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Association of different uncus lesions on magnetic resonance imaging with epilepsy

Manyetik rezonans görüntülemede saptanan farklı unkus lezyonlarının epilepsi ile ilişkisi

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SUMMARY

Objective: Uncus is the hook-like most anteromedial portion of the parahippocampal gyrus and is a part of the limbic system. It is the only gyrus, together with the amygdala, that contains nuclei and is associated with seizures accompanied by olfactory hallucinations. The aim of this study is to examine the relationship between different uncus lesions detected by magnetic resonance imaging (MRI) and epilepsy/seizures.

Method: 33 patients with unilateral or bilateral uncus lesions on MRI obtained between March 2008 through May 2014 were enrolled in the study. MR images and clinical charts of patients were retrospectively investigated for MRI findings and presence of epilepsy/seizures.

Results: Bilateral uncus involvement was observed in herpes encephalitis (n=5), autoimmune limbic encephalitis (n=2), mesial temporal sclerosis (n=3), metastasis (n=1) and Rasmussen encephalitis (n=1), whereas unilateral involvement of the uncus was seen in glial tumors (n=4), metastases (n=4), mesial temporal sclerosis (n=4), cavernous angioma (n=2), dysembryoplastic neuroepithelial tumor (DNET, n=5), herpes encephalitis (n=1), and autoimmune limbic encephalitis (n=1). Epilepsy/seizures were present in two-thirds of patients. However, none of the 5 patients with a metastatic uncus lesion showed epilepsy/seizures.

Conclusions: Many uncus pathologies can be detected by MRI and most of them are associated with epilepsy.

Keywords: Epilepsy, Hippocampus; Magnetic resonance imaging; Uncus; Uncinate gyrus

ÖZET

Amaç: Parahipokampal girusun çengel şeklindeki anteromedial kısmı olan unkus, limbik sistemin bir parçasıdır. Amigdala ile birlikte nükleus içeren tek girus parçası olup olfaktör halüsinasyonların eşlik ettiği epilepsiler ile ilişkilidir. Bu çalışmada manyetik rezonans görüntüleme (MRG) ile saptanan farklı unkus lezyonlarının klinik olarak epilepsi ile ilişkileri araştırılmıştır.

Yöntem: Mart 2008- Mayıs 2014 tarihleri arasında kranial MRG'de tek taraflı ya da iki taraflı unkus lezyonu saptanan 33 hastanın lezyonları ve dosyaları retrospektif olarak incelendi. Klinik olarak epilepsi/nöbet varlığı ve MR bulguları ile ilişkisi değerlendirildi.

Bulgular: Çalışmaya alınan 33 hastanın 12'sinde (%36) iki taraflı, 21'inde (%64) tek taraflı unkal lezyon vardı. Herpes ensefaliti (n=5), otoimmün limbik ensefalit (n=2), mezial temporal skleroz (n=3), metastaz (n=1) ve Rasmussen ensefaliti (n=1) bilateral tutulum yaparken, glial tümör (n=4), metastaz (n=4), mezial temporal skleroz (n=4), kavernöz anjiom (n=2), disembrioplastik nöroepitelyal tümör (n=5), herpes ensefaliti (n=1) otoimmün limbik ensefalit (n=1) ise tek taraflı unkal lezyonlara neden olmuştu. Hastaların 2/3'ünde epilepsi/nöbet mevcuttu, ancak unkus metastazı olan 5 hastada epilepsi/nöbet görülmedi.

Sonuç: MRG ile unkus tutulumu yapan pek çok değişik patoloji saptanmakta olup unkus lezyonlarının büyük bölümü epilepsi ile ilişkilidir.

Anahtar sözcükler: Epilepsi; Hipokampus; Manyetik rezonans görüntüleme; Unkus; Unsinat girus

INTRODUCTION

The hippocampus is the inferomedial part of the temporal lobe of brain which is responsible for the memory and emotional functions, spatial orientation and learning[1,2]. Uncus, also called the uncinate gyrus, is the most medial part of the parahippocampal gyrus and it is the connection between the medial hippocampus and the amygdala. It is a part of the limbic system which is primarily responsible for the emotional functions[3,4]. It also involves the olfactory cortex and is responsible for seizures with olfactory or gustatory hallucinations[5,6]. Another major clinical consequence related to uncus is herniation in a case of a space-occupying lesion, especially located in the middle cranial fossa[7].

On MRI normal uncus has a somewhat lower signal on T1- and a higher signal on T2-weighted images compared to the other parts of the brain. This may lead to wrong interpretation of bilateral hyperintensities as pathologic, or conversely, bilateral diffuse lesions may sometimes be overlooked radiologically if the observer is unfamiliar with this normal appearance of the uncus. On the other hand, unilateral lesions are relatively easy to depict although they may clinically be silent. Many intracranial pathologies may affect uncus and most of them are diagnosed radiologically with MRI. The aim of this study is to assess the relationship of different uncus lesions detected with MRI with seizures.

MATERIAL AND METHODS

Patient selection

This study was approved by the institutional ethics committee. Clinical data and radiologic images of patients with uncus lesions on MRI between 2008 and 2014 were retrospectively analyzed. Patients with infarction, tumors occupying a large area including the uncus such as GBM or lymphoma, widespread diseases such as confluent ischemic brain lesions and diffuse atrophy including Alzheimer's disease were excluded to eliminate the bias on whether the clinical signs and symptoms were related to uncus lesions or other parts of the brain involved in these disease states. Patients with MR images of low quality, such as motion or metallic susceptibility artifacts, were also excluded. A total of 33 patients with unilateral or bilateral involvement of the uncus on MRI were examined for the radiological and clinical findings.

Image Acquisition and Data Analysis

The MRI examinations were done with two 1.5 Tesla MRI units (Magnetom Aera, Siemens, Erlangen, Germany and

Excelart Pianissimo, Toshiba, Tokyo, Japan) using 20-channel phased array head coil and standard head coil, respectively. Diffusion-weighted images were acquired using echo planar imaging (EPI) sequences. The parameters used for image acquisition by each MR device (Siemens and Toshiba, respectively) were as follows: axial and sagittal T1-weighted spin echo (SE) (TR: 520 and 550 ms; TE: 5.6 and 15 ms; FA: 150° and 70/180°; NEX: 3 and 1.2; FOV: 220×84 and 220×180 mm; matrix: 256×100 and 256×160; slice thickness: 5 and 5 mm; interslice gap: 1.7 and 1 mm); axial and coronal, T2-weighted fast SE (TR: 4400 and 5000 ms; TE: 102and 94 ms; FA: 150° and 90/180°; NEX: 2 and 2; FOV: 220×97 and 220×180 mm; matrix: 320×90 and 320×224; slice thickness: 5 and 5 mm; interslice gap: 1.7 and 1 mm) and axial fluid-attenuated inversion recovery (FLAIR) (TR: 8000 and 7500 ms, TE: 86 and 94 ms, TI: 2384 and 2200 ms; FA: 150 and 90/160; NEX: 1 and 1; FOV: 220×97 and 220×180 mm; matrix: 256×100 and 256×160; slice thickness: 5 and 5 mm; interslice gap: 1.7 and 1 mm). In patients with known or suspected epilepsy, a T1-weighted FLAIR sequence in axial and coronal planes (TR: 5390 and 4800ms; TE: 15 and 18 ms; TI: 500 and 800ms; FA: 150° and 160°; NEX: 1 and 1.2; FOV: 200×100 and 220×180 mm; matrix: 256×100 and 256×160; slice thickness: 3 and 5 mm; interslice gap: 1.7 and 1 mm) and thin-section angled coronal T2-weighted/FLAIR images at right angles to the longitudinal axis of hippocampus were also included. Susceptibility-weighted images were also available in some of the MRI examinations. Axial and coronal T1-weighted intravenous contrast-enhanced images were obtained with a 0.1 mmol/kg intravenous paramagnetic agent (gadolinium-DTPA or gadodiamide) in patients with an indication for contrast administration, such as a tumor or an infection.

Brain MR images of the patients were evaluated to characterize uncus lesions. Bilateral and unilateral involvement were noted. In addition, the clinical charts of the patients included in the study were searched for the presence of seizures and these findings were correlated with the MRI findings. Chi-square test was used to assess the difference between laterality of lesions in terms of clinical findings. The significance level was set at $p<0.05$.

RESULTS

Fifteen (45.5 %) patients were male and 18 (54.5%) patients were female. The mean age of the subjects was 46.6 ± 20.0. Demographic, imaging and clinical findings are briefly summarized in Table 1.

Table 1. Demographic, clinical and imaging data of patients.

No	Age	Gender	Involvement	Diagnosis	Epilepsy/ seizures
1	26	Female	Unilateral	Mesial temp. scler.	+
2	31	Male	Unilateral	DNET	+
3	18	Female	Bilateral	Herpes encephalitis	+
4	34	Female	Bilateral	Limbic encephalitis	-
5	66	Female	Bilateral	Herpes encephalitis	+
6	49	Female	Unilateral	DNET	+
7	43	Male	Unilateral	Cavernoma	-
8	21	Female	Unilateral	Mesial temp. scler.	+
9	33	Female	Unilateral	Glial Tm	+
10	56	Male	Unilateral	Cavernoma	-
11	72	Female	Bilateral	Metastasis	-
12	18	Male	Unilateral	Limbic encephalitis	+
13	84	Female	Bilateral	Herpes encephalitis	-
14	69	Female	Unilateral	Glial tm	+
15	54	Female	Bilateral	Limbic encephalitis	-
16	53	Male	Unilateral	DNET	+
17	49	Female	Bilateral	Rasmussen encephalitis	+
18	43	Male	Unilateral	DNET	+
19	48	Male	Unilateral	Glial tm	+
20	53	Male	Unilateral	Metastasis	-
21	20	Male	Unilateral	Mesial Temp Scl.	+
22	33	Female	Unilateral	Metastasis	+
23	27	Female	Unilateral	Glial tm	+
24	58	Female	Unilateral	Mesial temp. scler.	+
25	32	Male	Bilateral	Herpes encephalitis	+
26	27	Male	Unilateral	Metastasis	-
27	59	Female	Bilateral	Mesial temp. scler.	-
28	73	Male	Unilateral	Herpes encephalitis	-
29	84	Male	Bilateral	Mesial temp. scler.	+
30	22	Male	Unilateral	DNET	+
31	78	Female	Bilateral	Herpes encephalitis	+
32	67	Female	Unilateral	Metastasis	-
33	38	Male	Bilateral	Mesial temp. scler.	+

Mesial temp. Scler. :Mesial temporal sclerosis, DNET: Dysembryoplastic neuroepithelial tumor

Twelve (36%) patients had bilateral, 21 (64%) patients had unilateral uncus involvement. Herpes encephalitis (n=5), autoimmune limbic encephalitis (n=2), mesial temporal sclerosis (n=3), metastasis (n=1) and Rasmussen encephalitis (n=1) caused bilateral uncus lesions. Unilateral involvement of the uncus was seen in glial tumors (n=4), metastases (n=4), mesial temporal sclerosis (n=4), cavernous angioma (n=2), dysembryoplastic neuroepithelial tumor (DNET, n=5), herpes encephalitis (n=1), and autoimmune limbic encephalitis (n=1) (Figs 1-6).

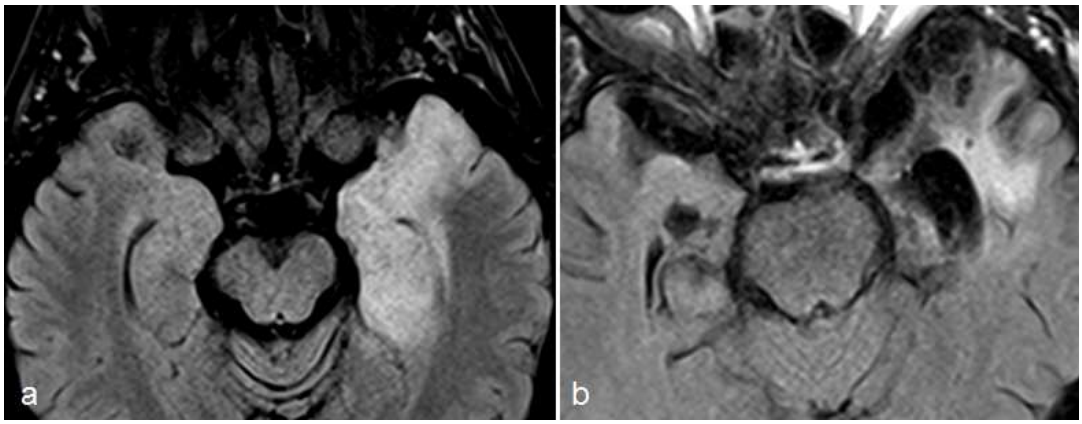

Figure 1. a. Herpes encephalitis mainly affecting the left uncus **b.** Bilateral sequelae of herpes encephalitis in the form of atrophy and gliosis.

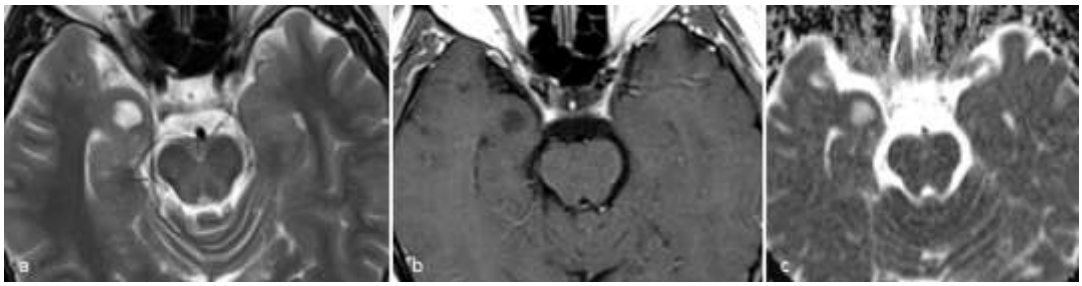

Figure 2. Axial T2-weighted (a), T1-weighted (b) images and apparent diffusion coefficient map (c) show a DNET in the right uncus.

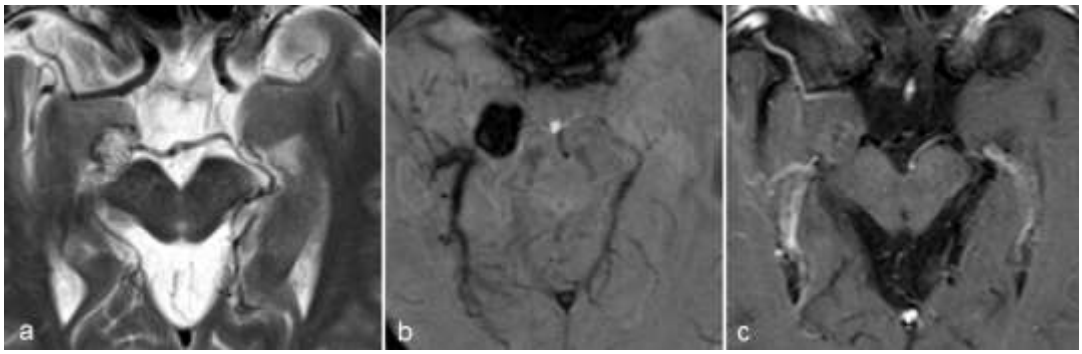

Figure 3. Axial T2-weighted (a), susceptibility-weighted and contrast-enhanced T1-weighted images reveal a cavernoma in the right uncus.

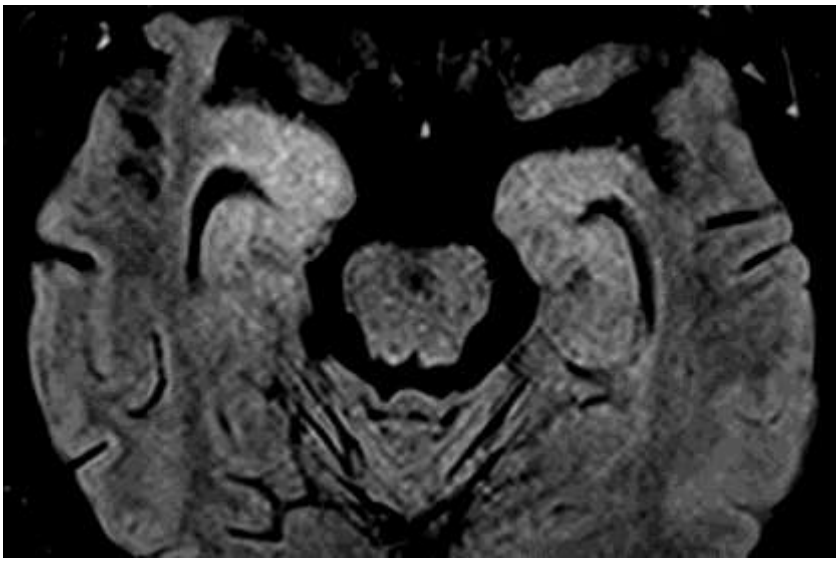

Figure 4. Axial FLAIR image shows autoimmune limbic encephalitis

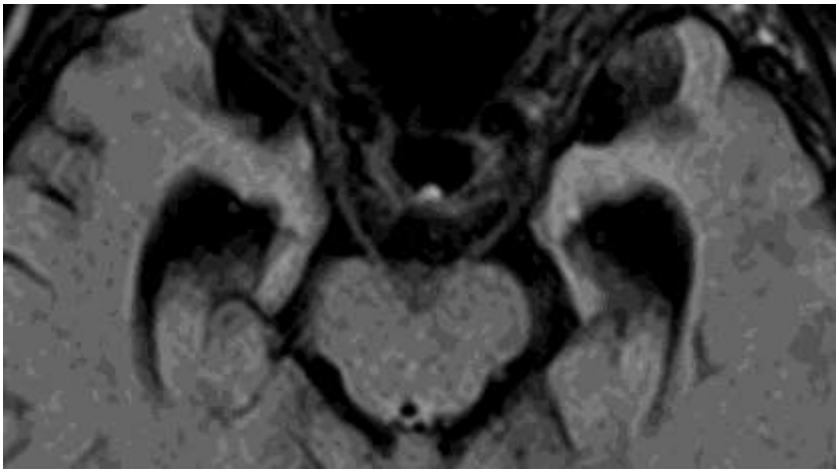

Figure 5. Bilateral mesial temporal sclerosis is seen in axial FLAIR image.

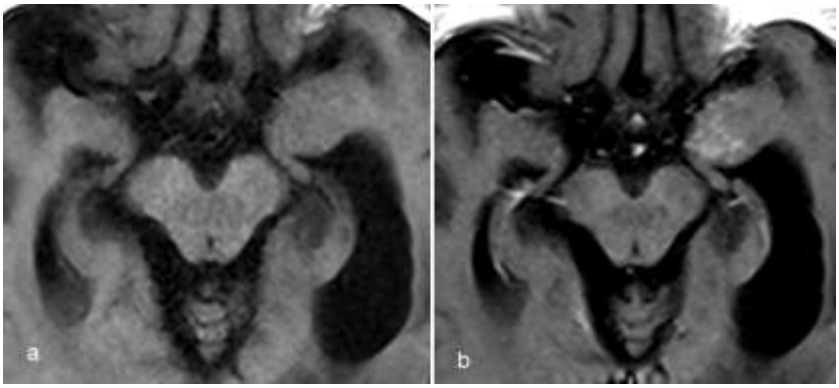

Figure 6. T1-weighted axial image (a) shows a Grade II astrocytoma on the left uncus which is more apparent after contrast administration (b).

Epilepsy/seizures were present in 22 (67%) of patients. There was no statistically significant difference between unilateral and bilateral uncus involvement in terms of occurrence of seizures (p=0,443).

DISCUSSION

Uncus is a part of the medial temporal lobe which has not been studied and understood well. Although hippocampus and epilepsy is still a hot topic, especially in terms of treatment of intractable epilepsy, relation of epilepsy with uncus lesions are not well-documented[8-12]. We think uncus is located in a very strategic point where the hippocampus, amygdala and parahippocampal gyrus meet. Thus, hypothetically, it may participate in many disease states other than known disorders of uncus such as olfactory dysfunction, cognitive impairment and seizures with olfactory and gustatory hallucinations[13,14].

Epilepsy/seizures were present in two-thirds of all patients although a very small number of patients were present in each subgroup of diagnosis. This result may suggest that MR examination should be done if seizures are seen in the adult age group to uncover the underlying etiology.

In only one of 33 patients, there was an olfactory hallucination accompanying seizures, although uncus is involved in all patients. Since medial temporal lobe structures are small and executed by each other, as in the case of hippocampus-uncus-amygdala complex, the lesion in the uncus was extending to adjacent temporal lobe structures in most cases. Although patients with lesions sitting with their largest portion in the uncus were enrolled in this study, that is, the lesion can easily be concluded to be an uncus lesion even at the first gaze, origin of the seizures may be the hippocampus and this may be the reason why most of the fits were not associated with olfactory or gustatory hallucinations.

Medial temporal lobe is a site of predilection for DNET, mesial temporal sclerosis and herpes encephalitis which are known to be highly associated with epilepsy[15,16]. The great majority of these patients (15 of 18 patients) in the current study are shown to experience epilepsy/seizures. Other glial tumors, named as 'limbic tumors' if located in the medial temporal lobe, showed a lower ratio of accompanying seizures[17].

Epilepsy is seen in 20-40% and is commonly the first presenting symptom in patients with brain metastases[18]. None of the five patients with a metastatic lesion in the uncus experienced epilepsy or any kind of seizures. Patient number is very small to conclude a negative association between metastases and seizures, however, this result may pave the way to a prospective trial to investigate the presence or absence of abnormal electrical discharges in patients with uncus metastases.

Some limitations of this study are that epilepsy and simple seizures were not evaluated separately and not in all patients it was possible to obtain the exact origin of the seizure activity, although we know that there was a lesion in the temporal lobe. Due to the retrospective design of the study, healthy controls were not enrolled.

Epilepsy/seizures are seen in the majority of uncus lesions, despite it remains to be investigated whether the abnormal electrical activity starts from the uncus or not.

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