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CT Evaluation of Pediatric Supratentorial Tumors

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I. Introduction

Brain tumors are the most common solid tumor of childhood and the second most common malignancy after the leukemias. Primary central nervous system tumors (CNS) are the most common solid neoplasms in children. The incidence of CNS tumors is 2-5 new cases per 100000 per year, which is stable throughout the World. About 7% of the reported brain and CNS tumors occur in children aged 0-19 years[1, 2]

Although infratentorial tumors predominate in children, supratentorial tumors are more common in the first 2 to 3 years of life[2]. The clinical manifestations in childhood with brain tumors are largely those of increased intracranial pressure. Headache is a common early symptom. Most other symptoms are non-specific and include vomiting, cranial neuropathies and stupor and coma in late stages.[3]

The largest percentage of childhood tumors (17%) are located within the frontal, temporal, parietal and occipital lobes of the brain. For children aged 0-14 years, pilocytic astrocytomas, embryonal tumors, and malignant glioma are the common tumors. The most common histologies in adolescent ages 15 – 19 years include tumors of the pituitary and pilocytic astrocytoma.[1]

Supratentorial intraaxial tumors are not very common in children but they are histologically more varied than in adults. Although there have been several neuroradiological investigations, accurate diagnosis by imaging modalities alone remains difficult in all cases, and final diagnosis in most cases requires histological examination. However, neuroradiological information is valuable in predicting tissue character and histological type or grade, and in helping establish treatment strategies. [4, 5]

The imaging modalities used are mainly CT and MR imaging with newer modalities like MR and CT perfusion, PET and SPECT.

CT has become the primary imaging investigation in cases of suspected brain tumors, surpassing many other invasive imaging modalities. It has considerably high sensitivity, it is non-invasive having no hazards except ionizing radiations. CT can predict the pathological nature of a lesion with reasonable degree of accuracy. CT scan is more accurate indicator of brain tumor, yet it is not always 100% accurate.[6]

MRI has its advantage of being a radiation free and multi-planar imaging facility. Hence a lesion can be seen in three planes and accurate localization of the lesion can be done. This modality provides better soft tissue characterization and can clearly demonstrate peritumoral edema, but has disadvantages like high cost , requires a long time for acquisition of the data and hence cannot be used for restless patient particularly neonates, infants or even uncooperative children. It cannot be done in patients having metallic implants for which CT is the modality of choice.[3]

Newer multi-slice helical CT scanners are capable of providing highly collimated sub millimeter thickness sectional images in extremely short acquisition times and thus areas of hyperostosis or bone destruction, intratumoral calcification and early intratumoral or peritumoral hemorrhage are more completely defined with greater certainty on CT than on MRI[3]

Objectives of the Study

1. To study the distribution of various supratentorial neoplasms in pediatric age group.
2. To study the CT features of supratentorial neoplasms in pediatric age group.
3. To localise and assess the extent of supratentorial neoplasms in pediatric age group.

II. Materials and Methods

This study of "CT EVALUATION OF SUPRATENTORIAL TUMORS IN PEDIATRIC AGE GROUP" was conducted on 36 patients at Assam Medical College & Hospital, Dibrugarh, with a suspicion of intracranial SOL by neurologists, pediatricians and physicians from in and around Dibrugarh over a period of three year from July 2011 to June 2014.

Methodology: This was a study done to evaluate the efficacy of computed tomography in the diagnosis of supratentorial tumors in pediatric age group.
Place of study: Department of Radiology, AMCH, Dibrugarh.

Duration of study: 3 years

Study group and Inclusion criteria:

The study comprised of patients less than (< or = to 18 years) 18 years presenting to the department of radiodiagnosis after suspected to have brain tumors by pediatricians, neurologists and physicians, were taken up for radiological evaluation by CT scan.

Criteria for exclusion:

All cases with supratentorial pathology and symptomatology due to infections, congenital malformations, trauma or cerebrovascular accidents etiology were excluded.

Study protocol:

The scheme started with patient's serial number, name, age, sex, address, hospital / MRD number, date of admission and examination. A thorough case history preceeded the clinical examination viz symptoms, duration of symptoms, type of onset with past and family history. The history was obtained from patients, eye witnesses as well as close family members.

Infants and children who were not co-operative were sedated by giving oral /IV sedatives.

Consent of the patient and attendant was taken for the contrast examination. The procedure and objective of performing examination was explained to the patients.

CT PROTOCOL :

All CT scans were performed using SIEMENS SOMATOM SPIRIT DUAL SLICE Computed Tomography system.

Scanning technique:

The examination by CT scan was tailored to the clinical problem at hand. Initially after positioning of the patient, a topogram was taken.

Routine axial scans will be performed in all cases, taking orbito-meatal plane as the baseline both prior to and after administration of non-ionic contrast, which were done with the consent of the patient. Scanning parameters used were 5 mm slice thickness with 5 mm table increment routinely. Thin contiguous slices of 2 mm or 3 mm were done whenever necessary. kVp and mAs were tuned to match age specific pediatric brain protocol.

Multiple coronal and sagittal reformatted images were frequently used to further analyse the lesions detected on axial scans.

The pre and post contrast attenuation values, size and location of lesions were reviewed to characterise the tumors.

All cases were followed up either with other imaging modalities like MRI/ PET and clinically correlated to confirm the diagnosis given on CT scan, either by the characteristic imaging features or post operative histopathological reports, wherever possible. Details of the treatment and the procedure done on patients studied on outpatient/ referral basis were obtained from the referring consultants and recorded.

III. Results and Observations

Intraaxial – 25

Extraaxial- 11

The ratio of intra-axial to extra-axial tumors was 2.27.

Supratentorial Tumors (Intraxial tumors)

Table-5.1. Astrocytomas (Number of Cases 12)

	TUMOR	NUMBER OF CASES	% OUT OF INTRA AXIAL	% OUT OF SUPRATENTORIAL	(% OUT OF ASTRO)
LGA	Pilocytic astro	3	12.00	8.33	25.00
	Diffuse LGA	2	8.00	5.55	16.66
	SEGCA	1	4.00	2.77	8.33
	Optic N Glio	2	8.00	5.55	16.66
	Total	8	32.00	22.25	66.66
HGA	Anaplastic astro	2	8.00	5.55	16.66
	GBM	2	8.00	5.55	16.66
	Total	4	16.00	11.10	33.33

Low grade astrocytomas accounting for 22.20% (8 cases) of all pediatric supratentorial tumors were the single largest group in our study, whereas high grade gliomas accounted for 11.10%(4 cases). Out of all astrocytomas, pilocytic astroytoma was the commonest accounting for 25 %(3 cases). Among high grade astrocytomas, 50% were anaplastic type and the rest 50% were of GBM type.

Table -5.2
Neuronal and Mixed Neuronal Glial tumors (No. of Cases 4)

Tumor	NUMBER OF CASES	% OUT OF INTRA AXIAL	% OUT OF SUPRATENTORIAL
Ganglioglioma	1	4.00	2.77
DIG	2	8.00	5.55
Central neurocytoma	1	4.00	2.77
Total(NMNG)	4	16.00	11.11

In our study, 4 cases were neuronal and mixed neuronal glial tumors which included 2 cases of DIG, 1 case each of Ganglioglioma and central neurocytoma. As a group, NMNGs were the third most common intraaxial tumors in our study accounting for 11.11% of all Supratentorial tumors.

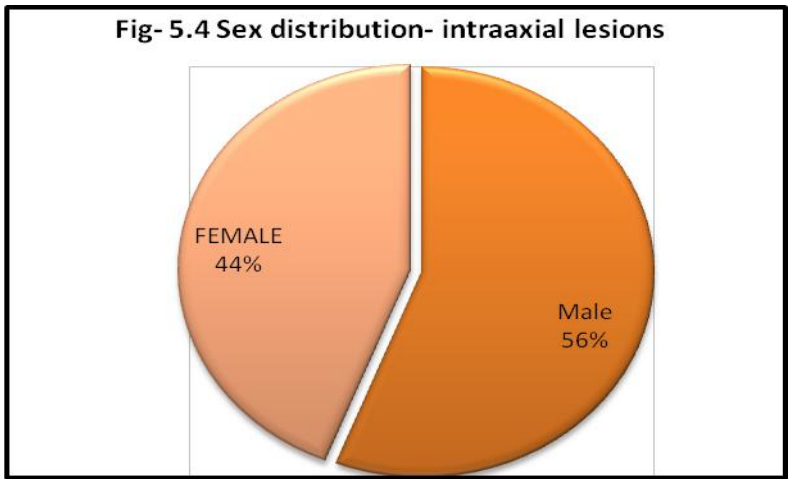
Table -5.3
OTHER INTRAAXIAL TUMORS. (9 cases)

Tumor	NUMBER OF CASES	% OUT OF INTRA AXIAL	% OUT OF SUPRATENTORIAL
PNET	5	20.00	13.80
Oligodendroglioma	2	8.00	5.55
Ependymoma	2	8.00	5.55

Among other Supratentorial lesions, PNET was the commonest accounting for 13.8% (5 cases). Among intraaxial lesions, PNET was the second most common after low grade astrocytomas accounting for 20% of intraaxial tumors, with ependymomas and oligodendrogliomas accounting for 8% each.

Table-5.4
SEX DISTRIBUTION IN INTRAAXIAL LESIONS (25 CASES)

SEX	NUMBER (n)	PERCENTAGE (%)
Male	14	56.00
Female	11	44.00
TOTAL	25	100.00



The male: female ratio amongst intraaxial lesions was 1.27:1.

Table-5.5
Age Distribution: Number of cases = 25

AGE(years)	LGA	HGA	NMNG	PNET	OLIGO	EPEND	TOTAL n(%)
<1	0	0	2	0	0	0	2(8)
1 to 5	0	0	0	2	0	0	2(8)
6 to 10	4	1	0	3	0	0	8(32)
11 to15	1	1	1	0	1	0	4(16)
16 to18	3	2	1	0	1	2	9(36)

16-18 years was the predominant age group amongst intraaxial tumors accounting for 36% of intraaxial tumors, but low grade astrocytomas and PNET were predominantly seen in the age group of 6-10 years.

Table-5.6
Symptoms: Number of cases-25

SYMPTOM	LGA	HGA	NMNG	PNET	OLIGO	EPEND	TOTAL n(%)
Headache	2	0	0	0	0	0	2(8)
Seizures	2	0	1	0	2	0	5(20)
Dim vision	2	0	0	0	0	0	2(8)
Raised ICT	1	3	3	3	0	2	12(48)
others	1	1	0	2	0	0	4(16)

Raised ICT was the most common symptom in our study seen in 12 cases (48%) amongst supratentorial intraaxial lesions, especially in high grade astrocytomas (75%), NMNGs (75%), PNET (60%) and Ependymoma (100%).

Table -5.7.
Location of intraaxial lesions

		LGA	HGA	NMNG	PNET	OLIGO	EPEND
Hemispheric	<1 lobe	3	1	1	2	2	0
	> 1 lobe	0	1	2	3	0	0
Basal ganglia		1	1	0	0	0	0
Periventricular		2	1	1	0	0	2
Optic chiasm		2	0	0	0	0	0

Supratentorial PNETs were large hemispheric lesions which were distributed in more than one lobe in 60 % (3 cases) and similar distribution was seen in 50% of NMNGs and 25% of high grade astrocytomas. Ependymomas showed periventricular distribution in our study.

Table – 5.8. Pre Contrast features of intraaxial lesions

Features (pre-contrast)	LGA	HGA	NMNG	PNET	OLIGO	EPEND
Hyperdense	1	1	2	5	0	0
Isodense	2	2	1	0	1	1
Hypodense	5	1	1	0	1	1
Calcifications	2	1	2	5	2	2
Multiplicity	0	0	0	0	1	0

On NECT, 62.5% (5 cases) were hypodense among low grade astrocytomas, whereas 100 %(5 cases) of PNET were hyperdense in attenuation in our study. In both oligodendrogliomas and Ependymoma, 50% of the cases were hypodense and the rest 50% were isodense on NECT.

100% of cases amongst PNET, oligodendrogliomas and ependymoma showed intralesional calcifications in our study. Calcification was seen in 25% of low grade astrocytomas and 25% of high grade astrocytomas.

Table 5.9- Secondary effects by intraaxial tumors (in %)

Secondary Effects	LGA	HGA	NMNG	PNET	OLIGO	EPEND
PLE	37.50	100	50	80	0	100
Mass effect	37.50	100	50	80	0	100
Hydrocephalus	12.50	50	75	60	0	50
Bone era/scal	25.00	0	50	40	0	0

Secondary effects like perilesional edema and mass effect were commonly seen in all high grade astrocytomas and larger lesions like DIG, PNET and ependymomas.

Oligodendroglioma was characteristically devoid of any secondary effects. Hydrocephalus was seen in 50% of high grade astrocytomas and ependymomas. Perilesional edema and mass effect were less commonly seen in low grade astrocytomas (37.5% cases). Bone scalloping was seen in both cases of DIG.

Table 5.10- Post contrast features of intraaxial tumors (in %)

Postcontrast features		LGA	HGA	NMNG	PNET	OLIGO	EPEND
Enhancement	Mild	62.5	25	25	0	100	0
	Mod	37.5	50	25	40	0	50
	intense	0	25	50	60	0	50
Pattern	Hom	87.5	0	25	0	50	0
	heter	12.50	100	75	100	50	100
Necrosis/cyst		50	100	100	100	100	50
Margin	sharp	75	0	100	100	100	100
	Ill def	25	100	0	0	0	0

Low grade astrocytomas predominantly showed homogenous post contrast enhancement in all but 1case and the intensity was mild (62.5%) to moderate (37.5%), whereas high grade astrocytomas showed heterogenous enhancement with necrotic areas in 100% of cases and the amount of enhancement was variable.

PNETs showed heterogenous post contrast enhancement in 100% and NMNGs in 75% of cases. In our study of 2 cases of oligodendrogliomas, heterogenous enhancement was seen in 50% and the enhancement was mild in both the cases. Both the cases of ependymoma showed heterogenous enhancement and the enhancement was moderate to intense.

Extraaxial tumors- 11 cases.

Table – 5.11.Distribution of extraaxial tumors.

	TUMOR	NUMBER OF CASES	% OUT OF EXTRA AXIAL	% OUT OF SUPRATENTORIAL
Sellar	Craniopharyngioma	5	45.45	13.88
	Germinoma	1	9.10	2.77
	Pitutary adenoma	1	9.10	2.77
Pineal	Germinoma	1	9.10	2.77
	Pineoblastoma	1	9.10	2.77
Other	CPP	1	9.10	2.77
	Meningioma	1	9.10	2.77

Among Supratentorial extraaxial tumors, craniopharyngioma is the commonest accounting for 46% of extra axial and 13.8% of all Supratentorial tumors. Overall sellar and suprasellar area is the commonest of extraaxial location (7 cases) followed by pineal region in our study (2 cases).

Table-5.12. Sex distribution of Extraaxial lesions.

Tumors	Sex	
	M	F
Sellar lesions	5	2
Pineal gland lesions	2	0
CPP	1	0
Meningioma	0	1

M: F ratio of overall extraaxial lesions is 2.67:1 and male predominance was noted in craniopharyngiomas and germinomas. We got a single case of meningioma in a female.

Table 5.13- Age distribution of extraaxial lesions

Age(yrs)	Sellar	Pineal	CPP	Meningioma
<1	0	0	0	0
1-5	0	0	1	0
6-10	2	0	0	0
11-15	2	0	0	0
16-18	3	2	0	1

Table- 5.14. Pre-contrast features of Sellar lesions.

Features	Cranio (%)	S. germinoma (%)	Pit. Adenoma (%)
Hyperdense	60	100	100
Isodense	20	0	0
Hypodense	20	0	0
Calcifications	80	100	100
Multiplicity	0	0	0

Craniopharyngioma was hyperdense in 60% cases, isodense in 20% and hypodense in 20%. Calcification was noted in 4 cases (80%). Both pituitary adenoma and sellar germinoma were hyperdense on NECT and showed evidence of intracranial calcifications.

Table- 5.15. Secondary effects by sellar lesions

Features	Cranio(%)	S. germinoma(%)	Pit adenoma(%)
PLE	20	0	0
Mass effect	100	0	100
Hydrocephalus	60	0	0
Bone ero/scal	100	100	100

Bone erosion/ scalloping was the commonest secondary effect by the extraaxial lesions noted in all the sellar lesions in our study, followed by mass effect and hydrocephalus.

Table 5.16- Post contrast features of Sellar lesions

Features (post-contrast)		Cranio	Pit adenoma	S.Germinoma
Enhancement	mild	20	0	0
	mod	60	100	0
	intense	20	0	100
Pattern	Hom	20	0	100
	Heter	80	100	0
Necrosis/cyst		80	100	0
Margin	sharp	100	100	100
	Ill def	0	0	0

Moderate post contrast enhancement was the commonest pattern of enhancement seen amongst sellar lesions, except in suprasellar germinoma which showed intense homogenous post contrast enhancement. Necrosis /cyst formation was noted in 5 cases (71.4%). Margins were sharp and well defined in all 7 sellar lesions in our study.

Table- 5.17-Precontrast features of other extraxial lesions

Features (pre-contrast)	Pineal lesions	CPP	Meningioma
Hyperdense	2	1	0
Isodense	0	0	1
Hypodense	0	0	0
Calcifications	2	1	1
Multiplicity	0	0	0

Both pineal lesions, germinoma and pineoblastoma were hyperdense on NECT and showed calcifications. In the patient of pineal germinoma we found a synchronous suprasellar lesion. We studied a single case of meningioma which was hypodense on NECT and contained calcifications.

Table – 5.18. Secondary effects by other extraaxial lesions.

Secondary effects	Pineal lesions	CPP	Meningioma
PLE	0	1	1
Bone ero/scal	0	0	0
Mass effect	1	0	0
Hydrocephalus	2	1	0

Hydrocephalus was the commonest secondary effect seen in pineal lesions and choroid plexus papilloma. Mild perilesional edema was seen in the solitary case of meningioma.

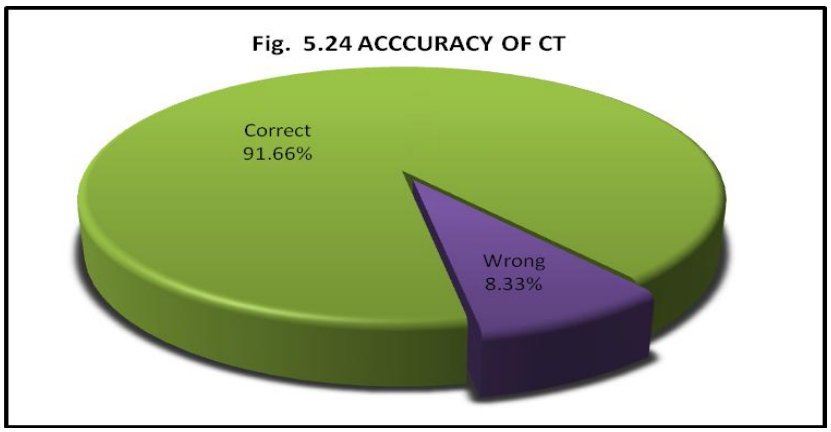
Table- 5.19. Post-contrast features of other extra-axial lesions.

Features (post-contrast)		Pineal Lesions	CPP	Meningioma
Enhancement	mild	0	0	0
	mod	1	0	1
	intense	1	1	0
Pattern	Hom	1	0	1
	heter	1	1	0
Necrosis/cyst		1	1	1
Margin	sharp	2	1	1
	Ill def	0	0	0

Pineal germinoma showed intense uniform post contrast enhancement whereas, pineoblastoma showed moderate heterogenous enhancement.

TABLE–5.20
CT ACCURACY

CT DIAGNOSIS	NUMBER (n)	PERCENTAGE (%)
Correct	33	91.66
Wrong	3	8.33
TOTAL	36	100.00



In the present study, CT was found to be accurate in 91.66% of cases. One case of CT diagnosis of diffuse low grade astrocytoma came out to be high grade on HPE. In a case of pineal germinoma CT had failed to diagnose a synchronous sellar germinoma which was detected on subsequent MRI. A case of ependymoma was misdiagnosed as supratentorial PNET.

Table-5. 21 Various Supratentorial tumors in our study.

TUMORS	NUMBER (n)	PERCENTAGE (%)
Pilocytic astrocytomas	3	8.33
Diffuse infiltrating LGA	2	5.50
Optic pathway glioma	2	5.50
SEGCA	1	2.77
Anaplastic astrocytoma	2	5.50
GBM	2	5.50
DIG	2	5.50
Central neurocytoma	1	5.00
Ganglioglioma	1	2.77
Supratentorial PNET	5	13.88
Oligodendroglioma	2	5.50
Ependymoma	2	5.50
Craniopharyngioma	5	13.88
Pitutary adenoma	1	2.77
Sellar germinoma	1	2.77
Pineal germinoma	1	2.77
Pineoblastoma	1	2.77
Choroid plexus papilloma	1	2.77
Meningioma	1	2.77
TOTAL	36	100.00

IV. Discussion

Many comprehensive studies have studied pediatric brain tumors. The conclusion reached by any supratentorial pediatric brain tumor survey vary according to the source of material and the age group studied, the percentage of biopsy proven entities, the geographic areas encompassed, the type of researchers and the scope of diagnostic modalities used to evaluate the patients enrolled in series.

Epidemiology

In our study of 36 supratentorial tumors, we found 25 intraaxial lesions and 11 extraaxial lesions. Overall the commonest tumor group was astrocytomas accounting for 33.3 %(12 cases), followed by craniopharyngiomas (5 cases) and PNET (5 cases) each accounting for 13.8%.

Our study showed close correlation with Rosemberg *et al*[28] (2005) who concluded that in the cerebral compartment, pilocytic astrocytomas were the single most frequent tumors (18%), followed by diffuse astrocytomas (14%), medulloblastomas/PNET (11%), and craniopharyngiomas (11%).

Our study also correlated well with studies of Haque *et al*[3] (2010) who in their study concluded that in the supratentorial region the common tumors are astrocytoma (25%), craniopharygioma (14%), suprasellar germinoma, and PNET (7%).

Intraaxial tumors.

Astrocytomas.

Astrocytomas are the most common primary pediatric brain tumors. In our study low grade astrocytomas accounted for 22.20% whereas high grade gliomas accounted for 11.10% of all pediatric supratentorial tumors and pilocytic astroytoma was the commonest astrocytoma. The ratio of low grade to high grade tumors was 2:1. This correlated with studies of Higano *et al* [4](1997) where out of 17 astrocytomas, 10 cases were low grade and remaining 7 were high grade and Naseem Ahmed [29] *et al* (2007), where they found pilocytic astrocytoma as the commonest, with 11 low grade and 6 high grade tumors among 17 astrocytomas giving a ratio of 1.8:1 .

Low grade astrocytomas

Low grade astrocytomas accounting for 22.2% of all pediatric Supratentorial tumors and 32% of intraaxial tumors were the single largest group in our study. The male: female ratio was 1.6:1. Most of the tumors were found in the age group of 6-10 years (4 cases).

Our study included 3 pilocytic astrocytomas, 2 diffuse infiltrating low grade astrocytomas, 2 optic pathway gliomas, and 1 SEGCA.

On plain CT 62.5% lesions were hypodense (5 out of 8 cases) and calcification was noted in 37.5%. Perilesional edema was seen in 37.5% (3 cases)

Mild homogenous post contrast enhancement was the commonest pattern of enhancement noted in 62.5% cases with cystic changes noted in 50% of cases.

Tumor margins were blurred in 2 of the cases located in the frontal lobe indicating diffuse infiltrating nature of neoplasm.

Pilocytic astrocytoma.

Epidemiology-

Amongst low grade astrocytomas, pilocytic astrocytoma was the commonest accounting for 25% of all the astrocytomas in our study which was in accordance with Rosemberg *et al* [28](2006) and Harmouch *et al*[32] (2012) who found pilocytic astrocytomas as the commonest tumors in their study.

All 3 tumors in our study was found in age group of 6-10 years which correlated with study of Dolecek *et al* [1](2012) who found predominance of pilocytic astrocytomas in age group of 5-9 years.

CT features-

All 3 cases of Pilocytic astrocytomas assumed a common appearance of cystic lesion with a mural nodule or peripheral enhancing solid components in our study. The solid component of the lesion was hypodense in all 3 cases and showed moderate post contrast enhancement in 2 (66.6%) cases. These features correlated with study by Lee *et al* [37](1989) who stated the tumor matrix was most often hypo or isodense with marked enhancement of mural nodule.

Mild perifocal edema was seen in 1 case whereas no edema was seen in other 2 cases. This correlated with Lee *et al*[37] (1989) who stated edema is rarely associated with pilocytic astrocytomas.

Cysts of varying sizes were seen in all three cases which was in accordance with studies by D Afra *et al* [36](1986) and Lee *et al* [37](1989).

HPE confirmation was obtained in one case of pilocytic astrocytoma.

Optic pathway glioma

Of the 2 cases of optic pathway glioma, one was a well defined fusiform enlargement of optic nerve with extension to optic chiasm, whereas the second lesion was ill defined.On CT they appeared as hypodense (50 %) to isodense (50%) lesions which showed mild homogenous post contrast enhancement. These findings correlated with Osborn[62] (2013) who stated that astrocytomas of optic pathway show variable enhancement.

Diffuse infiltrating low grade astrocytoma.

In our study we found 2 cases of diffuse low grade astrocytomas. Both the lesions were found in frontal lobe and in the age group of 16-18 years.

On plain scan the lesions appeared hypodense in 1 case (50%) and isodense in other case (50%). Calcification was seen in 1 case. Both the cases showed faint contrast enhancement. Margins were ill defined in both the cases.This was in correlation with Feng *et al* [89](2012) who concluded that diffuse low grade astrocytomas demonstrated abnormal density with obscure margin, mild peritumoral edema and mass effect. Patchy enhancement, nodular enhancement, or irregular ring-like enhancement or no appreciable enhancement was noted on post-contrast MR or CT scans.

Subepndymal giant cell astrocytoma

In our study we found a single case in a 16 year male patient with tuberous sclerosis. This corresponded with Nabbout *et al* [43](1999) who stated that SEGCAs are present in 5% to 10% of the cases of tuberous sclerosis

Patient presented with symptoms of seizures, which is one of the common presenting symptoms in a patient of tuberous sclerosis.

On NECT scans the lesion was noted as a well circumscribed hyperdense lesion in foramen of Monro showing intralesional calcifications, inciting perilesional edema.

On contrast study moderate heterogenous enhancement was noted. Our study correlated with Adriaensen *et al*[45] (2009) who used the definition of a partially calcified lesion showing marked enhancement located near the foramen of Monro, measuring at least 1 cm in maximum axial diameter as the CT criterion similar to that concluded by Nabbout *et al* [43](1999).

High grade astrocytomas.

Epidemiology-

In our study, high grade tumors were 33.3% of astrocytomas and accounted for 11.1 % of all Supratentorial tumors. Out of 4, 2 were anaplastic type and 2 of GBM type. Study by Fangusaro *et al* [46](2012) concluded that the most common histologies amongst high grade gliomas as anaplastic astrocytoma (WHO Grade III) and GBM (WHO grade IV).

Out of 4 cases M: F ratio was 1:1, which correlated with conclusions of Fangusaro *et al* [46](2012) who found in most series that distribution between males and females is equal.

50% of the tumors were hemispheric in location followed by basal ganglia (25%) and periventricular locations (25%). 50% of the cases are seen in the age group of 16-18 years without any sex predilection. Our study correlated well with Fangusaro *et al* [46](2012) who stated 33% of 35–50% are located within the cerebral hemispheres and found the highest incidence of supratentorial HGG among children is in patients 15–19 years . Broniscer and Gajjar *et al*[47] (2004), also found a higher incidence of high grade astrocytomas in 15-19 year age group.

Raised ICT was the commonest presenting features which was seen in 75% patients which correlated with study of Fangusaro *et al* [46](2012) who found that presenting signs in high grade tumors are often due to increased intracranial pressure.

CT features

On NECT 25% of the cases showed calcification. All 4 cases showed perilesional edema and mass effect. 50% cases were isodense, 25% hypodense and 25% hyperdense on NECT but all the tumors showed heterogenous pattern of enhancement with non-enhancing areas within suggestive of necrosis. Tumor margins were ill defined in all the cases suggesting infiltrative pattern of growth. These features correlated with studies by Leeds *et al* [90](1984) and Ahmed Massaryk *et al* [91](2007) who stated that these tumors typically appear on noncontrast CT as heterogeneous masses with irregular borders of normal or slightly increased density with central cavitation of diminished attenuation. The irregular hyperdense borders demonstrate avid contrast enhancement.

Cage *et al*[50](2012) stated that on (CT) scans high grade tumors are seen as an irregular isodense or hypodense lesion which show heterogeneous post contrast enhancement corresponded to our study .

Neuronal and mixed neuronal glial tumors

In our study we found 4 cases of NMNGs which included 2 DIG, 1 ganglioglioma and a case of central neurocytoma. As a group they accounted for 11.1% of all supratentorial tumors. A study by Rosemberg *et al* [28](2005) found that the frequency of neuronal and mixed neuronal glial tumors is increasing (8%).

DIG

We found 2 cases of DIG in our study, both in males in the age group <1 year which correlated with Ganesan *et al* [92](2006) who observed that DIG is common in male children and these tumors are generally observed in the first 18 months of life, especially in the first 4 months.

Both patients presented with clinical signs of raised ICT which correlated with study by Shin et al [65] (2002).

They were seen as large hemispheric tumors occupying more than one lobe with both solid and cystic components. The solid component was plaque or nodular with hyperdense attenuation on NECT and showed intense heterogenous post contrast enhancement in both cases. These findings were similar in a case report by Avci E *et al* [93](2008) and M Gonzalez *et al* [68](2011)who found that more than one lobe is affected in over 60% of cases and found DIG as a giant mass with an aggressive radiological appearance and a cystic component that exhibited marked contrast uptake.

Ganglioglioma

We studied a single case of Ganglioglioma in a boy aged 13 years, who presented with seizures.

On NECT we found a hypodense predominantly cystic mass lesion in temporal lobe with peripheral calcification. Mild enhancement noted in the peripheral aspect of the lesion.

Our study correlated with Castillo *et al* [67](1990) who described Ganglioglioma as a cystic lesion with mural nodule seen in 40% of cases.

Study by Shin *et al* [65] (2002) stated that calcification is seen in about 40% of gangliogliomas.

Im S H *et al* [94](2002) stated that seizure was the most common presenting symptom (85%) and found tumor calcification in 54.5% cases, cystic components in 50% and tumor enhancement in 53%. Our findings correlated with these studies.

Central neurocytoma

We studied a case of central neurocytoma in a female adolescent aged 17 years. On plain CT it appeared as a heterogenously isodense lesion in the lateral ventricle near foramen of Monro. On post contrast study the lesion was noted showing moderate heterogenous enhancement.

The findings in our study corresponded to the studies by Goergen *et al* [70](1992) and Shin *et al* [65](2002) who had concluded in their studies that central neurocytoma is typically a lateral ventricular mass attached to septum pellucidum , which is iso to slightly hyperdense on NECT and shows heterogenous enhancement .

Supratentorial PNET.

PNETs were found to be the second most common intraaxial tumors accounting for 20% intraaxial tumors and 13.8% of all supratentorial tumors. 40% of the tumors were found in 2-5 year age group and another 60% between 5-10 yr age group. This correlated with studies of Haque *et al* [3](2010), where PNETs constituted 7% of all Supratentorial tumors.

The most common clinical presentation was raised ICT seen in 60 %(3 cases) of patients. All the tumors were hemispheric in location with 60% of them involving more than one lobe. Dai *et al*[72] (2003) found hemispheric location in 8 out of 13 patients in their study and M.Z. Boudawara *et al* [95](2001) found that clinical presentation in PNETs was dominated by a syndrome of intracranial hypertension.

All 5 lesions were hyperdense on NECT and showed intralesional calcification. Mass effect was a common feature seen in 80% cases. Scalloping of adjacent calvaria is noted in 40% of cases. These findings correlated with Dai *et al* [72](2003) who in their study found that all cases were hyperdense on NECT with a significant midline shift observed on all scans. M.Z. Boudawara *et al* [95](2001) in their study stated that PNET in all cases, were large and presented triple component: solid, cystic and calcified parts.

80% cases showed intense heterogenous post contrast enhancement with ill defined margins in 20% of cases. Cysts were evident in 66% of the cases and heterogeneous enhancement was noted in all cases in the study by Dai *et al* [72](2003).

Oligodendroglioma.

In our study we found two cases of oligodendroglioma, both presenting with complaints of seizures with a mean age of 16 years. Both the tumors were noted in frontal lobe. This finding correlated with Lee *et al* [52](1989) who stated oligodendrogliomas most often present as supratentorial frontal tumors.

On NECT, 1 case (50%) was hypodense and another (50%) was isodense with calcification seen in both the cases. Perilesional edema and mass effect were noticeably absent in both the cases. On contrast examination, mild enhancement was noted in both the cases but the pattern was homogenous in one of the cases, while heterogeneous in the other. These findings correlated with Lee *et al*[52] (1989) who described oligodendroglial tumors as large, calcified, and poorly to non-enhancing peripheral tumors with calcification in

60% cases. Oligodendrogliomas were hypodense in 60% cases. Reiche *et al* [97](2002) in their study of 12 low grade oligodendrogliomas, found contrast enhancement in 3 cases, no enhancement in 6 and post contrast scans were not available in other 3.

One of the cases showed ependymal spread to 4th ventricle. Wai hoe *et al* [96]2006) reported a case of oligodendroglioma (grade II) with ventricular dissemination.

Ependymal tumors.

In our study we found 2 cases of ependymal tumors and both were found in 16-18 year age group. Both the patients presented with features of raised ICT and on CT examination were found to be periventricular in location. This correlated with Mermuys *et al* [56](2005) who stated that within the pediatric population, Supratentorial ependymomas are often seen in older childhood.

On NECT both the lesions were large and heterogeneous in appearance. Both the lesions showed calcification, perilesional edema and mass effect whereas hydrocephalus was seen in 1 case. Koeller *et al* [59](2002) stated calcification is a common feature seen 40-80% cases.

On contrast study both lesions showed moderate to intense heterogenous enhancement. This feature correlated with Yuh *et al* [60](2009) who stated that ependymomas generally show heterogenous enhancement.

Extraaxial tumors

Epidemiology

In our study extraaxial tumors accounted for 30.5% (11 cases) of supratentorial tumors and sellar region was the commonest location (7 cases). Craniopharyngioma was the commonest diagnosis accounting for 13.8% of Supratentorial and 45.45% of extraaxial tumors.

Male predominance was found in craniopharyngiomas and germinomas in our study.

54.54% (6 cases) of all extraaxial tumors were found in age group of 16-18 years. Headache (36.36%) and raised ICT (27.27%) were the commonest symptoms in our study.

Craniopharyngiomas

We studied 5 cases of craniopharyngioma. In 2 cases we got histological confirmation that they belonged to adamantinomatous variety on post operative HPE analysis.

Accounting for 13.8% of all supratentorial tumors, it was the commonest extraaxial tumor. Haghighatkhah *et al* [98](2010) stated that craniopharyngiomas are the most common non-glial pediatric brain tumor.Haque et al [3](2010) found craniopharyngiomas as the second most common (14%) tumor in their study of pediatric brain tumors which is similar to our study.

3 cases (60%) were found in the age group of 16-18 years and 2 cases (40%) in the age group of 11-15years. Male: female ratio was 3:2.

On NECT they were predominantly hyperdense (60%) and both peripheral as well as coarse intralesional calcification was noted in 80%. Cystic changes of varying sizes were noted in 4 cases. Post contrast study revealed moderate to intense heterogenous post contrast enhancement. Sellar erosion was seen in 60% of cases and perilesional edema in 20% of cases. Our study correlated with study by Haque *et al*[3] (2010) where calcification was present in 87.5% cases and contrast enhancement in 100% cases.

Haghighatkhah *et al* [98](2010) stated in their study that on CT scan, the pediatric type is predominantly suprasellar and calcified cystic mass with solid components in 90% of cases.

Pituitary adenoma

We studied a single case of pituitary adenoma in a 18 year old male patient with clinical diagnosis of acromegaly.

Keil *et al* [99](2008) stated the frequency of pituitary adenomas increases during adolescence but they remain relatively rare tumors which correlated with our study.

Webb and Prayson *et al* [100](2008) studied 20 tumors. Of these 9 adenomas stained solely for prolactin, 5 for adrenocorticotropic hormone, and 3 for growth hormone.[96] Chaudhary and Bano *et al* [101] (2012)stated Somatotropinomas or growth hormone producing adenomas compromise approximately 5–15% of pituitary tumors in children and adolescents.

On plain CT it was a heterogenous predominantly hyperdense lesion with intralesional calcification. On post contrast study the lesion showed intense enhancement of the solid component with central non enhancing areas. These findings correlated with Osborn *et al* [62](2013) who has stated that cystic changes is common (in 15-20% cases) and moderate but heterogeneous enhancement is common on CECT .This case was followed up with MR scanning which confirmed the diagnosis by its characteristic location and imaging findings.

Germinomas .

In our study we found 2 cases of germinomas, one in suprasellar and another case where there were synchronous pineal and suprasellar germinomas.

Suprasellar germinoma

We studied a single case of suprasellar germinoma which presented in a 10 year old male with headache. On NECT it was seen as a homogenously hyperdense mass lesion containing fine calcific densities within .On post contrast study the lesion shows intense enhancement.

Pineal germinoma

This case was seen in a male patient aged 18 years who presented with symptoms of headache. Plan CT scans showed a homogenously hyperdense mass lesion engulfing normal pineal calcification which showed homogenous post contrast enhancement. CT had missed a synchronous suprasellar lesion which was detected on follow up MR scans.

Our findings in germinomas correlated with Kaprelyan *et al* [76](2006), who found a 5-10% incidence of synchronous sellar and pineal tumors and stated that CT scans demonstrated well circumscribed tumor lesions with a homogeneous contrast enhancement in the suprasellar and pineal germinomas.

Pineoblastoma

A 13 year male patient presented with clinical signs of lateral gaze palsy. Plain CT revealed a large hyperdense lesion with peripheral calcifications showing moderate heterogeneous post contrast enhancement .Hydrocephalus was noted in our case.

Ganti *et al* [102](1986) reported moderate enhancement with a small central lucency in 80% cases of pineoblastoma in their study which correlated with our findings.

Smith *et al* [87](2010) stated that CT reveals a large, lobulated, typically hyperattenuating mass. The pineal calcifications, if seen, may appear exploded at the periphery of the lesion which correlates with our study.

Choroid plexus papilloma

We studied a single case of papilloma in a 2 year old male patient with features of raised ICT. This was in accordance with Naeini *et al*[61] (2009) who stated that most common trigonal masses in young children (< 5 years) and have a marked predominance in boys.

On plain CT, it was seen as a lobulated hyperdense mass lesion in lateral ventricle with intralesional calcifications. All the ventricles were grossly dilated suggestive of communicating hydrocephalus. On post contrast study the lesion shows moderate heterogenous post contrast enhancement. These findngs were similar to Naeini *et al* [61] (2009) who stated that CPPs typically appear as lobulated, intraventricular masses that are iso- or mildly hyperdense on unenhanced CT and homogeneously enhancing after the injection of contrast material with calcifications in about 25% of cases. They have also found that aggressive papillomas may incite perifocal edema suggesting growth into adjacent white matter in our case.

Meningioma.

In our study we found a case of meningioma in a 17 year old female who presented with symptoms of headache. On examination it was noted as an extraaxial isodense parasagittal mass lesion was noted on NECT with a trapped arachnoid cyst which was an atypical feature. On post contrast study, the lesion showed moderate homogenous post contrast enhancement. Intralesional calcific densities were noted .This correlated with Tufan K *et al* [81](2005) who stated that atypical meningiomas are more common in childhood and adolescence on comparison with adults.

CT accuracy:

Computed Tomography was accurate in delineation of the nature of lesion and extension in most of the cases. In the present study, CT was positive in 91.66% of pediatric supratentorial tumors.

One case of CT diagnosis of diffuse low grade astrocytoma came out to be of high grade on HPE. In a case of pineal germinoma CT had failed to diagnose a synchronous sellar germinoma which was detected on subsequent MRI. A case of ependymoma was misdiagnosed as supratentorial PNET.

The present study correlated well with the study of Khalid *et al* [6] (2009), who reported an accuracy of 86.67% for CT on comparison with histopathology.

Haque *et al* [3] (2010) reported an overall accuracy of 95% to 97% with CT as a diagnostic modality in preoperative diagnosis of brain tumors in their study. For astrocytomas and craniopharyngiomas the diagnostic accuracy with CT was 95.2% and 97.7% respectively. They concluded that CT is an invaluable imaging modality in preoperative diagnosis of pediatric brain tumor due to its excellent characterization of tumors.

Summary

Thirty six (36) cases of supratentorial tumors were evaluated by computed tomography in the Department of Radiodiagnosis, Assam Medical college & Hospital, Dibrugarh to study their distribution, pre and post contrast features and to localize and assess the extent of tumors.

- ☑ Out of the 36 cases, 25 lesions were intraaxial and 11 were extraaxial in distribution. The commonest tumors in our study were low grade astrocytomas (22.22%), followed by Supratentorial PNETs (13.8%) and craniopharyngimas (13.8%)
- ☑ Male: Female ratio in our studies was 1.27:1 for intraaxial lesions, 2.67:1 for extraaxial lesions and 1.57:1 for overall tumors. Male predominance was seen in DIG and germinomas.
- ☑ Low grade astrocytomas and PNET were predominantly seen in the age group of 6-10 years, whereas high grade astrocytomas, oligodendrogliomas and sellar lesions predominated in adolescent age group (16-18 years).
- ☑ Raised ICT and headache were the common clinical features with which patients presented in our study.
- ☑ Pilocytic astrocytoma was the commonest of all astrocytomas (25%). All 3 tumors in our study assumed a common appearance of a cystic lesion with a mural nodule or peripheral enhancing solid component.
- ☑ Amongst high grade astrocytomas, 2 were anaplastic astrocytomas and 2 were GBM. Commonest clinical presentation amongst them were raised ICT. Features that enabled differentiation from low grade tumors were ill defined margins, heterogenous enhancement with large areas of nerosis within.
- ☑ 2 cases of DIG were identified typically as large hemispheric masses with both solid and cystic components and presented in age of less than 1 year.
- ☑ A single case of ganglioglioma was seen as cystic lesion in temporal lobe with peripheral calcification, with typical clinical feature of seizures.
- ☑ Supratentorial PNETs were the second most common intraaxial tumors. All the tumors presented in < 10 years with usual CT features of large hemispheric tumors exerting mass effect leading to features of raised ICT.
- ☑ We studied 2 cases of oligodendrogliomas, in which ependymal spread to ventricle was seen in one case.
- ☑ In our study we found 2 cases of ependymal tumors and both were found in 16-18 year age group. Both tumors were periventricular in distribution with internal calcifications.
- ☑ Sellar and suprasellar region is the commonest extraaxial location amongst Supratentorial tumors in which craniopharyngiomas was the commonest.
- ☑ Headache and diminished vision were the common presenting features in craniopharyngomas. Calcfication and cysts of "machine oil" nature were noted in 4 out of 5 cases.
- ☑ A case of pineal germinoma was studied, in which a synchronous sellar lesion was later detected on follow up MRI which was missed on initial CT scans.
- ☑ Pituitary macroadenoma with characteristic CT features was noted in an adolescent male with clinical diagnosis of acromegaly.
- ☑ Choroid plexus papilloma was detected in a 2 year old boy in characteristic location of trigone of ventricle.
- ☑ Atypical meningioma with trapped arachnoid cyst was detected in an adolescent female.
- ☑ Computed tomography permitted accurate localization of Supratentorial tumors in pediatric age group with accurate characterisation in most cases. Calcifications, hyperdense nature of tumors due to cellularity were well appreciated. CT obviated the need for anaesthesia in most cases due to faster acquisition when compared to MRI.

Abbreviations

- ☑ Ana : Anaplastic
- ☑ Astro : Astrocytoma
- ☑ CPP : Choroid Plexus papilloma
- ☑ Dim : diminished
- ☑ Ero : erosion
- ☑ Ependym : Ependymoma
- ☑ h/o : History
- ☑ Heter : heterogenous
- ☑ HGA : High grade astrocytoma
- ☑ Hom : Homogenous
- ☑ Hyper : Hyperdense

- ☑ Hypo : Hypodense
- ☑ ICT : Intracranial tension
- ☑ Iso : Isodense
- ☑ LGA : Low grade astrocytoma
- ☑ M:F : Male:Female
- ☑ Mod : Moderate
- ☑ No/n : Number
- ☑ Oligo : Oligodendroglioma
- ☑ N : No
- ☑ P : Pineal germinoma
- ☑ PET : Positron Emission Tomography.
- ☑ PLE : Perilesional edema
- ☑ PNET : Primitive Neuroectodermal Tumor
- ☑ S : Suprasellar
- ☑ SOL : Space occupying lesion
- ☑ Scal : Scalloping
- ☑ Y : Yes
- ☑ Yrs : Years.

Masterchart

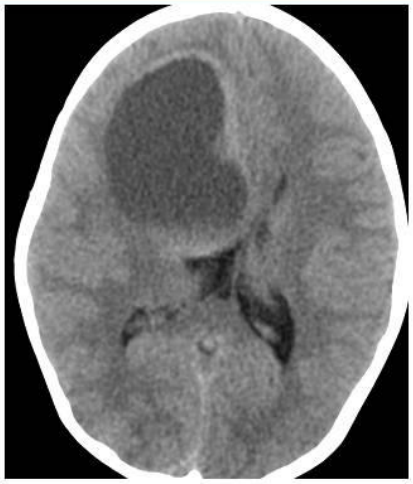
Serial No.	Name	IP/OP No	Age	Sex	Symptom					IA/EA	Location	Precontrast Features					Secondary Effects				Post Contrast Features							CT DIAGNOSIS
												Density									Pattern		Enhancement				Margins		
					Headache	Seizures	Dim Vision	Raised ICT	Others			Hyper	Iso	Hypo	Calcification	Multiplicty	PLE	Mass Effect	Bone Erosion/Scalloping	Hydrocephalus	Hom	Heter	Mild	Mod	Intense	Necrosis/cyst	Sharp	Ill	
1	SAGAR PANDEY	186239	16	M	Y	N	N	N	N	EA	SELLAR/SUPRASELLAR	Y	N	N	Y	N	N	Y	Y	Y	N	Y	N	Y	N	Y	Y	N	CRANIOPHARYNGIOMA
2	LAKHI SAWASI	188512	3	F	N	N	N	Y	N	IA	PARIETOTEMPORAL	Y	N	N	Y	N	Y	Y	N	Y	N	Y	N	N	Y	Y	N	Y	PNET
3	SOMALIKA GOGOI	221620	6	F	N	N	N	Y	N	IA	FRONTAL	N	N	Y	N	N	N	N	Y	N	Y	N	Y	N	Y	Y	Y	N	PILOCYTIC ASTROCYTOMA
4	BOGI BARUAH	224385	18	M	N	N	N	N	Y	EA	SELLAR/SUPRASELLAR	Y	N	N	N	N	N	Y	Y	N	N	Y	N	Y	N	Y	Y	N	PITUTARY MACROADENOMA
5	KINSHUK GOGOI	367842	10	M	N	N	Y	N	N	EA	SELLAR/SUPRASELLAR	Y	N	N	Y	N	N	Y	Y	Y	Y	N	Y	N	N	N	Y	N	CRANIOPHARYNGIOMA
6	SAHINA BEGUM	232620	17	F	Y	N	N	N	N	IA	FRONTAL	N	Y	N	Y	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	DIFFUSE LGA
7	AFTAR ALI	263714	16	M	N	Y	N	N	N	IA	FORAMEN OF MONRO	Y	N	N	Y	N	Y	Y	N	Y	N	Y	N	Y	N	Y	Y	N	SEGCA
8	BIRINA BARUAH	178856	2	F	N	N	N	Y	N	IA	FRONTOPARIETAL	Y	N	N	Y	N	Y	Y	N	Y	N	Y	N	Y	N	Y	Y	N	PNET
9	SUMI GOWALA	231212	6	F	N	N	N	N	Y	IA	FRONTAL	Y	N	N	Y	N	Y	Y	Y	Y	N	Y	N	Y	N	Y	Y	N	PNET
10	BHASKAR PEGU	178856	13	M	N	N	N	N	Y	EA	PINEAL REGION	Y	N	N	Y	N	N	Y	N	Y	N	Y	N	Y	N	Y	Y	N	PINEOBLASTOMA
11	JAGDISH HAJONG	231212	10	M	Y	N	N	N	N	EA	SUPRASELLAR	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	Y	N	Y	N	SUPRASELLAR GERMINOMA
12	SIMANTA NEOG	178927	1	M	N	N	N	Y	N	IA	FRONTOTEMPORAL	Y	N	N	N	N	N	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	DIG
13	BULTI DEB	233964	17	F	N	Y	N	N	N	IA	FRONTAL	N	Y	N	Y	N	N	N	N	N	Y	N	Y	N	N	Y	Y	N	OLIGODENDROGLIOMA
14	PREITI KUMARI	324561	14	F	N	N	Y	N	N	EA	SELLAR/SUPRASELLAR	Y	N	N	Y	N	N	Y	Y	N	N	Y	N	Y	N	Y	Y	N	CRANIOPHARYNGIOMA
1	RUMAN	433	1	M	N	N	N	Y	N	I	PERIVENTRICU	N	N	Y	Y	N	Y	Y	N	Y	N	Y	N	Y	N	Y	Y	N	EPENDYMOMA

5	GOGOI	810	6						A	LAR																	
16	PINKU	224975	18	M	N	Y	N	N	N	IA	FRONTAL	N	N	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	DIFFUSE LGA
17	RINTU TANTI	181813	6	M	N	N	Y	N	N	IA	OPTIC CHIASM	N	Y	N	N	N	N	Y	N	N	Y	N	Y	N	N	N	Y	N	OPTIC PATHWAY GLIOMA
18	YAKI KONGONG	193254	11	M	Y	N	N	N	N	EA	SELLAR/SUPRASELLAR	N	N	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	N	Y	Y	N	CRANIOPHARYNGIOMA

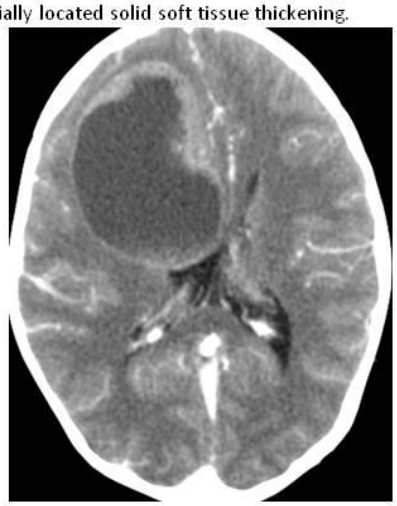
Serial No.	Name	IP/OP No	Age	Sex	Symptom					IA/EA	Location	Precontrast Features					Secondary Effects				Post Contrast Features								CT DIAGNOSIS
												Density									Pattern		Enhancement				Margins		
					Headache	Seizures	Dim Vision	Raised ICT	Others			Hyper	Iso	Hypo	Calcification	Multiplicty	PLE	Mass Effect	Bone Erosion/Scalloping	Hydrocephalus	Hom	Heter	Mild	Mod	Intense	Necrosis/cyst	Sharp	Ill	
19	AROTI MOL	189729	16	F	N	N	Y	N	N	EA	SELLAR/SUPRASELLAR	N	Y	N	Y	N	N	Y	Y	N	N	Y	N	N	Y	Y	Y	N	CRANIOPHARYNGIOMA
20	RAJEN LITIN	257632	18	M	N	N	N	Y	N	EA	PINEAL AND SELLAR	Y	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	N	Y	N	PINEAL GERMINOMA
21	NANDA GOGOI	268342	17	F	Y	N	N	N	N	EA	PARASAGGITAL	N	Y	N	Y	N	Y	N	N	N	Y	N	N	Y	N	Y	Y	N	MENINGIOMA
22	ANI TANTI	321598	7	M	N	N	N	N	Y	IA	PARIETAL	Y	N	N	Y	N	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	PNET
23	JASHMIN BEGUM	269850	17	F	N	N	N	Y	N	IA	PERIVENTRICULAR	N	Y	N	Y	N	Y	Y	N	N	N	Y	N	N	Y	N	Y	N	EPENDYMOMA
24	DIANA NGUTE	276284	2	M	N	N	N	Y	N	EA	LATERAL VENTRICLE	Y	N	N	Y	N	Y	N	N	Y	N	Y	N	N	Y	Y	Y	N	CHOROID PLEXUS PAPILLOMA
25	THANESH WAR	183733	8	M	Y	N	N	N	N	IA	BASAL GANGLIA	N	N	Y	N	N	N	N	N	N	Y	N	Y	N	N	Y	Y	N	PILOCYTIC ASTROCYTOMA
26	MUKESH SAIKIA	243471	9	M	N	N	N	N	Y	IA	PERIVENTRICULAR	N	N	Y	N	N	Y	Y	N	N	Y	N	N	Y	N	Y	Y	N	PILOCYTIC ASTROCYTOMA
27	ALI AHMED	287329	13	M	N	Y	N	N	N	IA	TEMPORAL	N	N	Y	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	Y	N	GANGLIOGLIOMA
28	RAHUL JAIN	376483	7	M	N	N	N	Y	N	IA	TEMPOROPARIETAL	Y	N	N	Y	N	Y	Y	N	N	N	Y	N	N	Y	Y	Y	N	PNET
29	AJIT CHANDRA	400312	14	M	N	N	N	Y	N	IA	FRONTAL	N	N	Y	N	N	Y	Y	N	Y	N	Y	N	N	Y	Y	Y	Y	ANAPLASTIC ASTROCYTOMA
30	PRIYASHRI	412238	16	F	N	N	N	Y	N	IA	PERIVENTRICULAR	N	Y	N	Y	N	Y	Y	N	N	N	Y	N	Y	N	Y	N	Y	ANAPLASTIC ASTROCYTOMA
31	PINTU NEOG	356218	8	M	N	N	N	N	Y	IA	BASAL GANGLIA	Y	N	N	N	N	Y	Y	N	N	N	Y	N	Y	N	Y	N	Y	GBM
32	BHAGYALATHA	179054	17	F	N	N	N	Y	N	IA	FRONTOPARIETAL	N	Y	N	N	N	Y	Y	N	Y	N	Y	Y	N	N	Y	N	Y	GBM
33	SANGITA SAIKIA	301298	12	F	N	N	Y	N	N	IA	OPTIC CHIASM	N	N	Y	N	N	N	N	Y	N	Y	N	Y	N	N	N	Y	N	OPTIC PATHWAY GLIOMA
34	BHIJITESH	287652	1	M	N	N	N	Y	N	IA	FRONTOTEMPORAL	Y	N	N	N	N	Y	Y	Y	Y	Y	N	N	N	Y	Y	Y	N	DIG
35	NAREN G	295682	15	M	N	Y	N	N	N	IA	FRONTAL & VENTRICLE	N	N	Y	Y	Y	N	N	N	N	N	Y	Y	N	N	Y	Y	N	OLIGODENDROGLIOMA
36	DIPTI ORANG	312785	17	F	N	N	N	Y	N	IA	LATERAL VENTRICLE	N	Y	N	Y	N	N	N	N	Y	N	Y	N	Y	N	Y	Y	N	CENTRAL NEUROCYTOMA

Representative cases

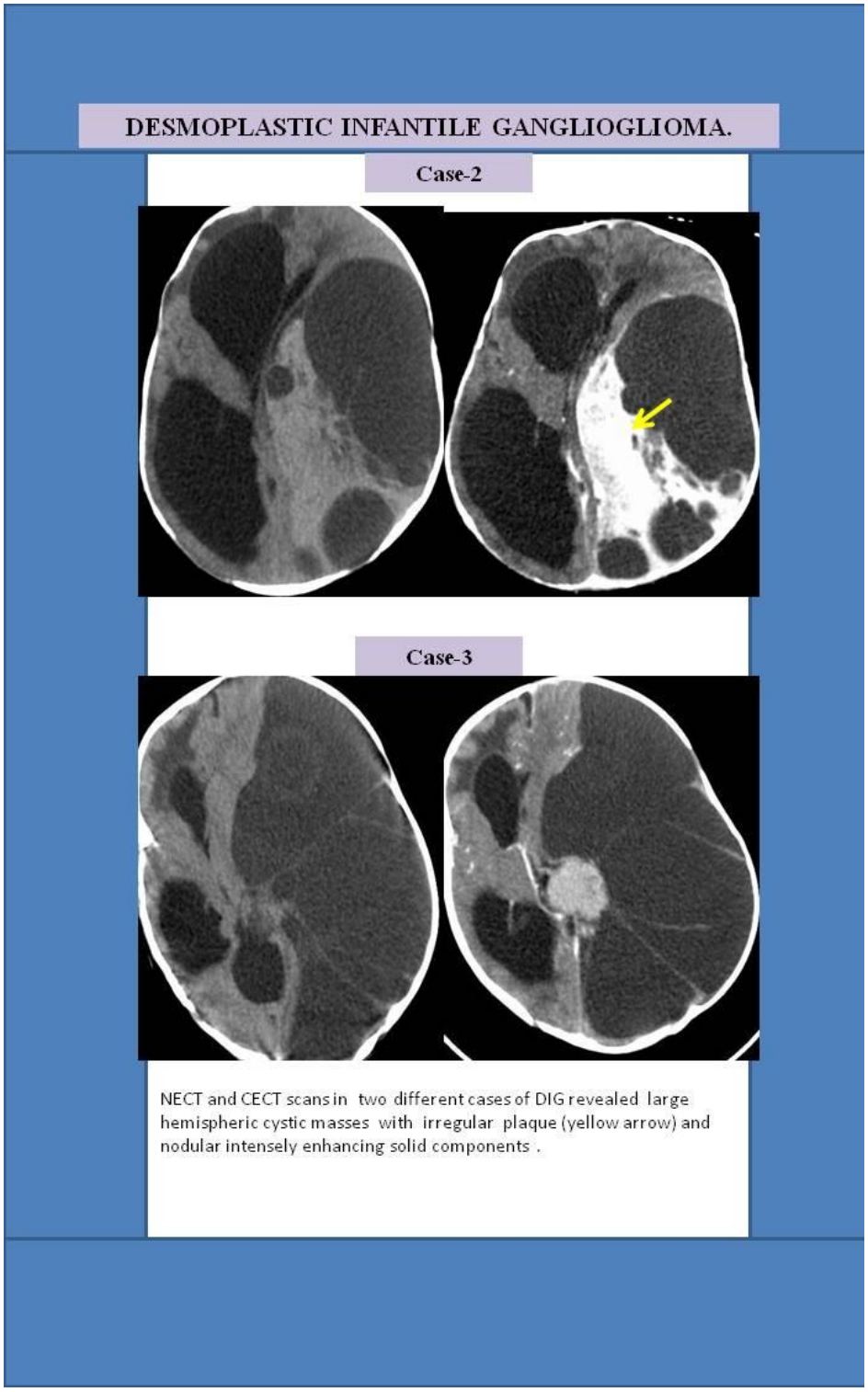
Case-1 Pilocytic astrocytoma



NECT shows a well defined cystic lesion with irregular anteromedially located solid soft tissue thickening.

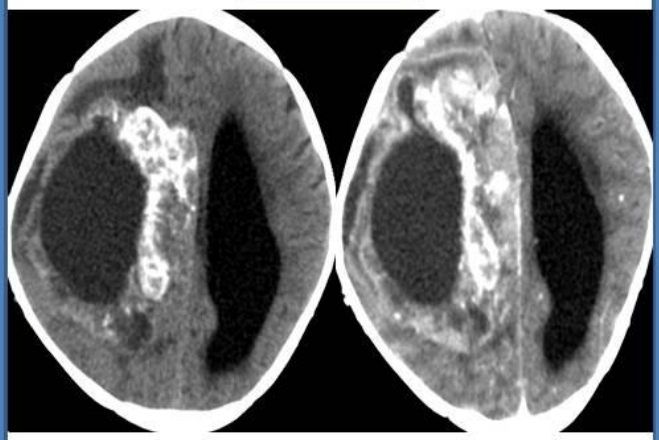


CECT shows irregular moderately enhancing solid component in the smooth peripherally enhancing rest of the cyst .No mural nodule noted


DESMOPLASTIC INFANTILE GANGLIOGLIOMA.
Case-2
Case-3
NECT and CECT scans in two different cases of DIG revealed large hemispheric cystic masses with irregular plaque (yellow arrow) and nodular intensely enhancing solid components .

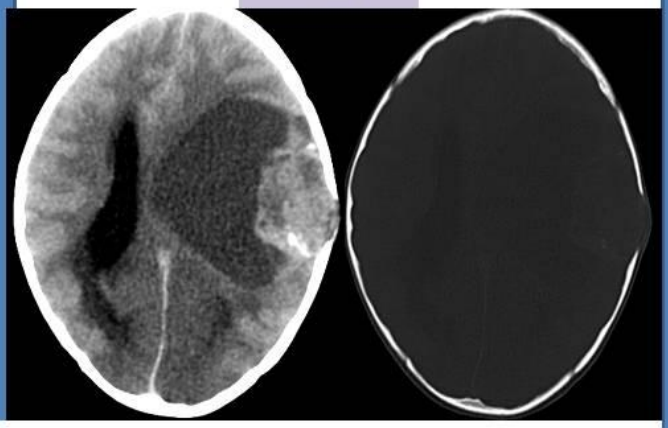
SUPRATENTORIAL PNET

Case-4

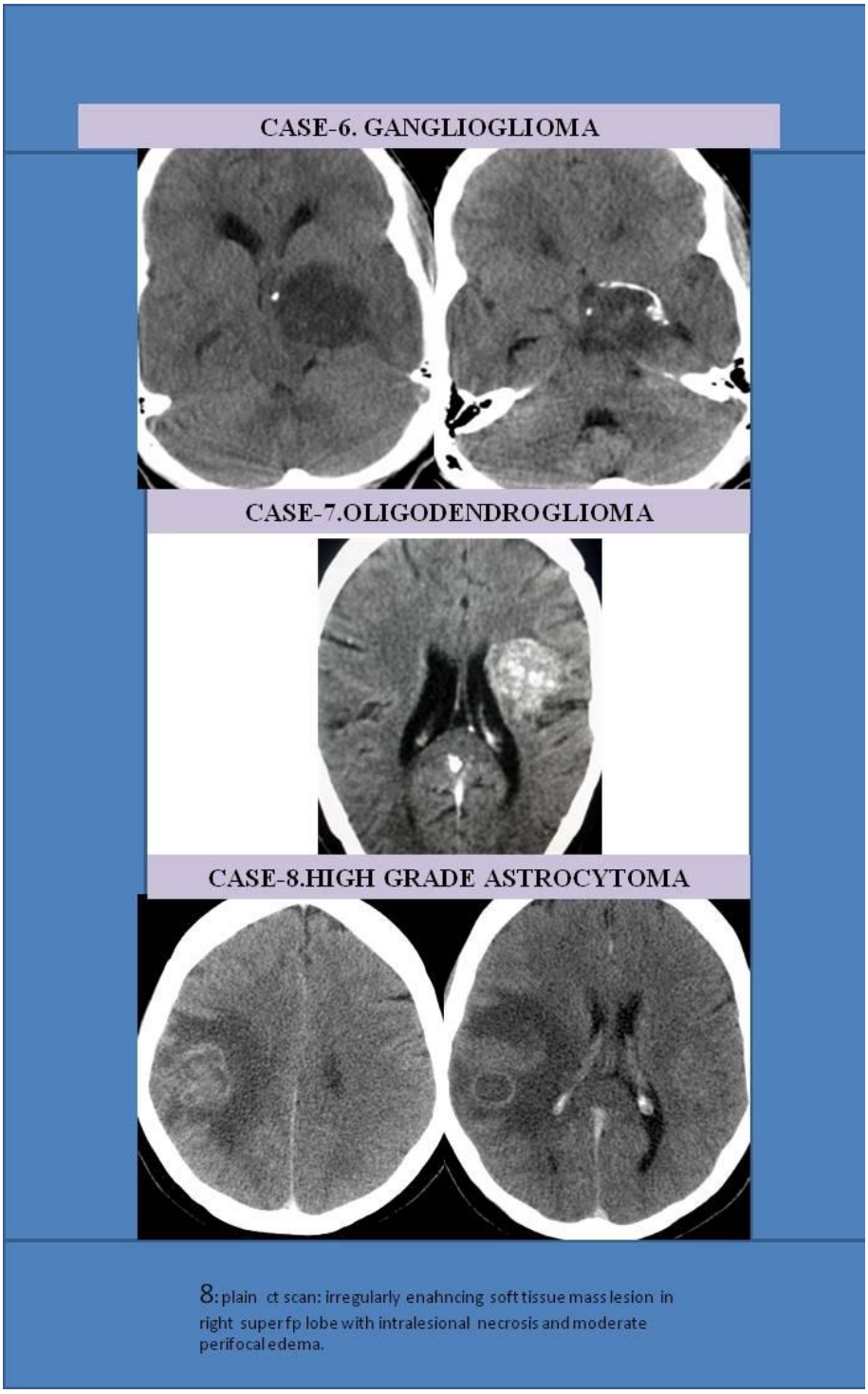


NECT shows a heterogeneous solid-cystic mass with coarse calcifications showing moderate heterogeneous peripheral enhancement on CECT.

Case-5



Another case of supratentorial PNET showed a hyperdense peripherally located solid component in a large cystic mass associated with smooth erosion and scalloping of nearby bony calvaria.



8: plain ct scan: irregularly enahncing soft tissue mass lesion in right superfp lobe with intralesional necrosis and moderate perifocal edema.

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