The role of 2-18F-fluoro-2-deoxy-D-glucose positron emission tomography in the diagnosis of giant cell arteritis of the temporal arteries

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Objective. As one of the diagnostic criteria for giant cell arteritis affecting the temporal arteries (temporal arteritis, Horton’s disease) is biopsy-proven vasculitis of the affected artery, the aim of our study was to evaluate the value of a non-invasive procedure, 2-18F-fluoro-2-deoxy-D-glucose (FDG) positron emission tomography (F-18-FDG-PET), in the diagnosis of Horton’s disease.

Methods. During a period of 10 months, 22 consecutive patients with the clinical diagnosis of giant cell arteritis and a positive hypoechoic halo in duplex sonography were re-examined with F-18-FDG-PET. Six patients had giant cell arteritis involving both the large arteries and the temporal arteries; five patients showed giant cell arteritis only in the large arteries without concomitant involvement of the temporal arteries, and the remaining 11 patients showed only involvement of the temporal arteries. All patients were examined by sonography and F-18-FDG-PET, which was performed before treatment with corticosteroids.

Results. All patients with positive signs of giant cell arteritis in duplex sonography, i.e. a hypoechoic halo in the large arteries (thoracic, subclavian, axillary, iliac, aorta), also showed elevated FDG uptake in the same vessels, with complete agreement in the anatomical distribution of changes. When positive sonography was limited to the temporal arteries, FDG-PET was completely negative in the temporal arteries and all other arterial locations.

Conclusion. PET is not yet suitable for the diagnosis of temporal arteritis and therefore cannot replace invasive biopsy. F-18-FDG-PET is well suited to the demonstration of giant cell arteritis in arteries exceeding 4 mm in diameter.

KEY WORDS: F-18-FDG-PET, Giant cell arteritis, Duplex sonography, Temporal arteries, Horton’s disease.

One of the five criteria established by the American College of Rheumatology (ACR) in 1990 for the classification of giant cell arteritis affecting the temporal arteries (temporal arteritis, Horton’s disease) is biopsy-proven vasculitis of the affected artery [1]. Non-invasive methods of replacing diagnostic biopsy have been investigated recently.

Schmidt et al. [2] have demonstrated the value of duplex sonography by showing a dark halo around the lumen as a specific sign caused by the oedematous wall of the temporal artery. Their suggestion that this phenomenon suffices to indicate the presence of giant cell arteritis has been partly disproved [3, 4]. A halo of 1 mm or greater in thickness increases the probability of giant cell arteritis.

However, 2-18F-fluoro-2-deoxy-D-glucose (FDG) positron emission tomography (F-18-FDG-PET) has recently shown promising results in the diagnosis of giant cell arteritis of the large thoracic arteries [5, 6]. As the oedematous lesions of the neointima in the large thoracic arteries, which are caused by the inflammatory process and which show FDG uptake, are not larger than 1 or 2 mm in effective diameter in duplex sonography and therefore have exactly the same size as a positive halo in the temporal arteries, we thought that F-18-FDG-PET would also show positive FDG uptake in smaller vessels, such as the temporal arteries. Therefore, the aim of the present study was to investigate the usefulness of FDG-PET in patients presenting with giant cell arteritis of the temporal arteries.

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In patients presenting with temporal artery involvement in duplex sonography, the region of the affected vessel was marked so that the surgeon could subsequently take a biopsy of the temporal artery.

The patients all gave informed consent for the FGD-PET procedure and in case of biopsy of the temporal artery.

**Results**

Out of the 22 consecutive patients with the clinical diagnosis of giant cell arteritis and a positive hypoechogenic halo on duplex sonography in at least one area, six patients had giant cell arteritis involving both the large arteries and the temporal arteries, five showed giant cell arteritis only in the large arteries without concomitant involvement of the temporal arteries, and the remaining 11 showed only involvement of the temporal arteries.

Eight of 17 patients gave their informed consent for biopsy of the temporal artery, and in seven of the eight patients giant cell arteritis of the temporal arteries was proven histologically.

Patient data are summarized in Table 1.

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**Table 1. Characteristics of the 22 patients enrolled in the study**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr): mean ± s.d.</td>
<td>73.3 ± 7.5</td>
</tr>
<tr>
<td>Sex (male/female): n/n (%/%)</td>
<td>6/16 (27/33)</td>
</tr>
<tr>
<td>Headache with no history: n (%)</td>
<td>12 (54.5)</td>
</tr>
<tr>
<td>Temporal artery abnormality: n (%)</td>
<td>11 (49.9)</td>
</tr>
<tr>
<td>Systemic symptoms: n (%)</td>
<td>11 (49.9)</td>
</tr>
<tr>
<td>Jaw claudication: n (%)</td>
<td>8 (36.4)</td>
</tr>
<tr>
<td>Scalp tenderness: n (%)</td>
<td>9 (40.9)</td>
</tr>
<tr>
<td>Visual symptoms: n (%)</td>
<td>6 (27.3)</td>
</tr>
<tr>
<td>Blindness: n (%)</td>
<td>2 (9.1)</td>
</tr>
<tr>
<td>Bilateral shoulder pain: n (%)</td>
<td>7 (31.8)</td>
</tr>
<tr>
<td>Bilateral hip pain: n (%)</td>
<td>7 (31.8)</td>
</tr>
<tr>
<td>Claudication of upper and lower extremities: n (%)</td>
<td>4 (18.2)</td>
</tr>
<tr>
<td>Central nervous system features: n (%)</td>
<td>3 (13.6)</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate (mm/h): mean ± s.d.</td>
<td>75.0 ± 29.0</td>
</tr>
<tr>
<td>C-reactive protein (mg/dl): mean ± s.d.</td>
<td>66.9 ± 61.5</td>
</tr>
</tbody>
</table>

* Tenderness on palpation or decreased or absent pulse.
* Fever, anorexia or weight loss.

**Table 2. Imaging findings**

<table>
<thead>
<tr>
<th>Vessel involvement</th>
<th>Colour-coded duplex sonography (halo)</th>
<th>F-18-FDG-PET (18F enhancement)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temporal arteries</td>
<td>Large arteries</td>
</tr>
<tr>
<td>Large arteries and temporal arteries</td>
<td>6/22</td>
<td>6/22</td>
</tr>
<tr>
<td>Large arteries without temporal arteries</td>
<td>0/22</td>
<td>5/22</td>
</tr>
<tr>
<td>Temporal arteries only</td>
<td>11/22</td>
<td>0/22</td>
</tr>
</tbody>
</table>

**Discussion**

One of the five criteria established by the ACR in 1990 for the classification of giant cell arteritis affecting the temporal arteries (temporal arteritis, Horton’s disease) is biopsy-proven vasculitis of the affected artery. The proof may be difficult to obtain as giant cell arteritis is a segmental arteritis and many patients frequently refuse biopsies, fearing the procedure itself.

Duplex sonography of affected vessels could be a promising alternative, but has its limitations. In the literature, the sensitivity is low (50%) even when the thickness of the halo is at least 1 mm, indicating that every second patient is missed. The hypoechogenic wall thickening is a specific indicator of the presence of giant cell arteritis, with a specificity of up to 93% [3, 4].

Therefore, it would be highly desirable to provide a non-invasive method of supporting the diagnosis of giant cell arteritis. F-18-FDG-PET has shown promising results in the diagnosis of giant cell arteritis in large arteries. As many of these oedematous lesions in the large thoracic arteries detected by duplex sonography, which show FDG uptake in F-18-FDG-PET, are not larger than 1 or 2 mm in effective diameter and therefore have exactly the same size as a positive halo in the temporal arteries, we thought that F-18-FDG-PET could also show FDG uptake in smaller vessels, such as the temporal arteries.

However, in smaller arteries, such as the temporal arteries, F-18-FDG-PET did not show positive results, in contrast to duplex sonography. On the contrary, F-18-FDG-PET showed a positive result in all patients with concomitant arteritis of larger vessels, detected by ultrasonography. Because giant cell arteritis of the large vessels was detected in 11 out of 22 patients by duplex sonography and F-18-FDG-PET, this seems to be a remarkable number. The differences in detection rates are apparently caused by the limited resolution of PET. PET images vessels with a diameter of at least 4 mm. Temporal arteries normally have a diameter of 1 mm and are enlarged to 2–3 mm on account of oedematous wall thickening.

At present, PET is not suitable for the diagnosis of temporal arteritis and therefore cannot replace the invasive biopsy. F-18-FDG-PET is well suited to the demonstration of giant cell arteritis in arteries exceeding 4 mm in diameter.

**References**