

SURGICAL CONSIDERATIONS ABOUT THE ANTERIOR SYPHON KNEE OF THE INTERNAL CAROTID ARTERY

AN ANATOMICAL STUDY

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SUMMARY - An anatomical study about the anterior knee of the intracavernous carotid artery is presented. Twenty cavernous sinuses (CS) were dissected in cadavers using microsurgical techniques. A fibrous ring around the internal carotid artery (ICA) at the CS roof was found in all specimens. This fibrous attachment could be dissected from the surrounding dura and a loose connective tissue could be demonstrated around the ICA. This anatomical finding makes possible the microsurgical approach to vascular lesions of this portion of the ICA, without opening the cavernous sinus.

KEY WORDS: surgical anatomy, infraclinoidal carotid artery, cavernous sinus, fibrous ring.

Considerações cirúrgicas sobre o joelho anterior do sifão da artéria carótida interna: estudo anatômico

RESUMO - Apresentamos um estudo anatômico sobre o joelho anterior da porção intracavernosa da artéria carótida interna (ACI). Foram dissecados vinte seios cavernosos de cadáveres utilizando técnicas microcirúrgicas. Um anel fibroso em volta da ACI na parte superior do seio cavernoso foi encontrado em todos os casos. Esta fixação fibrosa pode ser dissecada da dura mater e um tecido conectivo frouxo pode ser visualizado em volta da ACI. Este achado anatômico possibilita o acesso microcirúrgico às lesões vasculares desta porção da ACI, sem abrir o seio cavernoso.

PALAVRAS-CHAVE: anatomia cirúrgica, artéria carótida (porção infraclínóidea), seio cavernoso, anel fibroso.

The surgical treatment of the infra or paraclinoidal carotid artery pathologies presents important technical difficulties. The surgical extradural approach through the lateral wall of the cavernous sinus³ has some disadvantages compared to the intravascular neuroradiological techniques concerning giant intracavernous aneurysms¹¹. The opening of the CS may cause bleeding of difficult control, and the course of cranial nerves (III, IV and V1)¹³ in the lateral wall of the CS increases the risk of postoperative neurological deficits.

The approach to the anterior knee of the carotid syphon without opening the venous structures⁴⁹ can be performed through the section of a fibrous ring around the ICA. This ring is located in the transition between the intracavernous and the intradural portion of the ICA. An anatomical study of the infra or paraclinoidal portion of the ICA, with special interest in the surgical approach to the pathologies in this region, is presented.

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Fig 1. Superior view: the anterior clinoidal process (ACP) is removed, and the optic nerve (ON) is cut to permit the visualization of the ophthalmic artery (OA) and the position of the fibrous ring (small arrows). The posterior syphon knee is also seen.

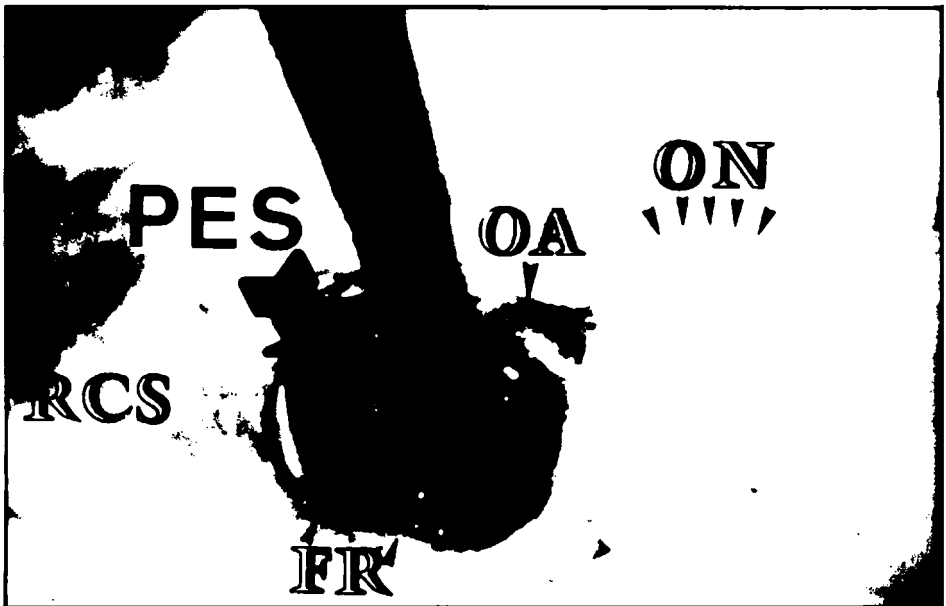


Fig 2. Superior view: the fibrous ring (FR) is cut and the internal carotid artery is retracted. The perivascular extracavernous space (arrow) is shown under the roof of the cavernous sinus (RCS). The ophthalmic artery (OA) and the optic nerve (ON and small arrows) are also seen.

MATERIAL, METHODS AND RESULTS

Twenty anatomical specimens were studied with microsurgical techniques. The arteries were filled with latex or red colored glue in 18 cases and the cavernous sinus was filled with blue latex in 4 cases. The dissections were realized with an operative microscope, studying the ICA, ophthalmic artery and the optic, oculomotor, trochlear, ophthalmic and abducent nerves. The cavernous sinus was examined through the opening of its lateral wall. Special attention was paid to the dimensions of the space between the cavernous sinus and the ICA under the fibrous ring. Laterally to the ICA, at the transition between intradural and intracavernous portion, the anterior clinoidal process (ACP) limits the microsurgical exposition. This extension of the lesser sphenoid wing can be removed by drilling after section and dissection of the dura-mater. The ACP may present anatomical variations in some cases, involving the ICA.

After perforating the dura-mater, the ICA has adhesions to some structures, like the diaphragma sellae and the ACP. A strong connective tissue creates a fibrous ring at the roof of the CS (Fig 1).

Besides removal of the ACP, it is also necessary to open the optic canal to allow mobilization of the optic nerve. With sharp dissection the fibrous ring is opened. A perivascular extracavernous space filled with loose connective tissue is exposed (Fig 2). The approach to the ICA pathologies, as in paraclinoidal aneurysms, is possible through this space. The average measures of this space are: lateral 5.9 mm, anterior 4.4 mm, medial 5.3 mm and posterior 5.3 mm. In its medial part, the connective tissue is less firm and permits an easier dissection.

COMMENTS

The technical difficulties of approaching the anterior knee of the ICA presents a particular neurosurgical interest. In this region aneurysms and tumors^{1,12} are in close relationship with important neuro-vascular structures. Aneurysms located at this portion of the ICA are called carotid ophthalmic, infra or paraclinoidal according to their position^{5,6-8,11}.

The surgical approach used is pterional ipsilateral to the paraclinoidal ICA region in lateral or anterior located aneurysms.

The ACP is removed intradurally and the optic canal is opened with diamond burrs. Extensive bone removal of the skull base is performed in special cases². The optic nerve can be gently mobilized to permit a better visualization of the paraclinoidal ICA. In some cases, as posterior and medial located aneurysms, a contralateral approach may be used. In these cases it is also necessary to remove the tuberculum sellae and the medial wall of the optic canal.

The ICA presents a fibrous ring in its transition between the cavernous sinus and the intradural portion, when perforating the dura-mater. This ring can be sectioned, giving a space around the ICA, without opening the CS avoiding venous bleeding. The connective tissue in this space is loose and permits an easy dissection avoiding injury to the cranial nerves, allowing to approach the anterior knee of the carotid syphon. This approach gives more than 5 mm exposure around the ICA, under the fibrous ring, permitting to clip the neck of an aneurysm.

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