

Case report

Non-lesional eating epilepsy with temporo-insular onset: A stereo-EEG study

Mubarak M. Aldosari^{a,b,*}, Holger Joswig^a, Ana Suller Marti^a, Andrew Parrent^a, Seyed M. Mirsattari^{a,c,d,e}^a Epilepsy Program, Department of Clinical Neurological Sciences, Western University, London, Ontario, Canada^b Epilepsy Program, National Neuroscience Institute, King Fahad Medical City, Riyadh, Saudi Arabia^c Department of Medical Biophysics, Western University, London, Ontario, Canada^d Department of Medical Imaging, Western University, London, Ontario, Canada^e Department of Psychology, Western University, London, Ontario, Canada

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ABSTRACT

Eating Epilepsy (EE) is a rare and often under-recognized form of reflex epilepsy, which manifests with seizures triggered during meals, with or without spontaneous seizures. The electro-clinical manifestations of EE are distinct with variable response to antiseizure drugs. We report the case of a 34-year-old man who was seen for a 4-year history of drug-resistant focal impaired awareness seizures associated with eating without a structural cause. Scalp video-EEG delineated a right temporal seizure focus with atypical features. Subsequent stereo-EEG revealed synchronized seizure onset from the right mesial temporal region and the right inferior insula. Resective surgery of the involved areas rendered this patient seizure-free with 3 years' follow-up. In non-lesional cases of drug-resistant EE, the epileptogenic zone can be large and deep, and therefore stereo-EEG was helpful in determining the seizure onset zone.

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1. Introduction

Reflex epilepsy is characterized by seizures that are triggered by internal or external stimuli. Based on the nature complexity of the trigger, the reflex epilepsies can be subdivided into simple and complex [1]. Eating epilepsy (EE) belongs to the complex reflex epilepsies and represents a heterogeneous electro-clinical syndrome [1–3]. The body of literature on EE consists mostly of a few case series with variable medical and surgical outcomes [3,4]. We present a case of non-lesional drug-resistant EE with excellent outcome from resective epilepsy surgery after an extensive pre-surgical investigation to identify of the seizure onset zone (SOZ).

2. Case

A 34-year-old, right-handed, otherwise healthy man of South Asian origin with no seizure risk factors was assessed for a 4-year history of drug-resistant epilepsy of focal onset with impaired awareness at London Health Sciences Centre Epilepsy Program. His seizure semiology consisted of a few seconds of a diffuse tingling sensation followed by loss of awareness with staring and right hand automatisms that lasted 1

to 2 min. Postictally, he was found to be unresponsive for 2 to 3 min. Interestingly, 90% of his seizures were observed to be induced by eating at the beginning of a meal. He only experienced 2 focal to bilateral tonic-clonic seizures. His neuropsychological testing was essentially normal.

The patient was first investigated in the epilepsy monitoring unit (EMU) with scalp video-EEG (Phase I) where independent bilateral temporal interictal epileptiform discharges (IEDs) were seen with a maximum frequency on the right side. Five eating-induced seizures were recorded immediately after initiation of eating with 2–3 Hz rhythmic activity over the right temporal region with perisylvian spreading (Fig. 1). Cranial magnetic resonance imaging (MRI) and fluorodeoxyglucose-positron emission tomography (PET) studies were normal.

Based on the working hypothesis of right perisylvian seizure onset, the patient underwent intracranial recordings with stereo-EEG (Phase II) to better delineate the SOZ. Sampling included the right temporal pole, amygdala, hippocampus, parietal operculum, temporal operculum and insula (Fig. 2A) according to our institutional operative protocol [5,6]. Frequent IEDs were seen mainly in the right anterior mesial temporal region and insula. Five seizures with typical semiology were captured immediately after initiation of eating, all of which had stereotypical electrographic onset involving the right amygdala, hippocampus and inferior insula (Fig. 2B). Extra-operative cortical electrical stimulation at intensities of 1 to 3.5 mA (0.5 ms pulse width; 50 Hz) elicited several prolonged after discharges in the same regions but did not provoke clinical seizures.

* Corresponding author at: Department of Clinical Neurological Sciences, Western University, Room B10-106, 339 Windermere Road, London, ON N6A 5A5, Canada.

E-mail address: mmaldosari@kfmc.med.sa (M.M. Aldosari).

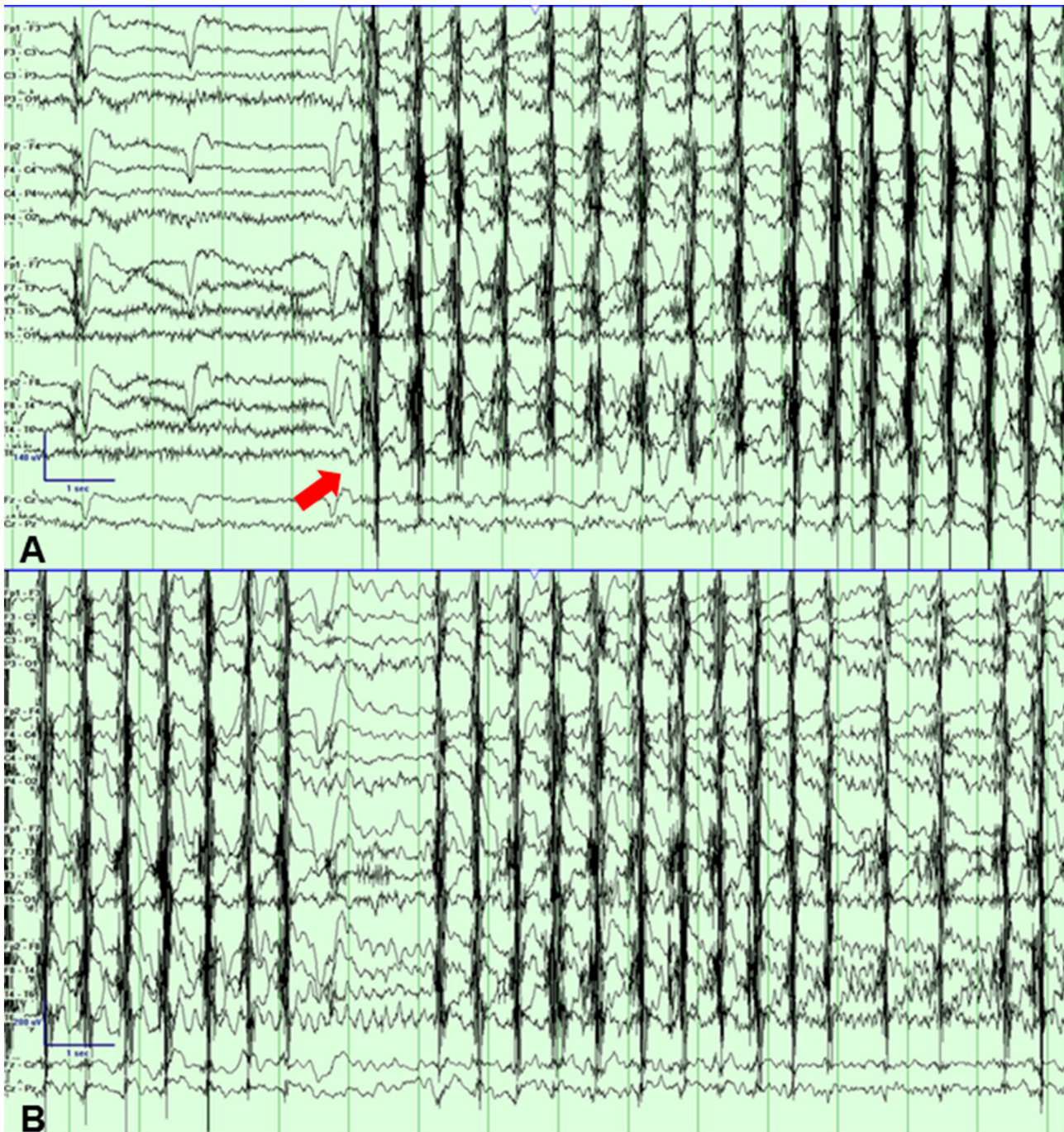


Fig. 1. A. Seizure onset of evolving rhythmic 2–3 Hz activity in right temporal region which intermingled with chewing artifacts. B. 15 s later showed clear seizure evolution with higher frequency and supra sylvian spread.

The patient thus underwent a navigation-guided 5 cm right anterior temporal lobectomy including the mesial structures (amygdala, uncus, and hippocampus) combined with a partial inferior insulectomy with decortication of the posterior short gyrus as well as the anterior and posterior long gyri (Fig. 2C). Pathology revealed transcortical and hippocampal gliosis. He remained seizure-free (Engel 1) at 3 years' post-surgical follow-up.

3. Discussion

EE is rare with an estimated prevalence of 1 per 1000–2000 epilepsy patients [7]. The prevalence of EE is highest in Sri Lanka, where the rate

is reportedly approximately 148 per 1000 people with epilepsy [8]. As with other forms of reflex epilepsy the pathophysiology of EE is unknown, but it is likely that the eating process triggers cortical activity that leads to subsequent brainstem activation [9].

In a large EE study ($n = 47$) conducted in India approximately half of the patients suffered exclusively from eating-induced seizures [3]. Cephalic sensation and visual auras were the most common epileptic auras, followed by extratemporal semiology of focal seizures with impaired awareness. Almost a third of the patients exhibited structural lesions, mainly in the posterior head region.

EE can be classified into two groups depending on the SOZ, temporal-limbic and extralimbic [7]. Temporal-limbic onset EE is

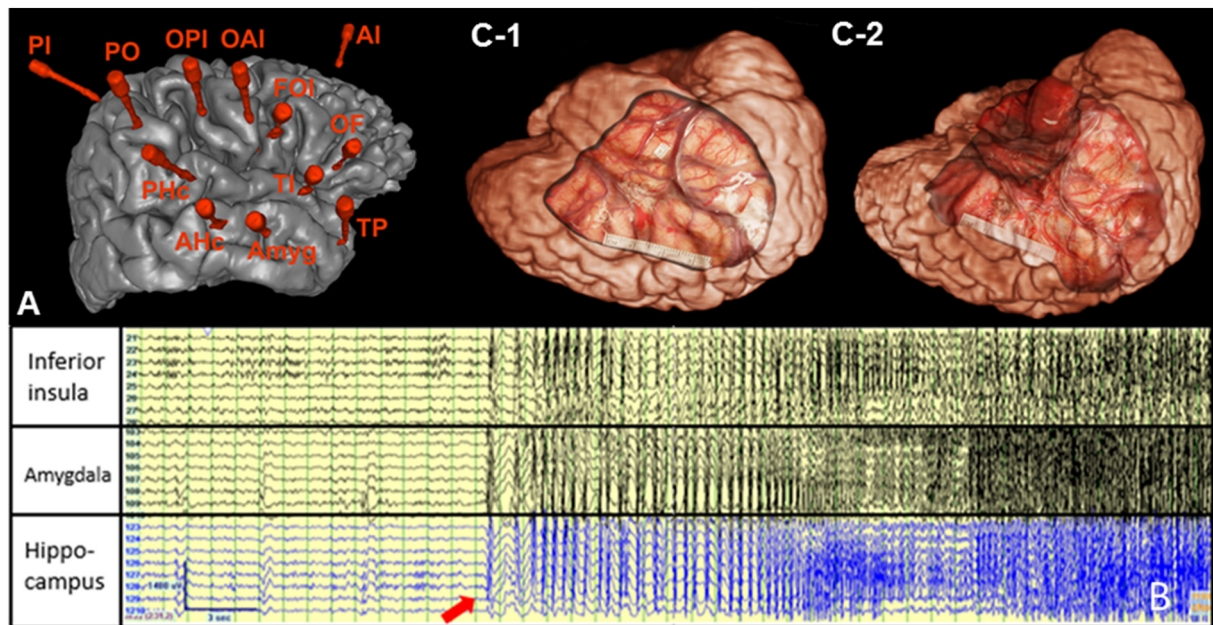


Fig. 2. A. Stereo-electroencephalography brain map demonstrating coverage of the right mesial temporal, temporal pole, frontal and parietal operculum, anterior and posterior insula. This 3-dimensional model was created by coregistering the patient's brain magnetic resonance imaging with the post-implantation computed tomography scan using open source 3D Slicer version 4.4.0. B: Stereo-electroencephalography seizure onset with widely synchronous high voltage spikes and waves involving the right inferior insula, amygdala and hippocampus (Time base: 10 mm/s, HFF: 15 Hz, LFF: 1 Hz). C: Intraoperative pre-resection photograph showing the exposure of the right temporal lobe with the 5 cm mark (measured from the pole), and part of the frontoparietal region (C-1). Resection of the non-dominant anterior temporal lobe including the mesial structures (amygdala, uncus, and hippocampus) was performed behind the 5 cm mark, just anteriorly to the Labbé vein, followed by decortication of the inferior insula with decortication of the posterior short gyrus as well as the anterior and posterior long gyri with sparing of the insular vasculature (C-2). Depth electrodes labels are as follows: AI = anterior insula (oblique), AHC = (T2) - anterior hippocampus, Amyg = (T2) - amygdala, FOI = frontal operculum - insula, OAI = operculum - anterior insula, OF = orbitofrontal, OPI = operculum - posterior insula, Phc = (T1) - posterior hippocampus, PI = posterior insula (oblique), PO = parietal operculum, TI = (T1) temporal - insula, TP = temporal pole.

characterized by eating-induced seizures that occur early in the course of the epilepsy. The seizures can occur during any phase of a meal, and are likely provoked by olfactory, autonomic, or gustatory stimuli. Extralimbic onset EE can be triggered either at the beginning or the end of a meal, but the temporal association between eating and clinical seizure onset is usually late. The seizures are also commonly provoked by just the smell or taste of food as well as by mastication. Spontaneous (*i.e.*, non-eating-induced) seizures are more common in patients with extralimbic onset EE [3,4].

Some EE patients are drug resistant to antiseizure drugs regardless of polytherapy [10]. Reported responder rates in terms of becoming seizure-free on medical treatment alone range from 10%–37% [3,11,12]. Only a few cases of excellent seizure outcomes (*i.e.*, Engel class I) following epilepsy surgery have been reported [2–4]. Scalp video-EEG alone is often not sufficient to identify the SOZ precisely, especially in cases in which the EEG ictal onset is not lateralizable or localizable and neuroimaging studies are non-contributory [2]. In our case, the presence of ill-defined ictal onset and chewing artifacts, and the lack of an epileptogenic lesion in brain MRI warranted invasive EEG. Typical mesial temporal seizures are usually associated with ictal onset 5–9 Hz rhythmic activity, which was not evident in the current patient's seizures [14]. The presence of a somatosensory component was atypical, and raised a possibility of temporal plus or extratemporal network involvement. Hence, stereo-EEG was proposed to explore the involvement of deeply situated perisylvian regions such as the mesial temporal structures, temporal operculum, and the insula.

A patient with a similar case of drug-resistant EE in which lesionectomy of a right operculo-insular cavernous malformation failed underwent stereo-EEG and simultaneous EEG-fMRI studies. That patient ultimately underwent resective surgery of the middle short gyrus of the insula and was seizure free during the subsequent 3 years of follow-up [15]. Surgical treatment for MRI-negative epilepsy is usually a challenge and intracranial EEG monitoring is required to explore the

epileptogenic network. Stereotactic implantation of depth electrodes has been used safely to identify the SOZ by exploring deeply located structures including the insulo-opercular and limbic networks, which subsequently guide the surgical resection plan resulting in a favorable seizure outcome [15,16]. The concept of temporal plus epilepsy was introduced to describe a complex epileptogenic network involving the temporal lobe and the neighboring regions, such as the insula in the present patient's case [17]. Temporal plus epilepsy appears to have a worse postsurgical seizure outcome than conditions involving pure temporal lobe seizures. In temporo-insular epilepsy an additional insular resection—when feasible—has reportedly yielded favorable outcomes [16,17,18].

To the best of our knowledge, no cases involving a widely synchronous area of the SOZ in a patient with non-lesional EE involving both the right mesial temporal region and insula have been reported. The case described herein underscores the complexity of the epileptogenic network underlying EE [4].

Conclusion

In non-lesional cases of drug-resistant EE the epileptogenic zone may be wide, and stereo-EEG is often required to determine the SOZ. The present case of drug-resistant non-lesional EE illustrates the value of stereo-EEG in the presurgical work-up, which led to a seizure-free outcome following combined right anterior temporal lobectomy and inferior insula resection.

Disclosures

Mubarak M. Aldosari, Holger Joswig MD, Ana Suller Marti, Andrew Parrent, Seyed M. Mirsattari hereby declare that they have no conflicts of interest disclose.

Ethical publication statement

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines. Written informed consent was obtained from the patient for publication of this report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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