POSSIBILITIES OF SURGICAL TREATMENT FOR METASTASES IN THE CERVICAL SPINE

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Some aspects of surgical treatment of metastases in the cervical spine are analyzed. The authors propose a strategy for multidisciplinary planning of clinical trials with high data reliability and tactics of surgical treatment of metastases in the cervical spine, which expand the range of treatment options for this pathology.

Key words: metastases, cervical spine, Tokuhashi scoring system, vertebral body reconstruction.

Bone metastases are a common manifestation of generalized cancer. Spinal metastases occur in an average of 10 % of patients with cancer: the thoracic (70 %) and lumbar (20 %) divisions are most often affected, less often (10 %) the pathological process is localized in the cervical spine [3, 6].

Clinical symptoms of spinal metastases are pain syndrome, which is often acute, and neurological deficit, which is acute in 50% of cases when the cervical region is affected [3, 4]. Theosteolytic effect of the tumor on the vertebral body is manifested by a violation of its bone structure with possible subsequent penetration into the cortical layer. The resulting significant bone destruction leads to a violation of the biomechanical properties of the vertebra and its possible fracture, as well as to dysfunction and instability of the entire spinal motor segment.

The pain caused by the tumor is acute and persistent, with a tendency to increase at night [4]. An increase in the frequency and intensity of pain should be considered as a warning signal to the body about the possibility of a pathological fracture. A number of signs that indicate a possible oncological etiology of back pain are called "red flags". Several works are devoted to the description of these features [1, 4]. In the case of metastatic lesions of the cervical spine, clinical data are so small that they cannot be specific markers of the oncological process [3].

If the vertebral body loses its support function as a result of a metastatic process, surgical tactics include resection of the tumor, decompression of nerve structures, and adequate stabilization. Studies have shown that in patients with metastatic lesions of the cervical spine, the combination of surgical treatment and radiotherapy, in contrast to treatment with radiation alone, has a better effect [12].

The question of the expediency of surgical intervention for metastatic lesions of the cervical spine is still controversial, since there is not enough reliable evidence and clinical studies [3]. When choosing treatment tactics, each neurosurgeon is based on their own experience and technical capabilities of the clinic, since it is impossible to determine in advance which of the surgical techniques in a particular VA Byvaltsev, Candidate of Medical Sciences, leading researcher. Member of the Scientific and Clinical Department of Neurosurgery and Orthopedics; P. Barza, Doctor of Medicine, neurosurgeon, leading expert of the European Society of Spinal Surgeons.

It is the contradictory and multidirectional nature of information about the surgical treatment of metastatic lesions of the cervical spine that motivated the publication of this material.

Objective: to analyze some aspects of surgical treatment of metastases in the cervical spine.

Anatomy of metastases in the cervical spine. Most often, metastases in the spine are localized in the vertebral bodies. The predominant lesion of the anterior column is associated with the mechanism of spread of tumor cells by hematogenic pathways: the Betson's venous plexus is the main route of penetration of tumor microemboles into the spine. Further spread of the tumor is associated with retrograde pressure due to any physical exertion or increased intra-abdominal pressure, then tumor microemboles settle in the spongy vertebral tissue [5]. The most frequent result of these processes is damage to the posterior part of the vertebral body, which, in turn, has a biomechanical effect on the development of secondary osteolytic changes.

Purpose of surgical treatment. Surgical treatment of metastases in the cervical spine is the best way to correct local anatomical and biomechanical symptoms. Decompression and stabilization of the spine, followed by a course of radiotherapy, in most cases reduces the pain syndrome and protects the nerve structures for a long time from further negative effects of the disease. Internal fixation with maximum primary stabilization creates conditions for early postoperative mobilization of the patient with minimal or no external mechanical support. Thus, the purpose of surgical intervention in this case is to improve the quality of his life,

caused by a decrease in the intensity of pain syndrome and an increase in its motor activity. The exception is cancer patients with single metastases, where removal of the solitary metastasis and primary tumor leads to suppression of the cancer as a whole. For such patients, surgical treatment is radical in nature.

In patients with already formed neurological deficits, surgical intervention may not achieve the goal set. As with any other spinal surgery, the surgeon must plan the expected outcome and risk of the operation before deciding whether palliative care is more appropriate for the individual patient. The frequency of surgical interventions on the cervical spine, compared with cases where the lesion covers the thoracic or lumbar spine, is due to the relative ease of surgical access [12].

Preoperative examination. In the case of metastatic lesions in the cervical region, preoperative examination plays an important role, much more than in any other pathological processes in the spine [10]. In addition to the question of anatomical localization of the process, determining the boundaries of resection and the method of replacing the vertebral body (s), it is necessary to take into account the average life expectancy of the patient and its expected quality. It is important to consider comorbidities, general health, and potential levels of neurological deficits. Finally, the selection of surgical treatment tactics should reflect the histological and pathomorphological characteristics of the generalized tumor process. All these characteristics, together with the possible results of combined cancer treatment,

determine the possibility and type of surgical intervention. The average life expectancy of a patient depends on the presence of metastases in other organs, the general state of health, the degree of motor deficit and is determined for each type of tumor separately. To determine the average life expectancy, the Tokuhashi scoring system is most often used [10] (Table 1).

If the average life expectancy of a patient with metastases is less than 3 months (<5 on the Tokuhashi scaleTokuhashi), the survival period is defined as short — term, and more than 12 months (>9 on the TokiYaBA scaleТокиЫаБЫ) - as long-term. The average survival period is determined by the interval between 3 and 12 months.

In the decision-making process, the neurosurgeon should be guided by specific criteria. If the estimated average life expectancy for metastases does not exceed 3 months, then surgical treatment is usually considered unreasonable. In the case of damage to the vertebral-motor segment at the cervical level (if para-or tetraplegia is threatened), when surgical intervention can improve the patient's quality of life, this time limit can be reduced at the direct request of an informed patient or his family members. In such cases, the operation involves only gentle palliative resection of the tumor, decompression with filling the formed defect with bone cement. At the same time, they try to avoid complex reconstructive operations and minimize surgical aggression in order to minimize the period of hospitalization in a specialized department: discharge or transfer to another department on the 2nd-3rd day after the operation.

Decompression. In the area of the cervical spine, anterolateral retropharyngeal access is used, which provides anatomically the most accessible and physiologically justified access to the spinal column with minimal intersection of the supporting muscles of the neck.

Anterior cervical соматэксsomatectomy (in some cases multi-stage) is performed in several variants depending on the biological characteristics and size of the tumor:

1) anteromedial or partial somatectomy;

2) middle somatectomy, including resection of the middle part of the vertebral body in cases of complete anterior lesion;

3) complete removal of the vertebral body (total somatectomy).

In addition to anterior somatectomy, if necessary, an extended somatectomy (removal of the entire anterior segment) and totalvertebroectomy (removal of the anterior segment, arch, and articular tubercles) are performed. In some cases, decompression can be achieved by simple extirpation (excochleation) of the metastatic formation without resection of the adjacent vertebra body (Figure 1).

Variants of vertebral body reconstruction. Reconstruction of the anterior column of the cervical spine after resection can be performed in several ways that have different goals, and requires an individual approach in a particular case. Each of the options for replacing the vertebral body has its own advantages and disadvantages.

Below is a description of replacing the vertebral body with a bone graft or its substitutes. This approach is used in cases of expected long life expectancy, as it provides for bone consolidation. All other methods of reconstruction are palliative methods that provide, first of all, adequate primary stabilization of the operated vertebral-motor segment. The formation of bone consolidation in these cases is not expected due to the short predicted life span or due to incomplete radical resection.

Replacement of the removed vertebral body and adjacent discs is historically the earliest and most physiological way to reconstruct the anterior vertebral column. After the development of bone consolidation between the graft and adjacent vertebral bodies, long-term stabilization of the entire operated vertebral-motor segment can be expected. The use of this method is subject to a number of conditions. To ensure an osteoproductive stage of bone consolidation, the patient needs a long-term intake of mineral substances, which may be difficult in cancer patients suffering from dyspepsia. Another prerequisite for physiological consolidation is the normal state of the patient's immune system, which is necessary for the first stage of bone proliferation. In the future, the process of bone consolidation requires the presence of the necessary mesenchymal elements in the area of bone formation, so in the case of local or systemic radiotherapy that inhibits the formation of cellular elements, problems may arise in the treatment process.

The use of a bone graft to replace the removed vertebral body or part of it requires radical resection of the metastatic formation. Local recurrence of osteolytic metastasis can not only prevent the development of consolidation, but even destroy the graft itself and subsequently cause the entire structure to fail.

Polymethylmethacrylate (PMMA) has been used in the treatment of cancer since 1967 [9] mainly in patients with limited

lifetime. The defect formed as a result of tumor removal can be successfully replaced with an amorphous cement substance, resulting in maximum contact with the adjacent normal bone tissue. Subsequent exothermic polymerization provides relatively high primary stability [7]. The tumor tissue does not penetrate the cement, and subsequent radiotherapy does not lead to secondary radiation from PMMA.

However, the available clinical experience of using this method has revealed a relatively high percentage of cases of graft displacement during spinal extension [11]. This led specialists to develop the fixation ofa polymethylmethacrylate graft to the bodies of adjacent vertebrae. The most well-known and frequently used method

- vertical fixation of cement grafts to the overlying vertebrae using two spokes (Fig. 2). Bone cement can also be used to fill metal cages, which will be discussed below.

Another treatment option is to stabilize the cervical region using traditional internal fixation with titanium plates (Figure 3). In this case, even greater stabilization is achieved, but metal construction is undesirable due to the possible postoperative course of radiotherapy.

Telescopic distraction implant after removal of the C5 and C6 vertebral bodies: there is a built-in movable cervical end plate that provides adequate lordosis

foot extension and deformity development. The ultimate goal of the operation in this case is to preserve movement in the cervical spine, although fixation associated with filling with spongy bone tissue from the inside and around the perimeter of the structure is not excluded. It is considered quite justified to use the described method in young patients with the expected high physical activity and long predicted average life expectancy, in whom radical intervention is impossible due to the spread of the pathological process in the area of paravertebral soft tissues.

Despite the fact that none of the methods of replacing the vertebral body described above meets the requirements of daily physical activity, our task is to return the patient to the usual lifestyle as much as possible, so it is necessary to pay maximum attention to the stability of the structure, in particular in the case of replacing the vertebral body with a metal structure. The effectiveness of combining vertebral body replacement with internal stabilization by anterior plate fixation has been convincingly confirmed by clinical experience [2, 11].

Conclusion

Surgical interventions on the spine are very important in the treatment of patients with generalized cancer. Despite the fact that surgical treatment in these cases cannot increase the average survival rate and does not guarantee the elimination of possible neurological deficits, improving the quality of life and reducing the intensity of pain clearly indicate the high effectiveness of this technique. However, very often in cancer clinics, patients with diagnosed spinal metastases are not given a timely consultation with a neurosurgeon to resolve the issue of possible surgical treatment. The strategy of multidisciplinary planning of clinical trials with high data reliability and tactics of treatment of metastases in the cervical spine expand the range of treatment options for this pathology.

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