

^{99m}Tc-ECD SPECT Image in Children with Gilles de la Tourette's Syndrome: A Preliminary Report

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Background: Gilles de la Tourette's syndrome (GTS) is a complex neuropsychiatric disorder. Functional neuroimaging technique such as ^{99m}Tc-hexamethylpropylene amine oxime (HMPAO) brain SPECT has been used widely to evaluate the patients with GTS; however, the feasibility of ^{99m}Tc-ethyl cysteinyl dimer (ECD) brain SPECT in evaluation of patients with GTS has not been reported, especially in children. The aim of this preliminary study was to evaluate the potential usefulness of ^{99m}Tc-ECD brain SPECT in detecting brain perfusion abnormalities in children with GTS.

Methods: A group of 7 normal control subjects and 17 unmedicated GTS children (15 boys and 2 girls ranging in age from 4 to 11 years) underwent a brain SPECT study with ^{99m}Tc-ECD. Those with a known underlying history of brain trauma, epilepsy or encephalitis/meningitis were excluded.

Results: 16 of 17 (94.1%) of the GTS children had lesions characterized by decreased brain perfusion on ^{99m}Tc-ECD brain SPECT scan. The left hemisphere was more frequently involved and major perfusion abnormalities were found in the frontal lobe, temporal lobe, parietal lobe and basal ganglia. In contrast, all 7 normal controls (100.0%) had negative results of ^{99m}Tc-ECD brain SPECT scan.

Conclusion: Our preliminary study showed that ^{99m}Tc-ECD brain SPECT scan may provide a useful functional

neuroimaging technique in the evaluation of children with GTS.

Key words: ^{99m}Tc-ECD brain SPECT, Gilles de la Tourette's syndrome

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Gilles de la Tourette's syndrome (GTS) is a neuropsychiatric disorder characterized by multiple motor and vocal tics of varying intensity and often associated behavioral disturbances including attention-deficit hyperactivity disorder and obsessive-compulsive disorder [1]. Although GTS seems to be not an uncommon disorder [2], the precise etiology of this disorder is unknown. Onset occurs in childhood, usually between 2 and 15 years of age. Early diagnosis of GTS in children is difficult but very important because appropriate treatment can be started as soon as possible. To date, there is no accurate diagnostic laboratory test for the early diagnosis of GTS and diagnosis is major based on the clinical features. Brain SPECT studies using ^{99m}Tc-hexamethylpropylene amine oxime (HMPAO) on GTS have been performed [3-6]; however, the study of ^{99m}Tc-ethyl cysteinyl dimer (ECD) brain SPECT in evaluation of GTS patients has not been reported in the previous literatures, especially in children. Therefore, we evaluated the changes of ^{99m}Tc-ECD brain SPECT scan in children with GTS.

Materials and Methods

Patients

A total of 17 unmedicated GTS children (15 boys and 2 girls, age ranged from 4 to 11 years) were enrolled in this

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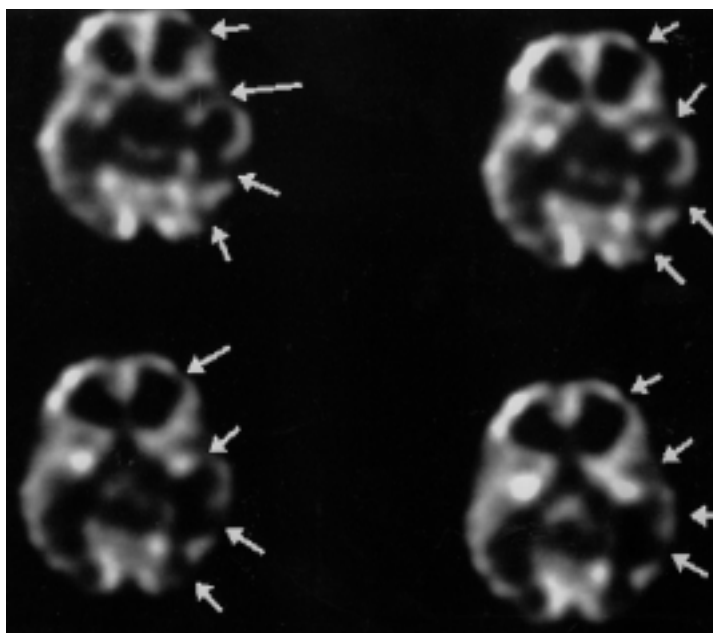


Figure 1. Demonstration of positive brain SPECT images in patient No. 3 of Table 1, decreased perfusion in the left hemisphere (arrows) was noted

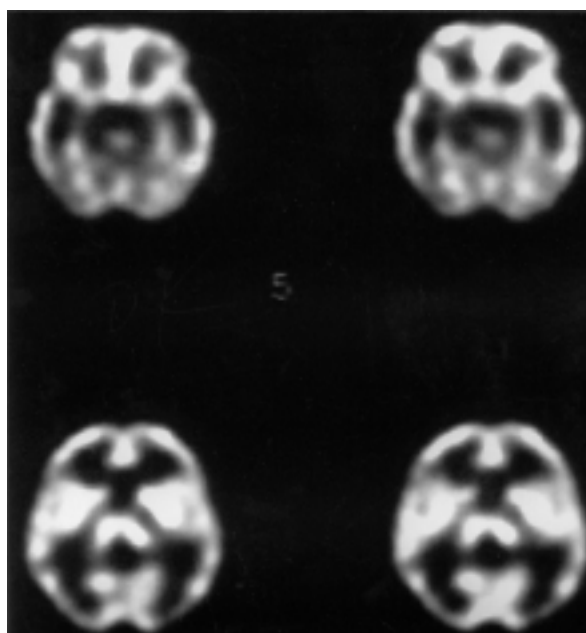


Figure 2. Demonstration of negative brain SPECT images, no definite perfusion defect was found

study. All patients underwent ^{99m}Tc -ECD brain SPECT scan. In addition, for comparative purpose, the ^{99m}Tc -ECD brain SPECT scan was also performed in 7 normal controls (5 boys and 2 girls; age ranged 5-12 years). Those with a known underlying history of brain trauma, epilepsy or encephalitis/meningitis were excluded. All patients with GTS fulfilled the diagnoses defined by the Tourette's Syndrome Classification Group [7].

Imaging Procedures and Interpretation

Preparation of a commercially available ^{99m}Tc -ECD kit was carried out according to the manufacturer's instruction. Radiochemical purity was measured to be at least 90% in all studies using thin-layer chromatography. Patients were injected in a dark and quiet room. From 15 to 45 min after ^{99m}Tc -ECD (15-20 mCi) injection, the SPECT data was obtained using a dual-headed gamma camera (ADAC, Vertex plus) equipped with fanbeam collimators. Data were collected from 64 projections in the 140 keV photopeak over 360° (180° for each head) in 128×128 matrices, with an acquisition time of 30 sec/view. Transaxial, coronal and sagittal slices were reconstructed. Reconstruction of the image was

performed with attenuation correction using Butterworth filter, with cutoff frequency of 0.2 per cm and an order of 20. All SPECT images were reviewed blindly and separately by at least two experienced nuclear medicine physicians. The findings were considered to be pathological if one or more areas of hypoperfusion in the regional brain flow were present in more than one view and slice. The results of SPECT images were classified as positive (Figure 1) or negative (Figure 2).

Results

The detailed data of patients and results of study are summarized in Table 1. In 16 of 17 cases with GTS (94.1%), ^{99m}Tc -ECD brain SPECT demonstrated brain perfusion abnormalities. The left hemisphere was more frequently involved and major perfusion abnormalities were found in frontal lobe (6 patients), temporal lobe (11 patients), parietal lobe (3 patients) and basal ganglia (3 patients). No scintigraphy-related discomfort or side effects were observed during study.

Discussion

The diagnosis of GTS depends upon clinical recogni-

tion of the phenomenon currently; however, the correct diagnosis of GTS is often delayed. Thus, we need a more objective method for early diagnosis of GTS in children and appropriated treatment can be selected.

According to the reports of previous studies [3-6], we believe that functional neuroimaging method such as the ^{99m}Tc -HMPAO brain SPECT is a useful tool in evaluation of GTS patients. However, the study of ^{99m}Tc -ECD brain SPECT in children with GTS has not been reported. In this study, we used ^{99m}Tc -ECD brain SPECT to evaluate the children with GTS and found decreased brain perfusion in frontal lobe, temporal lobe, parietal lobe and basal ganglia compared with control subjects. The findings of this study similar to the previous ^{99m}Tc -HMPAO SPECT studies [3-6].

^{99m}Tc -ECD is a new radiopharmaceutical for cerebral blood flow imaging and it has similar kinetics to the ^{99m}Tc -HMPAO in the brain [8,9]. ^{99m}Tc -ECD is an effective marker of cerebral perfusion imaging, showing rapid and good uptake by the brain. Furthermore, ^{99m}Tc -ECD has high in vitro stability than ^{99m}Tc -HMPAO [10]. In addition, use of ^{99m}Tc -ECD is favorable in children based on the radiation dosimetry because ^{99m}Tc -ECD is eliminated more rapidly than ^{99m}Tc -HMPAO from most tissues and more than 50% of ^{99m}Tc activity is excreted in the urine within 2 h [11]. No side

effects that might have been related to ^{99m}Tc -ECD were observed. Cerebral hypoperfusion abnormalities in children with GTS were predominantly located in the left hemisphere in our study and which was also similar to the findings of previous ^{99m}Tc -HMPAO SPECT studies [3-6].

Although we demonstrated that ^{99m}Tc -ECD brain SPECT scan is a useful imaging method in detecting brain abnormalities in children with GTS; the present results must be considered as a preliminary report due to the small case number studied. A larger patient number to further confirm the utility of ^{99m}Tc -ECD brain SPECT scan in evaluation of children with GTS is needed. Following-up patients after treatment to evaluate if different initial findings on ^{99m}Tc -ECD brain SPECT scan can predict different prognosis in patients with GTS may also be necessary because one GTS patient had negative result in our study.

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Table 1. Patient data and ^{99m}Tc -ECD SPECT results

Patient no.	Sex	Age (years)	^{99m}Tc -ECD SPECT results
1	boy	4	left temporal lobe (hypoperfusion)
2	boy	9	right frontal and left parietal lobes (hypoperfusion)
3	boy	7	left hemisphere (frontal, parietal, temporal, and occipital lobes (hypoperfusion)
4	boy	7	left temporal lobe (hypoperfusion)
5	boy	6	left frontal and left temporal lobes (hypoperfusion)
6	boy	7	right basal ganglia (hypoperfusion)
7	girl	11	right temporal lobe (hypoperfusion)
8	boy	10	left temporal and left parietal lobes (hypoperfusion)
9	boy	11	left frontal and left temporal lobes (hypoperfusion)
10	boy	10	left frontal and left inferior temporal lobes (hypoperfusion)
11	boy	9	negative
12	girl	9	right basal ganglia (hypoperfusion)
13	boy	6	left temporal lobe (hypoperfusion)
14	boy	10	left temporal lobe (hypoperfusion)
15	boy	9	right temporal lobe (hypoperfusion)
16	boy	11	right frontal lobe (hypoperfusion)
17	boy	7	left basal ganglia (hypoperfusion)

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鎝-99m-ECD腦部單光子射出斷層掃描在兒童 特雷托氏症方面的診斷價值

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背景：特雷托氏症是一種複雜的神經精神病學方面的病症。功能性腦部掃描如鎝-99m-HMPAO腦部單光子射出斷層掃描已被廣泛使用於評估此類的病患。但是，鎝-99m-ECD腦部單光子射出斷層掃描卻未被評估使用過，尤其在兒童的診斷方面。本初報之目的在於評估鎝-99m-ECD腦部單光子射出斷層掃描對於兒童患有特雷托氏症的評估價值。

方法：本先期研究包含了17位未曾接受過治療的兒童特雷托氏症病患和7位正常對照組來接受鎝-99m-ECD腦部單光子射出斷層掃描。如有過腦部外傷、癲癇、腦炎或腦膜炎情形之病患與對照組就不被包括在本研究的範圍之內。

結果：在17位特雷托氏症的兒童當中，16位（94.1%）發現鎝-99m-ECD腦部單光子射出斷層掃描中有腦內血流灌注缺損病灶的情形，大部分在左大腦半球，而且主要分佈在額葉、鼻葉、頂葉和基底核的區域。相反的，7位正常對照組的鎝-99m-ECD腦部單光子射出斷層掃描結果皆為正常。

結論：本先期研究結果顯示鎝-99m-ECD腦部單光子射出斷層掃描在評估患有特雷托氏症的病患方面也是一個很有用的腦部功能性檢查。

關鍵詞：鎝-99m-ECD腦部單光子射出斷層掃描，特雷托氏症

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