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OUR EXPERIENCE IN THE TREATMENT OF AGGRESSIVE SPINAL HEMANGIOMAS BY THE METHOD OF PERCUTANEOUS VERTEBROPLASTY

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ABSTRACT

The experience of the operations performed during this time shows that filling the hemangioma with bone cement stops further tumor growth, reliably stabilizes the body of the affected vertebra and provides a clinical effect, which is manifested by regression of the pain syndrome. PVP can be performed both before and after radiation therapy. It does not exclude, but complements other methods of treating spinal hemangiomas. [3].Despite the great popularity of PVP method in various countries and the sufficient period of its application, the issues of choosing puncture accesses at different levels and with different localizations of hemangiomas in the vertebra, advisability of using bilateral accesses still remain deft, and how to calculate the amount of cement necessary for filling the body of the affected vertebrahas not been defined yet. In the Republican Scientific Center of Neurosurgery using the PVP method in 2016-2017, 32 patients (22 women and 10 men) aged from 21 to 69 years with aggressive spinal hemangiomas were operated on. All patients underwent a comprehensive examination, including spondylography, CT, MRI, MSCT. The indications for PVP were signs of aggressiveness of hemangiomas, progressive development of clinical and radiological symptoms, as well as MRI data. During the surgery, venous spondylographywas performed to visualize the venous outflow collectors. At the mid- and lower cervical level (CIII - CVII), the access of choice is anterolateral part.

Based on large number of experimental works on the biomechanics of the spine and clinical material, it was found that to stabilize the vertebral body and relieve pain, introduction of 3 ml of bone cement is enough.[5, 10]. The maximum volume of bone cement in the treatment of aggressive spinal hemangiomas is determined according to the data of visual control using an intraoperative electron-optical image intensifier. Transpedicular puncture access is the access of choice in the treatment of

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aggressive hemangiomas of the spine by PVP, localized in the thoracic and lumbar regions, and anterolateral - with the localization of hemangioma in the cervical region.
KEY WORDS: aggressive spinal hemangiomas, percutaneous vertebroplasty

抽象的

在此期间进行的手术经验表明，用骨水泥填充血管瘤可以阻止肿瘤进一步生长，可靠地稳定受累椎体并提供临床效果，这表现为疼痛综合征的消退。 PVP 可以在放射治疗之前和之后进行。它不排除，而是补充治疗脊髓血管瘤的其他方法。 [3].尽管PVP方法在各国大受欢迎，应用时间也很长，但在选择不同层次和椎体血管瘤部位不同的穿刺通路的问题上，使用双侧通路的可取性仍然是灵巧的，以及如何计算填充受影响椎骨所需的水泥量尚未确定。 2016-2017 年，共和党神经外科科学中心采用 PVP 方法对 32 名 21 至 69 岁的侵袭性脊髓血管瘤患者（22 名女性和 10 名男性）进行了手术。所有患者均接受了全面检查，包括脊椎造影、CT、MRI、MSCT。PVP 的适应症是血管瘤侵袭性的迹象、临床和放射学症状的逐渐发展以及 MRI 数据。在手术过程中，进行了静脉脊柱造影以显示静脉流出收集器。在中和下颈椎水平（CIII - CVII），选择的通路是前外侧部分。

基于对脊柱生物力学的大量实验研究和临床资料，发现为了稳定椎体和缓解疼痛，引入3ml骨水泥就足够了[5, 10]。骨水泥治疗侵袭性脊髓血管瘤的最大体积是根据使用术中电子光学图像增强器的视觉控制数据确定的。经椎弓根穿刺通路是 PVP 治疗脊柱侵袭性血管瘤的首选通路，定位于胸腰椎区域，以及前外侧 - 定位于颈部区域的血管瘤。

关键词：侵袭性脊柱血管瘤，经皮椎体成形术

INTRODUCTION

The results of surgical treatment of 32 patients with aggressive hemangiomas were analyzed. Specific features of the technique and anatomical substantiation of puncture accesses used in their treatment by percutaneous vertebroplasty are described.

35 years have passed since the advent of the method of percutaneous vertebroplasty (PVP) and its use in the treatment of spinal hemangiomas. So-called aggressive hemangiomas are of surgical interest, they occur in 3-4% of cases of the number of detected hemangiomas, which are potentially dangerous by narrowing of the spinal canal as a result of hypertrophy of the affected bone, epidural spread of the soft tissue component of the tumor, compression fractures of affected vertebral bodies, extradural hematomas due to hemorrhage from tumor tissue and medullary is chemia as a result of steal syndrome [2, 9].The experience of the operations performed during this time shows that filling the hemangioma with bone cement stops further tumor growth, reliably stabilizes the body of the affected vertebra and provides a clinical

effect, which is manifested by regression of the pain syndrome. PVP can be performed both before and after radiation therapy. It does not exclude, but complements other methods of treating spinal hemangiomas. [3].Despite the great popularity of PVP method in various countries and the sufficient period of its application, the issues of choosing puncture accesses at different levels and with different localizations of hemangiomas in the vertebra, advisability of using bilateral accesses still remain deft, and how to calculate the amount of cement necessary for filling the body of the affected vertebrahas not been defined yet.

According to R.S. Sherman (1961) and J.P. Nguyen (1989), the most common place of hemangiomas localization is the thoracic spine (in 76% of cases), less often they are localized in the lumbar spine (21%). One vertebra is affected in 77.5% of cases, multiple lesions are from 10 to 15.5% [5, 6, 7, 10]. As a rule, firstly hemangioma affects the vertebral body, spread of the tumor into the epidural space and compression of the spinal cord are secondary [2, 9].

The purpose of the study is to improve the results of surgical treatment of patients with aggressive spinal hemangioma by choosing the optimal access to percutaneous vertebroplasty.

MATERIALS AND METHODS

In the Republican Scientific Center of Neurosurgery using the PVP method in 2016-2017, 32 patients (22 women and 10 men) aged from 21 to 69 years with aggressive spinal hemangiomas were operated on. All patients underwent a comprehensive examination, including spondylography, CT, MRI, MSCT. The indications for PVP were signs of aggressiveness of hemangiomas, progressive development of clinical and radiological symptoms, as well as MRI data. During the surgery, venous spondylographywas performed to visualize the venous outflow collectors. According to our data, in 65% of patients, hemangiomas were localized in the thoracic spine, in 32% in the lumbar spine (figure), and in 3% in the cervical spine. According to the topographic classification of hemangiomas by J.P. Nguyen et al. [10], the first type was 29%, the second - 46%, the third - 25%. In 2 patients, the soft tissue component of the tumor spread intracanally with the corresponding neurological symptoms of compression of the spinal cord and roots.

RESULTS AND DISCUSSION

Knowledge of the features of the microsurgical anatomy of the spine and paraspinal structures allows for various puncture accesses at all levels, preferring safer and more effective. The presence of a transpedicular stabilizing structure at the level of the lesion is not a contraindication and does not create technical difficulties for the conduct of PVP [6].

For the treatment of patients, a combined surgical intervention was used, combining PVP and open surgery aimed at removing the soft-tissue component of the tumor, located intracanally. During surgical interventions, the following puncture accesses were used: at the lumbar level - transpedicular (in 8) and open- vertebroplasty (in 2); at the level of thoracic spine - transpedicular (in 20);at the cervical - parapharyngeal (2). The volume of bone cement injected ranged from 1.5 to 5.0 ml (an average of 3.5 ml).

Transpedicular access involves the puncture of the vertebral body through the root of the arch. It can be one- or two-sided. The latter is advisable to use when spreading hemangioma to both halves of the vertebral body. An interesting fact is that patients

whose PVP was produced by bilateral transpedicular access did not note any pain when injecting bone cement, and this can be explained by the creation of conditions for this access that prevent an increase in intraosseous pressure. Theoretically, these same conditions should help reduce the risk of possible embolic complications. The popularity of transpedicular access is due to the peculiarities of the microsurgical anatomy of the thoracic and lumbar spine. The thickness of the cortical layer of the arches of the thoracic and lumbar vertebrae is approximately the same, with the exception of the middle thoracic spine, the arches of which have a thicker cortical layer. The inner cortical layer of the arches is 2/3 times thicker than the outer layer [8]. Due to this anatomical feature, when installing a transpedicular structure, a fracture is possible, which often occurs in the outer wall of the arch. [10]. To exclude similar complication with transpedicular puncture access, it is necessary to monitor the correspondence of the arch diameter and the caliber of the used needle. For this purpose, spondylograms are produced in the antero-posterior projection, on which the image of the oval of the root of the arc corresponds to its narrow waist, the size of which determines the size of the arch [4In general, the size of the arches tends to decrease from T1 to TV and gradually increase from TIV to TV vertebrae. The average height and width of TIV, TVIII and TXII arches are 10.4 and 3.7 respectively; 11.2 and 4.8; 15.2 and 8.7 mm. The length of the arches in the thoracic region increases gradually from T1 to TX and then slightly decreases to TXII [6]. Knowledge of these anatomical features allows selecting a needle for PVP. For transpedicular puncture access to thoracic vertebrae with small arches (TIII-TIV), 13-K needle is used or for safety reasons it is necessary to use another access.

The spatial orientation of the arches is described in two planes. The transverse angle is formed at the intersection of the line drawn through the center of the arch and the line parallel to the spinous processes. It tends to decrease from T1 (30°) to TCII (10°) vertebra. Changes in the sweep angle are devoid of a similar sequence [6]. When carrying out puncture access, constant intraoperative image intensifier control is a prerequisite, however, knowledge of the above anatomical features can reduce the time of surgical intervention and reduce the radiation exposure to the patient and staff.

Features of the thoracic spine is that the medial wall of the arch is located next to the spinal cord and the distance between the exit of the root and the spinal cord is 2-4 mm [7]. Ignorance or underestimation of these anatomical features of the thoracic spine can lead to damage, compression of the nerve, rupture of the dura mater with subsequent liquorrhea, which was mentioned in the literature as complications arising from the installation of transpedicular stabilizing structures. However, these complications are also possible with transpedicular puncture access, if you make a mistake when choosing the entry point, the wrong direction of the needle advance, and the discrepancy between the size of the arches and the diameter of the used needle. Due to the peculiarities of microsurgical anatomy of the thoracic and lumbar spine, transpedicular puncture access is the access of choice when performing PVP at these levels.

The reserve puncture access at the lumbar level is the posterolateral one, which, as a rule, is used when it is impossible to perform transpedicular access. The entry point with the posterolateral approach is 6-14 cm from the line of the spinous

processes, depending on the level of the vertebra of interest and the patient's constitution. The needle is advanced to the vertebral body retroperitonially, bypassing the transverse process. Weaknesses of access are: the possibility of nerve damage, increased traumatization of paraspinal soft tissues due to the elongation of the wound canal, as well as the likelihood of retroperitonial bleeding. In our practice, this access was used in one patient, the arches of the vertebra of which were destroyed by a hemangioma.

On the thoracic spine, intracostopedicular puncture access can be used, at whichthe point of needle injection is determined by the intersection of two lines: the 1st lineis drawn paravertebrally at a distance of 5-7 cm from the line of spinous processes, the 2ndline - in the horizontal plane 1 cm below the spinous process of the overlying vertebra in the lower thoracic spine, 0.5 cm - in the upper thoracic spine. In this case, the needle must be moved deep into the soft tissues at an angle of 30-40 ° to the sagittal plane and 70-80 ° - to the horizontalplane.The depth of immersion of the needle is 7-9 cm The needle passes along the base of the triangle, the sides of which are the transverse process, the arch plate and the rib section to the costotransverse joint. With this puncture access, it is possible to do vertebroplasty of the vertebral body even if a transpedicular stabilizing system is installed at the level of interest. [3] Inintracostopedicular access, the angle of entry of the needle into the vertebral body is sharper than in transpedicular access, especially this is clearly seen at the upper thoracic level, where the arches are located almost parallel to the spinal cord. If the hemangioma extends to the entire body of the upper thoracic vertebra or occupies its anterior third part, then vertebroplasty requires either bilateral transpedicular access or intracostopedicular access, in which a sharper angle of entry of the needle into the vertebral body allows vertebroplasty of the opposite half of the vertebral body.

On the cervical spine, the following punctureaccesses are used: transoral, anterolateral and posterior. Due to the small size of the arches of the cervical vertebrae, proximity of the location of the vertebral artery, spinal cord and nerve roots, transpedicular puncture access on the neck is very difficult technically and has a high degree of risk.

However, in literature [7] there are isolated reports of the use of this access for vertebraplasty of the cervical vertebrae. Transoral access can be used for PVP bodies of CII and CIII vertebrae. The anatomical justification for this access is the proximity of the location of the pharynx and the bodies of the SI, SS vertebrae, reducing the likelihood of damage to nearby anatomical structures.[10]. The weaknesses are the need for general anesthesia and the use of a special retractor that expands the oral cavity without injury to the teeth, as well as low level of sterility during the manipulation.

At the mid- and lower cervical level (CIII - CVII), the access of choice is anterolateral part.

Based on large number of experimental works on the biomechanics of the spine and clinical material, it was found that to stabilize the vertebral body and relieve pain, introduction of 3 ml of bone cement is enough.[5, 10]. The maximum volume of bone cement in the treatment of aggressive spinal hemangiomas is determined according to the data of visual control using an intraoperative electron-optical image intensifier.

a b

Hemangioma of VL3 vertebral body: a - MRI of the lumbar spine; b - R-scopy after transpedicular percutaneous vertebroplasty.

There were no complications during the performed surgical interventions. The intensity of the pain syndrome, assessed by the visual analogue scale (VAS), immediately after the operation decreased by an average of 60%. In 2 patients in the postoperative period, there was a short-term hyperthermia up to 38 ° C, which was stopped without drug treatment, it was regarded as a reaction of the body to bone cement. The average length of patients stay in the hospital was up to 1.5 days. According to follow-up data (observation period is1.5 years), all patients retained their ability to work and returned to their previous labor activity.

When analyzing the results of surgical treatment, on average, 10-14 days after the operation, it was found that all 32 (100%) patients managed to achieve good results according to Karnofsky score. Evaluation of the nearest results on Karnofsky scoreindicates positive effect of surgery on the health and well-being of most patients.

CONCLUSION

Transpedicular puncture access is the access of choice in the treatment of aggressive hemangiomas of the spine by PVP, localized in the thoracic and lumbar regions, and anterolateral - with the localization of hemangioma in the cervical region. To reduce the risk of epidural spread of bone cement and embolic complications before vertebroplasty, venospondylography is mandatory, which allows visualizing venous collecting pools and, taking them into account, correcting the position of the needle. The needle bevel is set perpendicular to the plane of arch laminae.

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