

ONE SESSION, TWO TARGETS – COMBINED ENDOSCOPIC THIRD VENTRICULOSTOMY AND PINEAL CYST FENESTRATION –IN THE TREATMENT OF OBSTRUCTIVE HYDROCEPHALUS

JEDNA INTERVENCIJA, DVA CILJA – KOMBINOVANA ENDOSKOPSKA TREĆA VENTRIKULOSTOMIJA I FENESTRACIJA PINEALNE CISTE U LEČENJU OPSTRUKTIVNOG HIDROCEFALUSA

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Case report
Prikaz slučaja

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Abstract

Introduction. Symptomatic pineal cysts are rare, and their optimal management remains controversial and not clearly defined. **Case Report.** We present a case of a 45-year-old female who presented with several weeks of headache and acute-onset vertigo beginning the night prior to admission. Her medical history included an asymptomatic pineal cyst incidentally identified on magnetic resonance imaging two years earlier. Current imaging demonstrated marked enlargement of the pineal cyst with compression of the Sylvian aqueduct, resulting in obstructive hydrocephalus. The patient underwent a single-session combined endoscopic procedure with neuronavigation guidance. An endoscopic third ventriculostomy was first performed via a right frontal burr hole (Kocher's point) to restore cerebrospinal fluid circulation. Through a second frontal burr hole, the pineal cyst wall was fenestrated and a biopsy was obtained. Both procedures were performed with the patient in the supine position and neutral head alignment. No intraoperative or postoperative complications were observed. Postoperative computed tomography confirmed ventriculostomy patency and reduction in ventricular size. At three-month follow-up, the patient remained asymptomatic. **Conclusion.** A combined minimally invasive endoscopic approach can effectively address both obstructive hydrocephalus and symptomatic pineal cyst in a single surgical session.

Key words: Hydrocephalus; Third Ventricle; Ventriculostomy; Pineal Gland; Cyst; Endoscopy; Minimally Invasive Surgical Procedures

Sažetak

Uvod. Simptomatske pinealne ciste su retke, a njihov tretman je i dalje kontroverzan i nejasno definisan. **Prikaz slučaja.** Prikazujemo slučaj 45-godišnje pacijentkinje koja se javila zbog glavobolje koja traje nekoliko nedelja i vrtoglavice koja je počela veće pre prijema. U medicinskoj istoriji postojala je asimptomatska cistična lezija pinealne žlezde, slučajno otkrivena na pregledu magnetnom rezonancom sprovedenom dve godine ranije. Magnetno-rezonantni imidžing je pokazao značajno uvećanje pinealne ciste, koja komprimuje moždani akvedukt dovodeći do opstruktivnog hidrocefalusa. Pacijentkinja je podvrgnuta kombinovanoj endoskopskoj proceduri u jednoj sesiji, uz upotrebu neuronavigacije. Najpre je urađena endoskopska treća ventrikulostomija kroz desni frontalni trepanski otvor (Koherova tačka) radi uspostavljanja protoka cerebrospinalne tečnosti. Kroz drugi, odvojeni frontalni trepanski otvor, izvršena je fenestracija zida pinealne ciste i uzet je uzorak tkiva za biopsiju. Oba zahvata urađena su u položaju na leđima, sa glavom u neutralnom položaju. Procedura je prošla bez intraoperativnih i postoperativnih komplikacija. Postoperativni nalaz kompjuterizovane tomografije je potvrdio prohodnost ventrikulostomije i redukciju veličine komora i ciste. Na kontrolnom pregledu sprovedenom nakon tri meseca pacijentkinja je bila bez simptoma. **Zaključak.** Ovakav kombinovani pristup omogućio je efikasno rešavanje i hidrocefalusa i same pinealne ciste, sprovedeno kroz jednu minimalno invazivnu proceduru.

Ključne reči: hidrocefalus; treći ventriculus; ventrikulostomija; pinealna žlezda; cista; endoskopija; minimalno invazivne hirurške procedure

Introduction

Pineal cysts (PCs) are benign, non-neoplastic lesions arising from the pineal gland, typically located within the quadrigeminal cistern, with the anterior wall often protruding into the third ventricle [1]. They are predominantly asymptomatic and frequently iden-

tified as incidental findings on brain imaging, with a reported prevalence ranging from 1.3% to 4.5% in imaging studies and in up to 40% of autopsy series [2]. However, large pineal cysts may compress the quadrigeminal plate and obstruct the cerebral aqueduct, resulting in obstructive hydrocephalus and increased intracranial pressure [3]. In such cases, patients may

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Abbreviations

ETV	– endoscopic third ventriculostomy
MRI	– magnetic resonance imaging
CT	– computed tomography
CSF	– cerebrospinal fluid

develop headaches, seizures, or persistent neurological deficits, including ocular movement abnormalities.

Management strategies for pineal cysts depend on clinical presentation and symptomatology. Asymptomatic lesions are typically managed conservatively with interval magnetic resonance imaging (MRI) surveillance [4]. Surgical treatment options for symptomatic pineal cysts associated with hydrocephalus include ventriculoperitoneal shunting or endoscopic third ventriculostomy (ETV) for cerebrospinal (CSF) diversion, microsurgical cyst resection, endoscopic cyst fenestration, or combined endoscopic approaches [5].

In this report, we present a case of obstructive hydrocephalus caused by a pineal cyst successfully treated using a combined ETV and cyst fenestration performed during a single surgical session.

Case Report

A 45-year-old woman presented with several weeks of headaches followed by acute onset vertigo beginning the night prior to admission. Her medical history included an asymptomatic pineal cystic lesion incidentally identified on MRI two years earlier during evaluation for elevated oxytocin levels.

Neurological examination revealed bilateral papilledema, while the remainder of the examination was unremarkable. Brain MRI demonstrated a well-defined 24-mm cystic lesion with peripheral calcifications localized in the pineal region, compressing the cerebral aqueduct and resulting in marked dilation of the lateral and third ventricles, consistent with obstructive hydrocephalus secondary to a pineal cyst (**Figure 1A and B**). Based on clinical presentation, neurological findings, as imaging results, delayed-urgent neurosurgical intervention was indicated.

The surgical procedure consisted of two sequential steps:

1. Endoscopic Third Ventriculostomy (ETV): A right frontal burr hole was created at Kocher's point, and endoscopic fenestration of the floor of the third ventricle was performed to establish a CSF bypass.

2. Cystotomy and biopsy: A second frontal burr hole was created to allow endoscopic access to the pineal cyst, enabling fenestration of the cyst wall and tissue biopsy.

The patient was positioned supine with the head secured in a neutral alignment. Neuronavigation was utilized for trajectory planning and intraoperative guid-

ance. A right frontal burr hole was made, and the right lateral ventricle was accessed via Kocher's point. A rigid endoscope was advanced along the planned trajectory, and the foramen of Monro was identified, permitting entry into the third ventricle. Using a monopolar instrument, fenestration of the third ventricular floor was performed, followed by enlargement with a balloon catheter to complete the ventriculostomy. CSF flow into the prepontine cistern was confirmed.

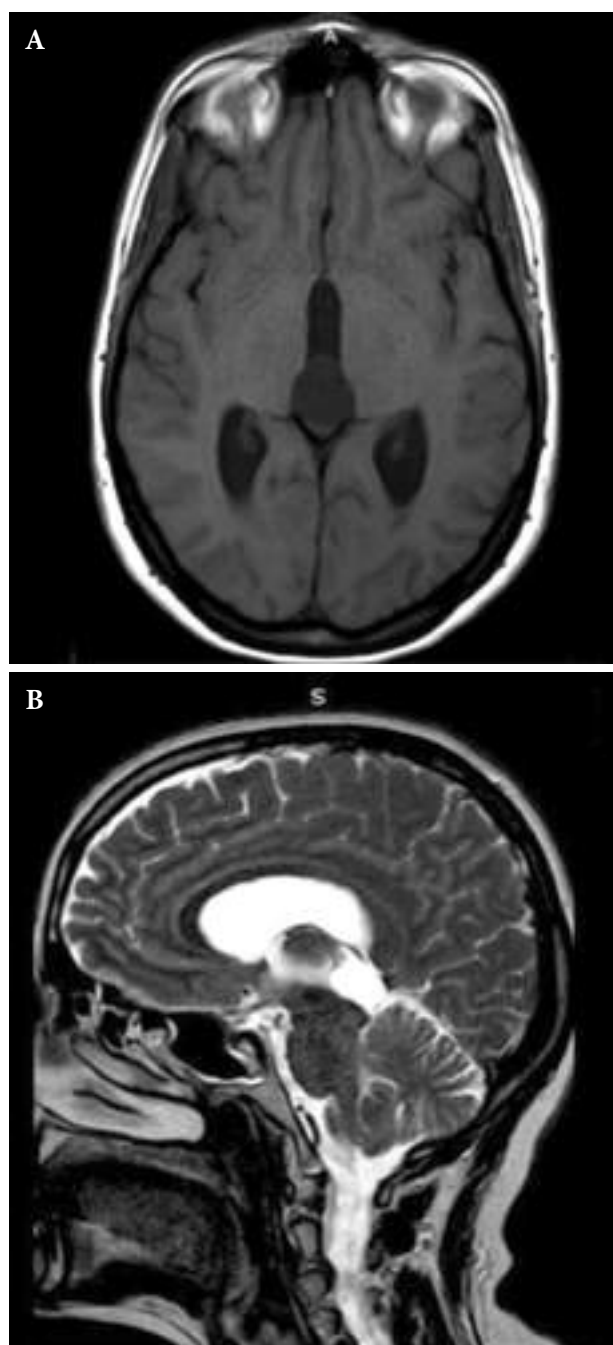


Figure 1A and B. Preoperative MRI images (A: axial T1-weighted; B: sagittal T2-weighted) demonstrating a cystic mass lesion measuring 24 mm in diameter in the pineal region, causing obliteration of the Sylvian aqueduct.

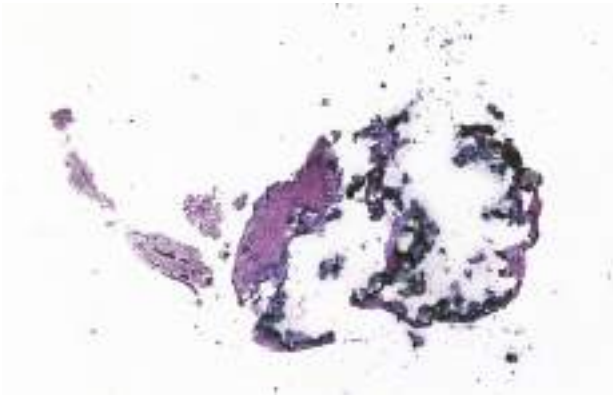


Figure 2. Histopathological appearance of a calcified pineal cyst (H&E staining). Fragments of a fibrotically thickened cyst wall with coarse lamellar and granular calcifications are present. No evidence of neoplastic proliferation is observed.

A second frontal burr hole was subsequently created anterior to the first. The frontal horn of the lateral ventricle was accessed according to navigation guidance, and the endoscope was reintroduced through the foramen of Monro into the third ventricle. A cystic lesion was identified posteriorly in the region of the Sylvian aqueduct. The cyst wall was fenestrated, establishing wide communication with the ventricular system, and a tissue sample was obtained for histopathological analysis.

After achieving adequate hemostasis, the wound was closed in anatomical layers. The total operative time for both procedures was 60 minutes (skin-to-skin).

The postoperative course was uneventful. CT performed on the first postoperative day confirmed ventriculostomy patency, reduction in ventricular size, and regression of the cystic lesion. The patient was discharged on postoperative day four in good clinical condition.

Histopathological examination confirmed a simple pineal cyst without evidence of neoplastic changes (**Figure 2**). Follow-up MRI at three months demonstrated decreased ventricular dilation and reduction in cyst size (**Figure 3A and B**). The patient remained asymptomatic at follow-up.

Discussion

Symptomatic pineal cysts are relatively uncommon but may result in life-threatening obstructive hydrocephalus due to compression of the cerebral aqueduct. When significant symptoms or radiological evidence of CSF pathway obstruction are present, surgical intervention is indicated [6]. Several treatment strategies have been described in the literature:

- **Ventriculoperitoneal shunting or endoscopic third ventriculostomy (ETV) alone:** These approaches provide CSF diversion but do not directly address the underlying cystic lesion. Consequently, the cyst

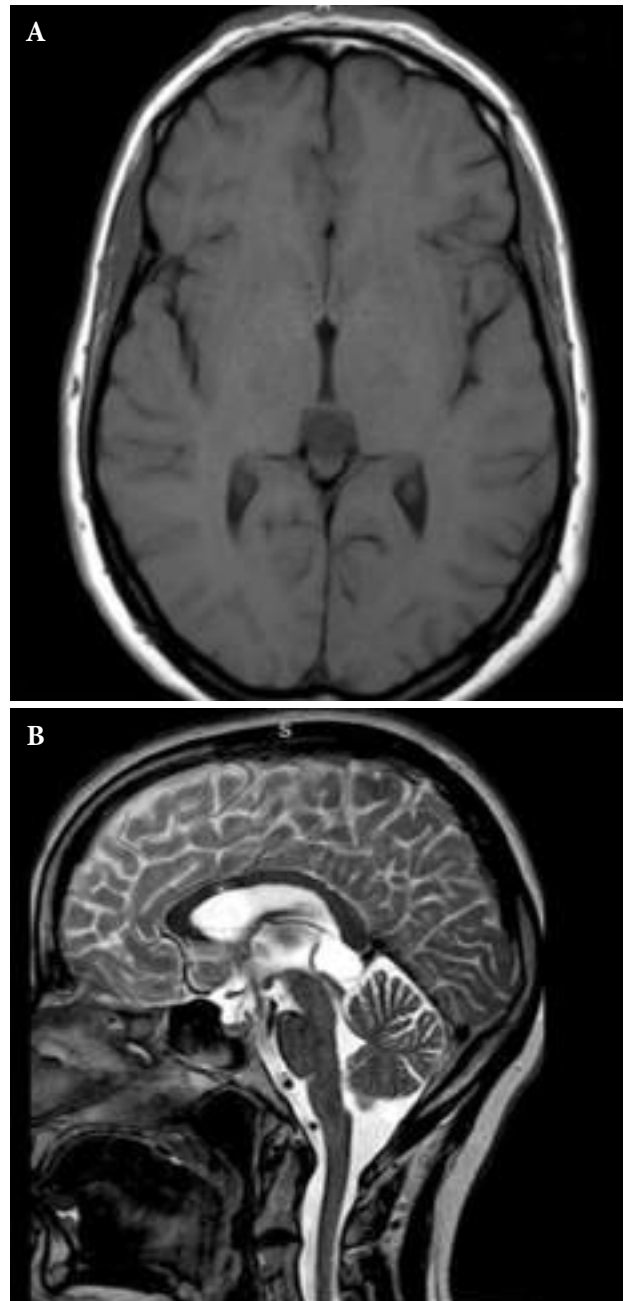


Figure 3A and B. MRI images obtained at 3-month follow-up (A: axial T1-weighted; B: sagittal T2-weighted) demonstrating postoperative changes, including reduced ventricular dilation and decreased size of the cystic lesion.

may continue to enlarge or cause recurrent obstruction over time [7].

- **Microsurgical pinealectomy:** Open surgical removal of the cyst, typically via a supracerebellar infratentorial approach, may offer definitive treatment but is associated with greater surgical invasiveness and a higher risk of complications [8].

- **Endoscopic cyst fenestration alone:** This minimally invasive strategy enables direct decompression of the cyst into the CSF spaces; however, persistent or re-

current hydrocephalus may occur if aqueductal obstruction is not adequately resolved [3,9].

– **Combined ETV and cyst fenestration:** This approach simultaneously addresses both CSF flow obstruction and cyst compression by establishing an alternative CSF pathway while decompressing the lesion, potentially providing a more definitive and durable solution [3].

The combined endoscopic strategy used in the present case offers several advantages. It avoids the morbidity associated with open microsurgical approaches and eliminates the need for permanent shunt placement. ETV restores CSF circulation by creating an alternative pathway, while cyst fenestration directly decompresses the pineal lesion and allows tissue sampling for histological confirmation. Furthermore, neuronavigation enhances procedural safety by enabling accurate trajectory planning to deep-seated anatomical targets. In our patient, this approach resulted in immediate symptom relief without intraoperative or perioperative complications [4,10].

Although some reports describe symptom resolution following cyst fenestration alone, there remains a risk of recurrent aqueductal obstruction if the fenestration narrows or closes over time. Incorporating ETV into the procedure provides an additional safeguard for CSF circulation, potentially reducing the likelihood of recurrence [1,3]. To our knowledge, performing both procedures during a single operative session remains relatively infrequently reported. The

sustained symptom-free status at three-month follow-up in our patient suggests that this combined approach may offer durable clinical benefits.

Potential risks associated with this dual procedure include bleeding or injury to adjacent critical structures, such as the internal cerebral veins [11]. However, meticulous preoperative planning and the use of intraoperative neuronavigation can substantially mitigate these risks [2,10]. The favorable outcome observed in this case supports the feasibility, safety, and effectiveness of single-session combined endoscopic ETV and cyst fenestration in appropriately selected patients.

Conclusion

We present a case of obstructive hydrocephalus caused by a pineal cyst successfully treated using a minimally invasive combined approach consisting of endoscopic third ventriculostomy and cyst fenestration performed during a single surgical session. This strategy effectively resolved hydrocephalus, decompressed the cyst, and avoided the need for open surgery. The excellent clinical outcome and sustained symptom resolution at three-month follow up suggest that this combined endoscopic technique represents a safe and effective therapeutic option. Based on current literature and our experience, this minimally invasive approach may provide immediate symptom relief and a potentially definitive solution for elected patients with symptomatic pineal cysts.

References

1. Jenkinson MD, Mills S, Mallucci CL, Santarius T. Management of pineal and colloid cysts. *Pract Neurol*. 2021;21(4):292-9.
2. Davidson L. Endoscopic management of pineal cyst-associated aqueductal stenosis. *Acta Neurochir (Wien)*. 2020;162(12):2975-82.
3. Ndukuba K, Ogiwara T, Nakamura T, Kamiya K, Hanaoka Y, Horiuchi T, et al. Surgical strategy for symptomatic pineal cyst: is endoscopic third ventriculostomy necessary in addition to cyst fenestration? *Nagoya J Med Sci*. 2021;83(3):627-33.
4. Schmutzer-Sondergeld M, Gencer A, Schmidlechner T, Zimmermann H, Niedermeyer S, Katzendobler S, et al. Comparison of surgical approaches and outcome for symptomatic pineal cysts: microscopic/endoscopic fenestration vs. stereotactic catheter implantation. *Acta Neurochir (Wien)*. 2025;167(1):27.
5. Májovský M, Netuka D, Beneš V. Is surgery for pineal cysts safe and effective? Short review. *Neurosurg Rev*. 2018;41(1):119-24.
6. Al Mutawa M, Lange I, Kirsch M, Flöel A, Fleck S, Schroeder HWS. Symptomatic pineal cysts without ventricular enlargement: diagnosis and treatment. *Dtsch Arztebl Int*. 2025;122(11):298-303.
7. Tseng KY, Ma HI, Liu WH, Tang CT. Endoscopic supracerebellar infratentorial retropineal approach for tumor resection. *World Neurosurg*. 2012;77(2):399.E1-4.
8. Májovský M, Netuka D, Beneš V. Clinical management of pineal cysts: a worldwide online survey. *Acta Neurochir (Wien)*. 2016;158(4):663-9.
9. Radojčić B, Jokić R, Grebeldinger S, Meljnikov I, Radojčić N. History of minimally invasive surgery. *Med Pregl*. 2009;62(11-12):597-602.
10. Rohde V, Behm T, Ludwig H, Wachter D. The role of neuronavigation in intracranial endoscopic procedures. *Neurosurg Rev*. 2012;35(3):351-8.
11. Chibbaro S, Di Rocco F, Makiese O, Reiss A, Poczos P, Mirone G, et al. Neuroendoscopic management of posterior third ventricle and pineal region tumors: technique, limitation, and possible complication avoidance. *Neurosurg Rev*. 2012;35(3):331-8.