The suitability of the ultrasound biomicroscope for establishing texture in giant cell arteritis

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Abstract

Aim—To establish whether ultrasound biomicroscope (UBM) is a helpful tool in locating the arterial segment responsible in patients with segmental attacks in giant cell arteritis.

Methods—The superficial temporal arteries of 19 patients with suspected giant cell arteritis were examined with the UBM before biopsy.

Results—20 specimens provided the histological proof of giant cell arteritis in five patients. Side differences, a dark perivascular halo, and high reflectivity of the intra-arterial space were found.

Conclusion—it is assumed that there are two types of arteritic inflammation: (1) the occlusion of intra-arterial space due to intimal fibrosis (UBM: high reflexive “filling”), and (2) inflammation of the perivascular zone with oedematous thickening and infiltration of the media (UBM: dark halo) and its combination. UBM is helpful in obtaining an indication of the side and segment for biopsy.

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Giant cell arteritis can be diagnosed on the basis of clinical findings, but a temporal artery biopsy is generally recommended to confirm the diagnosis. The American College of Rheumatology requires that three out of five criteria are met in order to obtain a correct diagnosis: age ≥50 years; new onset of localised headache; temporal artery tenderness or decreased pulse; erythrocyte sedimentation rate alterations in the range from 61 to 104 mm (arteritic group) and 2–90 mm (non-arteritic group). A suspect palpation was noticed in four of the five patients with giant cell arteritis. All of them had received corticosteroids for less than 6 days.

The following different sonographic conditions were observed only in the giant cell arteritis group:

- a hypoechoic halo around the arterial lumen (see Fig 1A) (three patients in the arteritic group).
- an intra-arterial middle reflexive “filling” (Fig 2A) (three patients of the arteritic group).
- the high frequency ultrasound biomicroscope (UBM) seems to be very suitable for imaging the superficial temporal artery, which is located on the fascia temporalis 3–4 mm under the surface of the skin. We wanted to obtain an indication of the location of the arterial segment.

Materials and methods

In this prospective study, 19 patients suffering from suspected active giant cell arteritis were treated from September 1997 to September 1998. Clinical data were recorded in nine men and 10 women aged 50–89 years (mean 71.3 years) including erythrocyte sedimentation rate and Doppler sonography to rule out collateral circulation as well as the evaluation of the appearance of the temporal artery.

Written informed consent for temporal artery biopsy was given. Before surgery (maximum 24 hours), the temporal arteries were investigated using the ultrasound biomicroscope (Humphrey Instruments Inc Zeiss group, 50 MHz probe). The dimension and reflex of the arterial lumen and wall were evaluated. Suspicous locations were marked on the skin in order to perform the biopsy exactly from this part of the artery. When side differences were observed, the side and segment with the greater contraction of the temporal artery was chosen for biopsy. An ultrasound examination gel of low viscosity was used in order to avoid pressure during the investigation.

Twenty specimens, 10 right and 10 left side, were obtained without complications. The temporal artery of one patient was excised bilaterally. The sonographic observations and results were correlated with the histopathological changes.

Results

Five of the 19 patients examined showed histological evidence of giant cell arteritis.

Clinically, a sudden loss of vision = 0.1 was observed four times in the giant cell arteritis group (five patients) and six times in the non-arteritic group (14 patients). We found erythrocyte sedimentation rate alterations in the range from 61 to 104 mm (arteritic group) and 2–90 mm (non-arteritic group). A suspect palpation was noticed in four of the five patients with giant cell arteritis. All of them had received corticosteroids for less than 6 days.

The side with the greater contraction of the artery

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a kinetic sign of intravascular movement (two patients of the non-arteritic group)

- three patients had a large intra-arterial lumen (non-arteritic group)
- four patients showed bad imaging; only wall and lumen could be identified (non-arteritic group)
- very small lumina were observed in nine patients (two arteritic group, seven non-arteritic group).

Discussion

There are several alternatives to the temporal artery biopsy—for example, angiographic imaging of the temporal artery. Using conventional ultrasonography (10 MHz) Brosig et al. and using Doppler sonography Dörnberger et al. showed that the vessel course can be detected as well as the vessel diameter, plaques, stenosis, and the perivascular tissue of extracranial vessels. It is possible to arrive at a fast first documentation in many inflammatory and arteriosclerotic diseases. Since high resolution ultrasonographs have become commercially available, there is an increased expectation of improved non-invasive vascular imaging.

There are two main types of arteritic changes that show a close correlation with the UBM images:

(1) The inflammation spills into the media, which is oedematous, congested, and thickened (UBM: dark halo) (see Fig 1).

(2) The intimal layer is greatly thickened by fine collagenous tissue with severe restriction of the lumen (UBM: intra-arterial “filling”). The normal sized muscularis media appears as the arterial wall (see Fig 2).

Both changes lead to a decrease in arterial lumen width and can be observed simultaneously.

Histologically, two patterns of the affected arteries can also be observed: the more common variant is a granulomatous inflammation of the inner half of the media centred on the internal elastic membrane with fragmentation of this internal elastic membrane together with the specific giant cells (Fig 2B).

The less common pattern is non-specific panarteritis with a mixed inflammatory infiltrate without giant cells. Naumann et al. describe the inflammatory infiltration of the adventitia expanding to the outer media as an early sign of arteritis temporalis consistent with Jennings’s observations.

Figure 1 (A) UBM image with arteritic changes of the temporal artery—longitudinal section left, cross section right. Hyporeflexive halo (white arrows) around the intra-arterial lumen (asterisk). (B) Light microscopy (van Gieson, original magnification) of artery with inflammatory changes. Small lumen (black circle). Intimal layer (black arrows) is thickened. In the media, the elastic lamina (black arrowheads) is fragmented and partially absent. A diffuse chronic inflammatory infiltrate is spread throughout the media (white asterisk).

Figure 2 (A) UBM image with arteritic changes of the temporal artery—longitudinal section. Middle reflexive filling of the intra-arterial lumen (asterisk). Note the high reflexivity of the arterial wall and the thinning of the artery due to a tortuous run (arrow). (B) Light microscopy (Elastica, original magnification) of an artery. The central lumen (black circle) is largely reduced. This is mostly because of intimal thickening (dark arrows). The media is not thickened (white asterisk). Fragmentation of the internal elastic lamina (black arrowheads) and chronic inflammatory infiltrates are present.
We observed the hyporeflective halo around the artery in three patients. Two have already had a decline of vision. Therefore, the ocular arteries can no longer provide the sole early sign.

Another method presented by Schmidt et al\(^2\) and by Kraft et al\(^3\) is colour duplex sonography (5–10 MHz). They also revealed the characteristic halo in 22 of 30 patients (Kraft et al: 10 patients) indicating the diagnosis of giant cell arteritis (verified by histology in 16 of 21 patients (Kraft et al: five verified)). In the healed phase together with steroid treatment, the histology shows a considerable scarring.\(^9\) This halo may be due to an oedema of the artery wall and it disappears 10–14 days after the commencement of corticosteroid therapy.\(^{12,15}\)

In 1997, Wenkel and Michelson\(^14\) reported on the use of the ultrasound biomicroscope in the diagnosis of giant cell arteritis and found the dark halo in all four patients with the histology shows a considerable scarring.\(^9\) For the moment, we need to clarify the specific, but varying, pathological changes in patients with giant cell arteritis. This variation of inflammation signs makes the non-invasive biomicroscopic diagnosis extremely difficult. Further observations in a larger number of patients are needed.

4 Slavin ML. Brow droop after superficial temporal artery biopsy; Arch Ophthalmol 1986;104:1127.