(18F)-FDG PET/CT IN ESSENTIAL TREMOR: PRELIMINARY RESULTS

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ABSTRACT
Introduction: A modest number of studies reported contradictory results for brain glucose metabolism in essential tremor (ET) patients.

Aim: To study the brain glucose metabolism in ET patients with (18F)-FDG PET/CT.

Materials and Methods: Ten patients were included, aged 60.4 years, with 8 months diseases duration. Five healthy persons, aged 60.2 years, were studied as controls. Resting state (18F)-FDG PET/CT was performed according to a standard protocol on a Phillips Gemini TF scanner. Images acquired were evaluated visually and quantitatively with specialized software NeuroQ, v. 3.0 for Phillips EBW workstation. Differences from database mean of more than ±2.5 SD were considered significant in both cluster and region analysis.

Results: Significant hypometabolism in left temporal, parietal, and frontal cortical areas, including Broca’s area and anterior cingulate cortex was found in 8 patients. One patient also showed significant hypermetabolism in cerebellar hemispheres, vermis, primary and associative visual cortical areas. Normal glucose metabolism was found in 2 patients and all the controls.

Conclusion: Our study confirmed the presence of functional abnormalities on (18F)-FDG PET/CT scans of ET patients in cortical and cerebellar areas and provides new data for possible changes in Broca’s area, visual areas, and anterior cingulate cortex.

Key words: Brain glucose metabolism, (18F)-FDG PET/CT, Essential tremor

INTRODUCTION
Growing evidences in the last decade suggest that essential tremor (ET) is not a benign monosymptomatic condition, rather a neurodegenerative disorder. A broad spectrum of motor and nonmotor symptoms was described with significant impact on quality of life [1, 2, 3]. A modest number of studies reported contradictory results for brain glucose metabolism in ET patients [4, 5, 6]. Therefore we decided to study the brain glucose metabolism in ET patients with (18F)-FDG PET/CT.

MATERIALS AND METHODS
Ten patients were included (6 males), aged 60.4±3.78 (54-64) years, with 8±3.43 (4-12) months diseases duration, diagnosed according to Deuschl’s criteria [7]. Cases with head tremor were not included. All patients were right handed, and drug naïve. None of them reported dysautonomic symptoms [8], cognitive complaints (MMSA 28.7±1.06), nor past or present depressive episodes. The tremor was evaluated by Fahn-Tolosa-Marin rating scale (25.9±2.6). Five healthy individuals (3 males), aged 60.2±3.77 (54-64) years, were studied as controls.

Resting state (18F)-FDG PET/CT was performed according to a standard protocol on a Phillips Gemini TF scanner. Images acquired were evaluated visually and quantitatively with specialized software NeuroQ, v. 3.0 for Phillips EBW workstation. Differences from database mean of more than ±2.5 SD were considered significant in both cluster and region analysis.

RESULTS
Significant hypometabolism in left temporal, parietal, and frontal cortical areas, including Broca’s area and anterior cingulate cortex was found in 8 patients (Table 1, Fig. 1 and 2).
Table 1. Regional analysis of hypometabolic zones.

<table>
<thead>
<tr>
<th>Patients</th>
<th>liLAT</th>
<th>iPCC</th>
<th>lsLT</th>
<th>IPTC</th>
<th>rPTC</th>
<th>lGFm</th>
<th>lGFd</th>
<th>lSM</th>
<th>lBroca</th>
<th>lGCa</th>
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*n* - normal result, d ±2.5 SD; liLAT - left inf lat ant Temporal Cortex; iPCC - left post Cingulate Cortex; lsLT - left sup lat Temporal Cortex; IPTC - left Parietotemporal Cortex; rPTC - right Parietotemporal Cortex; lGFm - left mid Frontal Cortex; lGFd - left medial Frontal Cortex; lSM - left Sensorimotor Cortex; lBroca - left Broca’s Region; lGCa - left ant Cingulate Cortex

Fig. 1 and 2. (18F)-FDG PET/CT of patient No. 7 showing hypometabolism in lsLT, IPTC, lGFd and lGCa
One patient showed also significant hypermetabolism in cerebellar hemispheres and vermis, primary and associative visual cortical areas (Tabl. 2, Fig. 3 and 4).

Table 2. Regional analysis of hypermetabolic zones (patient No. 5).

<table>
<thead>
<tr>
<th>Patient</th>
<th>lA VC</th>
<th>rA VC</th>
<th>lCbm</th>
<th>rCbm</th>
<th>lPVC</th>
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lA VC- left Associative Visual Cortex; rA VC- right Associative Visual Cortex; lCbm- left Cerebellar hemisphere; rCbm- right Cerebellar hemisphere; lPVC- left Primary Visual Cortex; rPVC- right Primary Visual Cortex; V- Vermis
Fig. 3 and 4. (18F)-FDG PET/CT of patient No. 5 showing hypermetabolism in lAVC, rAVC, lCbm, rCbm, lPVC, rPVC and V.
Normal glucose metabolism was found in 2 patients and all the controls (Fig. 5 and 6).
Fig. 5 and 6. (18F)-FDG PET/ CT of patient No. 9 showing normal metabolism
DISCUSSION

Our results showed brain glucose hypometabolism in 8/10 patients (80%), almost entirely in the dominant hemisphere. We found functional deficits in frontal, temporal, and parietal cortical areas, anterior cingulated cortex, and Broca’s area. Only one patient had also hypermetabolism: in cerebellar areas, and, unexpectedly, in primary and associative visual cortices.

Previous (18F)-FDG PET/CT studies in ET reported different findings. A study from 1993 of 8 patients found hypermetabolism of the medulla and the thalami [5]. Researches from 2013 and 2014 in 12 and, respectively 17 patients, reported hypometabolism in primary motor cortices bilaterally and left posterior parietal area [6], and hypometabolism in medial frontal and temporal areas, and precuneus [4].

The variety of our and previously reported results might be due to the small number of patients studied, short disease duration of our contingent, and heterogeneity of ET itself [9, 10].

We selected patients less than 65 years of age to avoid potential age-related autonomic and cognitive decline, and with disease duration up to 1 year. Such short duration may be misleading for exact diagnosis and the patients could further develop full clinical picture of another neurodegenerative disease, explaining the unexpected areas involvement in our cases.

Our results for Broca’s area changes may mark the presence of presymptomatic cognitive deficit. Anterior cingulate hypometabolism in our group might be a basis for further development of dysautonomic, cognitive or depressive symptoms. Hypermetabolism in primary and associative visual cortical areas is not previously reported and this case requires further observation. Our results support prior data for brain glucose metabolism abnormalities in ET [4, 5, 8]. These abnormalities, however, spread outside the motor zones and may be an early marker for nonmotor symptoms development.

Fig. 6. (18F)-FDG PET/CT of patient No. 9 showing normal metabolism
In conclusion our study confirmed the presence of functional abnormalities on (18F)-FDG PET/CT scans of patients with ET in cortical and cerebellar areas and provides new data for changes in Broca’s area, visual areas, and anterior cingulate cortex. Further follow-up and more extensive investigations are required to elucidate the brain glucose metabolism in ET.

REFERENCES: