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The parietal transcortical approach to the lateral ventricle: Opening Pandora's box

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Original Article

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ABSTRACT

Background: Intraventricular tumors present a difficult decision regarding the selection of the optimal surgical approach for their resection. Among various possibilities, the parietal transcortical approach (PTA) is currently used in this endeavor.

Methods: A comprehensive literature review was conducted on the surgical approaches used for the resection of intraventricular tumors, focusing on the PTA.

Results: This approach presents multiple potential sequelae, some of them clinically recognized, sequelae that have varying clinical significance.

Conclusion: The PTA should be replaced by other safer ones.

Keywords: Intraventricular tumors, Neurological sequelae, Optic radiation, Parietal transcortical approach, Surgical approaches

INTRODUCTION

In Greek mythology, Pandora's box was actually a large sealed storage jar that contained multiple curses, curses that would be released upon its opening causing great and unexpected troubles to mankind. Tumors located within the lateral ventricular trigone are infrequently encountered in clinical practice^{[3],} and a number of different surgical approaches have been tried for their resection [6,8,9], depending on their size and location within the ventricle. Nevertheless, the selection of a safe approach, causing no new neurological deficits, still poses a significant challenge.[5]

MATERIALS AND METHODS

A comprehensive literature review was conducted on the surgical approaches used for the resection of intraventricular tumors, focusing on the parietal transcortical approach.

RESULTS

This approach presents multiple potential sequelae, some of them clinically recognized, sequelae that have varying clinical significance.

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DISCUSSION

A surgical approach currently used for the resection of intraventricular tumors is the parietal transcortical approach (PTA). In it, by necessity, a cortical incision along the superior parietal lobe is done, which has minimal clinical consequences. That notwithstanding, the necessary surgical tract, extending from that parietal site into the lateral ventricle, results in significant white matter disruption.^[19] Being the cerebral white matter, the framework through which multiple neural pathways run in all directions interconnecting diverse cerebral regions, its disruption may cause injury to any of these connecting fiber systems, resulting in a number of unwanted neurological deficits of variable clinical import. The purpose here is to highlight some of these unwanted neurological deficits potentially incurred by PTA, which may include any of the following:

Homonymous hemianopia (HH)

It is the most frequent complication of PTA, resulting from optic radiation trauma at the roof of the trigone, which is the point of entry into the ventricle by this approach. This is an area covered by optic radiation fibers,^[7,10] and therefore, interrupting the visual circuit connecting the lateral geniculate nucleus with the striate cortex may cause a variety of visual field defects, the most frequent among these being HH, a visual defect which is frequently permanent with only occasional recovery.^[21]

Optic ataxia

A high-order integrative sensorimotor deficit causes incoordination of visually goal-directed reaching and grasping of objects when observed under peripheral vision.^[1] It is caused by the disruption of the dorsal visual stream,^[15] a white matter pathway that transfers visual information from the striate cortex to the parietal lobe for its further processing. This stream is vulnerable in PTA.

Amusia

It is a neural deficit that denotes the partial or total loss of a preexistent ability to process music in any of its diverse aspects, a loss that can be transient or permanent. Since, thus far, there has been no defined circumscribed cerebral location solely entrusted with any specific musical function (if it exists at all), it has become evident that, in normal conditions, music functions require the participation of various interconnected cerebral regions (frontal, temporal and/or parietal), interconnections that are achieved through white matter pathways.^[11] These connections, when disrupted (as is the case in PTA), can result in Amusia, a defect that probably affects a significant segment of the general population but becomes clinically evident only in the case of professional musicians or music enthusiasts.

Visual allesthesia

An exceptional visual phenomenon, transient or persistent, where the image produced by a visual stimulus is transposed from one homonymous visual field to the opposite one, resulting in the duplication of the image.^[12] It appears to be the result of damage to an occipitotemporal white matter pathway ^{[2],} i.e., the ventral visual stream, a pathway that is also liable to injury in PTA.

Loss of a preexistent normal level of libido

A symptom rarely investigated in preoperative or postoperative evaluations of patients submitted to cranial or spinal surgical surgery^{[4,15],} probably because it may be felt as an odd or uncomfortable type of inquiry. It is a sequela that causes a significant impact on the patient's wellbeing and sexuality. It is caused, in the case of PTA, by the unavoidable manipulation of the subependymal arteries (during the process of detaching the ependymal layer from the tumor capsule), a manipulation that may cause vasospasm or occlusion of some of these vessels. These, being centrifugal end arteries,^[13,14,16] may result in ischemia in the territory they supply, which includes the limbic system, a neural circuitry fundamental for the maintenance of a normal level of sexuality.

Hemiparesis

Hemiparesis, which in this case is usually transient. It is also due to spasm or occlusion of one or more of the sub-ependymal arteries, incurred by manipulation of the ependymal lining or by coagulation of the choroid plexus^[13,14,16] resulting in infarction in the lateral posterior choroidal artery's territory,^[17,20] with ischemia of the corticospinal tract.

Cognitive deficits such as acalculia, apraxia, and or a complete Gerstmann's syndrome

These are deficits that may result from vascular pathology or brain tumors affecting the parietal angular or superior parietal lobes when in the dominant hemisphere. In PTA, the unavoidable parietal white matter disruption, when PTA is done in the dominant hemisphere, can cause this condition. With the exception of homonymous hemianopia, hemiparesis, and cognitive deficits, which are clinically evident, these other sequelae might pass clinically unnoticed because their clinical expression is not obviously disabling and are not usually investigated in pre or postoperative evaluations.

CONCLUSION

The potential sequelae herewith described should foster a change in the surgical approach to these lesions to alternative approaches, a suggestion that has been previously raised.^[18,19] Among these, the interhemispheric transcallosal approach,^[9] by entering the ventricle through its medial wall, has the advantage of avoiding damage to the optic radiations. Nevertheless despite this potential advantage, this approach still can result in other potential neural deficits. The keyhole supracerebellar transtentorial approach^[8] offers the advantage of avoiding white matter disruption. The neuroportal transcortical approach,^[6] by the use of tubular systems with endoscopic assistance, offers minimal brain retraction with good visualization and consequently less white matter disruption. Although each one of these approaches is theoretically safer than PTA, more experience with them is required to allow for a solid evaluation of their real value.

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