Abdominal Aura and Its Localizing Value

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ABSTRACT

Background: In focal epilepsies, seizure symptomatology depends on the location of epileptogenic zone and the pattern in which epileptic activity spreads. Objective: The aims of this study are to analyze the character and evolution of the abdominal aura in patients with focal epilepsies and to assess the localizing and lateralizing value of the abdominal aura. Methods: Nineteen patients with epilepsy preceded by abdominal aura were subjected to complete neurological examination, prolonged video electro-encephalography (EEG) monitoring, cranial magnetic resonance imaging (MRI) and Brain Single Photon Emission Computerized Tomography (SPECT) study. Results: This study revealed epileptic focus localized to temporal lobe in 11 patients (57.9%). The abdominal aura evolved into simple partial seizures with secondary generalization in thirteen patients (68.4%), into pure complex partial seizures in one patient (5.3%), into multiple seizures in 4 (21.1%) patients, and remained simple in one patient (5.3%). Temporal hypoperfusion was found in 46.2% of patients having simple partial seizures with secondary generalization, in the patients with simple partial seizures and complex partial seizures, and in 75% of patients with multiple seizures. Conclusion: Analyzing the evolution of abdominal aura into other seizure types provides more localizing information of the epileptic focus. Moreover the use of video EEG monitoring and SPECT study is helpful in localizing and lateralizing the epileptic focus. (Egypt J Neurol Psychiat Neurosurg. 2010; 47(1): 117-122)

Keywords: Abdominal aura, temporal lobe epilepsy, EEG, SPECT

INTRODUCTION

In focal epilepsies, the initial seizure semiology usually provides valuable information about the seizure onset zone and the pattern in which epileptic activity spreads. Several studies suggest that abdominal auras are more frequent in temporal lobe epilepsies (TLE) and other authors recently have questioned this observation. Many authors described recurrent abdominal pain, and vomiting, which are not explained by other pathophysiological mechanism, as a cause of abdominal epilepsy that is described as a type of temporal lobe epilepsies. The frequencies of abdominal auras reported in previous investigations widely diverge ranging from 18.5% to 67% in patients with TLE and from 0 to 22% in patients with extratemporal epilepsy. Recent tools of investigations such as non invasive EEG evaluation, MRI scan and SPECT studies can identify the epileptogenic zone in most patients especially with TLE.

The aim of our study is to analyze the character and evolution of the abdominal aura in patients with focal epilepsies, who underwent prolonged EEG video monitoring and cranial MRI. Assessment of the localizing and lateralizing value of the abdominal aura by observing the changes in brain SPECT study is another goal of this study.

PATIENTS AND METHODS

Nineteen epileptic patients with abdominal aura were included in this study. Fourteen males (73.7%), and five females (26.3%). Their ages were ranged from 9 to 51 years with a mean of 24.21±11.12 S.D. Excluded from this study, patients with systemic diseases like liver and kidney diseases, GIT troubles and diabetes mellitus. Also patients with low IQ and patients with special epileptic syndromes were excluded.

All patients were submitted to:
1. Complete neurological examination with precise history taking of epilepsy from one eye witness.
2. Routine laboratory investigation including fasting and post prandial blood glucose, complete blood picture, electrolytes (Na, K, Ca), liver and renal function tests.
3. Abdominal ultrasound.
4. Seizures with the abdominal auras were analyzed and classified according to the International league Against Epilepsy classification.
5. Prolonged video EEG monitoring.
6. Cranial MRI (T₁, T₂, proton density weighted images and FLAIR in axial, coronal and sagittal planes.

Electrophysiological evaluation:
A day time short term video-EEG monitoring was performed for 2-4 hours without any cessation of the medication. The apparatus used was Dantec paperless EEG equipment, (Denmark) version 5.1 with a Panasonic video and a digital video-camera for recording the EEG signal and the patient's clinical state simultaneously and both being time-locked.

The EEG electrodes were placed according to the 10-20 international system for electrode placement. The recording parameters were: Time constant: 0.3 sec, speed: 3.0 cm/sec filter: 75H, gain: 50 µV/cm. During the display, the parameters could be changed to minimize movement and other artifacts for correct interpretation.

MRI of the brain:
MRI of the brain was done. T₁, T₂, PD weighted images in axial, coronal and sagittal planes, FLAIR were used in this study. Temporal lobe was inspected for pathological lesions and atrophy

Single Photon Emission Computerized Tomography (SPECT):
SPECT scans of the brain were performed using Tc99m Hexamethyl propylenamine (HMPAO).
SPECT images were acquired 60 minutes post-injection of the radiopharmaceutical by a dual head gamma camera equipped with high resolution collimators interfaced to a dedicated computer. That was done in the department of Nuclear medicine, Kasr Al-Aini hospital.

Statistical Methods:
Data were expressed as mean and SD. Frequency tables were used for all categorical data.

RESULTS
This study included 19 patients with different types of epilepsy presenting by abdominal aura. The abdominal aura is classified according to the International League Against Epilepsy (ILAE) as simple partial seizure with autonomic manifestation. According to (ILAE)(12), one patient (5.3%) had simple partial seizures (abdominal aura only, not evolved into any other types of seizures), 13 patients (68.4%) had simple partial seizures with secondary generalization (abdominal aura evolved into generalized tonic, clonic fits). One patient (5.3%) had pure complex partial seizures (abdominal aura, absence automatism, amnesia) and 4 patients (21.1%) had multiple seizures: complex partial and simple partial with secondary generalization (Table 1).

Family history of epilepsy was found in one patient (5.3%). Relevant past history was found in 6 patients (31.6%) (CNS infection, head trauma, dehydration). The frequency of fits ranged from once per week to once per year with a mean of twice per month. Four patients (21.1%) were on monotherapy, 4 (21.1%) on polytherapy, while 11 patients (57.9%) were non compliant or received no treatment.

The character of abdominal aura:
The abdominal aura was in the form of epigastric pain, spasm, nausea, vomiting, bad taste sensation, rising up gastric sensation and/or gastric upset. It was accompanied with visual and auditory hallucination in 2 patients (10.5%), Fear, anxiety and sweating in one patient (5.3%), Sense of suffocation and vertigo were associated one patients (5.3%) (Table 2).

EEG results:
Seven patients (36.8%) had normal video-EEG findings, while 12 patients (63.2%) had abnormal one. The abnormalities detected were in the form of: spike-wave complex in 12 patients (63.1%), besides focal discharge in 4 patients (21.1%), background disturbance in 3 patients (15.8%), generalized discharge in 1 patients (5.3%), and focal with secondary generalization in 7 patients (36.8%).

Epileptic focus was localized to temporal lobe in 11 patients (57.9%) [either alone in 6 (31.6%) or associated with extratemporal regions in 5 (26.3%)]. The EEG lateralized the focus in the right hemisphere in one patients (5.3%), to left hemisphere in 8 patients (42.1%) and bilateral in 2 patients (10.5%) (Table 3).

Neuroimaging studies results:
Abnormal imaging was found in 3 patients (15.8%): left temporal lobe atrophy in one patient, focal area of gliosis in right fronto-temporoparietal region with right cerebral hemiatrophy in another patient, and one patient had left temporoparietal glioma.

SPECT Results:
Thirteen patients (68.4%) with abdominal aura had abnormal hypoperfusion in SPECT studies and six patients (31.6%) had normal SPECT results. Epileptic focus was localized to temporal lobe in 11 patients (57.9%) [either alone in 3 (15.8%) or associated with extratemporal regions in 8 (42.1%)]. SPECT lateralized the epileptic focus to left side in 10 patients (52.6%), and to the right side in 3 patients (15.8%) (Table 4). Figure 1 shows a sample result of SPECT study.

Relation of the SPECT finding to semiology of seizures (evolution of aura):
Temporal hypoperfusion was found in 6 patients (46.2%) of patients having simple partial seizures with secondary generalization, in patients with simple partial seizures and complex partial seizures and in 3 patients (75%) of those having multiple seizures.

**Relation of the SPECT finding to the character of abdominal aura:**
Temporal hypoperfusion was found in 53.3% of patients with pure abdominal aura, in all patients having abdominal aura with fear and with vertigo, and in 50% of patients having abdominal aura with auditory and visual hallucination.

**Relation of the SPECT finding to EEG finding:**
In 6 patients (31.6%) the EEG coincided with SPECT in localizing the focus in the temporal lobe and in one patient (5.3%) in extra-temporal localization. They coincided in 5 patients (26.3%) in lateralizing the focus to left side and in one patient (5.3%) to right side.

**Table 1. Classification of seizures types among the patients (evolution of aura).**

<table>
<thead>
<tr>
<th>Seizure type</th>
<th>No. of patient</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple partial (only aura)</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>Partial with secondary generalization</td>
<td>13</td>
<td>68.4</td>
</tr>
<tr>
<td>Complex partial</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>Multiple seizures</td>
<td>4</td>
<td>21.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table 2. Characters of abdominal aura.**

<table>
<thead>
<tr>
<th>Characters of abdominal aura</th>
<th>No. of patients (19)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure abdominal aura</td>
<td>15</td>
<td>78.9</td>
</tr>
<tr>
<td>Abdominal aura with fear and anxiety</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>Abdominal aura with visual and auditory hallucination</td>
<td>2</td>
<td>10.5</td>
</tr>
<tr>
<td>Abdominal aura with vertigo</td>
<td>1</td>
<td>5.3</td>
</tr>
</tbody>
</table>

**Table 3. The results of the EEG.**

<table>
<thead>
<tr>
<th>Localization</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal lobe</td>
<td>11</td>
<td>57.9</td>
</tr>
<tr>
<td>Extratemporal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Frontal</td>
<td>4</td>
<td>21.1</td>
</tr>
<tr>
<td>- Parietal</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>- Occipital</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lateralization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Right hemi</td>
<td>1</td>
<td>5.3</td>
</tr>
<tr>
<td>Left hemi</td>
<td>8</td>
<td>42.1</td>
</tr>
<tr>
<td>Bilateral</td>
<td>2</td>
<td>10.5</td>
</tr>
<tr>
<td>Generalized</td>
<td>1</td>
<td>5.3</td>
</tr>
</tbody>
</table>

**Table 4. SPECT results among epileptic patients.**

<table>
<thead>
<tr>
<th>SPECT</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal hypoperfusion</td>
<td>11</td>
<td>57.9</td>
</tr>
<tr>
<td>Extratemporal hypoperfusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Frontal</td>
<td>3</td>
<td>15.8</td>
</tr>
<tr>
<td>- Parietal</td>
<td>3</td>
<td>15.8</td>
</tr>
<tr>
<td>- Occipital</td>
<td>2</td>
<td>10.5</td>
</tr>
<tr>
<td>Right side hypoperfusion</td>
<td>3</td>
<td>15.8</td>
</tr>
<tr>
<td>Left side hypoperfusion</td>
<td>10</td>
<td>52.6</td>
</tr>
<tr>
<td>Normal</td>
<td>6</td>
<td>31.6</td>
</tr>
</tbody>
</table>
DISCUSSION

This study was conducted to analyze the evolution of abdominal aura into various seizure types that provides more localizing information of the epileptic focus. Moreover, it stresses on the role of video EEG monitoring and SPECT study in localizing and lateralizing the epileptic focus. This study revealed that epileptic focus was localized to temporal lobe in 11 patients (57.9%) associated with extratemporal localization was found in 5 patients (26.3%) using EEG and in 8 patients (42.1%) using brain SPECT. Pure extra-temporal localization was found in 2 patients (10.5%) in SPECT and in one patient (5.3%) in EEG. These observed findings were supported by some previous studies that reported that abdominal auras are more frequently encountered in TLE (up to 67%) but also occur in extratemporal epilepsy (up to 22.5%) 2,3. With agreement to our results, a study conducted on focal epilepsy, their patients underwent prolonged EEG video monitoring, PET study and MRI scan. Abdominal auras were more frequent with TLE (52%) than in extratemporal epilepsy (12%) and more frequent in mesial TLE (64%) than in neocortical TLE (39%) 14.

In contrast, Dileep et al. studied the localizing value of painful epileptic auras in 25 patients with focal epilepsy. Abdominal pain was present in 5% of all abdominal auras in temporal lobe epilepsy and 50% of all abdominal auras in frontal lobe epilepsy 14. Another study did not find any association between the type of aura and the localization of “interictal cerebral dysfunction” documented by EEG 4.

These controversies between our results and the others could be attributed to the small number of patients, difference in technical methods used as SPECT and EEG.

Our results showed that in 6 patients (31.6%), the EEG coincided with SPECT in localizing the focus in the temporal lobe which is considered a small percentage. So localizing the epileptogenic zone is better studied by use of modern imaging techniques such as functional MRI or that are based on patients who were seizure-free after epilepsy surgery 2,10.

As regards the lateralization of the focus by EEG and SPECT In contrast to the results of this study, Anja et al. 13 found no significant preponderance to one side. Some previous reports found a preponderance of right vs left focal epilepsies with abdominal aura in TLE 15,16. Won et al. postulated that the type of aura, when elicited by careful history-taking, provides as

Figure 1. SPECT study showing left temporofrontal hypoperfusion.
useful localizing, but often not lateralizing information.\textsuperscript{1}

We found that analyzing seizure evolution may be helpful in providing more localizing information, however, due to small number of our patients, our study gave conflicting results with others. This study showed that temporal hypoperfusion in SPECT in 46.2\% of patients classified as simple partial seizures with secondary generalization, one patient (5.3\%) had complex partial seizures, one patient (5.3\%) had simple partial seizures, and 3 patients (15.8\%) in whom aura evolved into multiple seizures. Anja et al.\textsuperscript{13} found that abdominal auras were followed by ictal oral and manual automatisms (automotor seizure) in at least one seizure evolution in all patients with TLE (117 patients, 100\%), only two patients with extratemporal epilepsy (2 of 13 patients, 15\%, p<0.0001) had abdominal auras evolving into automotor seizures. Moreover, they postulated that the semilologic progression in TLE seizures were related to the propagation of the perfusion pattern of PET from ipsilateral temporal lobe to contralateral temporal lobe, insula, basal ganglia, and frontal lobe.\textsuperscript{13}

Regarding MRI results in this study 3 abnormal cases were recorded. Similarly Tezer et al. described a case report of a young female presented with abdominal pain and persistent myoclonic twitches of the abdominal muscles that were considered to represent a rare manifestation of epilepsia partialis continua due to cortical dysplasia.\textsuperscript{13}

As regards the characters of aura, temporal hypoperfusion was found in 53.3\% of patients with pure abdominal aura, in all patients having abdominal aura with fear and with vertigo and in 50\% of patients having abdominal aura with auditory and visual hallucination. To the best of our knowledge, no published data regarding this issue.

In conclusion, abdominal aura is more frequently encountered in temporal lobe seizures. Analyzing the evolution of abdominal aura into other seizure types provides more localizing information of the epileptic focus that is assessed by the use of video EEG monitoring and SPECT study. This is considered a useful step in assessment the patient who is candidate for epilepsy surgery.

## REFERENCES

الملخص العربي

الهدف من هذه الدراسة هو تقييم مقدمة النوبة الصرعية البطنية ومتانة تطورها لنوبة صرعية حيث يمكن بالتحليل الإكليلي وساعدت الأشعة المقطعة باستخدام النظرتية المختصة للنوبة، ودرس المخ الكهربائي المصور تحديد مكان النوبة الصرعية بالمخ. وقد أجريت هذه الدراسة على 19 مريضاً يعانون من نوبات صرعية سيئة مسببة بعضاً بطنيه. وتم عمل فحص إكليلي شامل للجهاز العصبي وعين مغناطيسي على المخ ورسم المخ الكهربائي المصور والأشعة المقطعة باستخدام النظرتية المختصة للنوبة، وفقًا لأوضاعت النتائج البحثية، يمكن تحديد مكان النوبة الصرعية بالمخ باستخدام الأشعة المقطعة مع النظرتية المختصة للنوبة، ورسم المخ الكهربائي المصور.

في 11 مريض (57.9%) من الالتهابات الدماغية، كما وجد تغييرات في الأروتين الدماغي بالفحص المغناطيسي توجد مقدمة النوبة الصرعية البطنية ولد لد نوبات صرعية. ومستخلص من ذلك الدراسة إن تقييم مقدمة النوبة الصرعية البطنية ومتانة تطورها لنوبة صرعية باستعمال الأشعة المقطعة باستخدام النظرتية المختصة للنوبة، ورسم المخ الكهربائي المصور يمكن إن يحدد مكان النوبة الصرعية بالمخ وهذا من شأنه يمكن إن يساعد في جراحات مرض الصرع.