Advanced MRI features of tumours associated to drug resistant epilepsy.

Poster No.: C-1891
Congress: ECR 2015
Type: Educational Exhibit
Authors: N. Bargalló Alabart, D. Vas, M. Warner, M. Carreño, X. Setoain, J. Rumià, S. Capurro; Barcelona/ES
Keywords: PET, MR-Diffusion/Perfusion, MR, Neuroradiology brain, Diagnostic procedure, Neoplasia, Seizure disorders
DOI: 10.1594/ecr2015/C-1891

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method ist strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

-To describe the most common types of brain tumours that causes untractable epilepsy.

-To describe the conventional and advances MR features of these tumours in order to know them and to differentiate from other fast-growing, malignant tumours.

-To learn the PET and SPECT patterns of these tumours.
Background

Some brain tumours can cause seizures during many years. Generally, they are slow grade benign tumours; however distinction with more aggressive types of tumours is sometimes difficult. Surgical resection of the tumour is the treatment of choice, however, the risk of severe neurological and neuropsychological deficits are usually high, especially if they are located in the left temporal lobe. There is a wide spectrum of different histological types of tumours that can be grouped in two: glial tumours and glioneural tumours.
Findings and procedure details

A retrospective revision of 851 patients studied in our institution for drug resistant epilepsy during the last 9 years has been performed. Fifty six patients had a tumour in the MRI. Fourteen of those patients underwent surgery and the majority of the other patients have been followed during an interval period of more than two years.

Location of the tumour, conventional MRI features such as signal abnormalities and enhancements, CT appearance, MRS, ASL, DCE, DTI and SWI and PET and SPECT findings will be described.

The most common tumours that will be described are ganglioglioma glio-neuro-capilar hamartoma, DNET, angiogenic glioma and pleomorphic xanthoastrocytoma.

Of the 57 epileptic patients which have a tumour, the most common location was temporal lobe (49/65; 74%), 3 were frontal, 3 were parietal, 1 was occipital and one was in the hypothalamus. Thirty three were located in the left hemisphere and 22 in the right hemisphere. Of the tumours located in the temporal lobe 17/48 were circumscribed in the amygdale and hippocampus while the others involves also white mater and neocortex.

Fourteen patients underwent surgery and the histology was gangliogliomas or gangliocitomas in 5 patients, 1, diffuse glioma, 2 DNET, 1 pleomorphic xanthoastrocytoma, 2 hamartomas. and 3 oligodendroglioma.

Gangliogliomas.

They are uncommon tumours accounting for 0.4 to 0.9% of all intracranial neoplasm. They are composed by mature neuronal and glial neoplastic cells. Although they can occur in any part of the brain, most common site are the temporal lobes.

Image findings:

The appearances are non specific, but most commonly they are solid or cystic-solid tumours, althought they can be completely cystic. Calcifications and contrast enhancement are not uncommon (around 50%). Perilesional oedema has been described but is not frequently associated. In the temporal lobe, they are usually not well defined. (1)
There are few cases reported with MMRS, and they usually showed reduced Cho/Cr and Naa/Cr and increased Cho/Naa ratios. The rCBV/ rCBF usually are decreased or normal in these tumours in PWI.

They commonly show hypoperfusion in interictal HMPAO-SPECT and hypometabolism in PET. However, recently Yeom et al, describe increased hyperperfusion in ASL in 5/6 gangliogliomas (2). (Figures 1-4)

**Dysembryoplastic neruopethelial tumours (DNET)**

Dysembryoplastic neruopethelial tumours (DNET) are slow growing and benign tumours, that are commonly related to intractrable epilepsy. Typically are centred in the cortical gray matter and in 80% of cases are associated to cortical dysplasia. Histologically DNET is composed of multiple nodules containing both neuronal and glial components that are located in a mixoid or dense neurofibrillary matrix. The temporal lobe is the most common site (62%) followed by frontal lobe (3).

**Image findings:**

They are non specific but usually they are cortical masses with hypointense signal on T1 and hyperintese signal on T2. Usually are multilobulated and multicystic. The cysts usually appear hyperintense in FLAIR, producing a soap-buble appearances A FLAIR hyperintense rim sign has been described in these tumours, as a thin rim of well defined hyperintenseity at the borders of the DNET separating it from the surrounding normal brain. Calcification, focal contrast enhancement (20-33%), scalloping of the overlying bone and perilesional oedema has been described in these tumours. (Figure 5 and 6) (4).

**Cerebral Hamartomas.**

Cerebral hamartomas are defined as lesions composed of disorganized but mature cells, mostly a combination of neural or ganglion cells, glial cells and blood vessels. They are a rare cause of intractable epilepsy and represent between 2.8 to 3.2% of all patients operated on for epilepsy. They most common location described is the temporal lobe, especially in the mesial structures.

**Image findings:**

The MR imaging findings are not well defined but again the MRI findings are non-specific.
In a series of 10 patients described by Diehl et al. all the patients has high signal in T2WI, while in T1, 6 were isointense to gray matter, while 2 were hyperintense and 2 hypointense. Gadolinium enhancement was seen in 2 patients (20%) and cystic component was present in 2 patients. Fifty per cent of them appear with mass effect. Neocortical involvement and gray matter blurring was also observed in 8 of the 10 cases described (5). (Figure 7 and 8).

**Pleomorphic xanthoastrocytoma**

Pleomorphic xanthoastrocytoma (PXA) is a rare tumour which has a particular immunohistochemical marker essential for the diagnosis consisting in the demonstration of glial fibrillary acidic protein (GFAP). It has been reported typically in children and young adults almost 70% under 30 years of age, and usually they present intractable epilepsy. They usually involve the temporal lobe (more than 50%)(6).

*Image findings:*

These tumours are often superficial with leptomeningeal extension; however leptomeningeal enhancement is not so often seen. Patterns of presentation are nonspecific, with solid, mixed cystic-solid or cystic appearances. Calcification can be presents (24%) and usually they enhanced intensely after contrast administration. The enhancement can be seen in the solid part of the tumour, but most frequently is a mural nodule inside a cyst (70%). Remodelling of the adjacent calvarium has been also described related to the slow growth of this superficial lesion. (Figure 9)

**Diffuse low grade glioma:**

Diffuse infiltrative gliomas are the most common primary tumour in adults. Hystopatologically, there are divided as astrocytic, oligondedroglial or astrocytic. In epilepsy patients, low grade glioma are the most frequent type of tumour observed in pathologic series. They are typically present in young adults.

*Image findings:*

They are usually hyperintense in T2 and iso or hyperintense in T1. Characteristically and in difference of gangliogliomas or DNET, they usually follow the white matter distribution, and cause expansion of the cortex. They usually have increased diffusibility in DWI, and usually they not enhance after contrast administration. Calcification are rare but can occur in oligodendroglomas. PWI and MRS are not helpful to differentiate to ganglogliomas, or DNET, although the Naa is usually little lower in these tumours than ganliolgliomas.
They are two type of tumors that are cortical based: oligodendroglioma and angiocentric glioma. (Figure 10)

Other causes mimicking tumours: status epilepticus.

In some patients with status epilepticus or recent seizures, lesions detected by MRI can mimic tumours and sometimes is very difficult to differentiate and follow up is determinant for the diagnosis. (Figure 11 and 12)
Fig. 1: Cystic-solid ganglioglioma in the right hippocampus, with nodule enhancement after gadolinium administration.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
Fig. 2: Multicystic and solid ganglioglioma of the left hippocampus, showing contrast enhancement and calcification. Ictal HMPAO-SPECT shows ictal hyperperfusion of the left hemisphere.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
**Fig. 3:** Small solid ganglioglioma in the left superior temporal gyrus. Note is made with marked CVF of the lesion in ASL sequences and marked hyper metabolism in PET.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
Fig. 4: Cystic ganglioglioma in the left frontal inferior gyrus. Note is made with peripheral hemosiderine, enhancing of the capsule and marked Mioinositol and lipid and lactate picks in the MRS.
Fig. 5: Soap-bubble appearances of the left DNET located in the left medial frontal gyrus. Note is made with the heterogeneity of the signal in FLAIR and bone scalloping.
Fig. 6: Left amygdale DNET, again with heterogeneity signal in FALIR, non enhancement after contras administration and mild elevated Cholina in MRS

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
**Fig. 7:** Right parahipocampal complex lesion, with calcification and cystic component, corresponding to a glio-neural hamartoma.
**Fig. 8:** Hamartoma in the left amygdale.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES

**Fig. 9:** Complex cystic and solid lesion in the left temporal pole corresponding to pleomorphic xanthoastrocytoma with an enhancing nodule, which appears with mild increased CBF in ASL and high mioinositol and lipid compound picks in MRS.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
Fig. 10: Diffuse low grade glioma which appears as a non well defined lesions involving the white matter, without enhancing, normal CVB in PWI and moderate low Naa pick in MRS.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
**Fig. 11:** Enlarged and hyperintense left amygdale, with a lineal enhancement and high signal in DWI and ADC map, in a patient with status epilepticus.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
Fig. 12: The same patient after 6 month follow up. The lesion has reduced in size and hippocampal sclerosis is noticed.

© NEURORADIOLOGY, HOSPITAL CLINIC I PROVINCIAL DE BARCELONA - Barcelona/ES
Conclusion

Tumours causing epilepsy are usually low growing tumour. However sometimes it is difficult to distinguish them from malignant tumours. To know features in the conventional and advanced MRI techniques could help in the differentiation and make the radiologist more confident about the clinical impression.
References

1- Intracranial ganglioglioma: clinicopathological and MRI findings in 16 patients
Clinical Radiology vol. 63 (1) p. 80-91


5- Hamartomas and epilepsy: clinical and imaging characteristics