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Vertebroplasty: Review of the Procedure in Relation to Patients with Fracture of Osteoporotic Origin

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Introduction

Vertebroplasty was initially described by Gallibert and cols. in 1987 to treat symptomatic hemangiomas of the vertebral body [1]. Percutaneous vertebroplasty (PV) is a minimally invasive technique used to reinforce pathological vertebral bodies. It is indicated in symptomatic hemangiomas, vertebral fractures due to osteoporosis and vertebral involvement due to metastasis or multiple myeloma with bone destruction and risk of spinal and/or root involvement. The efficacy of VP is based on its analgesic effect, in addition to preventing vertebral fractures and, in the event of a vertebral fracture already existing, the VP prevents its progression. The technique involves the injection of methyl-methacrylate cement (M-M) into the pathological vertebra, in a semiliquid or pasty state so that in a very short time it polymerizes to a solid state, giving a good support to the vertebral body. When hardened within the cancellous bone of the pathological vertebra, the M-M cement increases the resistance of the vertebral body, which prevents the progression of the fracture thereof and produces an analgesic effect [2]. In addition to the mechanical effect produced by cement, it also performs two other actions: the first is the thermal effect, due to the polymerization process that releases a large amount of heat, destroying the tumor cells in the event of neoplastic infiltration. The second action is the cytotoxic effect of M-M on cells in direct contact with cement, described in previous investigations.

The cement was used for the first time in 1960 in hip surgery [3], whereas in 1984 Galibert first described vertebroplasty by direct injection. In 1985 Galibert and Deramond described the VP and since then the use of cement M-M in medicine has been increased and the indications of VP have expanded. Initially VP was used for the treatment of aggressive vertebral hemangiomas with pain, expansion and bone destruction. Currently, its application has been extended to tumor pathology such as metastasis and multiple myeloma as palliative and adjuvant treatment with radiotherapy, chemotherapy and surgery. Another main indication of the technique is fracture due to osteoporosis that does not respond to the usual conservative treatment.

Pathology

Osteoporosis

The functional disability of patients with osteoporosis is due to vertebral and hip fractures. Patients with fractures of one vertebra may be asymptomatic, but in the case of multiple vertebral fractures or hip fractures, their functional capacity may be severely diminished. Some authors have compared older female patients with osteoporosis, and with two or more vertebral fractures with loss of height greater than 25%, with women in similar conditions without fractures. Patients with fractures had functional abilities well below the control group. Functional limitations due to vertebral fractures affected all aspects of everyday life, such as housework, walking, playing sports or driving a car. These limitations appear to increase as the number of fractures increased. Pain in patients with osteoporosis can be acute and is usually due to recent fracture, although there are vertebral fractures without acute pain. The painful symptoms of vertebral fractures usually disappear at 4-6 weeks if there is no medullar or radicular involvement. The usual treatment of acute pain due to vertebral fracture consists of bed rest, local analgesia with cold and heat, massage, nerve root block and physiotherapy, as well as non-steroidal analgesics, myorelaxants. Prolonged bed rest can also aggravate osteoporosis.

Chronic back pain and low back pain in patients with osteoporosis are usually of muscular origin due to contractures due to skeletal deformities. This pain should be treated with physical exercises to strengthen the lumbar muscles and in case of exacerbation with rest, cold-heat, analgesics, muscle relaxants and physiotherapy.

Percutaneous Vertebroplasty

In addition to the invasive surgical techniques, for the repair and stabilization of the injured vertebrae, with the consequent anesthetic and surgical risk and the high cost of the procedure, a new percutaneous technique has been introduced that is much less invasive, less expensive and with very good results positive.

The cement

The cement we use in percutaneous vertebroplasty is MM. There are several brands with the same product and some contain antibiotics. The cement has the following constituents: a) powdered components: gentamicin sulfate, polymethyl methacrylate, benzoyl peroxide, barium sulfate; b) Liquid components: methyl methacrylate, N,N-dimethyl-ptoluidine,hydroquinone. Bone cements do not have adhesive properties [4]. They harden quickly within the bone and when distributed in the cancellous bone they allow to reinforce it and to distribute the weight and other tensions in a regular way [5].

Percutaneous Vertebroplasty Technique

The technique used in VP is the following:

- Positioning of the patient: In cervical lesions, the patient is placed in the supine position, in dorsal lesions in the prone position, while in the lumbar lesions he is placed in the prone or lateral decubitus position.
- Analgesia: The most used in neuroleptoanalgesia, plus local anesthesia. Some authors use general anesthesia.
- Approach: a) at the cervical level, access is anterolateral; b) at the dorsal level it is transpedicular; c) at lumbar level it is transpedicular or posterolateral.
- Access is usually bilateral, although in some procedures a unilateral puncture is sufficient.
- Injection control: with fluoroscopy.
- Contrast used: tungsten or tantalum in quantity corresponding to 0.5-1 g for each vertebral body. Some authors use barium [6].

Vertebroplasty with transpedicular approach

The patient is placed in the prone position when the lesion is dorsal or lumbar. A peripheral line is taken and the patient is monitored. We proceed to neuroleptoanalgesia. The area of the puncture is localized with the help of fluoroscopy and cleaned with betadine. The patient is covered with sterile drapes leaving the puncture area open. Local anesthesia is performed with novocaine. A small cut is made in the skin with a scalpel blade to facilitate the introduction of the VP needle [7].

Under a fluoroscopic control in anteroposterior projection the pedicle of the affected vertebra is located where the needle is inserted. Then the fluoroscopy is placed on a lateral projection to advance the needle until it reaches the anterior third of the vertebral body. A vertebrography is performed to assess the filling of the vertebra and the possible escape routes of the cement. The cement is prepared. The M-M is first mixed in powder form with the contrast (tungsten or tantalum) and then the methyl-methacrylate is added as a liquid to obtain a paste mixture. The cement is quickly injected into the vertebral body before it solidifies [8].

Some authors use a combination of CT with fluoroscopy to perform the intervention. CT is used to place the needle into the vertebral body and fluoroscopy to control the injection of cement [9].

Contraindications of use

The use of cement is contraindicated in patients with allergy to any of its components. Cements with gentamicin should not be used in the presence of myasthenia gravis or hypersensitivity to gentamicin [10].

Limitations of Vertebroplasty

Vertebroplasty is contraindicated in generalized and localized infections where the procedure has to be performed, in severe alterations of coagulation and cardio-respiratory pathology [11].

Cases - The two patients with symptomatic vertebral fracture have severe back pain after a traumatism or a bad gesture. The pain worsened with the erect position and presented a kyphotic postural attitude in standing (**Figure 1**).

Figures 2 and 3, shows the location of the osteoporotic fractures in T11 (**Figure 3**) and L3 and L4 (**Figure 2**), the cementation system of both cases (**Figures 4 and 5**). After resting for 30 minutes with neurological assessment and monitoring, and when there were no problems, the patients were discharged.

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Figure 1: Osteoporosis Fractures in Theatre.



Figure 2: Needle in L3 and L4.



Figure 3: Needle in T11.

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Figure 4: Cement in L3 L4.



Figure 5: Cement in T11.

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