Cerebral Intraventricular Neoplasms

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Case History

- 25 year-old female

Presenting complaint

- Left-sided headache two days duration with one episode of vomiting seven days earlier (August 2009)
- No other significant history

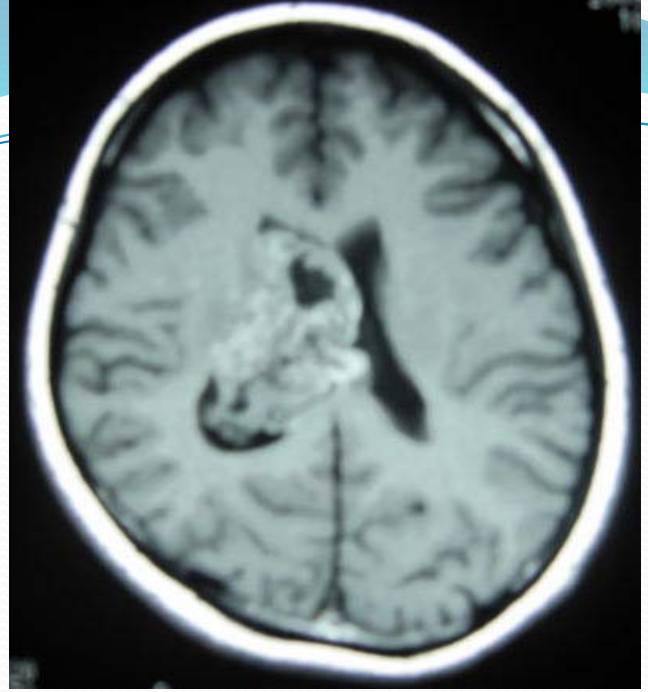
Examination findings

- Physical examination normal
- No focal neurological signs

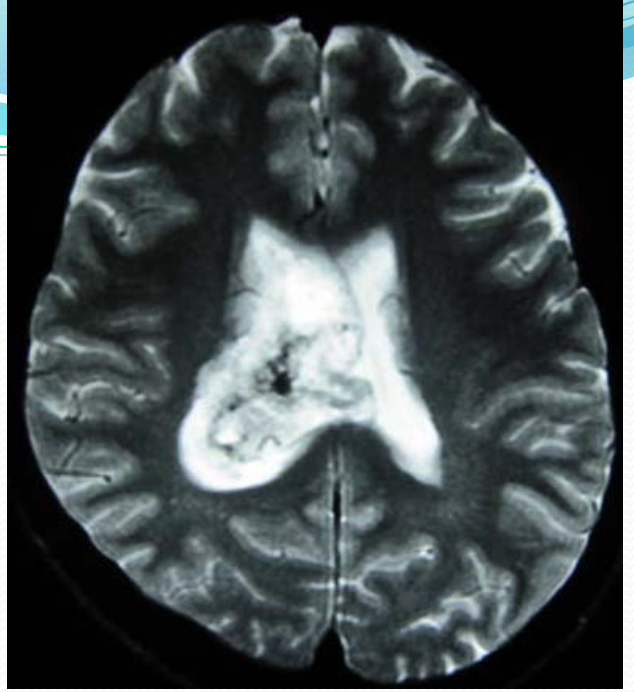
Investigations

- Lab data (May 2009) Hb 10.6g/dl, haematocrit 31.8%
- MRI (August 2009)

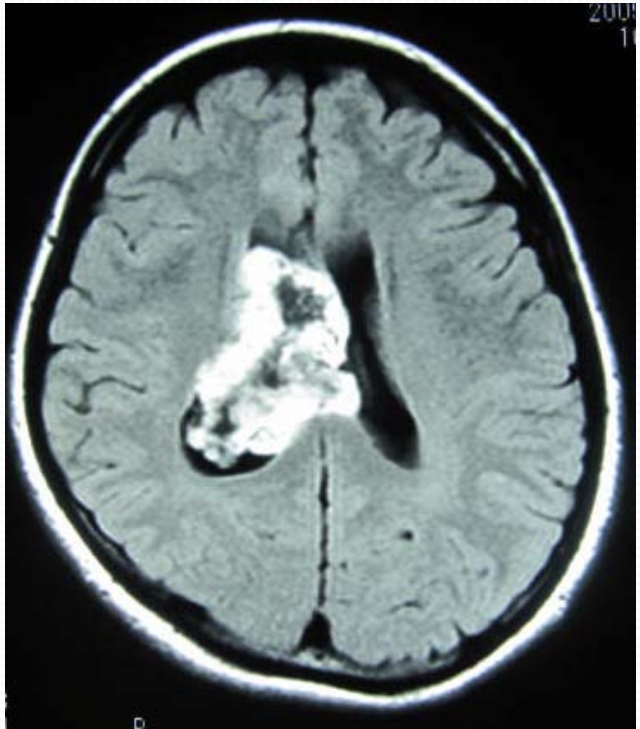
T1WI



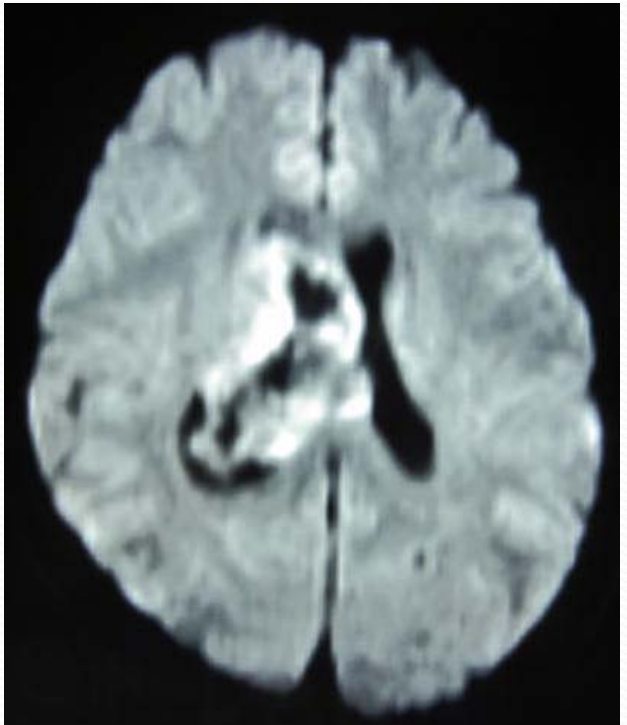
T2WI
Fat Saturation



FLAIR



Diffusion
weighted image



Diagnosis

- Patient returned to Osaka for treatment, therefore follow-up not possible
- Central neurocytoma most likely diagnosis

Cerebral intraventricular neoplasms

- Cerebral intraventricular neoplasms are a rare but important group of neoplasms

- They arise from periventricular structures such as the walls of the ventricular system, the septum pellucidum and the choroid plexus

Differential diagnosis

Ventricular wall and septum pellucidum	Choroid plexus	Other neoplasms	Non-neoplastic lesions
•Ependymoma •Subependymoma •Central neurocytoma •Subependymal giant cell astrocytoma	•Papilloma •Carcinoma	•Meningioma •Metastasis •Oligodendroglioma •Pilocytic astrocytoma •Glioblastoma multiforme •Lymphoma •Medulloblastoma •Primitive neuroectodermal tumour •Sarcoma •Teratoma	•Colloid cysts •Neurocysticercosis •Hydatid cyst •Tuberculoma

Most common lesions

Ventricular wall and septum pellucidum	Choroid plexus	Other neoplasms	Non-neoplastic lesions
•Ependymoma •Subependymoma •Central neurocytoma •Subependymal giant cell astrocytoma	•Papilloma •Carcinoma	•Meningioma •Metastasis •Oligodendroglioma •Pilocytic astrocytoma •Glioblastoma multiforme •Lymphoma •Medulloblastoma •Primitive neuroectodermal tumour •Sarcoma •Teratoma	•Colloid cysts •Neurocysticercosis •Hydatid cyst •Tuberculoma

Ependymoma

- Common neoplasms
- Arise from differentiated ependymal cells
- Well-circumscribed lesions
- Fill ventricular lumen and may extend into brain
- Mean age 6yrs (4^{th} ventricle tumours), 18-24yrs for supratentorial lesions
- Histology shows rare mitotic figures, perivascular pseudorosettes and ependymal rosettes

Ependymoma radiological findings

CT appearance:

- Usually isoattenuated
- Calcification in 40-80% of lesions
- Enhancement usually intense but variable

MRI appearance:

- Usually heterogeneous
- Isointense on T1WI
- Hyperintense on T2WI

Ependymoma in a 16-month-old child. A: Axial CT image shows 4th ventricular mass, slightly hyperattenuated compared with surrounding cerebellum. Focal calcification (arrow) is noted. **B:** Axial T1W MR image shows the mildly heterogeneous mass, slightly hypointense compared with the cerebellum. (AFIP, 2002, 22: 1473-1505)

C.

D.

C: Axial T2 W MR Image. The mass is hyperintense compared with the cerebellum. **D:** Contrast-enhanced axial T1 W MR image. Mass shows intense heterogeneous enhancement. (AFIP, 2002, 22: 1473-1505).

Subependymoma

- Arise from subependymal glial cells
- More common in males
- Most cases >15yrs old
- Well circumscribed lesions
- Histology shows a dense fibrillary matrix interrupted by numerous small cysts and nests of isomorphic nuclei that resemble subependymal glia

Subependymoma radiological findings

CT appearance:

- Iso- to hypoattenuated
- Hydrocephalus in 85% of cases
- Calcification in 31% of cases
- Focal enhancement

MRI appearance:

- Hypointense on T1WI
- Hyperintense on T2WI
- Variable enhancement

A.

B.

Subependymoma in a 53-year-old man. A: Axial CT image shows a right frontal horn mass that is predominantly isoattenuated compared with the brain parenchyma. Calcification (arrow) is seen. **B:** Axial T1W MR image shows isointensity within the mass, compared with the white matter. (AFIP, 2002, 22: 1473-1505).

C.

D.

C: Axial T2 W MR image shows heterogeneous hyperintensity within the mass.
D: Contrast-enhanced axial T1 W MR image shows scattered heterogeneous enhancement within the mass. (AFIP, 2002, 22: 1473-1505).

Central neurocytoma

- Arise from septum pellucidum or ventricular wall
- 50% found in the lateral ventricles
- Most commonly present from 20-40yrs of age
- Tumours are typically friable, often containing calcification or haemorrhage
- Histology shows round cells having round or oval nuclei

Central neurocytoma radiological findings

CT appearance:

- Hyperattenuated
- Many small cyst-like areas
- Calcification in 50% of cases

MRI appearance:

- Hyperintense on T1WI
- Solid portions hypointense and cysts hyperintense on T2WI

A.

B.

Central Neurocytoma. A: Axial CT image shows a hyperattenuated mass with focal calcification (arrowhead) centred near the Foramen of Monro. **B:** Axial T1 W MR image shows mild heterogeneity within the mass. The septum pellucidum is displaced toward the contralateral side and the ipsilateral ventricle is clearly enlarged. (AFIP, 2002, 22: 1473-1505).

C. **D.**

C: Coronal T2 W MR image. The mass shows a heterogeneous appearance. **D:** Contrast-enhanced coronal T 1W MR image shows patchy enhancement within the mass. (AFIP, 2002, 22: 1473-1505).

E.

E: Intra-operative photograph shows the mass at the depths of the retractors (r). (AFIP, 2002, 22: 1473-1505).

Subependymal giant cell astrocytoma

- Arise in lateral ventricle near foramen of Monro
- Occasionally extend into 3rd ventricle
- Associated with tuberous sclerosis
- Mean age 11yrs
- Histology shows a mixed glioneuronal pattern with a low proliferative index, corresponding to slow growth

Subependymal giant cell astrocytoma radiological findings

CT appearance:

- Calcified nodule near foramen of Monro
- Intense enhancement

MRI appearance:

- Hypointense on T1WI
- Heterogeneously hyperintense on T2WI

A.

B.

Subependymal giant cell astrocytoma in a 16-year-old boy. A: Axial T1 W MR image shows bilateral masses (arrows) near the foramen of Monro. The masses are slightly hypointense compared with the white matter. **B:** Axial T2 W MR image. The masses are slightly hyperintense compared with the white matter. (AFIP, 2002, 22: 1473-1505).

C.

C: Contrast-enhanced axial T1 W MR image shows intense enhancement of both masses. (AFIP, 2002, 22: 1473-1505).

Choroid plexus papilloma

- 50% occur in lateral ventricle, 40% in 4th ventricle, 5% in 3rd ventricle
- 5% occur in more than one location
- Lateral ventricle tumours more common <10yrs
- 4th ventricle tumours evenly distributed among patients 0-50yrs
- Histology shows fibrovascular connective tissue surrounded by columnar cells without significant mitotic activity

Choroid plexus papilloma radiological findings

CT appearance:

- Iso- to hyperattenuated, lobulated mass typically centred in atria of lateral ventricle
- Calcification in 24% of cases
- Intense enhancement

MRI appearance:

- Iso- to hypointense on T1WI
- Variably hyperintense on T2WI

A.

B.

Choroid plexus papilloma in a 34-year-old man. A: Axial CT image shows a heterogeneous, partially calcified soft-tissue mass within the 4th ventricle. **B:** Coronal T1 W MR image shows the heterogeneous mass, which is slightly hypointense compared with the cerebellum. (AFIP, 2002, 22: 1473-1505).

C.

D.

C: Axial T2 W MR image. The mass is heterogeneously hyperintense compared with the cerebellum. **D:** Contrast-enhanced axial T1 W MR image. The mass shows intense, near homogeneous enhancement. (AFIP, 2002, 22: 1473-1505).

E.

E: Intra-operative photograph shows the lobulated vascular mass. Findings from the histological examination confirmed a choroid plexus papilloma. (AFIP, 2002, 22: 1473-1505).

Intraventricular meningioma

- Rare: only 0.7% of all meningiomas
- Peak age 30-60yrs
- More common in females
- Trigone of lateral ventricle most common site
- May arise in 3rd or very rarely 4th ventricle
- Arises from arachnoidal cap cells trapped within choroid plexus, tela choroidea, or velum interpositum

Intraventricular meningioma radiological findings

CT appearance:

- Hyperattenuated atrial mass
- Calcification in 50% of cases
- Intense enhancement

MRI appearance:

- Iso- to hypointense on T1WI
- Iso- to hyperintense on T2WI
- Intense enhancement

A.

B.

Intraventricular meningioma in a 16-year-old girl. A: Axial T2 W FLAIR image shows a lobulated, hypointense mass (arrow) within the atrium of the right lateral ventricle. **B:** Contrast-enhanced axial T1 W MR image shows intense enhancement of the mass. (AFIP, 2002, 22: 1473-1505).

C.

C: Photograph of the resected specimen shows lobulated morphology. (AFIP, 2002, 22: 1473-1505).

Summary

Tumour	Patient age	CT appearance	MRI appearance
Ependymoma	6yrs (4th ventricle) 18-24yrs (supratentorial lesions)	Isoattenuated; calcification in 40-80%; enhancement intense	Heterogeneous; T1WI-isointense; T2WI-hyperintense
Subependymoma	82% >15yrs	Iso- to hypoattenuated; hydrocephalus in 85%; focal enhancement	T1WI-hypointense; T2WI-hyperintense; variable enhancement
Central neurocytoma	20-40yrs most common	Hyperattenuated; many small cyst-like areas; calcification in 50%	T1WI-hyperintense; T2WI-solid portions hypointense, and cysts hyperintense
Subependymal giant cell astrocytoma	Children	Calcified nodule near foramen of Monro; intense enhancement	T1WI-hypointense; T2WI-heterogeneously hyperintense
Choroid plexus papilloma	50%<10yrs (lat.ventricle); 0-50yrs (4th ventricle)	Iso- to hyperattenuated; lobulated mass; calcification in 24%; intense enhancement	T1WI- iso- to hypointense; T2WI-variably hyperintense
Intraventricular meningioma	Adults 30-60yrs most common	Hyperattenuated atrial mass; calcification in 50%; intense enhancement	T1WI- iso- to hypointense; T2WI- iso- to hyperintense; intense enhancement

Conclusion

- Case presented of a 25 year-old female with a probable diagnosis of central neurocytoma
- Central neurocytoma is one of a large number of differential diagnoses for cerebral intraventricular neoplasms
- Using clinical, demographic and imaging findings it is possible to limit the differential diagnosis for the most common intraventricular neoplasms