding to the level of the fracture, refractory to medical therapy
- The exclusion of contraindications

### 25.6.1 Fracture

The diagnosis of a VCF is made radiologically. Plain film radiographs of the thoracic or lumbar spine or the thoracolumbar junction in an anteroposterior (AP) and lateral view are required. Radiographs of the total spine are helpful for the identification of thoracic target level(s) in the presence of multiple fresh and old fractures; transition abnormalities at the lumbosacral and the thoracolumbar junction can be visualized more easily.

An MRI study of the part in question of the spine is extremely helpful in determining the age as well as the healing status of a fracture. The typical bone marrow edema (signal hypointensity on T1- and hyperintensity on T2-weighted images) pinpoints a recent or a non-healed fracture (pseudarthrosis) and is particularly obvious with fat saturation techniques (Fig. 25.1).

Fractures of metastatic and traumatic origin require additional computed tomography (CT) with sagittal reconstructed images, which allow the evaluation of osteolytic areas (perforation of the cortical wall, involvement of the pedicle) and the classification of the fracture type, respectively. A bone scan usually provides no additional information in patients with osteoporotic fractures.

As an exception to this we recommend the performance of percutaneous vertebroplasty in morphologically normal and non-fractured vertebrae, if both adjacent vertebral bodies are treated due to fractures and an osteoporosis has been diagnosed. This regimen follows biomechanical considerations: an osteoporotic vertebral fracture increases the risk of another fracture by 4 times and after a second fracture it is 12 times higher [23, 24]; furthermore vertebrae are at an increased risk of collapse if the adjacent vertebral bodies have been augmented [9, 30]. But the evidence is limited and, therefore, this so-called prophylactic augmentation is still a matter of discussion.

### 25.6.2 Pain

Most osteoporotic vertebral fractures occur due to minor traumas, are not very painful, and, therefore, if at all, are diagnosed months or years later by accident [19]. In the remainder, morbidity is significant and pain is severe and debilitating. For these patients the same therapeutic guideline should apply as for patients with other immobilizing fractures: to achieve the earliest possible mobilization in order to reduce the morbidity and to shorten the rehabilitation period. Despite the fact that there is a remission of pain in 85% of the patients within 2–12 weeks [19], we propose an early aggressive treatment in patients with debilitating pain.

Failure of a comprehensive conservative treatment with persistence of pain for months (chronic fractures, pseudarthrosis) is the classic indication for vertebroplasty. In rare cases an indication might be given in patients with less or even no pain if progressive subsidence of a fracture is observed.

### 25.7 Contraindications

In general percutaneous vertebroplasty has the same absolute contraindications as any other surgical intervention: systemic or local infections, bleeding disorders (e.g., oral anticoagulation), and anesthetic obstacles, which prohibit its performance under conscious sedation or general anesthesia.

Specific contraindications are unstable fractures, especially if they are accompanied by a compromise of the spinal canal or nerve roots due to a retropulsed