BRAIN TUMOURS SYSTEMIC CLASSIFICATION AND DIAGONSIS BY CT. AND MRI.

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ABSTRACT

Brain Tumours can be classified systemically according to the normal anatomical structures from outer layer into the internal structural contents to the brain tissues starting from meninges, the most superficial, to the innermost structure of the brain, i.e. the ventricles. They can be classified as primary tumours and metastatic tumours.

Primary Brain Tumours.

1. Meningiomas, Crista Galli, Frontal, Temporal, Sphenoidal, Peri-sella tumours.

2. Brain Tissues, Consisted of nerve cells and connective tissue cells, specially called Glia cells.

   2.1 Nerve cells, no tumours originated from nerve cells are found at present neither benign nor malignant.

   2.2 Glia Cells 2.2.1. Astrocytoma, cell with one axon and multiple dendrites.
   2.2.2. Oligodendroglioma, cell with one axon and only few dendrites.
   (Olig = Few)

   Malignant Astrocytoma and oligodendroglioma are classified into 4 grades, i.e. grade I, II, III, IV. The grading are classified according to 4 criteria according to

   1. Proportion of malignant cells and fibrous tissue cells, either scanty or abundant.
   2. Proportion of the nucleus and cytoplasm, scanty cytoplasm with large nucleus is more malignant.
   3. Regularity of the size of malignant cells, uniformity of the shape and size of cells in one field of microscopic section of the staining slide.
   4. Properties of nucleus. Normal, regularity of shape, size and staining.
      4.1 Karyorhexis, or broken nucleus.
      4.2 Karyolysis, or dissolved nucleus.
      4.3 Pycnosis, the nucleus have deep staining.

   Grade IV malignant Astrocytoma, the most malignant and most frequently found have a special name as "Glioblastoma Multiforme"

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3. Tumours of Embryonal Rest which can make seedling through the ventriculo-spinal system via the CSF. There are five malignant tumours which can make seedling through the cerebro-spinal system.
   3.1 Pineal-Pnet (Primitive Neuro-Ectodermal Tumour)
   3.2 Choroid Plexus Tumour
   3.3 Medulloblastoma (Medulloblast, Cerebello-Pontine Angle)
   3.4 Ependymoma (Primitive Ependymal cells which is the cell lining of the ventriculo -spinal system)
   3.5 Leukaemia

4. Blood Vessels.
   - Haemangioendothelioma - tumour of endothetial lining the wall of blood vessels.
   - Haemangiopericytoma - pericyte cells are cells, which re-enforce the strength of blood vessels.

5. Pituitary. A, B, C cells tumouse.
   A = Acidophile-Hormone producing-Acromegaly, Gigantism.
   B = Basophile-Hormone producing-Cushing syndrome.
   C = Chromophobe, (Non-hormone producing) causing pressure symptoms.
   A, B are Microadenoma - A. Acidophile produce somatotrophin, gonadotrophin etc.
   B. Basophile produce ATCH-Cushing syndrome.
   C, Macroadenoma produce pressure effect: 1. On other two. kinds of cells i.e. A and B cells making deprivation of sex hormones
   in female, making the symptoms of amenorrhea,
   in male, decreasing of libido, delayed or decreasing of the secondary sex characteristics e.g. the growing of beard, pubic hair, the difference between male and female voices.

6. Others or miscellaneous, such as: Optic Glioma, Acoustic Neuroma, Craniopharyngioma, Chordoma or tumour of notochord.

7. Metastatic Tumours to Brain: Bronchogenic Ca. Breast Ca, Thyroid Ca, etc.

INTRODUCTION

Brain Tumours are rather complicated because these are so many different kinds of cells in the brain with different funstone and different natural behaviours. In treating brain tumours, one must have to assess for the following questions: where is the lesion, the number of lesions, sinless or multiple, the natures of the lesions. The treatments have to be carefully planned which will depend as the position, the natures of the tumour, the staging, etc.

The management of brain tumour needs a broad field of knowledges and careful planning of treatment. The first step to do is to get the accrual diagnosis, the sooner, the better. The quickest and

most convenient diagnosis can be dried by CT and MRI, or bolt CT and MRI with or without contras media. Examples of cases will be shown systematically according to classification of Brain tumors and Diagnosis by CT and MRI.

CATEGORY I:

Case I. 1. Meningioma: left frontal lobe.
Clinical: Female, age 30 years, having Headache and weakness of extremities for 1 month. The Roentgen studies were done by CT. and MRI. with and without contrast media.

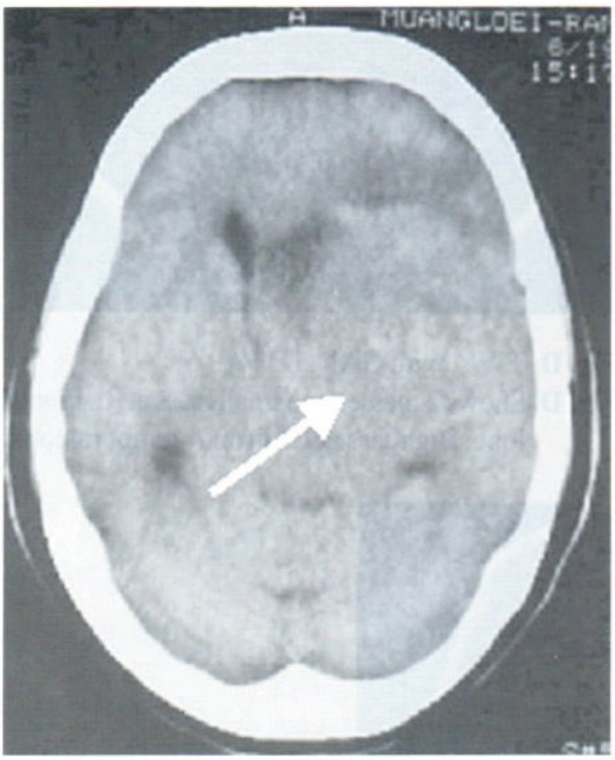


Fig. A Non-contrast. CT, show ill-defined mass at left fronto-temporal region displacing the lateral ventricle, anterior horn to the Rt. Side.

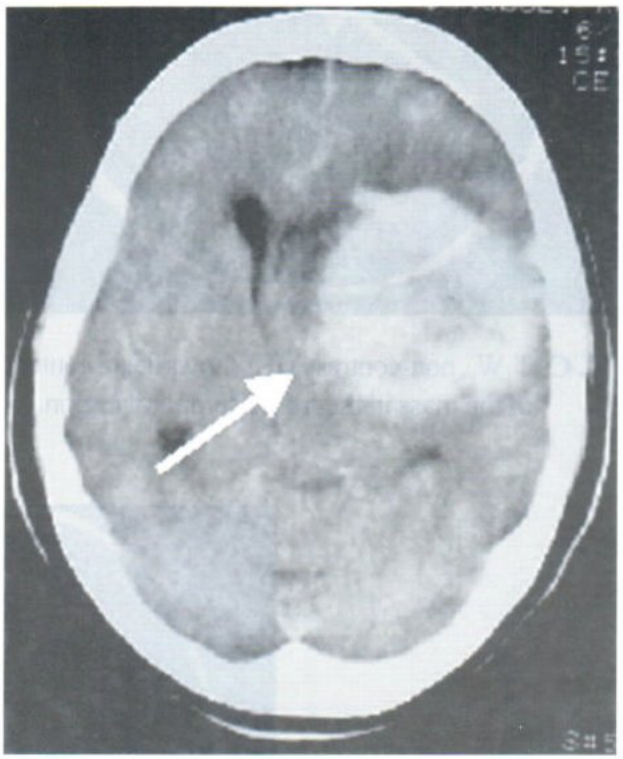


Fig. B Contrast enhancement CT. shows dense enhancing masses at left frontal lobe and one big dense enhancing mass at the fronto-temporal region.

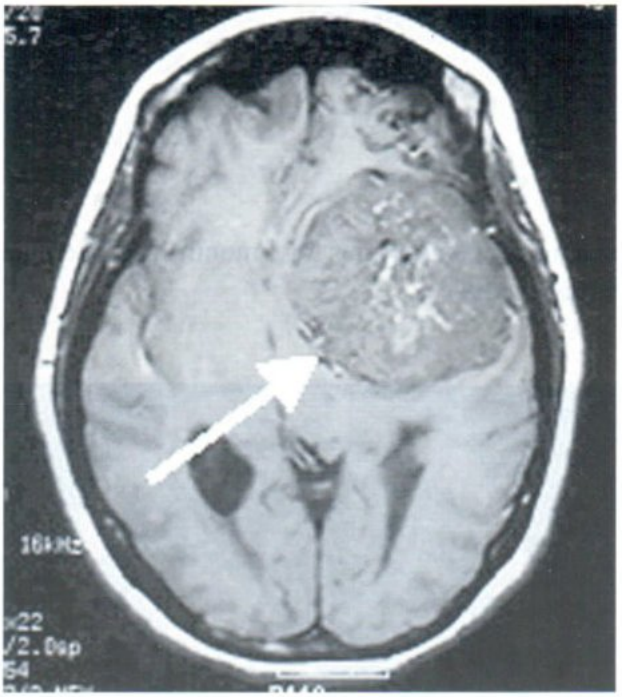


Fig. C T_1W_1, non-contrast MRI shows detail content of the mass in the fronto-temporal region.

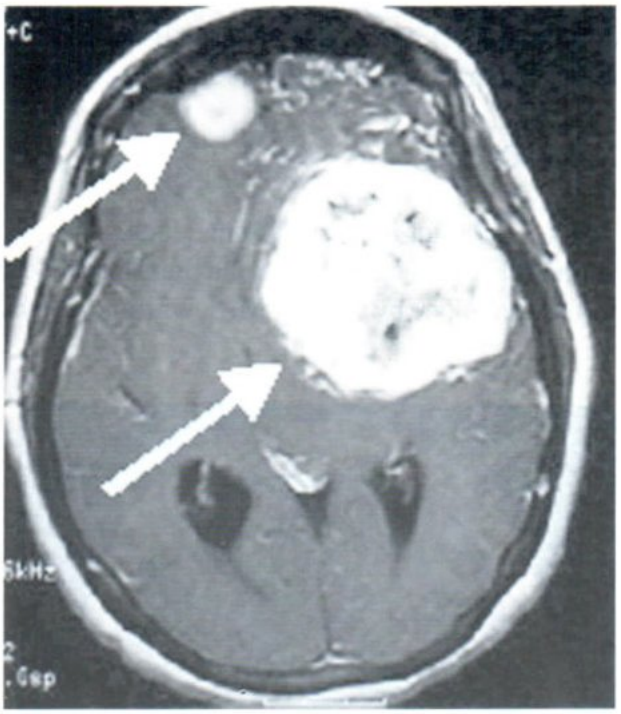


Fig. D T_1W_1, with GAD. DTPA
Fig. D Shows 2 masses one small mass at Rt. Frontal lobe. Big mass at Lt. Fronto-temporal lobe.

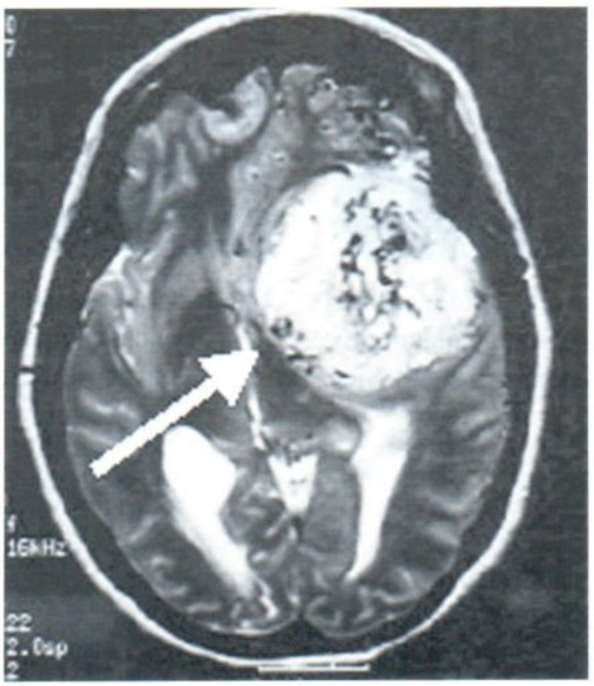


Fig. E T_2W_1, with GAD. DTPA

CATEGORY I:

Case II Meningioma: Petrous ridge Meningioma
Clinical: Female, 54 years, chief complaint hearing defect Rt. side.

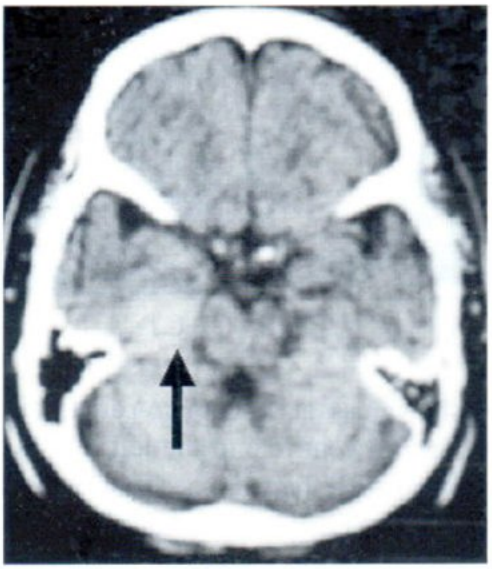


Fig. A Non-contrast CT shows ill defined mass at right petrous ridge.

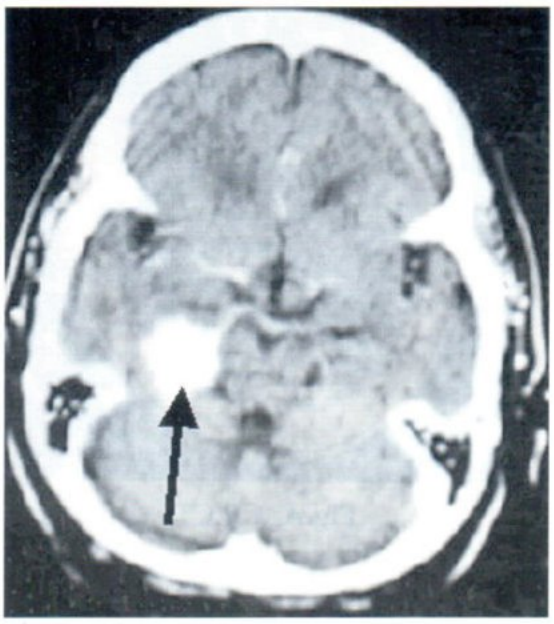


Fig. B Contrast enhancement CT. shows round opaque shadow at the posterior surface of Petrous ridge compatible with Meningioma.

CATEGORY II:

Case I Astrocytoma: grade II
Clinical: Girl: age 10 years. Headache, vomitting 1 week. Left upper and lower extremities weakening.

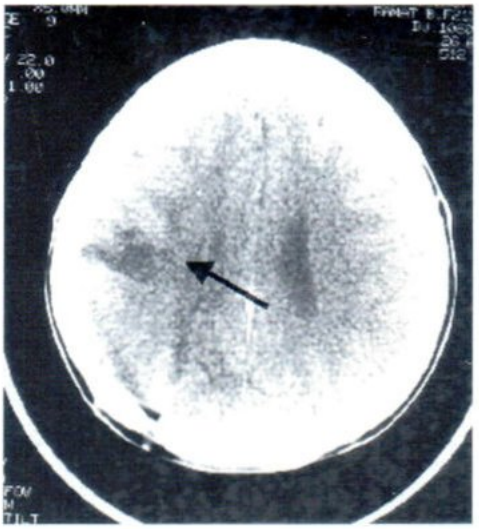


Fig. A NC.CT.

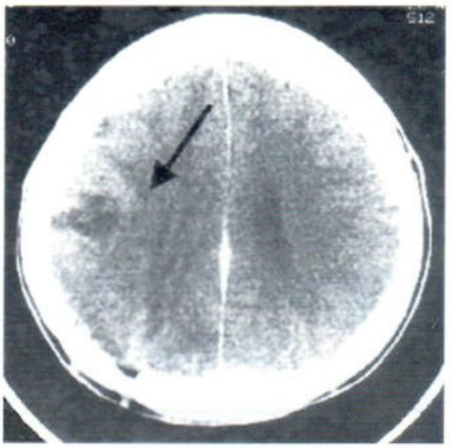


Fig. B CE.CT.

Fig. A and Fig B. NC.CT and CE.CT: An ill-defined non-enhancing mass at Rt. Frontal lobe.
Glia cells tumors are classified as: malignant-Astrocytoma, Grade I, II, III, and IV. Astrocytoma Grade IV have a special name as Glioblastoma Multiforme. Malignant-Oligodendroglioma have also been divided into Grade I to Grade IV according to their cellular differentiation, maturity, and malignant behaviours, the same as Astrocytoma but have no special name in Grade IV.

CATEGORY II:

Case II: Astrocytoma: grade IV (Glioblastoma Multiforme)

Clinical: Female, age 21 years. Headache 2 weeks, left hand and foot weakening.

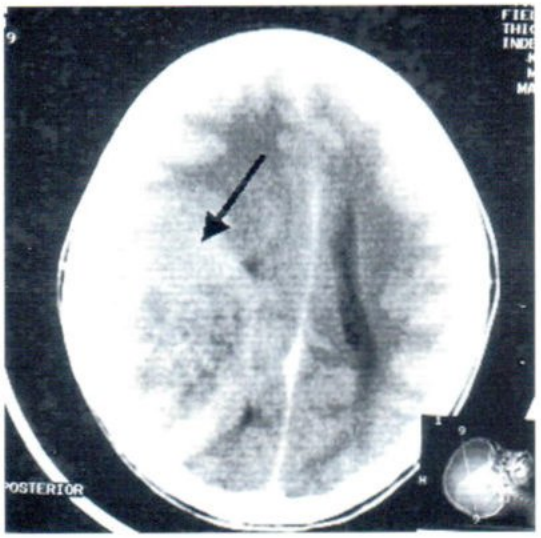


Fig.A NC.CT.

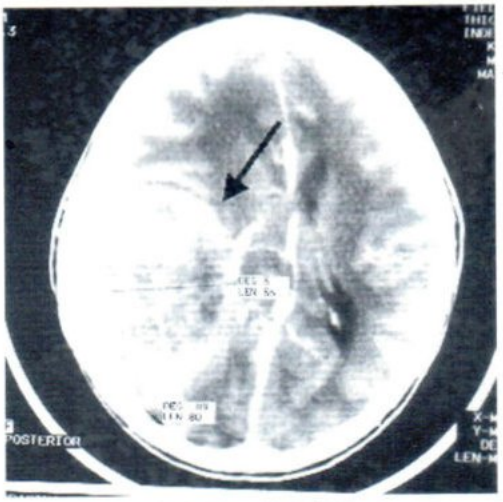


Fig.B CE.CT.

Fig.A. shows mass at Rt. temporo-parietal displacing the Rt. lateral ventricle to the left. **Fig.B.** shows enhancing mass Rt. Temporo-occipital lobe infiltrating larger area than Fig.A. and also invading into the Lt. lateral ventricle at the middle part.

CATEGORY II:

Case III: Glioblastoma Multiforme (GBM)

Clinical: Female, age 60 years, headache, vomiting, weak and drowsy, bed ridden for 1 week. Left upper and lower extremities are weak.

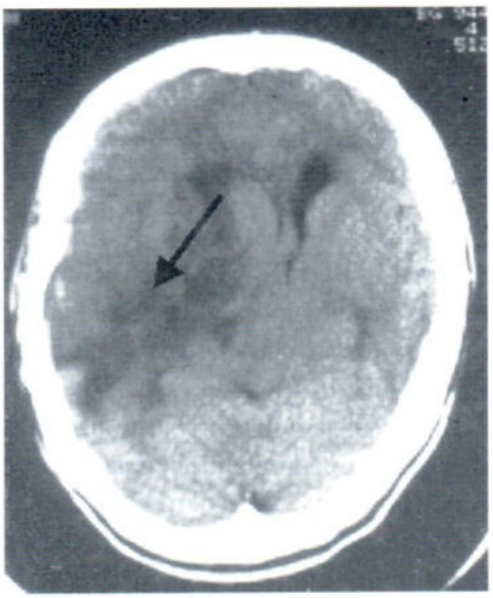


Fig.A NC.CT.

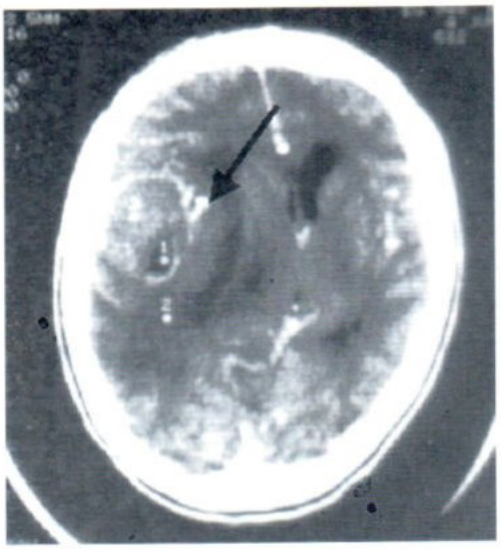


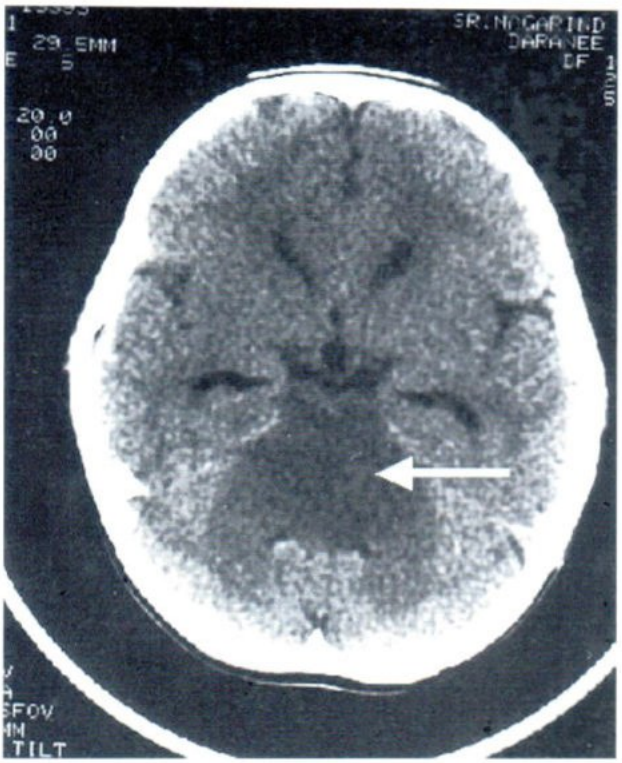
Fig.A CE.CT.

Fig. A. and **Fig. B.** show enhancing mass at Rt. Fronto-temporal lobe infiltrating into the right occipital lobe. The Lt. lateral ventricle is displaced with obliteration of the lower part.

CATEGORY II:

Case IV: Brain stem Glioma

Clinical: Girl, age 4 years. Weakness of both upper and lower extremities NC.CT. shows low density mass in the Pons.



Pituitary Adenoma: There are 3 kinds of cells easily to be remembered A, B, C,

A and B are chromophilic which means having affinity to staining. The adenomas are small and called Microadenoma.

"A" cells are Acidophilic, Staining Red in the histologic section.

"B" cells type are Basophilic, staining Blue.

A. cells produced trophic hormones such as Somatotrophin or growth hormones, and Gonadotrophin, the sex stimulating hormones.

B. cells produce ACTH (Adreno-Cortico Trophic Hormones) causing Cushing Syndromes.

C. cells are called chromophobe, staining pink or neutrophilic. The adenomas are not producing hormones, growing fast and become macroadenomas, causing pressure effects to the neighboring organs and cells. The neighboring organ is optic chiasma causing monolateral or bilateral hemianopsia. The neighboring cells are the A. and B. cells. Pressure on hormone secreting cells caused deprivation of hormones depending on the numbers and types of the secreting cells.

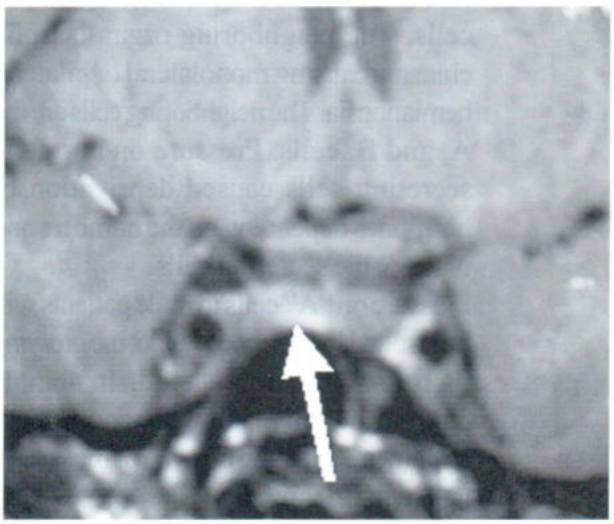
Pressure on "A" cells in male patients will be resulted in decreased libido, the growing of beard will be delayed. In female patients, it will result in amenorrhea or hypomenorrhea, the delayed of menarche, and hypertrichosis.

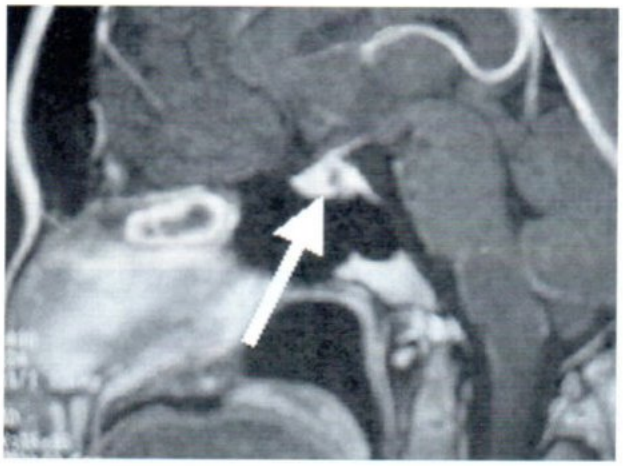
CATEGORY III: Pituitary Microadenoma

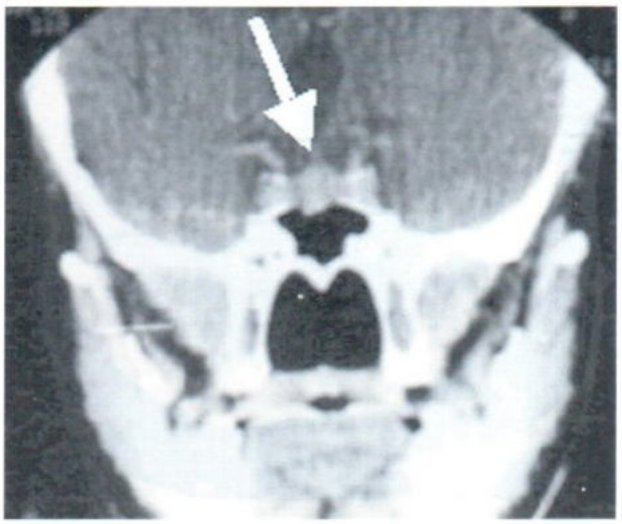
Case I: Female, age 27 years, single, non-married, headache with abnormal nipple discharge without pregnancy.

Theoretical background: Pituitary Microadenoma, Acidophile cell type produced gonadotrophin stimulate ovaries to produce excess of estrogen. Lateral view of skull, normal sella turcica, no ballooning. Hypertension with or without symptoms detectable by taking blood pressure. Discharge or milk running through nipples in single, unmarried or married with no pregnancy, or not after post- partum period.

CT. and MRI with contrast or without contrast show Microadenoma at pituitary. Hormonal assay in the blood showed gonadotrophin and estrogen values increased than normal. Menstruation increased in number of days and quantities of blood in each period.



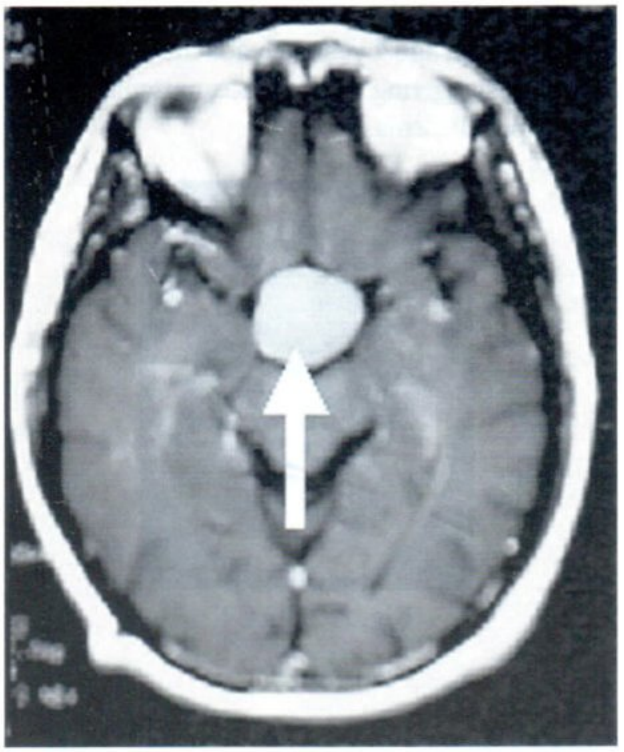




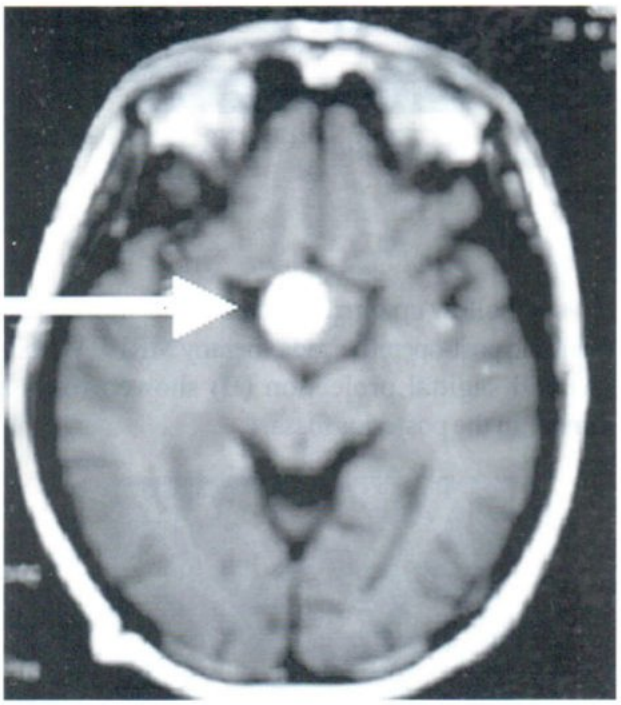
White arrow in each picture shows pituitary gland with microadenoma without ballooning of sella turcica.

CATEGORY III: Pituitary macroadenomas.

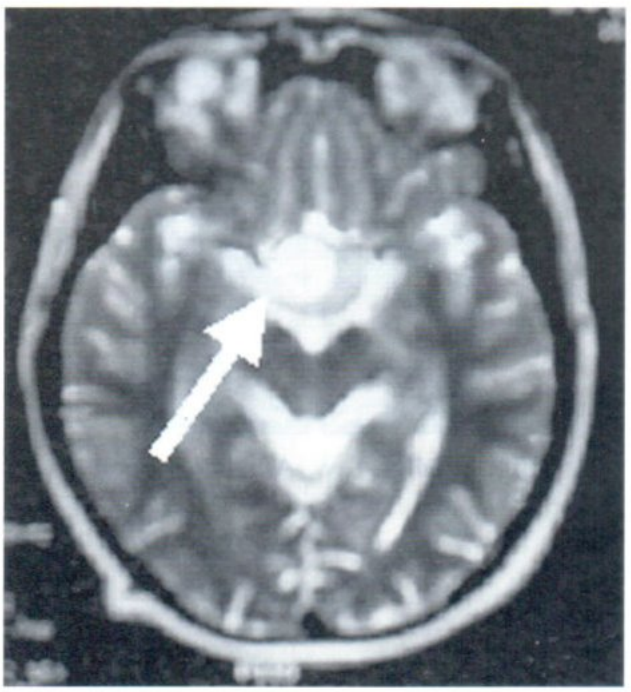
Case II: Male, age 43 years, headache, especially temporal region, for 1 month. Fields of vision, narrowing in the temporal fields both sides.



MRI. $T_1 W_1$ with Gad. DTPA enhancement



MRI. $T_1 W_1$ Pituitary Macro-Adenoma sella and suprasella parts.



MRI. $T_2 W_1$ Pituitary adenoma sella and suprasella parts contrast enhancement.

CATEGORY: IV.1: Medulloblastoma. **Case I**
Clinical: Boy, age 4 years, Headache for 3 moths, vomitting, staggering, somnolence, muscular spasm, bilateral paplilledema.

A. Non-contrast CT. and **B.** Contrast enhancement CT. show enhancing mass at posterior fossa.

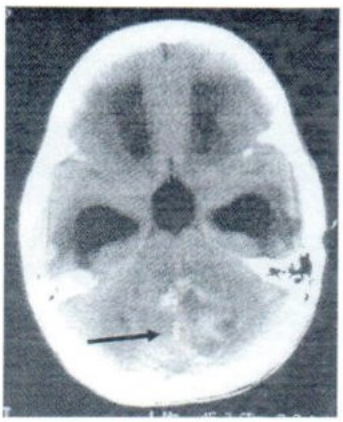


Fig. A NC.CT.

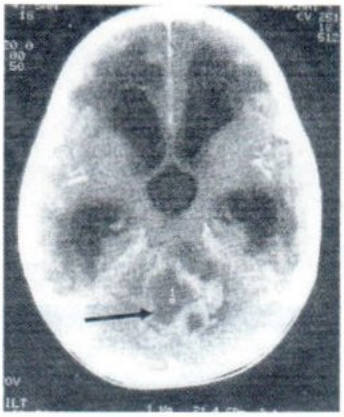


Fig. B CE.CT.

CATEGORY: IV. 2: Medulloblastoma **Case II**
Clinical: Medulloblastoma, age 9 years, headache for 3 months, cerebellar sign positive. Histopathology result: Medulloblastoma.

Follow up film 2 months after surgical treatment and post-operative radiotherapy MRI T_1W_1 axial **(A)** and sagittal projection **(B)** showed residual tumour in the posterior fossa.

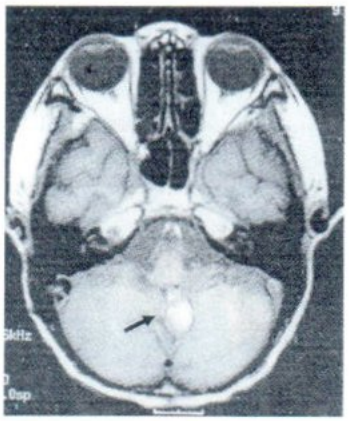


Fig. A MRI. T_1W_1 Axial projection

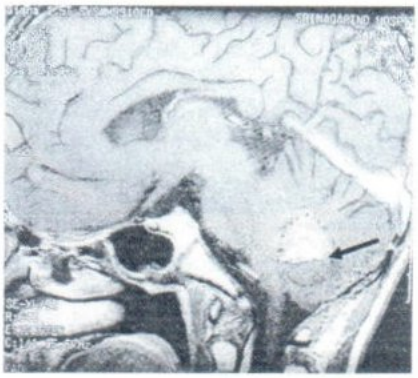


Fig. B MRI. Sagittal projection

CATEGORY V: Acoustic Schwannoma.
Clinical: Male, age 49 years, and loss of hearing Rt. ear.
Fig.A MRI, T_1 W_1 axial projection, **Fig.B** MRI. axial projection with contrast enhancement. Histopathology: Acoustic Schwannoma.

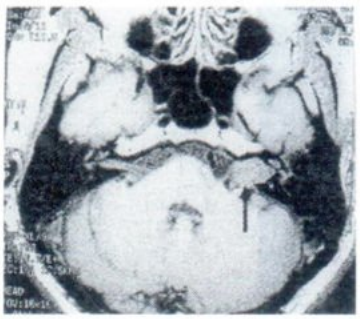


Fig. A Axial MRI. (black arrow)

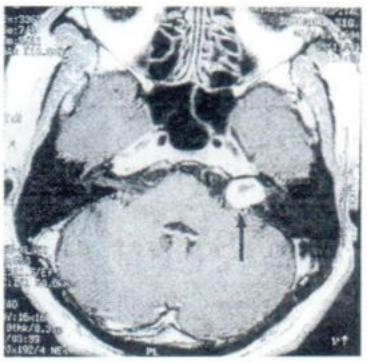


Fig. B Axial MRI. with GDPA enhancement.(black arrow)

CATEGORY VI: Acute Myelocytic Leukemia (AML)
Clinical: Girl, age 3 years, known case of AML. CT. of Brain **(A)** before contrast injection, **(B)** after contrast injection Contrast enhancing masses (black arrows) show extra axial masses in the CSF.

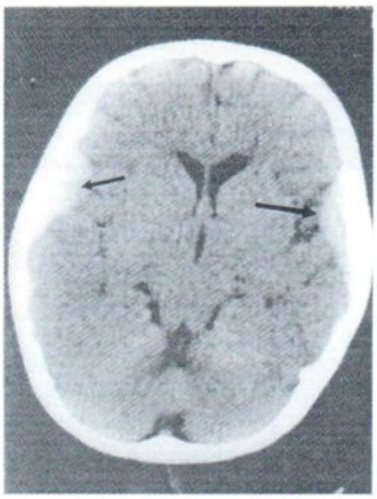


Fig. A NC.CT.

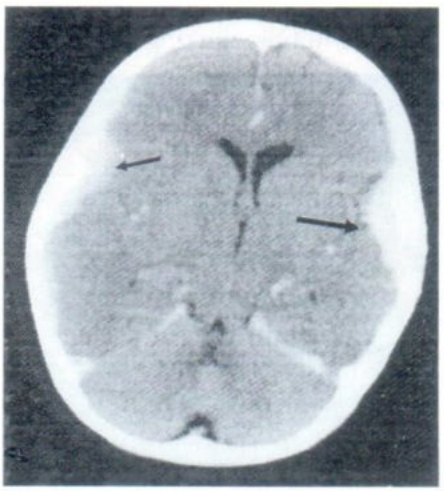


Fig. A CE.CT.

CATEGORY VII: Retinoblastoma

Clinical: Boy, 2 years old, known case of Retinoblastoma. After enucleating of Rt. eye. White arrow at the retina left eye, showing the mass. This is a case of bilateral Retinoblastoma occuring one after the other verifying a genetic cause.

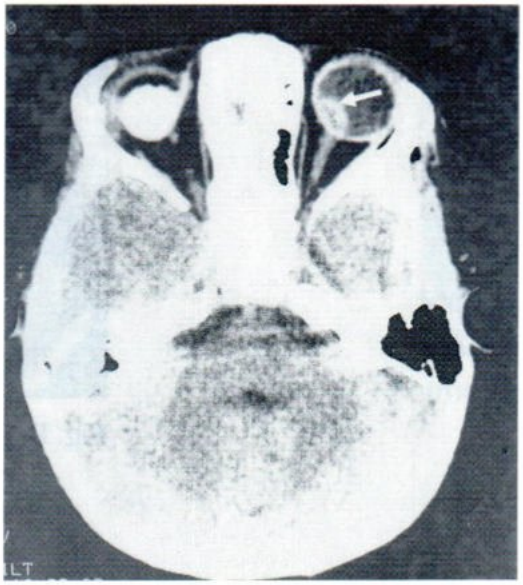


Fig. A White arrow Lt. eye showing Retinoblastoma occuring after enucleation of Rt. eye.

CATEGORY VIII: Brain metastases: CA. Thyroid.

Clinical: Female, age 53 years known case of CA. Thyroid, headache, vomiting.

Fig. A NC.CT. show ill-defined masses in both cerebral hemispheres.

Fig. B CE.CT. Multiple rim ring enhancing masses in both cerebral hemispheres (white arrows)

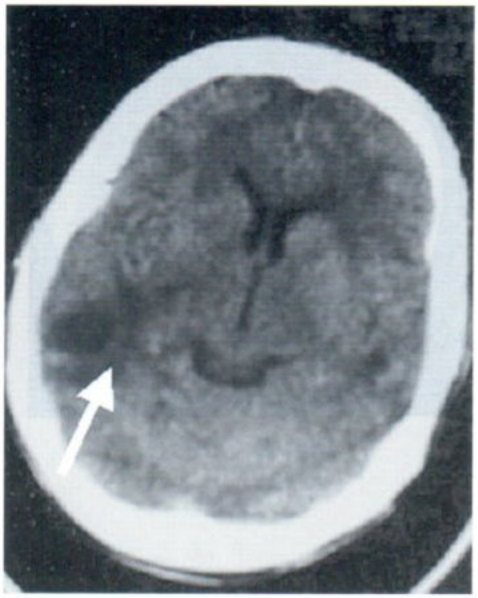


Fig. A NC.CT.

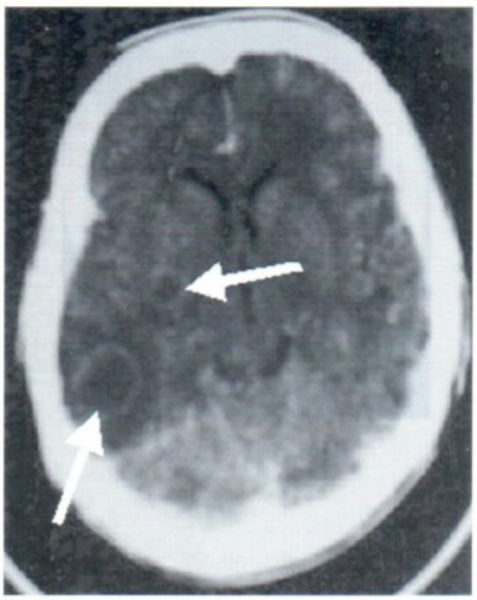


Fig. A CE.CT.

CATEGORY IX: Brain metastasis. Bronchogenic CA. (BCA.)
Clinical: Male, age 73 years, known case of Bronchogenic CA, headache, vomiting, somnolence.
Fig. A NC.CT.
Fig. B CE.CT
Enhancing mass, Haemorrhage in right frontal lobe, compressing and obstructing anterior horn of right ventricle making dilatation of anterior horn right side.

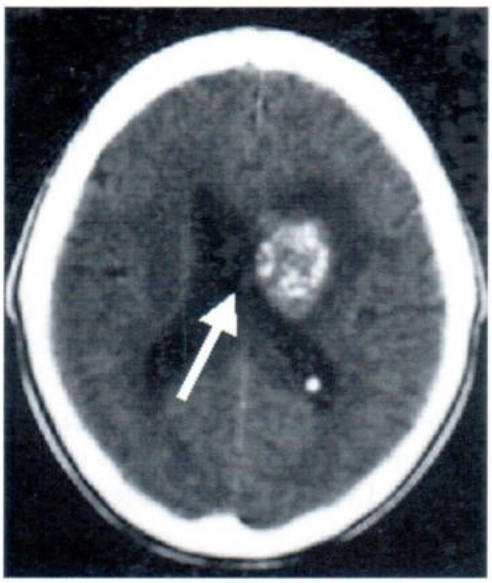


Fig. A NC.CT.

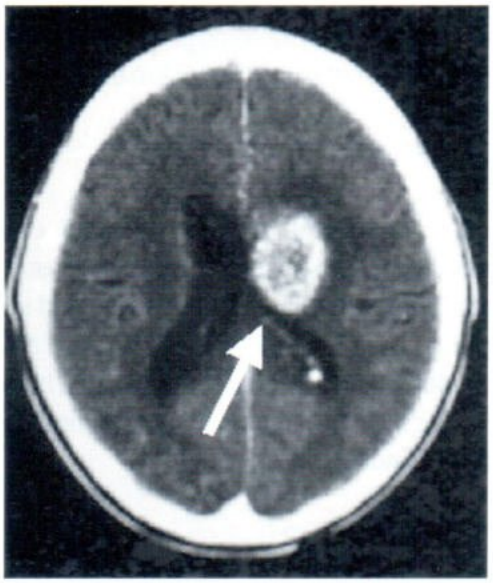


Fig. B CE.CT.

DISCUSSION

There are many kinds of classification of brain tumours in different text books and journals which are rather confusing. In this report we are reporting cases of brain tumours commonly found in Srinakarin Hospital and Medical School, Khon Kaen University, Khon Kaen, Thailand in the past 30 years.

In our Faculty of Medicine, Khon Kaen University Hospital, we have been using the International Classification base on the normal anatomical structures of human structures of Nervous System from the meningies, to the brain tissues, to the ventricles. All the normal contents of the brain tissues can be become a tumour which may be benign or malignant. All kinds of cell composition in the brain including the embryonal cell rest can become tumors and do the seedling along the cranio-spinal and the central nervous system via the CSF. around and inside the CNS. by the central canal of spinal cord and ventricles of brain in the skull. As in other systems of human body, brain tumors are divided into two big groups i.e, primary tumors and metastatic tumors. The primary tumors have the tumor cells originated from the varieties of normal cells of the brain contents, such as the meninges, the glia cells, the embryonal cells rest such as the pineal, the choroid plexus cells, the medulloblast, the ependymal cells, and the white blood cells in the CSF. causing leukaemia. The wall of blood vessels cells may cause tumors called haemangioendothelioma and haemangiopericytoma. The pituitary cells, A, B, C, also cause both hormones producing and hormone non-producing tumors. Making many different trophic symptoms in both male and female victims. The macro-adenoma may also cause pressure symptoms on the

adjacent cells and nerves causing deprivation of hormones if the surrounding cells are the hormones producing cells. If the adjacent structures are cranial nerve, it will cause dysfunction or non-function of the cranial nerve or nerves, detectable clinically by non-functioning of the cranial nerves which had been pressed by the tumors or tumors. Metastatic tumors in the brain may cause symptoms produced by both the primary and the metastatic tumors in the brain.

CONCLUSION

CT. and MRI. with or without contrast enhancement may be used either both or one after the other. This paper had demonstrated and studied the findings of CT. and MRI. of all these patients together with the laboratory blood chemistry, hormonal assay findings in correlation with clinical findings and pathological findings.

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