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CLINICAL STUDY

The use of ultrasound as an aid in the diagnosis of giant cell arteritis: a pilot study comparing histological features with ultrasound findings

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Abstract

Aims **We present our preliminary experience with the use of ultrasound in aiding the diagnosis of giant cell arteritis (GCA). Schmidt *et al* have previously described a hypoechoic or 'halo' effect surrounding the walls of affected arteries on examination with ultrasound. We illustrate these features and explore the attributes and limitations of this technique.**

Method **Two groups of patients were recruited: (1) patients with suspected GCA awaiting temporal artery biopsy and (2) patients with no history or symptoms of GCA of a similar age group. All the recruited patients underwent ultrasound examination of both temporal arteries.**

The findings on ultrasound were compared with the results of the histological specimens in group 1. For this study, the histological findings alone were used to define if a patient was suffering from GCA. No biopsies were taken in the patients in group 2.

Results **Out of 26 patients with suspected GCA, seven patients were found to be positive on biopsy, of which six had been identified on ultrasound. Six patients were found to be false positive on ultrasound, but all had moderate-to-severe features of arteriosclerosis on histology. A total of 13 patients were found to be negative on ultrasound and negative on biopsy for GCA, two of these patients had histological features of arteriosclerosis.**

In the group with no symptoms of GCA (12 patients), in two patients hypoechoic areas were detected.

The results presented give a sensitivity of 86%, specificity of 68%, and positive predictive value of 50% for the use of ultrasound in the diagnosis of GCA.

Conclusions **This preliminary study indicates that this test may be helpful in those patients with symptoms suggestive of GCA, but currently we cannot recommend any change of present practice.**

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Keywords: ultrasound; giant cell arteritis; arteriosclerosis; temporal artery biopsy

Introduction

Giant cell arteritis (GCA) affects medium- and large-sized arteries in patients over the age of 50 years. It is a clinical diagnosis which can be confirmed with a histological specimen of the temporal artery. Several authors have suggested the use of ultrasound in the diagnosis or management of GCA.[1–10] Schmidt *et al*[1,2] have previously described a hypoechoic or 'halo' effect surrounding the walls of affected arteries on examination with ultrasound. In this study, we compare the features on ultrasonography with the histological findings.

Method

Inclusion and investigation of patients in this study were according to the guidelines of the declaration of Helsinki. Two groups of patients were recruited: (1) patients awaiting temporal

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artery biopsy and (2) patients with no history or symptoms of GCA recruited from day cases awaiting routine cataract surgery. All the selected patients underwent bilateral examination of the temporal arteries with ultrasound by the same radiologist.

Bilateral ultrasound was carried out using a Siemens Elegra scanner with a linear array probe at a frequency of 10.3 Hz. The settings were optimised for soft tissue imaging. Colour Doppler facility was available. Contact jelly was used to allow good soft tissue contact. Bilaterally, the territory of the temporal arteries was fully examined and images recorded from any abnormal segments. The investigating groups were unable to blind the radiologist to the clinical history of the patients.

All the histological specimens taken from group 1 patients underwent routine examination for identification of GCA. All the pathology specimens were treated in a routine fashion and all reported on by the same pathologist. On the request form for the histology, a clinical history is routinely provided. Group 2 patients did not undergo temporal artery biopsy.

The findings on ultrasound were compared to the results of the histological specimens. The histological findings were used to define if a patient was suffering from GCA.

Results

Patients were defined as being 'positive' or 'negative' for GCA on the basis of their histological results. A 'positive' ultrasound image indicates the presence of the hypoechoic area being detected.

Figure 1 demonstrates the appearance on ultrasound of a biopsy-proven artery affected with GCA and biopsy-proven unaffected artery. The top images (a,b) illustrate the hypoechoic area surrounding the affected artery in both longitudinal and axial sections as described by Schmidt *et al*.[1,2] The lower images (c,d) illustrate the appearance of a biopsy-proven unaffected artery.

A total of 26 patients were recruited with suspected GCA (age range 55–95). The results are presented in Table 1. Seven patients were found to be biopsy positive, of which six had been identified on ultrasound to have the characteristic hypoechoic feature. One patient was biopsy positive but on ultrasound negative. six patients were found to be false positive on ultrasound, but all had moderate to severe features of arteriosclerosis on histology (Figure 2). In all, 13 patients were found to be negative on ultrasound and negative on biopsy for GCA with two having histological features of arteriosclerosis.

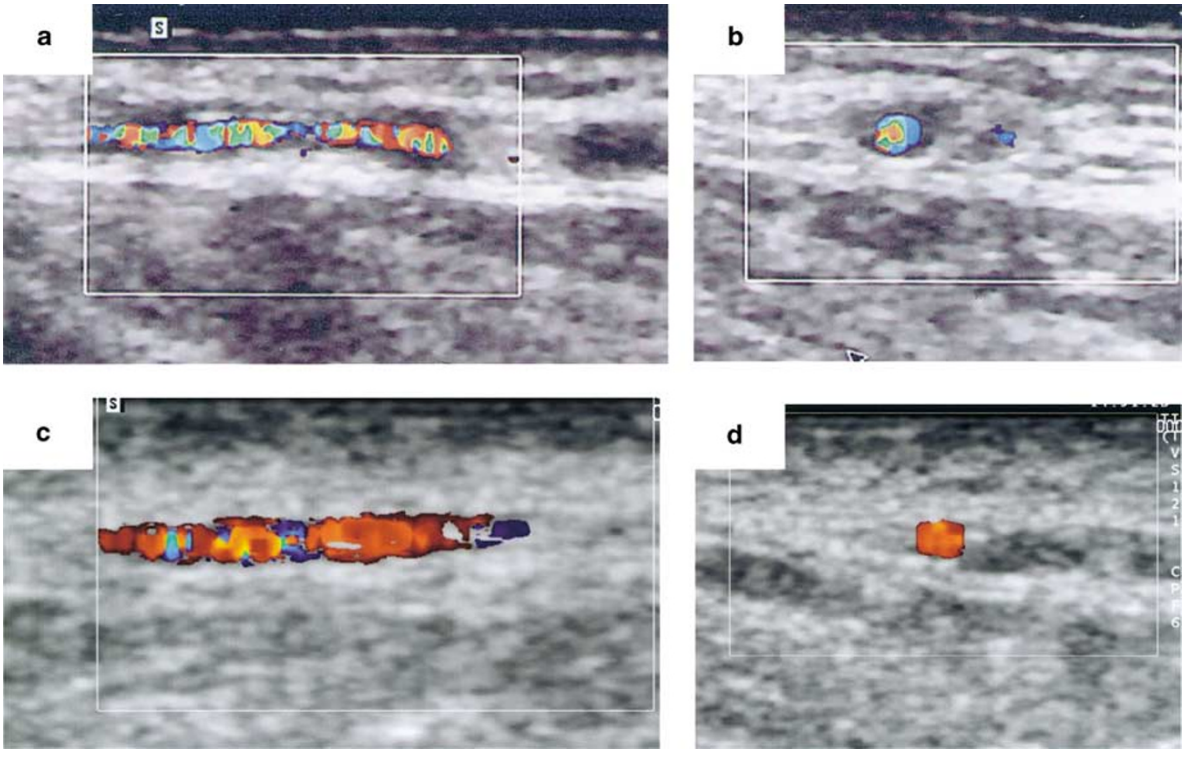
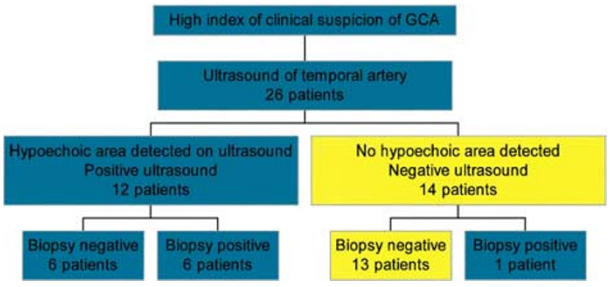


Figure 1 Appearance on ultrasound of a biopsy-proven artery affected with GCA and biopsy-proven unaffected artery. (a,b) Hypoechoic area surrounding the affected artery in both longitudinal and axial sections as described by Schmidt *et al*.[1,2] (c,d) Appearance of a biopsy-proven unaffected artery.

The asymptomatic group contained 12 patients (age range 60–85) in whom a hypoechoic area was recorded in two patients.

The results presented give a sensitivity of 86%, specificity of 68%, and positive predictive value of 50% for the use of ultrasound as an aid in the diagnosis of GCA.

Table 1 Results of ultrasound and temporal artery biopsies in group 1 patients



The group highlighted in the table was identified as being true negatives on ultrasound (13 patients). This group of patients could potentially be spared a biopsy with the use of ultrasound (see Discussion).

Discussion

GCA is a vasculitis which can affect large- and medium-sized vessels in people aged 50 years or older. The incidence has been estimated to be 17 per 100 000[11] with a marked increase in incidence with age and a three-fold greater incidence in women than men. The condition shows geographical and racial distribution with the highest incidence in Scandinavian countries and North American populations of the same descent. Morbidity and mortality in this disease are related to blood vessel occlusion or more rarely arterial ruptures.

GCA can be a challenging disease both to diagnose and to treat. Temporal artery biopsy is widely considered the gold standard for diagnosing GCA. Many clinicians are keen to obtain histological confirmation of GCA prior to exposing the patient to high-dose, long-term corticosteroid or alternative immunosuppression. While a positive biopsy confirms the diagnosis, a negative biopsy does not exclude it. It has been estimated that up to 5–10% of biopsies are false negatives.[12] Sudlow,[13] in a letter to the BMJ, illustrated an increase in the rate of positive biopsy with increasing length of the specimen. The temporal artery biopsies were taken in this study by a variety of surgeons with varying lengths of specimens

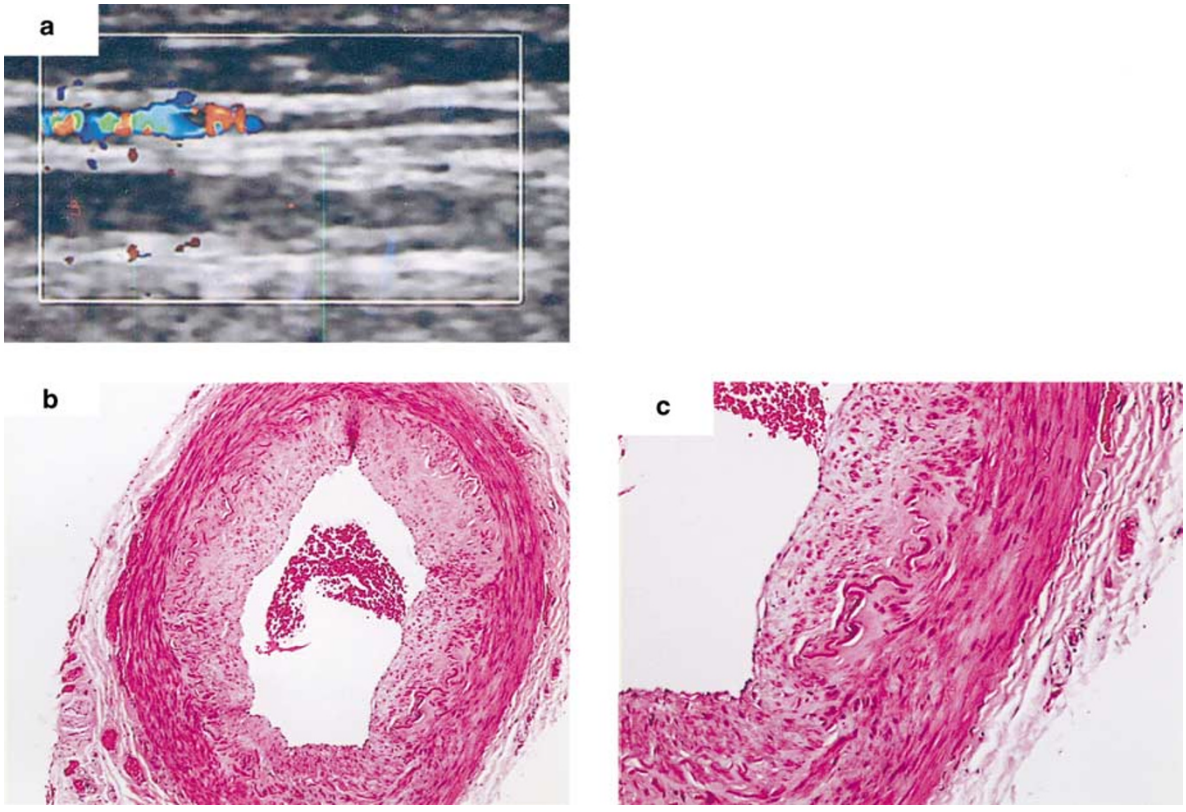


Figure 2 (a) Longitudinal ultrasonography scan identifying a hypoechoic area. (b,c) The corresponding histology, illustrating signs of arteriosclerosis, with fragmentation of the internal elastic lamina.

from 5 to 18 mm. Several authors have advocated taking bilateral biopsies, or at least considering taking a contralateral biopsy in cases in which the first was negative, but a high level of clinical suspicion exists.[14] Despite the limitations of temporal artery biopsy, for the use of this study we required a biopsy-proven GCA to label a patient as a true positive for the disease. No bilateral biopsies were obtained in this patient group.

The American College of Rheumatology criteria for the diagnosis of GCA suggest the presence of any three of the following features for the diagnosis:[15]

- age greater than or equal to 50 years,
- new onset of unilateral headache,
- temporal artery tenderness or decreased pulse,
- ESR greater than or equal to 50 mm/h,
- positive temporal artery biopsy.

Several authors have looked at the sensitivity and specificity of various signs, symptoms, and laboratory investigations other than temporal artery biopsy, illustrating poor correlation with them and a diagnosis of GCA.[16,17] In both these studies the presence of a positive biopsy was used to define the presence of GCA.

Temporal artery biopsy is an invasive procedure associated with some morbidity, with case reports of scalp necrosis, damage to the facial nerve, and cerebrovascular events due to extracranial/intracranial anastomosis. A biopsy allows a small segment of the artery to be examined histologically. Ultrasound permits a more extensive area to be examined with a noninvasive examination.

It has been suggested that ultrasound could have a role in various areas of management of GCA. In the early 1980s, several authors described the use of ultrasound to identify the course of the temporal artery to optimise the location of biopsy.[3,4] It has been reported that orbital blood flow could be measured and the dose of immunosuppression titrated to the findings.[5] Puechal *et al*[6] used Doppler to assess the degree of stenosis, irregularity and asymmetry of flow in the temporal, facial and ophthalmic arteries reporting a sensitivity of 77% and specificity of 80% for the diagnosis of GCA. Schmidt, in a letter to the *Lancet* in 1995[2] followed by an article and editorial in the *New England Journal of Medicine*[1,7] presented his experience with the use of ultrasound in the diagnosis of GCA. He described a hypoechoic area or 'halo' effect surrounding arteries affected by GCA. Schmidt used the American College of Rheumatology criteria for the diagnosis of GCA and the cases were not necessarily biopsy proven. His group reported a sensitivity of 70% and specificity of 100%. In peer review it has been suggested that not only the American College of Rheumatology criteria should be considered for diagnosis but also temporal artery biopsy result and clinical outcome.[8] In this pilot study we have not considered clinical features, but concentrated on comparing histological findings with the ultrasound characteristics.

The investigation is equipment and operator sensitive. Schmidt[9] stressed that a high-resolution scanner such as the Siemens Elegra used in this study was required. Care was also needed with the gain control; if it is too high, the colour obliterates any wall features.

In this study, we have been able to illustrate the hypoechoic features as described by Schmidt. The aetiology of these features has been attributed to oedema in the wall of the artery.[9] As experience developed with the technique, we appreciated that a considerable length of both arteries could be examined (approximately 5 cm). During the period of the study, modification of the technique occurred; initially, we were only recording axial scans, but subsequently axial and longitudinal recordings were made. The single false negative recording with the ultrasound was one of the first patients examined and prior to modification of our technique. The present 'gold standard' for diagnosis of GCA is a temporal artery biopsy which is associated with an estimated false negative rate between 5 and 10%.[12]

In the study group, we were unable to differentiate between GCA and arteriosclerosis on ultrasound. Schmidt did not comment on problems differentiating between these two conditions, but he was not comparing histology results with ultrasound findings. Other groups[10] have reported similar difficulties differentiating between the two pathologies.

The patients recruited to the second group had no symptoms, signs or previous therapy for GCA. Two patients were found to be positive on ultrasound. We believe, in the context of our other findings, that these two patients could have had arteriosclerotic changes. This was not proven histologically as no biopsies were taken.

A total of 13 patients (50% of group 1) were identified as being true negatives on ultrasound, this group is highlighted in Table 1. This group of patients could potentially be spared a biopsy with the use of ultrasound. It is imperative that ultrasound is not used to 'screen' patients. Only patients in whom there is a high clinical suspicion of GCA and in whom a temporal artery biopsy is planned should have an ultrasound undertaken.

The results of this preliminary study are encouraging and we plan to continue to recruit patients. Temporal artery ultrasound is a noninvasive procedure, which allows a significant length of the arteries to be examined bilaterally and repeatably. At present, we do not suggest that ultrasound is a replacement for temporal artery biopsy, but we hope it may have a role in reducing the number of biopsies required in the future.

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