The pages and lines of the manuscript should be numbered consecutively (in Word: Layout section - Line Numbers - Continuous)

NEUROSURGERY

HOW I DO IT

**Title of the article**

Briefly (no more than 20 words) and clearly reflects the topic, abbreviations and introductory words ("current view", "to the question", etc.) are not used, use «How I do it»

**How I do it: microsurgical clipping of carotid-ophthalmic aneurysms through minipterional approach with extradural resection of the anterior clinoid process**

**Annotation**

Structured, 140-150 words

**Background.**

**Method.**

**Conclusion.**

**Keywords:** 5-8 words or collocations

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**Compliance with ethical standards.** Consent statement. The patient consented to the publication of the article “…” in the “Sechenov Medical Journal”.

**Conflict of interest.**

The authors declare that there is no conflict of interest.

Ivan I. Ivanov is the co-founder of the company that produces the device ... used in this study.

**Financing.**

The study had no sponsorship (own resources).

The study was supported by the Russian Science Foundation, project no. … - …[[1]](#footnote-1)

**Acknowledgments.** The authors express their deep gratitude to

The main text of the manuscript (not including metadata and bibliography) without illustrations and list of abbreviations is from **12,000 to 15,000** characters with spaces

and includes 10-15 illustrations of the method.

**List of abbreviation**

ACP – anterior clinoid process

ICA – internal carotid artery

Only commonly used abbreviations should be used, and they should be decoded once in the text: before the first mention of the abbreviation. All abbreviations used in the manuscript should be deciphered, except for symbols of chemical elements and abbreviations of commonly known metric units.

**Introduction** (the subheading "introduction" should not be written)

One or two paragraphs summarizing the uniqueness of the method. Include references to the most relevant publications from the last 3-5 years.

The conventional pterional approach is the "gold standard" in the surgical treatment of most neurosurgical pathologies [1, 2]. However, in modern neurosurgery, there has been a tendency to develop minimally invasive procedures. A classic example is the transition from standard surgical approaches to keyhole approaches, 3-5 cm in size, and in particular, the transition from pterional approach to minipterional approach [3-5].

Along with a wide range of advantages of these approaches, there are several limitations. The combination of keyhole approaches with elements of skull base surgery can significantly expand the range of indications [6].

…

The article describes the technique and features of performing the minipterional approach with extradural clinoidectomy demonstrated by the case of the carotid-ophthalmic aneurysm clipping.

**ANATOMICAL FEATURES**

…

Anatomically, the ACP is attached to the wing of the sphenoid bone by three bony structures (pillars) (fig. 1):

**Figure**

**FIG. 1.** Schematic representation of the pillars of the anterior clinoid process

Note: ACP – anterior clinoid process; IP – inferior pillar (optic strut); LP – lateral pillar (sphenoid wing); OC – optic canal; MP – medial pillar (roof of the optic canal); SOF – superior orbital fissure

The main text of the manuscript should be illustrated by at least 10 figures, but no more than 15. Reference to figures should be clearly indicated in the text. Measurements should be in accordance with the International System of Units (SI). If there are abbreviations in the figure, they should be deciphered in a note to the figure.

**SURGICAL TECHNIQUE**

Describe the technique of the surgery or method in detail and step-by-step, with illustrations (10-15).

**Patient positioning and skin incision**

The patient's head is fixed in the Mayfield® skull clamp in the same way as described for the classic pterional approach. A 5–7 cm curvilinear skin incision along the hairline is usually sufficient to expose an area of the bone for the craniotomy (fig. 2).

**FIG. 2.** Patient positioning, skin incision planning

An arcuate skin incision is made just behind the hairline, 1 cm above the zygomatic bone.

Note: STL – superior temporal line; SW – sphenoid wing; ZA – zygomatic arch

To prevent intraoperative damage to the branches of the facial nerve, dissection of interaponeurotic fatty tissue is performed along the border between the latter and the temporal muscle. The temporalis muscle can then be safely dissected downwards without the risk of damaging the branches of the facial nerve that remain in the adipose tissue (fig. 3a, 3b).

**FIG. 3.** Schematic representation of the dissection of interaponeurotic fatty tissuealong the border with the temporal muscle to prevent damaging the branches of the facial nerve

А. The aponeurotic skin flap is separated along the border with the interaponeurotic fatty tissue, and the branches of the facial nerve are crossed.

В. The aponeurotic skin flap is separated along the border between the interaponeurotic fatty tissue and the temporalis muscle. The facial nerve is intact.

Note: F – interaponeurotic fatty tissue; FN – facial nerve; S – skin; SFT – subcutaneous fatty tissue; TB – temporal bone; TM – temporal muscle; ZA – zygomatic arch

…

**FIG. 11.** Postoperative view of the skin wound and good cosmetic effect, no face asymmetry

A. Frontal view;

B. Side view.

**INDICATIONS**

This research paper describes the use of …

However, the range of indications for this technique is quite wide, with the main ones being other aneurysms of the paraclinoid internal carotid artery that cannot be 'turned off' endovascularly; small mass lesions of the sella turcica, the areas of the sphenoid bone wings, and the anterior clinoid process; ophthalmic nerves gliomas; necessity for the optic canal decompression, etc.

**MAIN ADVANTAGES**

Excellent cosmetic effect (skin incision 5-7 centimeters long behind the hairline, maintaining the integrity of the branches of the facial nerve, craniotomy with a diameter of 3-5 centimeters). Additional resection of bone tissue at the extradural stage provides additional volume for surgical manipulations and optimal angles of attack for this keyhole approach, which determines the absence of direct manipulations with brain tissue during extradural clinoidectomy, and, accordingly, the absence of brain injury.

Early proximal control obtained after ACP resection allows for safe clipping of aneurysms that have a high risk of rupture, and in the case of an intraoperative rupture, a temporary clip can easily be applied to the ICA region, proximal to the aneurysm.

**MAIN LIMITATIONS**

The main limitation of the minipterional approach with extradural ACP resection is the possible intraoperative rupture of the aneurysm during rough clinoidectomy. However, the learning curve of the operating neurosurgeon and the use of delicate specialized neurosurgical instrumentation minimizes the possibility of this complication.

The small size of the craniotomy makes it difficult for two neurosurgeons to work simultaneously, which requires relevant surgical training and experience, along with appropriate neurosurgical instruments.

In addition, it is always necessary to be aware of possible bleeding from the cavernous sinus located in the immediate vicinity of the surgical manipulation area, and to have the necessary means and experience to perform a thorough hemostasis.

**SPECIFIC INFORMATION TO PROVIDE THE PATIENT WITH REGARDING THE SURGERY AND POTENTIAL RISKS**

The information to be given to the patient before the surgical intervention is essentially the same as in the case of microsurgical clipping of aneurysms, but the potential risks are higher due to the nature of the craniotomy performed. The risk of intraoperative aneurysm rupture is increased by extradural clinoidectomy, and the patient should be informed of this before the operation, but the risk is still low, and such complications have not occurred in our practice. The risk of haemorrhagic complications also increases with the surgical procedures described and may be associated with some heavy bleeding from the cavernous sinus, which must also be communicated to the patient before the operation. The small size of the craniotomy can make it difficult to seal the dura mater and lead to early postoperative complications in the form of CSF leakage and infectious inflammatory changes. Nevertheless, if the operating surgeons have enough experience, the risk is insignificant and such cases have not occurred in our series.

**CONCLUSION**

Briefly (about 120-150 words ) summarize the main advantages of the new method, what should be paid attention to, prospects of application.

The minipterional approach with extradural resection of the ACP is a safe surgical approach, which can exemplify the efficacy of adding some elements of skull base surgery to keyhole approaches. This combined approach contributes to a significant expansion of the range of neurosurgical pathologies which could benefit from this type of craniotomy. However, this technique is more demanding both from the point of view of the manual skills of the surgeon and the instrumental support needed. But with qualified personnel, as well as all the necessary tools, for example, in neurosurgical clinics, as well as in modern neurosurgical departments of multidisciplinary clinical centers, this approach can become a “method of choice” in the treatment of a wide range of neurosurgical pathology.

**AUTHOR CONTRIBUTION**

**Ivan I. Ivanov -**study concept and design,

* patient management, treatment.
* acquisition of data.
* analysis and interpretation of data,
* drafting the manuscript.
* critical revision of the manuscript.

All authors approved the final version of the article.

**REFERENCES**

**20-30 sources**

It is recommended to include in the bibliography current works published in the last 3-5 years.

Unpublished works, preprints, manuals, newspapers, popular science magazines, materials contained in Wikipedia, StatPearls [Internet] shouldn’t be included in the references.

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All references to journal publications should contain DOI (unique digital identifier of the article in the CrossRef system), PMID (identification number in the PubMed database).

1. *Cintrón-Colón A.F., Almeida-Alves G., Boynton A.M., et al.* GDNF synthesis, signaling, and retrograde transport in motor neurons. Cell Tissue Res. 2020 Oct; 382(1): 47–56. https://doi.org/10.1007/s00441-020-03287-6.  Epub 2020 Sep 8. PMID: 32897420; PMCID: PMC7529617
2. *Hu X., Xu W., Ren Y., et al.* Spinal cord injury: molecular mechanisms and therapeutic interventions. Signal Transduct Target Ther. 2023 Jun 26; 8(1): 245. Published 2023 Jun 26. https://doi.org/10.1038/s41392-023-01477-6. PMID: 37357239; PMCID: PMC10291001

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**SUPPLEMENTARY**

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1. Link to electronic source (date of application: …) [↑](#footnote-ref-1)