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Research Article

PUNCTION VERTEBROPLASTY WITH BONE CEMENT FOR OSTEOPORTIC FRACTURES OF THE VERTEBRAS

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ABSTRACT

The results of treatment using puncture vertebroplasty in 81 patients with various diseases of the thoracic and lumbar vertebrae are presented. The purpose of this study is to study the effectiveness of vertebroplasty in osteoporotic fractures of the thoracolumbar spine. Treatment of traumatic spinal injury is an urgent problem of modern neurosurgery. The work is devoted to the surgical treatment of uncomplicated compression fractures using the method of puncture vertebroplasty. The results of treatment of 81 victims were analyzed. The high efficiency and safety of puncture vertebroplasty were noted.

KEYWORDS

Compression fractures of vertebral bodies, diagnostics, puncture vertebroplasty.

INTRODUCTION

Osteoporosis is a systemic metabolic disease of the skeleton in which decreased bone mass and microstructural changes in bone tissue lead to

decreased bone strength and an increased risk of fracture [4].

Every minute in Russia, seven vertebrae are fractured due to osteoporosis. Only one third of these are diagnosed; approximately 750,000 vertebral fractures with osteoporosis are diagnosed annually in the US. The prevalence of vertebral body fractures with osteoporosis in Uzbekistan averages 15%. The most common complications of osteoporosis are "uncomplicated" fractures of the thoracolumbar spine accompanied by severe pain syndrome [9,11]. Osteoporosis occurs most commonly in patients on long-term steroid therapy and in postmenopausal women. 16% of women in this period have one or more vertebral compression fractures. Patients with these fractures experience severe pain that causes disability despite conservative therapy [2,8,11].

Back pain is one of the most pressing problems of modern neurology. This is primarily due to the high incidence of this pathology. According to statistics, 60 to 80% of the able-bodied population suffer from lumbosacral pain [6]. According to Batysheva et al., in 2003 in Moscow this group of diseases was the cause of almost 380 thousand days of temporary disability and almost 1,700 primary cases of permanent disability [2]. The currently used surgical and functional treatment methods for osteoporosis fractures cannot be applied in all cases in the treatment of patients, especially in the older age group. And the available medications used in the treatment of osteoporosis are expensive and do not allow for pain relief in the acute period of injury. In the late 1980s, vertebroplasty with bone cement was developed in France and became widespread for oncological and traumatic lesions of the spine [1,3,5]. Bone cement vertebroplasty is used as an independent surgical treatment or in addition to other techniques. However, it has not been widely used for osteoporotic fractures to date due to the lack of clear indications, algorithms for examination and

selection of patients, and prediction of treatment outcomes [12].

In recent decades, neurosurgeons' interest in minimally invasive interventions on the spine has increased dramatically. Such aspirations are primarily driven by the desire to reduce surgical trauma: to minimize postoperative pain, hospitalization and incapacity of the patient, and thus, the costs of surgical treatment. Minimally invasive accesses to all parts of the spine have been developed. Percutaneous vertebroplasty is currently the method of choice in the treatment of osteoporotic fractures [10].

The aim of this study was to investigate the effectiveness of vertebroplasty for osteoporotic vertebral fractures.

MATERIAL AND METHODS

During examination and treatment of 81 patients with osteoporotic fractures of the thoracolumbar vertebrae in the National Center for Rehabilitation and Prosthetics of the Disabled of the Republic of Uzbekistan were under observation for 2020-2021.

We observed 81 patients with uncomplicated fractures of lower thoracic and lumbar vertebral bodies against the background of osteoporosis. The group consisted of patients aged 55 to 80 years. They were admitted in the first hours and days and up to 4 weeks after injury. According to X-ray data, fractures were localized at Th3-Th12 level in 38 (47.0%) and L1- L5 in 43 (53.0%) vertebrae. There were isolated fractures of one vertebral body in 22 patients. In 59 patients there were multiple fractures: in 39 patients the bodies of two adjacent vertebrae; in 13 patients compression fractures of the bodies of three adjacent vertebrae; in 7 patients the bodies of 3 or more adjacent vertebrae.

The patients' complaints were divided into specific ones: blunt pain in the area of vertebral deformity in 41 (50.6%); changes in the shape of the spine (kyphotic deformity, the appearance of stooping, reduction in height) in 9 (11.1%); the appearance of hump in 7 (8.6%); pain and heaviness in the thoracic and lumbar spine (lumbar osteoporosis) in 24 (29.7%) patients.

Preoperative examination included assessment of the patients' general condition, orthopaedic and neurological statuses, and radiological diagnostic methods: densitometry, CT scanning, and, when indicated, MRI. According to densitometry, a decrease in the T-criterion was noted in all patients down to 2-2.5, which indicates severe osteoporosis. The mean admission score in the patients observed was 56 (69.1%), corresponding to severe pain.

RESULTS AND DISCUSSION

Vertebroplasty was performed under local anesthesia transcutaneously, transpedicularly, with Stryker contrast cement - Simplex with barium (1:10 to parts of dry cement) being injected on both sides. We use Stryker trocars and PCD systems to prepare and inject the cement. During the operation cardiovascular and respiratory system monitoring is mandatory. The addition of sedation is possible. During the postoperative period concomitant diseases were treated, if necessary, medical gymnastics was done, individual selection of the osteotropic antiresorptive therapy was made.

Surgery technique. The patient's position on the operating table was lying on the abdomen. All vertebroplasty operations were performed by the surgeon under local anesthesia (0.5% novocaine solution), with the anesthesiologist's supervision. The surgery was performed under radiological monitoring. Transpedicular access was used in all cases. The EOP

was installed in the straight projection and the trocar needle insertion points were marked along the paravertebral lines.

On the skin, the insertion point should be located 1.5-2.5 cm to the outside of the projection of the base of the stem of the injured vertebra, in order to give the necessary convergence. Anaesthesia is administered from one or both sides, using standard needles and 10-20 ml syringes. The anaesthetic is injected up to the bone.

Under EOP control, an 11G bone biopsy needle was inserted into the anterior aspect of the vertebral body. Polymethyl methacrylate powder (SIMPLEX, CARL STORZ) was mixed with solvent and filled into regular 5 ml syringes threaded to the needle. When the bone cement reached paste consistency, it was slowly injected into the vertebral body under fluoroscopic control. The injection was continued until the cement reached the cortical bone or resistance was noted. If the filling of half of the vertebral body was inadequate, a second needle was placed in it on the other side and additional cement was filled.

The vertebral body was filled with bone cement as completely as possible. Control radiographs were taken after vertebroplasty. Surgery was performed on one level in 36 patients, on two levels in 27 patients, and on three levels in 18 patients. The dynamics of pain and activity after vertebroplasty did not depend on the degree of vertebral body compression. The average volume of cement injected during percutaneous vertebroplasty into the vertebral body was 5 ml (1 to 7). Grade I compression or wedge-shaped vertebral body deformation, where the height of the vertebral body or its anterior segments was reduced by less than 1/2 of the original height, was found in 58 patients, Grade II was reduced by 1/2 of the original height in 18 patients,

and Grade III was reduced by more than 1/2 of the original height in 5 patients.

Spine radiography was performed in all patients, but it often does not provide a complete picture of the extent of injury and the nature of the fracture, so it does not allow choosing the optimal treatment tactics. Spondylography is also insufficiently informative to detect spinal cord compression by bony fragments of vertebral bodies or arches, although we consider it a mandatory diagnostic procedure for traumatic injuries, since its performance allows an objective assessment of the condition of bony structures.

Computed tomography (CT) and magnetic resonance imaging (MRI) were performed in all spinal trauma victims. The CT scan allows the most accurate assessment of the vertebral bone condition and the feasibility of SP. With its help it is possible to detail the fracture(s): establish the level, number of damaged vertebrae, identify fractures of arches, articular processes, vertebral bodies, determine the length of fracture lines. Simple vertebral body compression fractures revealed fractures within the spongy tissue. The contour of the vertebral body was unchanged in all observations and the integrity of other bone structures was not disturbed. Particular attention was paid to the presence of fractures in the posterior wall of the vertebral body, since such changes can cause epidural leakage of bone cement during RV.

The high effectiveness of SP was confirmed by the restoration of motor activity in all patients, although all patients had limited mobility in the sitting (64) or lying position (17) before surgery. However, when such high results are cited, careful selection of patients for SP should be pointed out, since in the presence of multiple lesions (not only of the spine), it would be extremely difficult to assess the effectiveness of the method.

According to our study, a decrease in pain intensity from 6-10 to 1-3 points was noted in all patients within the first day after surgery. The patients were activated on the first day after surgery. Non-steroidal anti-inflammatory drugs were administered during the activation period if indicated. Lightweight orthoses were used in some cases, but their use was not mandatory. The average postoperative spinal pain score on the VAS scale was 0.1, which corresponded to the term "discomfort". This group of patients was monitored up to 36 months after vertebroplasty.

No patient showed signs of instability at the level of vertebroplasty performed. Stabilization of the spine was accompanied by pain relief in 13 patients. Pain from other spinal segments was observed in 5 patients, with an average intensity of 23 VAS points, which corresponds to moderate pain. No recurrence of vertebral body fractures at the level of the performed vertebroplasty was observed in our patients. All patients were discharged several hours after the control CT scan of the area of interest.

No increase in the kyphotic deformity of the spine was detected radiologically either. Neurological symptoms corresponded to the preoperative level, and we did not observe any irritation of the spinal roots at the level of vertebroplasty. Individual selection of osteotropic drugs, physical therapy and an active lifestyle prevented the progression of osteoporosis. Good results were obtained in 78 patients, satisfactory in 2 and poor in 1.

CONCLUSIONS

Percutaneous vertebroplasty is thus an effective treatment for uncomplicated vertebral compression fractures with osteoporosis, providing reliable spine

stabilization with pain relief, and significantly improving the quality of life of the victims.

Percutaneous vertebroplasty is a minimally invasive and highly effective technique for treating various vertebral body disorders. At the same time, it requires a highly skilled surgeon and constant monitoring by means of radiation diagnostics methods, because neglecting them can lead to clinical complications, up to urgent surgical interventions.

Using new treatment modalities makes it easier for the surgeon to perform a puncture vertebroplasty more appropriately and avoid complications. The treatment of vertebral body injuries of various etiologies requires a differentiated approach based on knowledge of the pathogenetic mechanisms of composite materials on bone tissue.

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