

Abstract

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PECULIARITIES OF TREATMENT OF PATIENTS
WITH TUMORS OF CERVICAL SPINAL NERVES WITH
PARAVERTEBRAL SPREAD

Introduction. We aimed to evaluate the results of surgical treatment of patients with peripheral nerve sheath tumors with specification of the peculiarities of their structure and extension pattern, and to determine prognostically unfavorable morphological features in tumors of peripheral nerves.

Materials and methods. The study is based on a retrospective analysis of the medical records of 65 patients who were operated in our Neurosurgical Department during 2008 to 2018. The indication for the operation was worsening of neurological symptoms as a result of the tumor process in the cervical spine, verified by methods of neuroimaging (spondylography, CT, SCT, MRI). The choice of the surgical access depended on such factors as the tumor location regarding to the dura mater and the nervous structures, bones.

Discussion: the expected response to surgical treatment in patients with peripheral nerve sheath tumors depends on many factors: localization, directions of neoplasm extension, radical nature of the treatment and the histological variant of the tumor. The tumors of the spinal nerves are quite common and form up to the 48% of all tumors of the spinal localization. The overwhelming majority of such tumors leads to the compression of the spinal cord and its nerve roots, and to considerable neurological symptomatology. Determining the tactics of surgery and the choice of surgical access is an important component for achieving long remission. The choice of an adequate approach makes it possible to totally remove the tumor, reduces the time of intervention, blood loss, injuries to the nervous structures during removal of the tumor.

Keywords: cerebral nerve tumors; surgical treatment; cervical spine, access to tumors, paravertebral growth.

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Резюме

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ОСОБЛИВОСТІ ЛІКУВАННЯ ХВОРИХ З ПУХЛИНАМИ
СПИННОМОЗКОВИХ НЕРВІВ ШИЙНОГО ВІДДІЛУ ХРЕБТА
З ПАРАВЕРТЕБРАЛЬНИМ РОЗПОВСЮДЖЕННЯМ

Мета: аналіз результатів хірургічного лікування пухлин
спинномозкових нервів шийного відділу.

Матеріали та методи: проведено дослідження засноване на
ретроспективному аналізі історій хвороб 65 пацієнтів, оперованих з
приводу пухлин спинномозкових нервів шийного відділу хребта з

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паравертебральним поширенням у відділенні патології хребта ДУ «Інститут нейрохірургії ім. акад. А. П. Ромоданова» НАМН України в період з 1998 по 2018 роки.

Результати: основною складністю видалення таких пухлини є значні розміри, яких вони досягають в процесі росту. Основною метою лікування є видалення пухлини з найменшою шкодою для спинного мозку на рівні ураження.

При проведенні хірургічного втручання обирався доступ який давав змогу напряму видалити пухлину, без додаткової хірургічної травми спинного мозку (без його зміщення під час видалення пухлини).

Висновки: позитивні результати хірургічного лікування пухлин спинномозкових нервів шийного відділу хребта з паравертебральним ростом пояснюється вибором адекватного хірургічного доступу, використанням інтраопераційних методів для покращення візуалізації пухлини, нервових структур, судин.

Ключові слова: пухлини спинномозкових нервів; особливості хірургічного лікування; шийний відділ хребта, доступи до пухлин, паравертебральний ріст.

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Introduction

For the most part, tumors of the spinal nerves are benign. The result of further life and the question of its fullness depend on early diagnosis and subsequent treatment. Unfortunately, in most cases, tumors of spinal roots of the cervical spine damage functionally important roots and compress the spinal cord, leading to significant neurological disorders and patient disability [1].

Today spinal surgery bears little resemblance of what was practiced in 1950. Incredible changes in the diagnosis and treatment of such patients are seen over the last fifty years [2].

A significant number of important anatomical formations are concentrated in the small area of the neck region: the great vessels, the beginning of the respiratory and digestive tracts, the vagus nerve and the border sympathetic trunks. In addition, a thyroid gland is located in the front part of this area and the branches of the brachial plexus and blood vessels of the upper extremities are passing in the lateral triangles. All this creates certain difficulties and requires considerable responsibility of the surgeon during the surgery. Modern surgical approaches for the treatment of peripheral nerve tumors of the cervical spine have been developed due to constant innovations in surgical approaches, stabilization methods, as well as neuroimaging methods. In patients with spinal nerve tumors, spreading paravertebrally, it is particularly important to choose

the correct access. This is due to the peculiarity of the disease, altered anatomy, the nature of compression of the spinal cord [3].

The aim that we set to ourselves was to analyze the results of surgical treatment of tumors of the spinal nerves of the cervical spine.

Materials and methods: Conducted study is based on a retrospective analysis of the medical histories of 65 patients who underwent surgery regarding tumors of cervical spinal nerves with paravertebral spread in the Department of Spinal Pathology of the State University "Institute of Neurosurgery n.a. A. P. Romodanov" of the NAMS of Ukraine during the period from 1998 to 2018.

We have divided neurological deficit into segmental and conductive disorders, separately defined pain syndrome.

Segmental impairments were determined on a 5 point scale, where 0 is the absence of segmental impairment, and 5 is a complete loss of function of the affected myotome, anesthesia of the corresponding dermatome.

In our study, they were 2.9 ± 0.3 points before the surgery and 1.4 ± 0.2 points after the surgery.

Conduction impairments were assessed using a modified McCormick scale, which was developed in the clinic by experts in spinal cord tumor surgery [4]. It best describes the condition of patients before and after the surgery. This scale is used in most cases to assess the results of surgical treatment. In 1992 Epstein F. J. modified the original version of the

scale by dividing the gradation number 3 on the degree of “moderate deficit, limitation of function, independent of outside help” and “severe motor or sensory deficit, limit of function, dependent on outside help” [5]. In our opinion, such division makes the scale more convenient for use.

Modified McCormick scale

I No neurological deficit, normal gait, minimal dyasthesia.

II Minor motor or sensory deficit, functional independence

III Moderate deficit, limitation of functions, independent of outside help

IV Severe motor or sensory deficit, limitation of functions, dependent on outside help

V Paraplegia or tetraplegia.

Table 1 presents data with distribution of patients based on the modified McCormick scale with tumors of the cervical spinal nerves with paravertebral growth before the surgery.

Table 1 – Distribution of patients based on the modified McCormick scale with tumors of the cervical spinal nerves with paravertebral growth before the surgery

Degree	Number of Patients	
	Abs	Percentages
I	2	3
II	23	35
III	23	35
IV	17	26
V	-	-
Total	65	100

Table 2 presents data with distribution of patients based on the modified McCormick scale with tumors of the cervical spinal nerves with paravertebral growth after the surgery.

Table 2 – Distribution of patients based on the modified McCormick scale with tumors of the spinal nerves of the cervical spine with paravertebral growth after the surgery

Degree	Number Of Patients	
	Abs	Percentages
I	27	41
II	21	32
III	15	23
IV	2	3
V	-	-
Total	65	100

Pain syndrome was determined on a 5 point scale, 0 is absence of the pain syndrome, 5 is the most pronounced pain syndrome. In the study group, the pain syndrome was 3.4 ± 0.4 points before the surgery and 1.5 ± 0.35 points after the surgery.

Table 3 presents the data on the pain syndrome before the surgery and Table 4 after the surgery.

Table 3 – Data of the pain syndrome before the surgery

Points	Number Of Patients	
	Abs	Percentages
0	1	1.5
1	1	1.5
2	16	25
3	20	31
4	21	32
5	6	9
Total	65	100

Table 4 – Data of the pain syndrome after the surgery

Points	Number Of Patients	
	Abs	Percentages
0	1	1.5
1	6	9.2
2	25	38
3	23	35
4	10	15
5	0	0
Total	65	100

Figure 1 presents a graphical relationship based on segmental impairments and pain before and after the surgery.

Surgical accesses for removal of tumors of spinal nerves extending paravertebrally were as follows:

- 1) posterior
- 2) posterolateral
- 3) far lateral
- 4) extreme lateral
- 5) lateral
- 6) anterolateral

The choice of surgical access depended on such factors as tumor level, tumor location relative to the dura mater and nerve structures, bones.

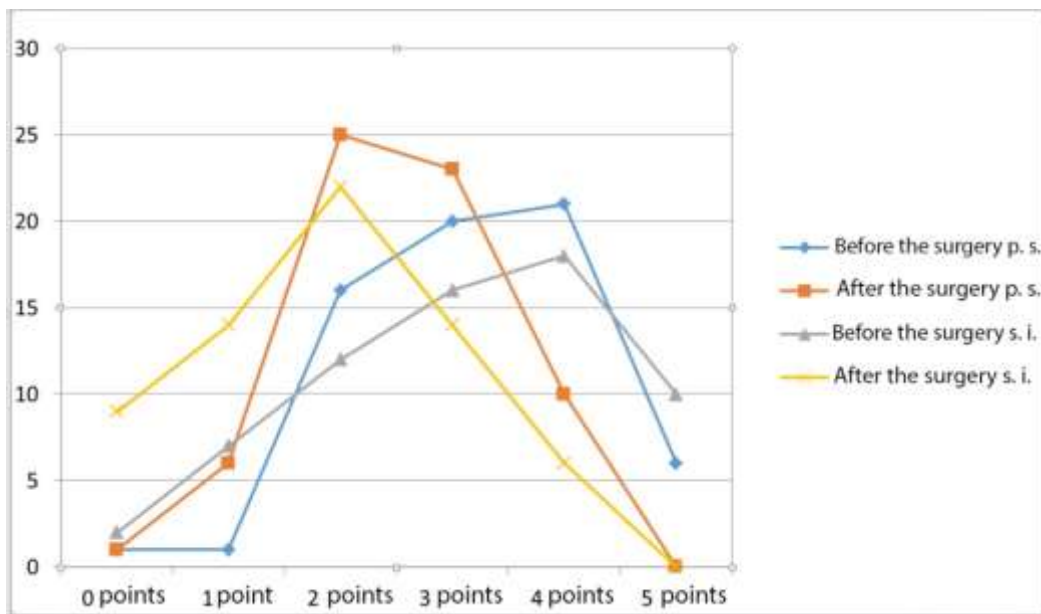


Figure1 – A graphical relationship based on segmental impairments and pain before and after the surgery

1. The posterior access was used to remove tumors that occupy the posterior and posterolateral space relative to the brain.
2. Posterolateral access was used to remove tumors located dorsolaterally, laterally to the brain.
3. Far lateral access was used in cases of ventrolateral tumor localization.
4. Extreme lateral access was used in ventrolateral and ventral tumors.
5. Lateral access provides control of the vertebral artery and was most convenient for tumors that spread laterally from the midline.
6. Anterolateral access was used to remove tumors located in front of the spinal cord.

Table 5 presents the distribution of patients by choice of surgical access in removing tumors of the cervical spinal nerves with paravertebral spread.

Table 5 – Distribution of patients by surgical access in removing tumors of the cervical spinal nerves with paravertebral spread

Surgical accesses	Number of patients	
	abs	%
Posterior	29	45
Postrolateral	21	32
Far lateral	6	9
Extreme lateral	3	5
Anterior	3	5
Anterolateral	3	5

All data is processed using the Statistic 6.0 program

Results and discussion:

1. Posterior accesses. Laminectomy is the main access, used for more than 100 years for most tumors located in the spinal canal. It was convenient for the removal of tumors of dorsal and dorsolateral localization at all impairment levels.

2. Posterolateral accesses. Hemilaminectomy with facetectomy is the most well-known surgery from this group. This access provided a good overview of the dorsolateral and lateral subarachnoid cavities of the spinal cord. Access is indicated for the removal of laterally and dorsolaterally located tumors of the spinal nerves.

3. In most cases, far lateral accesses were the most appropriate and least traumatic in ventrolateral tumors at the level of craniovertebral transition, C1-C2-C3 vertebrae. Access allowed to reach the upper cervical region and visualize the anterolateral surface of the spinal cord and trunk.

4. Extreme lateral access allowed to visualize the anterior surface of the lower medulla oblongata and the upper spinal cord, significantly facilitated surgical manipulation of tumor isolation, minimized the traction of nerve structures.

5. Lateral accesses. Of these, we used the clavicular-mastoid (on the projection of the posterior edge of the nodal muscle, between the scaleni muscles and the neurovascular bundle). This access was convenient for the removal of tumors,

which spread through the intervertebral opening or in the area of the vertebral artery.

6. Anterolateral access allowed direct access to the tumor, located ventrally. This access allowed controlling the vertebral artery and reducing the risk of injury during tumor removal.

The main difficulty of removing the tumor is the significant size that they reach in the process of growth. The main purpose of treatment is to remove the tumor with the least damage to the spinal cord at the level of the impairment.

During the surgical intervention, an access which made it possible to directly remove the tumor without additional surgical trauma of the spinal cord (without its displacement during the tumor removal) was chosen.

Surgical strategy differed depending on the tumor localization.

There is a large number of tumors of the spinal nerves with paravertebral spread in the upper parts of the cervical spine.

Since the spinal canal is wide, compression of the spinal cord can be asymptomatic until the tumors reach significant sizes. Anatomically, since there are no intervertebral openings and no surrounding bone structures, tumors tend to spread paravertebrally.

For the upper cervical tumors of the spinal nerves, access was chosen based on the direction of the intradural component. Sometimes the extradural component of the tumor was removed first to obtain a wider surgical field so that the artery feeding the

tumor could be tied, if possible. Otherwise, the intracanal component is removed first to prevent surgical compression of the spinal cord during the surgery.

The surgical strategy for the removal of tumors of the spinal nerves with paravertebral spread, located in the middle or lower cervical spine, is complex, and the choice of the most correct approach remained controversial. We often encountered difficulties during the removal of such tumors. In these cases tumors reached considerable sizes, both paravertebrally and intracranially, involving important anatomical structures. Complete removal of such tumors is an achievable goal, providing good results. For complete removal of spinal nerve tumors, it is necessary to perform a significant surgical resection of the vertebrae to obtain adequate access to the tumor. It has been highlighted in the literature that these manipulations can lead to severe complications such as vertebral deformity and spinal artery injuries. Our observations had no such complications. In large tumors, we used combined approaches to minimize surgical injury of the spinal cord.

Taking into account the results of surgical treatment, which we compared before and after the surgery, we determined a significant regression of neurological deficit, regression of pain syndrome, restoration of conductive dysfunction.

In our opinion, this is due to the choice of adequate surgical access, the use of a surgical microscope, endoscope etc.

the anterior surface of the lower medulla oblongata and the upper spinal cord (including the anterior surface of the opposite side), significantly facilitated surgical manipulations of tumor isolation, minimized the traction of nerve structures.

4. The positive results of surgical treatment of tumors of the cervical spinal nerves with paravertebral growth are explained by the choice of adequate surgical access, the use of intraoperative methods to improve the visualization of the tumor, nerve structures, vessels.

Conclusions

1. Lateral access was convenient in removing tumors spreading through the intervertebral opening and involved the vertebral artery into the pathological process.

2. Far lateral access was the most appropriate and least traumatic in ventrolateral tumors at the level of craniovertebral transition, C1–C2–C3 vertebrae. Access allowed to reach the upper cervical region and visualize the anterolateral surface of the spinal cord and trunk.

3. Extreme lateral access allowed to visualize

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