Third ventricle approaches

Latest Pubmed Related Articles

- Ghrelin ameliorates sepsis induced acute skeletal muscle wasting via hypothalamic JAK2/STAT3 -AgRP pathway
- Role of Transcatheter Treatment in Intermediate-to High-risk Pulmonary Embolism
- Suprasellar Versus Third Ventricular Cysts: Anatomic and Surgical Considerations
- Outcomes and Surgical Approaches for Pineal Region Tumors in Adults: A Retrospective Study of a Single-Center Over 12 Years
- Individualized retrograde endoscopic transoccipital-fourth ventricular-midbrain aqueduct to third and lateral ventriculoperitoneal shunt for complex multilocular hydrocephalus with isolated fourth ventricle: a case report
- Endoscopic Approach for Colloid Cyst Resection
- Endoscopic resection of a giant colloid cyst in the cavum septum pellucidum: Illustrative case
- Case Report: Moderate-to-severe paravalvular leak regurgitation after recurrent prosthetic valve endocarditis in a patient with a double-chambered right ventricle associated with a restricted membranous ventricular septal defect

---

The approaches suitable for lesions within or compressing the anterior portion of the third ventricle are the transsphenoidal approach, subfrontal approach, frontotemporal approach, subtemporal approach, anterior transcallosal approach, and anterior transventricular. The approaches suitable for reaching the posterior portion of the 3rd ventricle are the posterior transcallosal, posterior transventricular, occipital transtentorial approach, and infratentorial supracerebellar approach [1].

The choice of the third ventricle approach basically depends on the exact location of the lesion, the diferential diagnosis, lesion size, patient's clinical status and anatomical knowledge.

Basically three major approaches to the third ventricle: transcortical, transcallosal and endoscopic approaches. Less used, would be the subfrontal via lamina terminalis access and stereotactic techniques.

General information

Classic references review the microsurgical anatomy [2] and surgical approaches [3], and are briefly summarized below.

Alternative approaches for lesions of the anterior third ventricle:

1. transcortical: approach is through the lateral ventricle and is feasible only in the presence of hydrocephalus; especially useful if the tumor extends from the third ventricle into one of the lateral ventricles. Risk of seizures is 5% (higher than with transcallosal)

see Transcortical approach to the third ventricle.

2. transcallosal: may be preferable in the absence of hydrocephalus

see Transcallosal approach to the third ventricle.

3. subfrontal: allows four different approaches

a) subchiasmatic: between optic nerve and optic chiasm

b) optico-carotid:through the triangula space bordered by optic nerve medially,carotid artery laterally, and ACA posteriorly

c) lamina terminalis: above the optic chiasm

d) transsphenoidal: requires removal of tuberculum sellae, planum sphenoidale, and anterior wall of the sella turcica

4. transsphenoidal

5. subtemporal

6. stereotactic: may be useful for aspiration of colloid cysts

---

Third ventricle tumors are surgical challenges because of the complex surrounding structures, including the hypothalamus, infundibulum, optic pathways, limbic system, and nearby vasculature [4].

These tumors cause obstructive hydrocephalus and thus necessitate a CSF diversion procedure such as an endoscopic third ventriculostomy (ETV), often coupled with an endoscopic biopsy (EBX). Lesions located posterior to the massa intermedia pose a technical challenge, as the use of a rigid endoscope for performing both an ETV and EBX is limited.

Roth and Constantini, recommend using a combined rigid-flexible endoscope for endoscopic third ventriculostomy and biopsy to approach posterior third ventricular tumors (behind the massa intermedia). This technique overcomes the limitations of using a rigid endoscope by reaching 2 distant regions [5].

The first choice treatment option for third ventricle lesions with dilated ventricles was endoscopic management [6]. Among microsurgical approaches, the expanded transcallosal transforaminal approach was a more recently practiced and safe method of accessing the anterior and middle third ventricle. With this approach, the risk of damage to most of the vital structures, such as the fornix or the thalamus was avoided [7]. The location of the junction of the anterior septal and internal cerebral vein is essential. Preoperative magnetic resonance (MR) venography can identify the junction. Some areas remain inaccessible, such as the anterosuperior and posterosuperior regions of the third ventricle [8].

The expanded transcallosal transforaminal approach remains a safe and relatively secure method of gaining access to the third ventricle [9].

There are three broad categories – anterior, lateral, and posterior routes. The anterior routes include transforaminal, interforniceal, transchoroidal, and subchoroidal. The subtemporal route is the main

lateral corridor to the third ventricle and recommended if the tumor is located lateral to the sella turcica or extends into the middle cranial fossa [10]. A transtubular access to the third ventricle is also practical. It enables blunt dissection of the corpus callosum which may minimize retraction injuries. Three-dimensional endoscopic visualization, coupled with a transparent plastic retractor, provides absolute and undeviating monitoring of the surgical corridor [11]. In the third ventricle's anterior portion, the endoscopic endonasal approach permits surgical maneuverability. The lamina terminalis and tuber cinereum are thought to be safe entry points for this approach [12]. Tumors leading to the blockage of the Sylvian aqueduct can cause obstructive hydrocephalus; this calls for a CSF diversion procedure, endoscopic third ventriculostomy, combined with an endoscopic biopsy. Posterior third ventricular tumors should be approached using a combination of a rigid-flexible endoscope [13].

Colloid cyst treatment.

Choroid plexus papilloma treatment.

Craniopharyngioma treatment.

Operative approaches to tumors of the third ventricle, mainly the bifrontal approach through the lamina terminalis, has several advantages. First, the main arteries can be exposed and the operative field is sufficiently wide to render the operative procedure safe. Second, cortical incision or excision is unnecessary. By cutting the lamina terminalis, which is usually thin and expanded as a result of hydrocephalus, even a large tumor can be removed. In addition, lethal complications are avoided, because this approach has less possibility of damage to the lateral wall of the third ventricle. Seventeen cases of tumor in the third ventricle underwent operation via this approach. The operative technique for the bifrontal approach through the lamina terminalis and three representative cases are reported. This approach can be applied not only to tumors, but to arteriovenous malformations or giant aneurysms adjacent to the third ventricle [14].

Complications

The most common complications were paresis (37%), abulia/aphasia (28%), memory loss (18%), and cognitive change (17%) and occurred independently of the chosen approach. Over 75% of complications resolved within 12 months. The permanent neurological complication rate determined by a staff neurologist was 19.7%. Seizure attributable to surgery occurred following 8% of transcortical and 25% of transcallosal operations.

Although the 2 traditional approaches to the ventricular system had similar major complication rates, the transcallosal approach was associated with significantly increased seizure risk. Accordingly, the chosen operative corridor should optimize tumor access and the protection of vulnerable neurovascular structures [15].

Approaches to the posterior wall of the third ventricle

Surgery of lesions in the posterior wall of the third ventricle requires great expertise due to its deep location and important surrounding structures. This region has been traditionally reached through a supracerebellar infratentorial approach, but new options have emerged, especially with the development of neuroendoscopy.

One formalin-fixed cadaver human head was dissected. Five different endoscopic approaches were performed: interhemispheric transcallosal transchoroidal approach, frontal transforaminal transchoroidal approach, supraorbital subfrontal translamina terminalis approach, expanded endonasal approach, and supracerebellar infratentorial approach. An anatomical description of the different approaches was conducted and quantitative measurements (craniocaudal and latero-lateral distances) were taken using the StealthStation ® workstation after performing a CT scan of the specimen.

The interhemispheric transcallosal transchoroidal, frontal transforaminal transchoroidal, and supraorbital subfrontal translamina terminalis approaches provided great view of all the structures of the posterior wall of the third ventricle. Maximum craniocaudal distance was obtained through the supraorbital subfrontal translamina terminalis approach (10.6 mm), with great difference from the expanded endonasal approach (5.2 mm). The widest latero-lateral distance from inside the third ventricle was achieved through the interhemispheric transcallosal transchoroidal approach (4.6 mm), similar to the expanded endonasal (4.1 mm), and differing from the supraorbital subfrontal translamina terminalis (2.4 mm).

The endoscopic approaches provided an adequate alternative to more traditional microsurgical approaches to the posterior wall of the third ventricle, with a great view of all its structures. The selection of the approach must be taken under consideration in each case [16)]

References

1)
Rhoton AL Jr, Yamamoto I, Peace DA. Microsurgery of the third ventricle: Part 2. Operative approaches. Neurosurgery. 1981 Mar;8(3):357-73. PubMed PMID: 7242884.
2)
Yamamoto I, Rhoton AL, Peace DA. Microsurgery of the Third Ventricle: Part 1. Neurosurgery. 1981; 8: 334–356
3)
Rhoton AL, Yamamoto I, Peace DA. Microsurgery of the Third Ventricle: Part 2. Operative Approaches. Neurosurgery. 1981; 8:357–373
4)
Tomasello F, Cardali S, Angileri FF, Conti A. Transcallosal approach to third ventricle tumors: How I do it. Acta Neurochir. 2013;155:1031–4.
5) , 13)
Roth J, Constantini S. Combined rigid and flexible endoscopy for tumors in the posterior third ventricle. J Neurosurg. 2015 Jun;122(6):1341-6. doi: 10.3171/2014.9.JNS141397. Epub 2015 Mar 27. PubMed PMID: 25816082.
6)
Chibbaro S, Di Rocco F, Makiese O, Reiss A, Poczos P, Mirone G, Servadei F, George B, Crafa P, Polivka M, Romano A. Neuroendoscopic management of posterior third ventricle and pineal region tumors: technique, limitation, and possible complication avoidance. Neurosurg Rev. 2012 Jul;35(3):331-38;

discussion 338-40. doi: 10.1007/s10143-011-0370-1. Epub 2012 Jan 19. PubMed PMID: 22258494.
7) , 9)

Patel P, Cohen-Gadol AA, Boop F, Klimo P Jr. Technical strategies for the transcallosal transforaminal approach to third ventricle tumors: expanding the operative corridor. J Neurosurg Pediatr. 2014 Oct;14(4):365-71. doi: 10.3171/2014.6.PEDS1452. Epub 2014 Aug 8. PubMed PMID: 25105512.
8)

Ahmed SI, Javed G, Laghari AA, Bareeqa SB, Aziz K, Khan M, Samar SS, Humera RA, Khan AR, Farooqui MO, Shahbaz A. Third Ventricular Tumors: A Comprehensive Literature Review. Cureus. 2018 Oct 5;10(10):e3417. doi: 10.7759/cureus.3417. Review. PubMed PMID: 30542631; PubMed Central PMCID: PMC6284874.
10)

Cikla U, Swanson KI, Tumturk 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. Epub 2016 May 27. Review. PubMed PMID: 27235145; PubMed Central PMCID: PMC5090015.
11)

Shoakazemi A, Evins AI, Burrell JC, Stieg PE, Bernardo A. A 3D endoscopic transtubular transcallosal approach to the third ventricle. J Neurosurg. 2015 Mar;122(3):564-73. doi: 10.3171/2014.11.JNS14341. Epub 2015 Jan 2. PubMed PMID: 25555026.
12)

Cavallo LM, Di Somma A, de Notaris M, Prats-Galino A, Aydin S, Catapano G, Solari D, de Divitiis O, Somma T, Cappabianca P. Extended Endoscopic Endonasal Approach to the Third Ventricle: Multimodal Anatomical Study with Surgical Implications. World Neurosurg. 2015 Aug;84(2):267-78. doi: 10.1016/j.wneu.2015.03.007. Epub 2015 Mar 28. PubMed PMID: 25827043.
14)

Suzuki J, Katakura R, Mori T. Interhemispheric approach through the lamina terminalis to tumors of the anterior part of the third ventricle. Surg Neurol. 1984 Aug;22(2):157-63. PubMed PMID: 6740479.
15)

Milligan BD, Meyer FB. Morbidity of transcallosal 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.
16)

Otero-Fernández P, Abarca-Olivas J, González-López P, Martorell-Llobregat C, Flores-Justa A, Villena-Martín M, Nieto-Navarro J. Endoscopic approaches to the posterior wall of the third ventricle: An anatomical comparison. Clin Neurol Neurosurg. 2024 Aug 19;245:108511. doi: 10.1016/j.clineuro.2024.108511. Epub ahead of print. PMID: 39180812.