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Peculiarities of the third ventricle surgery in endoscopic frontal transcortical approach

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Goal. To analyze the results of surgical treatment patients with the third ventricular pathology.

Objective. To improve methods of transchoroidal dissection. To make enough space for surgery of the third ventricle by expanding the foramen of Monro. To reduce the risk of surgical treatment in the pathology at the posterior compartment of the third ventricle.

Materials and methods. The results of treatment of 27 patients with tumors and colloid cysts to the third ventricle were analyzed. In all 27 patients endoscopic frontal transcortical approach was performed. In 24 cases of them extended anterior choroidal dissection was performed (transchoroidal and transforaminal approach); in 3 cases — transcortical transforaminal approach (without choroidal dissection). In all case there was fully endoscopic removal (100%).

Results. Gross total resection was achieved in 14 cases, subtotal resection — in 13 cases. Karnofsky Performance Scale in the postoperative period demonstrated ≥ 70 points in all patients. Complications occurred in 4 patients (14.8%). No postoperative mortality was observed.

Conclusions. 1. Transcortical transforaminal approach can be used for the pathology in the anterior compartment of the third ventricle. 2. Transcortical transchoroidal approach can be performed for the pathology, which localized or spread into the posterior part of the third ventricle. 3. Anterior transchoroidal dissection can be combined with transforaminal approaches if the ventricular hydrocephalus is not much expressed, foramen of Monro is not much enlarged to complete transforaminal procedure as well as when the tumor spreads to the posterior compartment of the third ventricle. 4. The number of complications related to the frontal transcortical transventricular approach in our series is 14.8%, and they had transient nature and relapsed within a month postop; no postoperative mortality.

Keywords: *third ventricle tumors and colloid cysts; transforaminal approach; transchoroidal approach*

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Особливості хірургії III шлуночка при застосуванні ендоскопічного, фронтального і транскортикального доступу

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Відділення ендоскопічної та краніофасіальної нейрохірургії з групою ад'ювантних методів лікування, Інститут нейрохірургії ім. акад. А.П. Ромоданова НАМН України, Київ, Україна

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Мета: проаналізувати результати хірургічного лікування хворих з патологією III шлуночка.

Завдання дослідження: поліпшити методи дисекції хороїдального сплетення; створити достатньо місця для хірургічного втручання в III шлуночку за рахунок розширення отвору Монро; знизити ризик хірургічного лікування при патології в задніх відділах III шлуночка.

Матеріали і методи. Проаналізовано результати лікування 27 пацієнтів з пухлинами та келоїдними кістами III шлуночка. В усіх пацієнтів застосовано ендоскопічний, фронтальний і транскортикальний доступ. У 24 випадках із них проведено розширений трансформінальний доступ (трансформінальний доступ та дисекція передніх відділів хороїдального сплетення), у 3 – трансформінальний (без дисекції хороїдального сплетення). В усіх випадках виконано повністю ендоскопічне видалення.

Результати. Тотального видалення пухлини досягнуто в 14 випадках, субтотального – у 13. В післяопераційний період усі пацієнти мали ≥ 70 балів за шкалою Карновського. Ускладнення виникли у 4 (14,8%) пацієнтів. Випадків післяопераційної летальності не було.

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Висновки. Транскортикальний трансфорамінальний доступ може бути використаний при патології, розташованій у передніх відділах III шлуночка. Транскортикальний трансхороїдальний доступ може бути виконаний при патології, яка локалізується або поширюється в задні відділи III шлуночка, однак інтраопераційний ризик є високим (пов'язаний із дисекцією між внутрішніми церебральними венами), тому в таких випадках ми рекомендуємо використовувати розширений трансфорамінальний доступ (трансфорамінальний доступ та дисекцію передніх відділів хороїдального сплетення). Розширений трансфорамінальний доступ (трансфорамінальний доступ та дисекція передніх відділів хороїдального сплетення) також може бути виконаний при невираженій гідроцефалії та незбільшеному отворі Монро. Частота ускладнень, пов'язаних з фронтальним, транскортикальним, трансвентрикулярним доступом, у нашій серії становила 14,8%, вони мали транзиторий характер та регресували протягом 1 міс.

Ключові слова: пухлини та келоїдні кісти III шлуночка; розширений трансфорамінальний доступ; дисекція передніх відділів хороїдального сплетення

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Особенности хирургии III желудочка при применении эндоскопического, фронтального и транскортикального доступа

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Цель: проанализировать результаты хирургического лечения больных с патологией III желудочка.

Задания исследования: улучшить методы диссекции хороидального сплетения; создать достаточно места для хирургического вмешательства в III желудочке за счет расширения отверстия Монро; снизить риск хирургического лечения при патологии в задних отделах III желудочка.

Материалы и методы. Проанализированы результаты лечения 27 пациентов с опухолями и келоидными кистами III желудочка. У всех пациентов применен эндоскопический, фронтальный, транскортикальный доступ. В 24 случаях проведен расширенный трансфорамінальний доступ (трансфорамінальний доступ и диссекция передних отделов хороидального сплетения), в 3 – трансфорамінальний (без диссекции хороидального сплетения). Во всех случаях выполнено полностью эндоскопическое удаление.

Результаты. Тотальное удаление опухоли достигнуто в 14 случаях, субтотальное – в 13. В послеоперационный период все пациенты имели ≥ 70 баллов по шкале Карновского. Осложнения возникли у 4 (14,8%) пациентов. Случаев послеоперационной летальности не было.

Выводы. Транскортикальный трансфорамінальний доступ может быть использован при патологии, расположенной в передних отделах III желудочка. Транскортикальный трансхороїдальний доступ может быть выполнен при патологии, которая локализуется или распространяется в задние отделы III желудочка, однако интраоперационный риск является высоким (связанный с диссекцией внутренних церебральных вен), поэтому в таких случаях мы рекомендуем использовать расширенный трансфорамінальний доступ (трансфорамінальний доступ и диссекцию передних отделов хороидального сплетения). Расширенный трансфорамінальний доступ (трансфорамінальний доступ и диссекция передних отделов хороидального сплетения) также может быть выполнен при невыраженной гидроцефалии и неувеличенном отверстии Монро. Частота осложнений, связанных с фронтальным, транскортикальным, трансвентрикулярным доступом, в нашей серии составила 14,8%, они имели преходящий характер и регрессировали в течение 1 мес.

Ключевые слова: опухоли и келоидные кисты III желудочка; расширенный трансфорамінальний доступ; диссекция передних отделов хороидального сплетения

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Introduction

Intermediate transcallosal or transcortical approaches are widely used to treat pathology of the ventricular system. Each of these approaches has advantages and certain features, which are still under discussion [1, 2].

The incidence of hydrocephalus, tumor location in the posterior third ventricle compartment, tumor spreading to the pineal region, cerebral peduncles or cerebral aqueduct, IV ventricle are the subjects related to the choice of surgical approach [3–5]. Depending on tumor location, its size and ventricular hydrocephalus, transcortical transforaminal or transcortical transchoroidal approach or their combination may be used [6–8]. The combination of them — extended transforaminal approach (transforaminal approach with anterior choroidal dissection) makes it possible to reduce postoperative complications, with adequate visualization of the pathology and an acceptable angle of “attack” upon the posterior third ventricle tumor.

The normal size of the foramen of Monro is just about several millimeters and there are so many important structures nearby, therefore, the operation around this area is very difficult and challenging.

The third ventricle is a location difficult to get approach. The region is deep seated and surrounded by critical structures that are easily injured, leading to potentially disastrous outcomes.

Goals. To analyze the results of surgical treatment of patients with the third ventricular pathology.

Objective. To improve the methods of choroidal dissection. To make enough space for surgery of the third ventricle by expanding the foramen of Monro. To reduce the risk of surgical treatment in the posterior third ventricle pathology.

Materials and methods

There were analyzed the results of treatment of 27 patients with tumors and colloid cysts to the III ventricle in the period of 2015–2018. Tumors of the anterior and posterior third ventricle compartments (including 3 colloid cysts of the third ventricle) were found in 6 patients; tumors in the posterior part of the III ventricle — in 21 patients. Histological distribution was as following: primary tumors of the III ventricle— pineocytoma in 2 patients. Invasive tumors: subependymoma — 6; central neurocytoma — 2; astrocytoma — 9; glioblastoma — 4; anaplastic oligoastrocytoma — 1. Colloid cysts to the third ventricle were found in 3 patients. The average size of tumors in the third ventricle was about 3.0 cm (varying from 1.7 cm to 5.2 cm; 60% of them were more than 3.2 cm). All patients underwent preoperative CT and MRI scanning of the brain, and CT scanning with contrast postoperatively (at the first day). In total 64 CT and 34 MRI scanning of the brain, as well as one angiography procedure were performed.

Surgery. The endoscopic frontal transcortical approach was performed in all 27 patients: the extended transforaminal approach (transforaminal approach with anterior choroidal dissection) — 24 cases; transforaminal approach alone (without choroidal dissection) — in 3 cases. In all of them fully endoscopic removal (100%) was achieved.

Results and discussion

Tumor located in the posterior third ventricle compartment is always a challenge. A variety of surgical approaches to the posterior third ventricle region exist. The choice of approach depends on the exact location of the lesion, the tumor consistency and size [12]. The transchoroidal approach begins with the opening of the taenia fornicis and the superior membrane of the tela choroidea, and then dissecting the vascular layer medially to the internal cerebral vein [8]. After the inferior membrane of the tela choroidea and the choroid plexus of the third ventricle have been opened in the midline, the cavity of the third ventricle can be completely seen. The extended transforaminal approach eliminates this risk [11]. Then the posterior limit of the foramen of Monro has been expanded through the choroidal fissure, without sacrificing any neural or even vascular structures. Thus additional space needed for surgery gained. The only structure that restricts further expansion of the foramen is the anterior septal vein, which can be sacrificed if necessary. Besides choroidal dissection at the posterior edge of the foramen of Monro at the very beginning of the internal cerebral veins is not that risky when doing transchoroidal exposure as internal cerebral veins diverge of the foramen of Monro, thus giving some space to start dissection between internal cerebral veins (which open roof of third ventricle without any risk) [9].

The thalamostriate vein is the largest tributary of the internal cerebral vein and is located in the striothalamic sulcus between the caudate nucleus and the thalamus, beneath the stria terminalis in the body of the lateral ventricle [6]. The thalamostriate vein curves medially around the anterior tubercle of the thalamus, where it merges to the internal cerebral vein at the posterior margin of the foramen of Monro. This characteristic U-shaped junction of the thalamostriate vein and internal cerebral vein adjacent to the posterior margin of the foramen of Monro is referred to as the venous angle. The injury of thalamostriate vein or the internal cerebral vein may cause serious consequences including hemiplegia, coma and even death [7]. The damage to the anterior part of the floor of the third ventricle may cause water-salt metabolism disorder symptoms. Lateral to the foramen of Monro there is thalamus and the internal capsule, the injury to which may lead to coma or hemiplegia [10].

The point is that choroidal dissection is done at the middle and posterior compartment of the roof of the third ventricle (the internal cerebral veins are closest). Risk is due to the not enough space to conduct this dissection [13, 14]. Anterior choroidal dissection proceeded to posterior edge of the foramen of Monro would eliminate this risk as internal cerebral veins diverge of the foramen of Monro to the sides. Extended transforaminal approach provides the opportunity to make a sufficient angle of attack to the posterior part of the third ventricle. Conducting anterior choroidal dissection, we expand the foramen of Monro, which gives us the opportunity to obtain a better visualization angle of the tumors of the posterior part and the entirely third ventricle. This visualization is enough to see internal cerebral veins, pineal recess, cerebral aqueduct, posterior commissure.

Hydrocephalus is often concomitant with the third ventricle tumors. In such cases, the enlargement of the foramen of Monro was present in 14 patients. In our series hydrocephalus occurred in 19 cases. In 6 cases it was caused by obstruction at the level of foramen Monro, in 13 cases it was caused by aqueduct tumor. Latter

This article contains some figures that are displayed in color online but in black and white in the print edition

took place if the tumor is located at the posterior third ventricle compartment. Not all of these 19 hydrocephalus patients experienced the foramen of Monro expanded. It took place only in 14 patients. The foramen of Monro was expanded in 14 cases: 6 of them due to tumor blocking and enlargement and in 8 patients the foramen of Monro expanded spontaneously due to hydrocephalus.

Extended trasforaminal approach (transforaminal approach with anterior choroidal dissection) was used in cases when the foramen of Monro was not changed in size (so we enlarged it, expanded it backwards). Also extended trasforaminal approach was performed in cases when the tumor was located in the posterior third

ventricle compartment (in such way we are trying to gain right angle of attack for the tumor visualization); the third indication for the extended trasforaminal approach was the significant size of the third ventricle tumor (we used extended trasforaminal approach to gain better visualization of anterior and posterior third ventricle compartment).

Tumor location in the anterior or posterior third ventricle compartment (with unchanged foramen of Monro — **Fig. 1**) or when the tumor is sizeable, we performed extended anterior choroidal dissection (transchoroidal approach with anterior choroidal dissection) (**Fig. 2**).

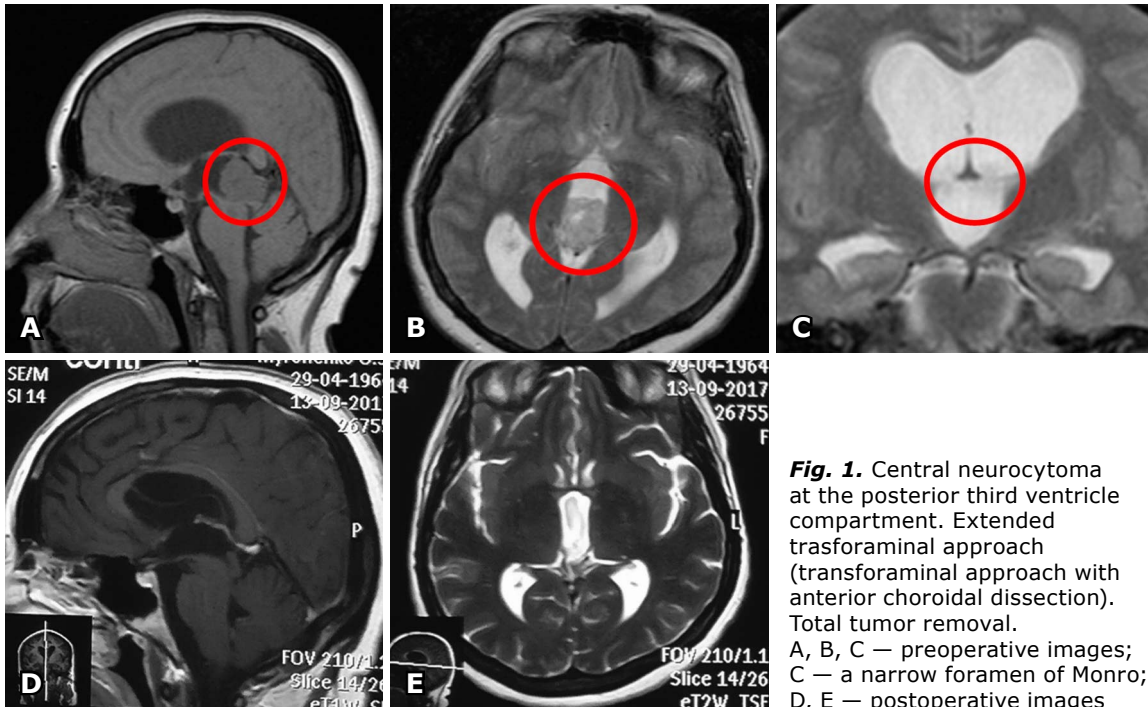


Fig. 1. Central neurocytoma at the posterior third ventricle compartment. Extended trasforaminal approach (transforaminal approach with anterior choroidal dissection). Total tumor removal. A, B, C — preoperative images; C — a narrow foramen of Monro; D, E — postoperative images

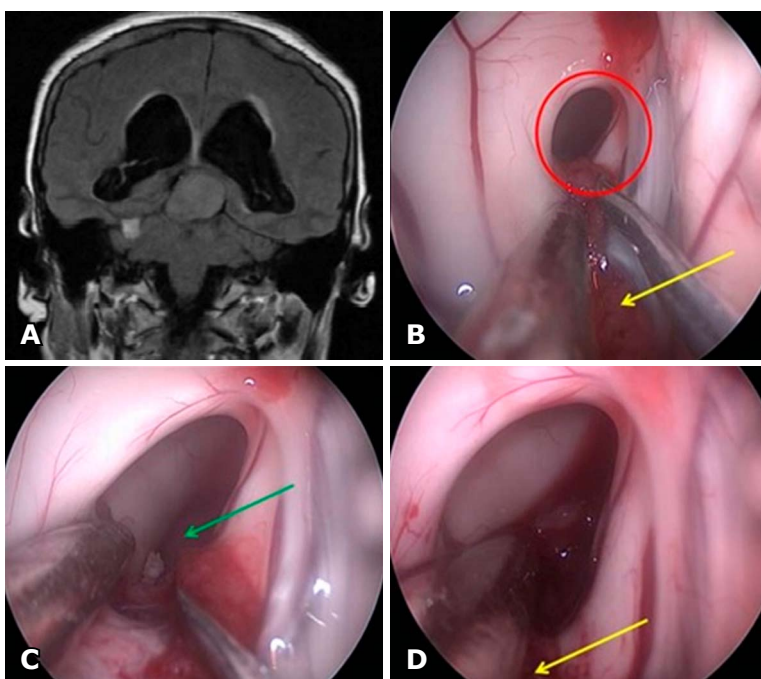


Fig. 2. Extended trasforaminal approach (transforaminal approach with anterior choroidal dissection). A — anaplastic oligoastrocytoma extension to the posterior third ventricle compartment. B — the foramen of Monro, initial enlargement. C — foramen of Monro enlarged to the size required. D — tumor visualized in the third ventricle

Radicality. Total removal was performed in 14 patients; subtotal removal — in 13. Radicality of tumor removal depends on tumor density. If the tumor was jelly-like, the removal was mostly total. In those cases when the tumor was tough, it was not always possible to perform radical removal (**Fig. 3**). Bleeding of the tumor did not signify; since as the tumor had been removed, the bleeding decreased spontaneously (**Fig. 4**). Another important factor in the volume of tumor removal was tumor adhesion to the surrounding structures (especially with internal cerebral veins). The spread of the tumor to the thalamus, the brain stem, and the aqueduct also reduces the radicality of the removal.

According to Karnofsky Performance Scale all patients had ≥ 70 points in the postoperative period. Four patients (14.8%) experienced complications. Selective mutism occurred in 4 cases (complete regression of speech disorders in all patients from 5 to 20 days; two of these patients experienced hemiparesis (complete regression in 2 weeks). No cases of postoperative mortality.

Conclusions

1. Transcortical transforaminal approach can be used for the pathology, which is located in the anterior part of the third ventricle.

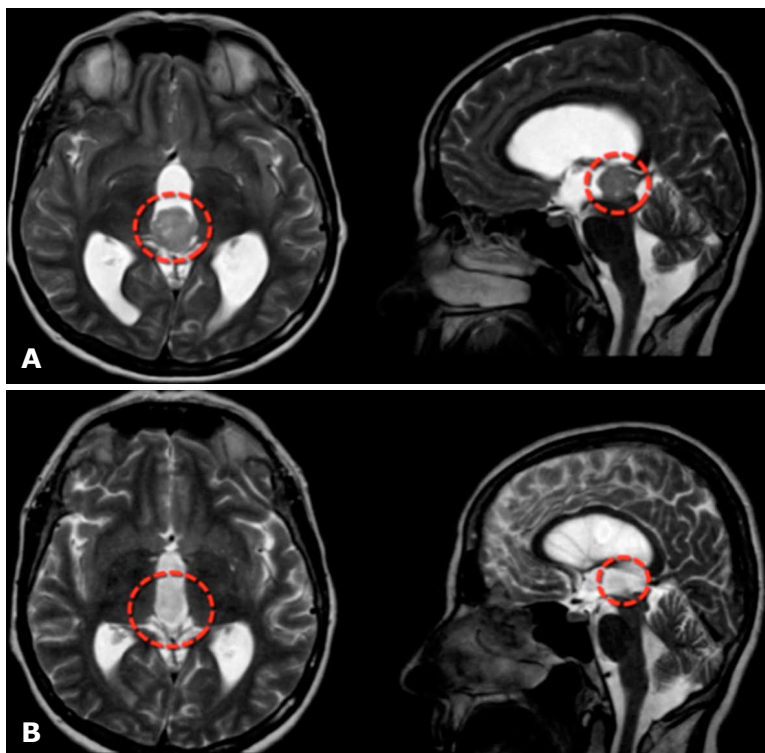


Fig. 3. Central neurocytoma in the posterior third ventricle compartment. Extended trasforaminal approach (transforaminal approach with anterior choroidal dissection). Total tumor removal. A — preoperative images; B — postoperative images

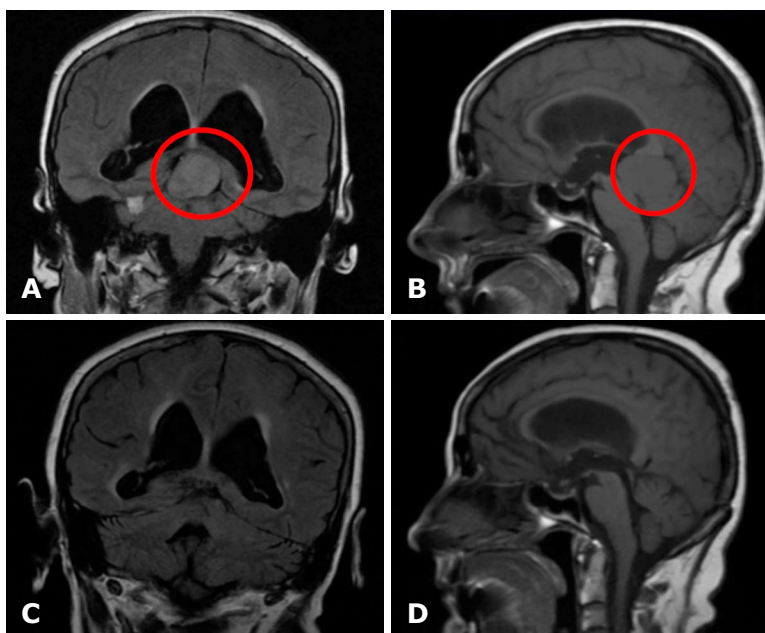


Fig. 4. Astrocytoma extension to the posterior third ventricle compartment. Extended trasforaminal approach (transforaminal approach with anterior choroidal dissection). Total tumor removal. A, B — preoperative images; C, D — postoperative images

2. Transcortical transchoroidal approach can be performed for the pathology, which is localized or spread into the posterior third ventricle compartment, but intraoperative risk is high (associated with dissection between internal cerebral veins); so we recommend the extended trasforaminal approach (transforaminal approach with anterior choroidal dissection) in these cases.

3. Extended trasforaminal approach (transforaminal approach with anterior choroidal dissection) can be performed in cases, when the ventricular hydrocephalus is not much expressed, the foramen of Monro is not much enlarged to complete transforaminal procedure.

4. The number of complications related to the frontal transcortical transventricular approach in our series was 14.8%, and they had transient character and regressed within one month postop; no cases of postoperative mortality.

Disclosure

Conflict of interest

The authors declare no conflict of interest.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

The written informed consent was obtained from each patient or appropriate family member before the surgery.

References

- Kim MH. Transcortical Endoscopic Surgery for Intraventricular Lesions. *J Korean Neurosurg Soc.* 2017 May;60(3):327-334. doi: 10.3340/jkns.2017.0101.008. PubMed PMID: 28490160; PubMed Central PMCID: PMC5426449.
- Carr K, Zuckerman SL, Tomycz L, Pearson MM. Endoscopic removal of an intraventricular primitive neuroectodermal tumor: retrieval of a free-floating fragment using a urological basket retriever. *J Neurosurg Pediatr.* 2013 Jul;12(1):25-9. doi: 10.3171/2013.3.PEDS12392. PubMed PMID:23621838.
- Milligan BD, Meyer FB. Morbidity of transcassal and transcortical approaches to lesions in and around the lateral and third ventricles: a single-institution experience. *Neurosurgery.* 2010 Dec;67(6):1483-96; discussion 1496. doi: 10.1227/NEU.0b013e3181f7eb68. PubMed PMID: 21107179.
- Ogiwara H, Morota N. Flexible endoscopy for management of intraventricular brain tumors in patients with small ventricles. *J Neurosurg Pediatr.* 2014 Nov;14(5):490-4. doi: 10.3171/2014.7.PEDS13648. PubMed PMID: 25148214.
- Souweidane MM. Endoscopic surgery for intraventricular brain tumors in patients without hydrocephalus. *Neurosurgery.* 2005 Oct;57(4 Suppl):312-8; discussion 312-8. PubMed PMID: 16234680.
- Elwatidy SM, Albakr AA, Al Towim AA, Malik SH. Tumors of the lateral and third ventricle: surgical management and outcome analysis in 42 cases. *Neurosciences(Riyadh).* 2017 Oct;22(4):274-281. doi: 10.17712/nsj.2017.4.20170149. PubMed PMID:29057852; PubMed Central PMCID: PMC5946376.
- Darkwah Oppong M, Müller O, Jabbarli R, Dammann P, Sure U, El Hindy N. Intraventricular mass lesions: Still a question of surgical approach? *J Clin Neurosci.* 2017 Sep;43:157-162. doi: 10.1016/j.jocn.2017.05.036. PubMed PMID: 28625588.
- Iacoangeli M, di Somma LG, Di Rienzo A, Alvaro L, Nasi D, Scerrati M. Combined endoscopic transforaminal-transchoroidal approach for the treatment of third ventricle colloid cysts. *J Neurosurg.* 2014 Jun;120(6):1471-6. doi: 10.3171/2014.1.JNS131102. PubMed PMID: 24605835.
- Apuzzo MLJ, Litofsky NS. Surgery in and around the anterior third ventricle. In: Apuzzo MLJ, ed. *Brain Surgery: Complication Avoidance and Management.* NewYork: Churchill-Livingstone; 1993:541-579.
- Ibáñez-Botella G, Domínguez M, Ros B, De Miguel L, Márquez B, Arráez MA. Endoscopic transchoroidal and transforaminal approaches for resection of third ventricular colloid cysts. *Neurosurg Rev.* 2014 Apr;37(2):227-34; discussion 234. doi: 10.1007/s10143-014-0529-7. PubMed PMID: 24526368.
- Nasi D, Iaccarino C, Romano A. Anterior trans-frontal endoscopic resection of third-ventricle colloid cyst: how I do it. *Acta Neurochir (Wien).* 2017 Jun;159(6):1049-1052. doi: 10.1007/s00701-017-3149-5. PubMed PMID: 28378097.
- Lozier AP, Bruce JN. Surgical approaches to posterior third ventricular tumors. *Neurosurg Clin N Am.* 2003 Oct;14(4):527-45. PubMed PMID:15024799.
- Cikla U, Swanson KI, Tunturk A, Keser N, Uluc K, Cohen-Gadol A, Baskaya MK. Microsurgical resection of tumors of the lateral and third ventricles: operative corridors for difficult-to-reach lesions. *J Neurooncol.* 2016 Nov;130(2):331-340. PubMed PMID: 27235145; PubMed Central PMCID: PMC5090015.
- Eboli P, Danielpour M. Acute obstructive hydrocephalus due to a large posterior third ventricle choroid plexus cyst. *Pediatr Neurosurg.* 2011;47(4):292-4. doi: 10.1159/000336046. PubMed PMID: 22378105.