

## Papillary Glioneuronal Tumor of Third Ventricle Endoscopically Treated: Case Report and Review of Literature

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Papillary Glioneuronal Tumor; PGNT; Endoscopic Surgery; Third Ventricle; Brain Tumor

## 1. Abstract

**1.1. Introduction:** Papillary Glioneuronal Tumor (PGNT) is a grade I tumor based on the new World Health Organization CNS tumor classification. Its special feature concerns its biphasic histologic pattern of both glial and neuronal elements. Because of the rarity of this entity, literature is mostly based on case reports.

**1.2. Research Question:** The objective of this paper is to display our experience treating endoscopically a papillary glioneuronal tumor located into the third ventricle in an adult patient and to highlight the main points of the literature.

**1.3. Material & Methods:** A 75-year-old patient with known Parkinson disease presented with episodes of loss of consciousness and gait disorders in our institution. Brain MRI demonstrated enlargement of ventricular system due to an obstruction caused by an intraventricular tumor in the third ventricle.

**1.4. Results:** Patient underwent an endoscopic subtotal removal of the tumor. Postoperative brain CT scan revealed minor residual of the tumor and patient was discharged 2 days after surgery in good clinical condition. Histopathological analysis of the tumor samples matched the diagnosis of PGNT. Postoperative follow-up in 1 month demonstrated great neurological improvement.

**1.5. Discussion & Conclusion:** Literature reports that total surgical resection is the treatment of choice in almost all cases of PGNT giving the most favorable clinical outcome. Only 4 cases of PGNT located in 3rd ventricle have been recorded and data for

endoscopic management found only for one of the cases concerning a pediatric patient. Therefore, we report for first time removal of third ventricle papillary glioneuronal tumor in adult patients via the endoscopic technique.

## 2. Introduction

Papillary Glioneuronal Tumor (PGNT) was discovered relatively recently, in 1998, and concerns a biphasic CNS neoplasm characterized by pseudopapillae lined glial cells with interpapillary neuronal elements. Based on the new 2021 edition of the WHO classification of CNS tumors, PGNT is considered a grade I tumor, in the category of glioneuronal and neuronal tumors [1]. The literature surrounding this tumor is mostly based on case reports and epidemiologic data demonstrate that the rare PGNT accounts only for 0,02% of intracranial oncology [2].

The purpose of this paper is to present our experience of this unusual neurosurgical entity and review its bibliography. The difference with this study lies in the fact that it is the 5th PGNT case in literature located in the third ventricle and we decided to treat it endoscopically. No data have been found for endoscopic management of ventricular PGNT tumors in adult patients.

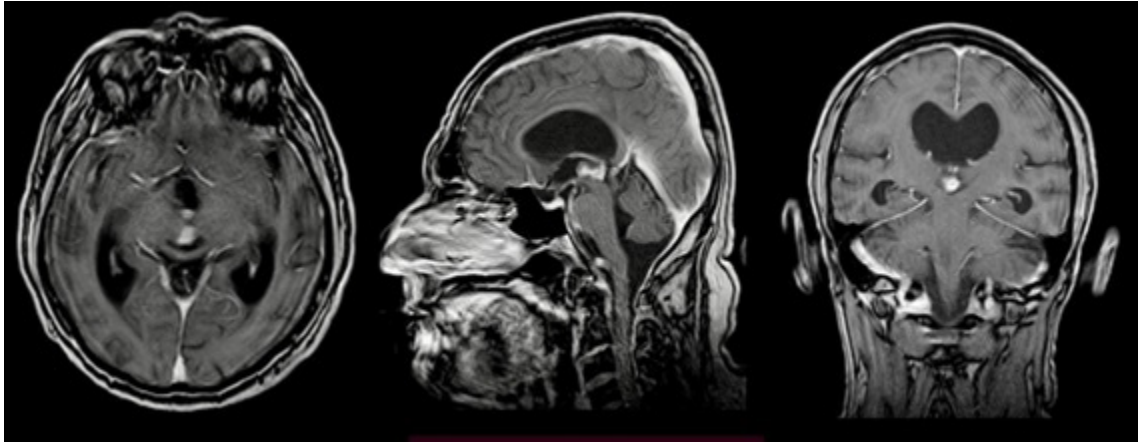
## 3. Case Presentation

A 75-year-old man, with known Parkinson disease on medication since 2009, presented with episodes of loss of consciousness and gait disorders. Contrast enhancement brain MRI demonstrated enlargement of ventricular system due to an obstruction caused by an

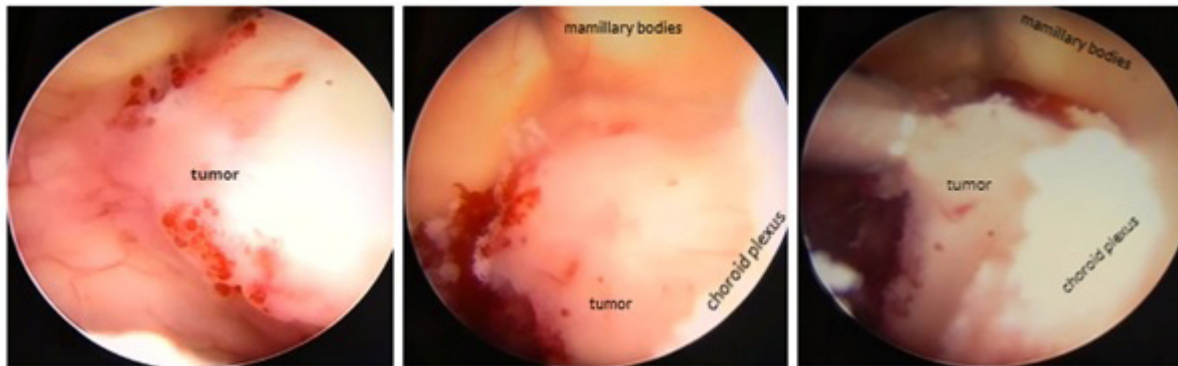
intraventricular tumor in the 3rd ventricle. Initially, it was thought to be a high-grade glioma and thus had to be operated on. Because of the patient's age, an endoscopic approach was suggested to manage this lesion as minimally as possible (Figure 1).

Patient underwent a right frontal burr hole at Kocher's point for an endoscopic subtotal removal of the tumor via right lateral ventricle -foramen of Monro – 3rd ventricle, and a third ventriculostomy - septostomy were performed for drainage of CSF. After a few minutes delay due to antiparkinsonian treatment, the patient was promptly extubated with an uneventful postoperative course (Figure 2).

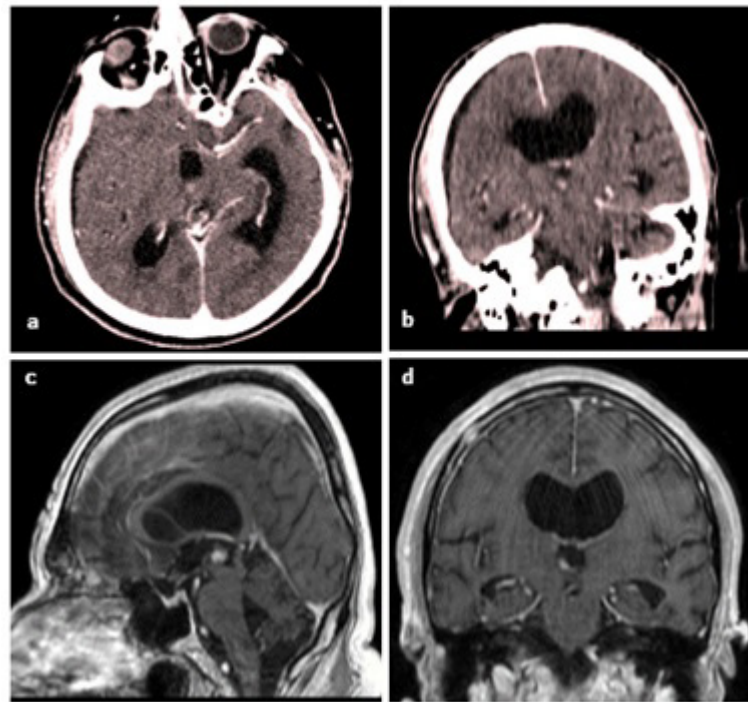
Post-operative brain CT scan revealed minor residual of the tumor. Patient was discharged 2 days after surgery in good clinical condition. Histopathological analysis of the tumor samples showed vascularized areas consisted of neuronal and oligodendroglia cells with immunophenotype of GFAP+, synaptophysin+, OLIG2+ that matching the diagnosis of Papillary Glioneuronal Tumor. Ki-proliferation index found at about 1%. Follow-up in 1 month after surgery demonstrated great improvement of gait and elimination of instability. Oncologic assessment and management was recommended to the patient (Figure 3).



**Figure 1:** Preoperative MRI T1 weighted contrast enhancement illustrating lesion into the third ventricle (axial, sagittal, coronal).



**Figure 2:** Endoscopic intraoperative images demonstrating the tumor and the anatomical correlations to the surrounding structures.



**Figure 3:** Postoperative brain CT scan with IV contrast day 1 postoperatively (a, b) and MRI T1 weighted contrast enhancement at 1 month follow-up (c, d).

#### 4. Discussion

The rare Papillary Glioneuronal Tumor (PGNT) was firstly reported in the article of Komori et al. in 1998, presenting 9 cases of an extraventricular tumor with indolent behavior composed primarily of glioneuronal elements with prominent pseudopapillary structure [3]. Its recognition as a separate entity was published in the 2007 edition of the World Health Organization (WHO) classification of CNS tumors and is considered as grade I tumor in the category of neuronal and mixed neuronal-gliial tumors [4]. In earlier bibliography, it was described as pseudopapillary ganglioglioneurocytoma or pseudopapillary neurocytoma with glial differentiation [5]. In the new WHO classification in 2021, gliomas, glioneuronal and neuronal tumors are divided in six groups, from which the category of glioneuronal and neuronal tumors (CNS5) include fourteen separate tumor subgroups with papillary glioneuronal tumor being one of them [1].

Approximately just under 140 papillary glioneuronal tumor cases were revealed by reviewing the literature until 2017, and less than 20 patients with PGNTs have been recorded from 2017 to 2021 [6-11]. It mostly affects young adults in age around 25 years old, however, it has been reported in all age groups (range 2-75 years old) [7, 8, 12]. In a systematic review of Ahmed et al. in 2017, it is reported that 80% of PGNT cases concern patients less than 40 years old [8]. While in most papers it is supported that there is no gender predilection, some authors suggest that PGNT is more frequent in males [5, 7, 8].

The features that make special PGNT are the two distinct histological patterns. This means that the macroscopic mixture of solid

and cystic components, microscopically, is formed by both glial (astrocytic) and neuronal elements [13]. The glial component consists of small uniform glial cells pseudopapillae lined with hyalinized vascular cores without atypia or mitosis [11, 13]. Additionally, the neuronal component is characterized by an interpapillary zone occupied by neurocytes with uniform nuclei and occasional perinuclear halos and mixed with ganglion and ganglioid cells [13, 14]. Vascular proliferation and necrosis are exceptional in PGNT and gliosis overwhelm the surrounding brain tissue [13]. Immunohistochemical exams of PGNT samples reveal again its biphasic character. Glial appearance has an immunophenotype of GFAP+, S100+ and nestin+, while neuronal components are explained by synaptophysin+, neuron-specific enolase+, and class III beta-tubulin+ [5]. Molecular analysis has demonstrated the association of PGNT with the presence of a fusion gene SCL44A1/PRKCA, which seems to be a common characteristic of most PGNTs with a high diagnostic value and detectable by FISH [2, 11, 15]. In the new WHO classification in 2021, PRKCA is regarded as a key-diagnostic gene for papillary glioneuronal tumors [1]. This type of cancer in general has a low proliferation index (Ki67  $\approx$  1-2%) [7, 13]. Only in a pooled analysis of Ahmed et al. in 2017, it was mentioned that average Ki67 of PGNT accounts of 3.6% [8]. However, in extremely rare cases, there have been reported cases with high mitotic index and aggressive behavior [5, 13].

Clinical manifestation of this glioneuronal tumor variates from an indolent behavior to mild neurological deficits. Symptoms may include fever, headaches, seizures, vertigo, vomiting, language disturbances, vision behavioral changes and neck pain [8].

Concerning its radiological appearance, literature review suggests a tumor usually presented as a demarcated and heterogeneously contrast-enhanced mass with some calcification. Occasionally, PGNT consists of cystic formation and hemorrhage with incidents of 86% and 10% respectively [2, 16]. Only slight edema may be present. MRI is the gold-standard for its illustration and PGNT is described isointense to hypointense on T1, heterogeneously hyperintense on T2, and Flair. While the cystic components may be suppressed, the solid nodules are heterogeneous enhanced. Regarding its topography, radiographic appearance of PGNT does not have any distinct characteristics and resembles to the one of ganglioglioma [16]. It may be surmised that this glioneuronal tumor may arise from anywhere in the central nervous system and mostly supratentorial locations close to the ventricles [2, 8]. The most preferred sites for PGNT are temporal, frontal, parietal lobes and less often it is developed in more than one lobes or into ventricles [2, 8, 12, 17]. The periventricular association of PGNT in the majority of cases suggests its possible origin from the germinative zone in the subependymal plate and explains its presentation with symptoms of obstructive hydrocephalus [3, 8, 17].

Because of its non-specific radiological and clinical presentation diagnosis of PGNT is difficult. Differential diagnosis may include other masses presenting radiologically with a cystic component and variably enhancing nodules [5, 18]. For instance, ganglioglioma- gangliocytoma, pleomorphic xanthoastrocytoma, pilocytic astrocytoma, astroblastoma, clear cell ependymoma, oligodendroglioma, diffuse astrocytoma, Rosette-forming glioneuronal tumors [13].

Papillary glioneuronal tumors are usually indolent and their complete surgical resection is the treatment of choice in almost all cases giving the most favorable clinical outcome [13]. In his article, Ahmed et al. described that PGNTs with Ki-67 $\leq$ 5% being resected in gross total mode, do not demand further management [2, 8]. After radical excision, prognosis with free survival and overall survival is very good, with follow-up free of disease for up to 7 years after total resection as reported by Bouvier-Labit et al. in their article in 2000 [6, 14]. Lavrador et al. propose the use of 5-ALA fluorescent in the lesion to achieve complete removal of PGNT [19].

Even PGNTs are classified as grade I, PGNT has the potential to exhibit an aggressive clinical course or recurrence [16]. Age and Ki-67 index may predispose patients to a worse outcome. Either the glial or neuronal component may be blamed for the malignant or anaplastic nature of glioneuronal tumor [20]. In the aggressive or anaplastic phenotype of PGNT, adjuvant radiotherapy and chemotherapy may be needed [8, 16]. Additionally, only scarce data have revealed, an extremely rare appearance of primary metastatic dissemination of such tumors.

Reviewing scientific data concerning papillary glioneuronal tumor cases similar to ours, literature demonstrated only 4 cases of

PGNTs in the third ventricle. In general, the intraventricular pattern of this tumor is more frequent in lateral ventricles and aqueduct than in the 3rd ventricle [20]. The cases found concern one adult - a female patients 28 years old with a PGNT located in the third ventricle, and 3 children - a 4-year-old boy with this tumor in the pineal region, 3rd, and lateral ventricle, a 7-year-old girl with a mass of PGNT in the 3rd ventricle and a similar case of a 8-year-old boy [15, 20-23]. Regarding the adult patient and the 8-year-old boy, no available data was found in the literature. However, as far as the other two children are concerned, the 4-year-old boy was treated endoscopically while the girl underwent a transcortical transventricular approach [22, 23]. In the vast majority of papers describing the technique used for total or subtotal resection of PGNTs, craniotomy was performed. Except from the endoscopic treatment of the 4-year-old boy with the PGNT lesion in pineal region, third and lateral ventricle, only in the article of Saratziotis et al. endoscopic endonasal surgery is mentioned for removal of a PGNT lesion located in the suprasellar area of the optic chiasm and aqueduct in a 14-year-old girl [9]. In no papers is referred removal of papillary glioneuronal tumor in adult patients via the endoscopic technique similar to the management of our case. Finally, our patient aged 75 years old belongs to the very rare category of papillary glioneuronal tumor occurring in the elderly.

## 5. Conclusion

PGNT is a rare newly diagnosed brain tumor group and therefore literature surrounding it is still based on case reports in order to complete its profile. Our paper adds an extra case of this entity and more particularly in the category of papillary glioneuronal tumors located into the third ventricle. It is the first time that endoscopic treatment is mentioned for a third ventricle papillary glioneuronal tumor in an adult patient.

## References

1. Louis DN, Perry A, Wesseling P, Brat DJ, Cree IA, Figarella-Branger D, et al. The 2021 WHO Classification of Tumors of the Central Nervous System: a summary. *Neuro Oncol.* 2021; 23: 1231-51.
2. Tamase A, Tachibana O, Nakada S, Yamada S, Iizuka H. A Case of Suprasellar Papillary Glioneuronal Tumor Mimicking Craniopharyngioma. *NMC Case Rep J.* 2020; 7: 85-8.
3. Papillary Glioneuronal Tumor: A New Variant of Mixed Neuronal-Glial Neoplasm. *Ovid n.d.* 2021.
4. Louis DN, Ohgaki H, Wiestler OD, Cavenee WK, Burger PC, Jouvet A, et al. The 2007 WHO classification of tumours of the central nervous system. *Acta Neuropathol.* 2007; 114: 97-109.
5. Radotra BD, Kumar Y, Bhatia A, Mohindra S. Papillary glioneuronal tumor: A new entity awaiting inclusion in WHO classification. *Diagn Pathol.* 2007; 2.
6. Yadav N, Rao S, Saini J, Prasad C, Mahadevan A, Sadashiva N. Papillary glioneuronal tumors: A radiopathologic correlation. *Eur J Radiol.* 2017; 97: 44-52.



7. Hoshino HSR, Santos BGS Dos, Nogueira AB, Guimarães ACA. Papillary glioneuronal tumor: a case report of the cerebral aqueduct and review of literature. *Br J Neurosurg.* 2021; 1-5.
8. Ahmed A-K, Dawood HY, Gerard J, Smith TR. Surgical Resection and Cellular Proliferation Index Predict Prognosis for Patients with Papillary Glioneuronal Tumor: Systematic Review and Pooled Analysis. *World Neurosurg.* 2017; 107: 534-41.
9. Saratziotis A, Zanotti C, Munari S, Pavone C, Cazzador D, Denaro L, et al. Operative Procedure in a Suprasellar Paediatric Lesion of the Optic Chiasm with Hydrocephalus Caused by a Papillary Glioneuronal Tumour. *Pediatr Neurosurg.* 2021; 56: 569-77.
10. Ahn JS, Ervin J, Cummings TJ, López GY, Wang S-HJ. Papillary Glioneuronal Tumor With a Novel GPR37L1-PRKCA Fusion. *J Neuropathol Exp Neurol.* 2021; 80: 1004-6.
11. Puzyrenko A, Cochran E, Giorgadze T, Nomani L. Papillary glioneuronal tumors: Distinctive cytological characteristics and cyto-histologic correlation. *Ann Diagn Pathol.* 2021; 53: 151757.
12. Pimentel J, Barroso C, Miguens J, Firmo C, Antunes JL. Papillary glioneuronal tumor - Prognostic value of the extension of surgical resection. *Clin Neuropathol.* 2009; 28: 287-94.
13. Pathology Outlines - Papillary glioneuronal tumor n.d.
14. Bouvier-Labit C, Daniel L, Dufour H, Grisoli F, Figarella-Branger D. Papillary glioneuronal tumour: Clinicopathological and biochemical study of one case with 7-year follow up. *Acta Neuropathol.* 2000; 99: 321-6.
15. Pages M, Lacroix L, Tauziède-Espariat A, Castel D, Daudi-geos-Dubus E, Ridola V, et al. Papillary glioneuronal tumors: histological and molecular characteristics and diagnostic value of SLC44A1-PRKCA fusion. *Acta Neuropathol Commun.* 2015; 3: 85.
16. Goethe EA, Youssef M, Patel AJ, Jalali A, Goodman JC, Mandel JJ. Recurrent Papillary Glioneuronal Tumor. *World Neurosurg.* 2019; 128: 127-30.
17. Borges G, Bonilha L, Menezes AS, Queiroz LDS, Carelli EF, Zanardi V, et al. Long term follow-up in a patient with papillary glioneuronal tumor. *Arq Neuropsiquiatr.* 2004; 62: 869-72.
18. Demetriades AK, Al Hyassat S, Al-Sarraj S, Bhangoo RS, Ashkan K. Papillary glioneuronal tumour: a review of the literature with two illustrative cases. *Br J Neurosurg.* 2013; 27: 401-4.
19. Lavrador JP, Kandeel HS, Kalb A, Reisz Z, Al-Sarraj S, Gullan R, et al. 5-ALA fluorescence in a WHO grade I papillary glioneuronal tumour: a case report. *Acta Neurochir (Wien).* 2020; 162: 813-7.
20. Carangelo B, Arrigucci U, Mariottini A, Lavallo L, Muscas G, Branco D, et al. Papillary glioneuronal tumor: Case report and review of literature. *G Di Chir.* 2015; 36: 63-9.
21. Tanaka Y, Yokoo H, Komori T, Makita Y, Ishizawa T, Hirose T, et al. A distinct pattern of Olig2-positive cellular distribution in papillary glioneuronal tumors: a manifestation of the oligodendroglial phenotype? *Acta Neuropathol.* 2005; 110: 39-47.
22. Husain N, Husain M. Endoscopic diagnosis of a pineal papillary glioneuronal tumor with extensive ventricular involvement: case report with review of literature. *Neurol India.* 2009; 57: 792-5.
23. Phi JH, Park S-H, Chae JH, Wang K-C, Cho B-K, Kim S-K. Papillary glioneuronal tumor present in a patient with encephalocraniocutaneous lipomatosis: case report. *Neurosurgery.* 2010; 67: E1165-9.