Original Article

Solid - Cystic CNS Neoplasm: Histopathological and Radiological Correlation Study

Mansi Madhubhai Nakrani[1], Sanjay V Dhotre[1,*], Hitendra Barot[1], Amit Satasiya[1], Bhumiben Rameshchandra Bhuva[1], Bharat Pateliya[1]

[1]Department of Pathology, B.J. Medical College and Civil Hospital, Ahmedabad, Gujarat, India

***Correspondence:** sanjayvdhotre@gmail.com

DOI
10.21276/apalm.3616

Article History
Received: 10-06-2025
Revised: 03-08-2025
Accepted: 13-01-2026
Published: 02-03-2026

How to cite this article
Nakrani M, Dhotre S, Barot H, Satasiya A, Bhuva B, Pateliya B. Solid - Cystic CNS Neoplasm: Histopathological and Radiological Correlation Study. Ann Pathol Lab Med. 2026;13(3):A146-A152.

Abstract

Background: Solid-cystic neoplasms of the central nervous system (CNS) present a diagnostic challenge due to overlapping imaging features and broad differential diagnoses. These lesions, which may be primary or metastatic, can affect patients across all age groups and often necessitate histopathological correlation for accurate diagnosis.
Materials and Methods: A retrospective observational study was conducted on 15 patients diagnosed with solid-cystic CNS lesions at B.J. Medical College, Ahmedabad, from January to May 2025. MRI findings were correlated with histopathological diagnoses based on the WHO 2021 CNS tumor classification. Data regarding demographics, imaging features, tumor location, and histological subtype were analyzed.
Results: Patients ranged from 5 to 74 years, with a male predominance (80%). Lesions involved various brain regions, predominantly the fourth ventricle, sellar region, and temporal lobe. MRI showed mixed solid-cystic components, perilesional edema, septations, and occasional calcifications or hemorrhage. Histopathology revealed diverse diagnoses: *craniopharyngioma* (20%), *ependymoma*, *pleomorphic xanthoastrocytoma*, *oligodendroglioma*, *astrocytoma*, *pilocytic astrocytoma*, *rosette-forming glioneuronal tumors*, and *pituitary neuroendocrine tumors*. Concordance between imaging and histopathology was observed in 12 of 15 cases.
Conclusion: Solid-cystic CNS tumors share overlapping imaging characteristics, often making MRI-based diagnosis inconclusive. Histopathological analysis remains the gold standard for accurate tumor classification and grading. This study underscores the critical role of combined radiologic and histopathologic evaluation in guiding diagnosis and management.

Keywords: solid cystic neoplasm; *craniopharyngioma*; *pleomorphic xanthoastrocytoma*; *oligodendroglioma*; *astrocytoma*; *pilocytic astrocytoma*

Introduction

Intracranial neoplasms exhibit a wide spectrum of radiological and pathological characteristics, with some presenting as solid masses, others as cystic lesions, and a subset demonstrating a mixed solid-cystic morphology. Among them, solid and cystic neoplasms pose a particular diagnostic and therapeutic challenge due to their overlapping imaging characteristics and broad differential diagnoses. These lesions can occur across all age groups and may be either primary or metastatic in origin. Solid-cystic morphology is a common radiologic pattern observed in several intracranial tumors, including low-grade gliomas, *pilocytic astrocytoma*, *gangliogliomas*, *ependymomas*, *pleomorphic xanthoastrocytoma*, and high-grade gliomas such as *glioblastoma multiforme* (GBM)[1, 2, 3]. Additionally, metastatic brain tumors—particularly from primaries such

as lung, breast, and renal carcinomas—frequently present as cystic lesions with enhancing mural nodules [4]. While T1- and T2-weighted sequences help define lesion morphology, contrast enhancement patterns, diffusion characteristics, and perfusion parameters offer additional diagnostic clues [5]. However, many lesions share similar imaging features, making histopathologic confirmation necessary in most cases. Notably, certain tumors have characteristic imaging signatures. For instance, *pilocytic astrocytoma* is often present as a well-demarcated cyst with a mural nodule, most frequently in the cerebellum of pediatric patients [6]. In contrast, adult-onset GBMs may demonstrate ring-enhancing solid-cystic components due to central necrosis, often accompanied by significant peritumoral edema [7].

This study aims to review the spectrum of such neoplasms, with a focus on radiologic features, differential diagnoses, and histopathological correlations, in order to aid clinicians and radiologists in formulating appropriate diagnostic and management strategies.

Aims and Objectives

To explore and characterize the radiological and histopathological features of solid and cystic neoplasms of the brain. To analyze differential diagnoses associated with cystic and solid brain tumors. To correlate radiological features with histopathology.

Material and Method

This retrospective observational study was conducted at department of pathology, B.J. Medical college, Ahmedabad, Gujarat, a tertiary care hospital. Only 15 cases of solid cystic neoplasms received from period of January 2025 to May 2025 in histopathology department, all of which are included in our study.

Clinical, demographic data (age and sex) and radiological data were collected from patient medical records.

The WHO 2021 classification is used for the categorization of CNS neoplasm. Utilizing morphological findings and classifying the cases histopathologically. All biopsies were taken from both solid as well as cystic representative areas and fixed in 10% neutral buffered formalin, processed by the routine paraffin method and stained with hematoxyline and eosin. Biopsy specimens were analyzed with regard to the following points: tumor location, type, morphology, grade.

Data analysis: Quantitative data entered in Microsoft Excel worksheet from LIS of our institute and was analyzed using descriptive statistics.

Inclusion criteria: Radiologically confirmed presence of an intracranial lesion with both solid and cystic components on MRI. Histopathological confirmation of the diagnosis following biopsy or surgical resection. Complete imaging and clinical data available for review.

Exclusion criteria: Incomplete imaging records. Lesions of non-neoplastic etiology (e.g., abscesses, benign cystic lesion/congenital anomalies, vascular malformations).

Result

A total of 15 patients with radiologically diagnosed solid-cystic brain lesions were included in this retrospective study. The mean age was approximately 30 years with youngest patient 5 years and oldest 74 years, with a clear male predominance (12 males, 3 females) (Table 1).

Table 1: Gender wise distribution.

Gender	No. of cases	Percentage
Male	12	80%
Female	03	20%
Total	15	100%

Radiological Findings: All lesions exhibited both solid and cystic components, with variable features such as: Perilesional edema, Septations and multiloculation, Occasional calcification or hemorrhagic areas, Lesions were found in both supratentorial and infratentorial compartments.

The fourth ventricle emerged as the most frequently involved site, followed by lesions in the temporal, frontal, and parieto-occipital lobes.

In our study, 12 out of 15 cases correlated and were concordant with radiological findings. Among 7 reported cases of glioma on radiological imaging, 7 correlated with histopathological findings. All 3 cases of *craniopharyngiomas* and 1 case

of *pituitary neuroendocrine tumor* where concordant with radiological findings. While out of 3 cases of *ependymoma*, 2 cases correlated with radiological findings. Overall radiological findings correlated with histopathological findings in 80 % of cases (Table 2).

Table 2: Correlation between radiological and histopathological findings.

Sr. No	Radiological findings	Histopathological findings
1	Intraaxial solid cystic lesion with hemorrhagic area - Glioblastoma	Mitosis, Necrosis and Microvascular endothelial proliferation - *Astrocytoma* Grade 4
2	Expansile solid cystic lesion with perilesional edema - Glioma	Necrosis and Microvascular endothelial proliferation - *Astrocytoma* Grade 3
3	Cystic solid space occupying lesion - Glioma likely	*Pleomorphic Xanthoastrocytoma* Grade 2
4	Intraaxial solid cystic - Neoplastic etiology	Perivascular pseudorossets - *Ependymoma* Grade 2
5	Solid cystic multiloculated and multiseptated lesion - *Pilocytic astrocytoma*	Eosinophilic body and rosenthal fibers - *Pilocytic astrocytoma*
6	Well defined intraaxial solid cystic lesion - *Pleomorphic Xanthoastrocytoma*	*Pleomorphic Xanthoastrocytoma* Grade 2
7	Solid cystic lesion with perilesional edema - High grade glioma	*Oligodendroglioma* Grade 3
8	Extraaxial solid cystic lesion - *Craniopharyngioma*	*Craniopharyngioma* Grade 1
9	Multicystic lesion with solid areas with edema - *Ependymoma*	*Ependymoma* Grade 3
10	Predominantly cystic with few solid area - *Ependymoma*	*Rosette forming glioneuronal tumor* Grade 1
11	Predominantly cystic space occupying lesion with septation - Recurrent *Ependymoma*	*Ependymoma* Grade 2
12	Extraaxial solid lesion with few cystic area - Pituitary adenoma	*Pituitary neuroendocrine tumor* Grade 1
13	Intraaxial cystic lesion with solid nodular area - *Pilocytic astrocytoma*	*Oligodendroglioma* Grade 3
14	Lobulated Solid with cystic lesion - *Craniopharyngioma*	*Craniopharyngioma* Grade 1
15	Predominantly cystic lesion with few solid area - *Craniopharyngioma*	*Craniopharyngioma* Grade 1

Histopathological Diagnosis

The histopathological spectrum was diverse. Each of these tumors presented with cystic components and variable solid portions on imaging, underscoring the overlap in radiologic features among tumor types (Table 3).

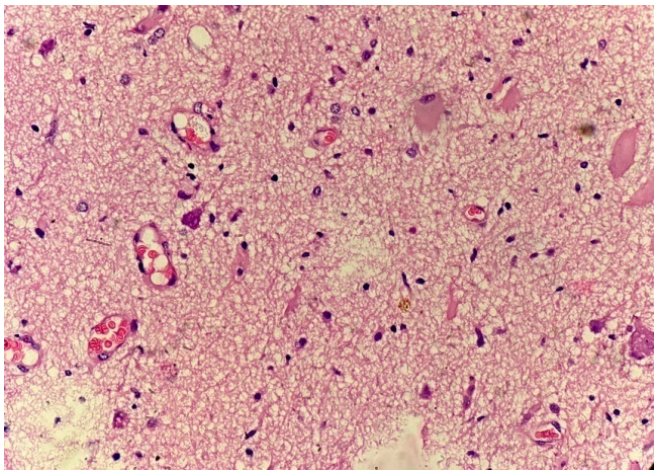

Figure 1: H & E section shows *pleomorphic xanthoastrocytoma* showing pleomorphic cells, giant cells and cells with abundant eosinophilic cytoplasm in fibrillary background (40x).

In our study according to CNS WHO classification out of 15 neoplasm 5 were Grade 1 and 5 were Grade 2 while of Grade 3 were 4 cases and Grade 4 was only one case (Table 4).

In our study according to location, 5 out of 15 cases located in ventricle, while 4 in sellar and suprasellar region, & 2 were in temporal lobe (Table 5).

Discussion

Solid-cystic brain neoplasm represents a diagnostic challenge due to their nonspecific imaging characteristics and wide histopathological range. Despite advanced imaging, the radiological features alone were often insufficient for precise

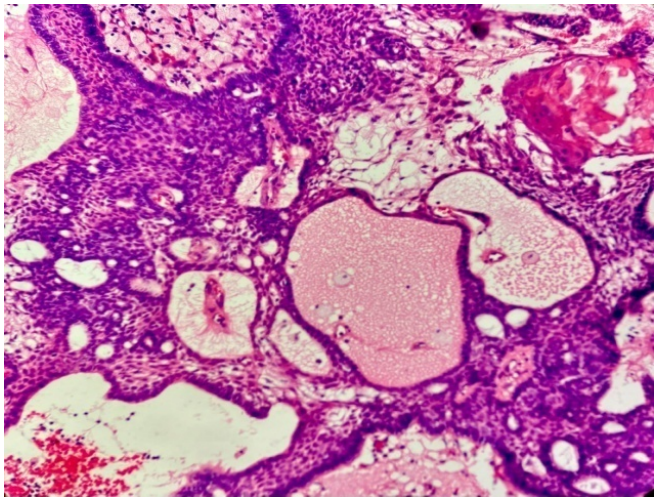

Figure 2: H & E section shows *craniopharyngioma* showing pallisading epithelium and wet keratin (40x).

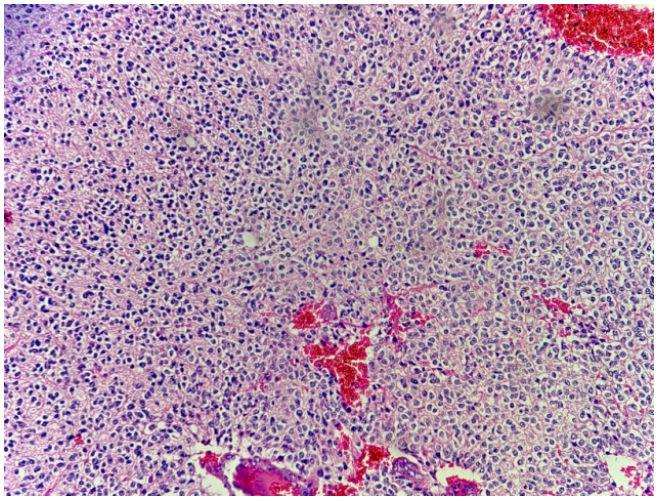

Figure 3: H & E section shows *oligodendroglioma* showing fried egg appearance and chicken wire capillaries (20x).

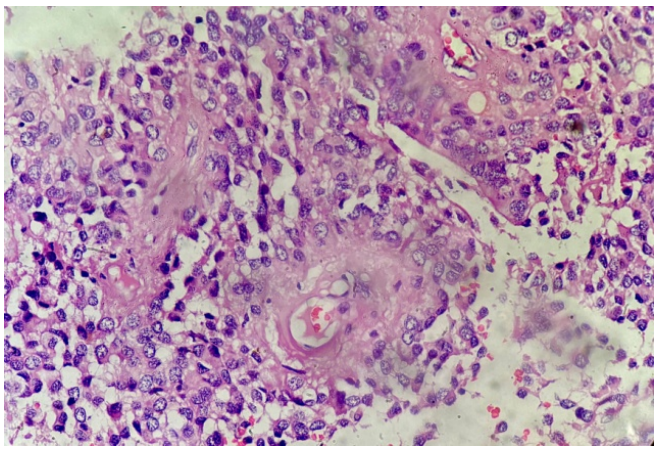

Figure 4: H & E section shows *ependymoma* showing perivascular pseudorosettes (40x).

diagnosis. For example:

Pleomorphic Xanthoastrocytoma presented with solid-cystic architecture and perilesional edema, mimicking high-grade gliomas. Metastases could not be reliably distinguished from high-grade primaries based on imaging alone.

Thus, reliance solely on MRI features can lead to diagnostic pitfalls without histopathological confirmation.

The study included only 15 patients, which limits the generalizability of findings and reduces the statistical power for identifying trends or correlations across subgroups. Data was collected over a brief period (January to May 2025), which may

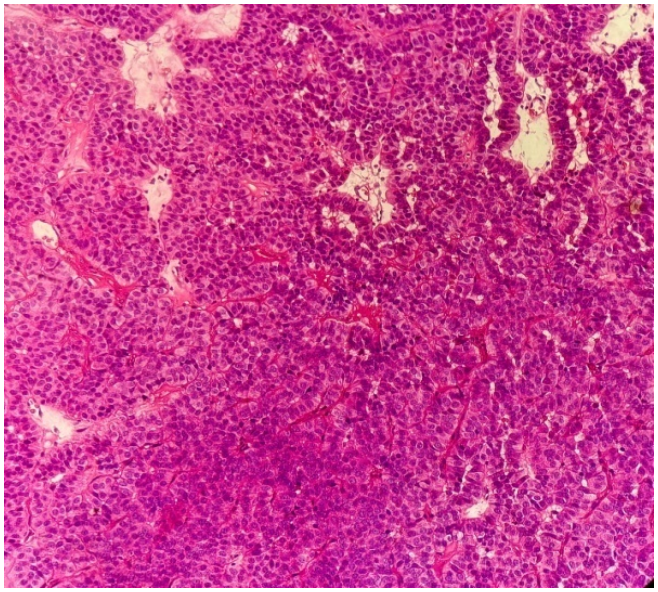

Figure 5: H & E section shows *pituitary neuroendocrine tumor* (20x).

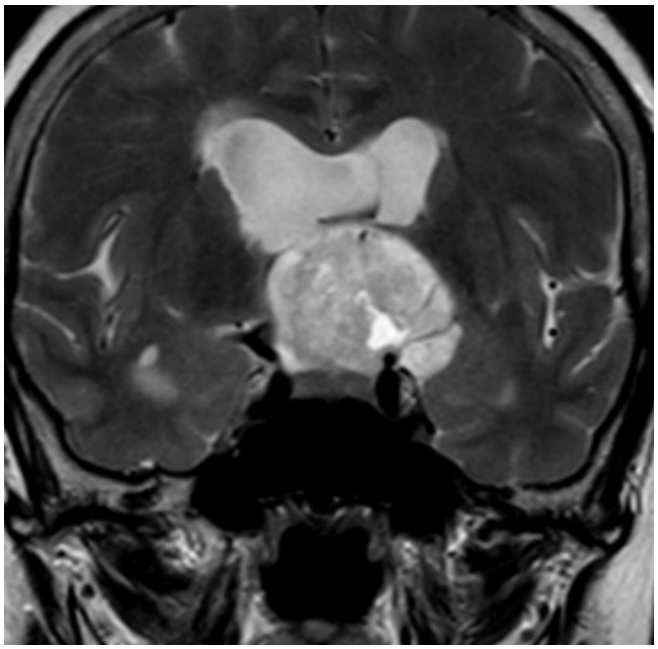

Figure 6: Coronal T2WI images showing solid cystic suprasellar mass lesion - *craniopharyngioma*.

Table 3: Histopathological spectrum of cases.

CNS neoplasm with WHO Grade	No. of case	Percentage (%)
Craniopharyngioma CNS WHO Grade 1	3	20
Ependymoma CNS WHO Grade 2	2	13.33
Pleomorphic Xanthoastrocytoma CNS WHO Grade 2	2	13.33
Oligodendroglioma CNS WHO Grade 3	2	13.33
Astrocytoma CNS WHO Grade 3	1	6.67
Astrocytoma CNS WHO Grade 2	1	6.67
Ependymoma CNS WHO Grade 3	1	6.67
Pilocytic Astrocytoma CNS WHO Grade 1	1	6.67
Rosette forming Glioneuronal CNS WHO Grade 1	1	6.67
Pituitary neuroendocrine tumor CNS WHO Grade 2	1	6.67
Total no. of cases	15	100

not reflect long-term variations in disease incidence or diagnosis patterns. Radiological interpretations and histopathological correlations were not blinded, introducing the possibility of confirmation bias.

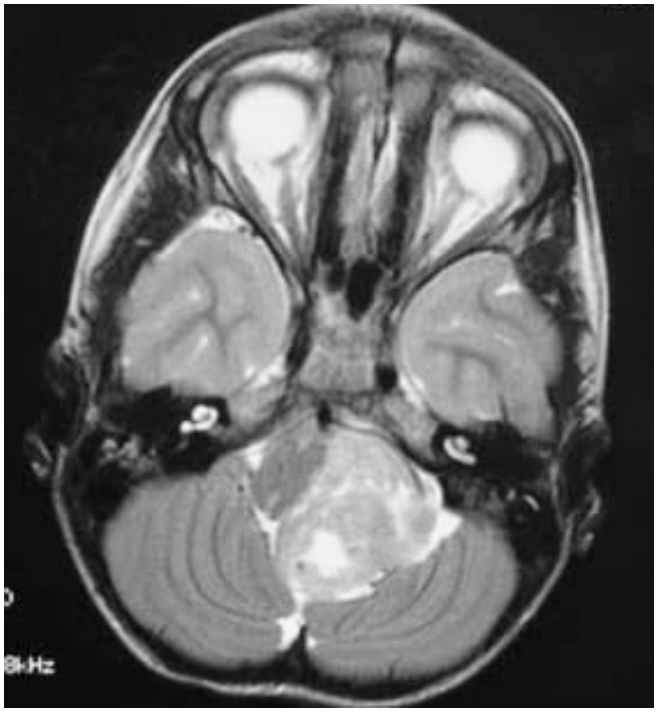

Figure 7: T2WI axial image shows solid cystic lesion in left foramen of luschka extending into 4th ventricle possibly *ependymoma*.

Table 4: WHO grade wise distribution of cases.

CNS WHO Grade	No. of cases
Grade 1	05
Grade 2	05
Grade 3	04
Grade 4	01
Total No. of cases	15

Table 5: Location wise distribution of neoplasm.

Location of neoplasm	No. of case
Ventricle	5
Sellar and suprasellar region	4
Temporal lobe	2
Frontal lobe	1
Corpus callosum	1
Occipital lobe	1
Cerebellum	1
Total No. of cases	15

Conclusion

This study of 15 patients with solid-cystic brain lesions highlights the diverse histopathological spectrum underlying a common radiological appearance. *Craniopharyngiomas*, *ependymomas*, and gliomas were the most frequently encountered tumors. Given the radiological ambiguity in many cases, histopathology remains essential for definitive diagnosis. Overall radiological findings correlated with histopathological findings in 80 % of cases.

Acknowledgements: I would like to extend my gratitude to Dr Ina Shah (Professor and Head of department Pathology, BJMC), who gave me this opportunity.

Funding: None

Competing Interests: No conflict of interest.

Statement of ethical approval of study: Ethical approval was taken from college ethical committee.

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