Color doppler ultrasound and the giant cell arteritis probability score for the
diagnosis of giant cell arteritis: a Canadian single center experience

Farah Zarka¹, Maxime Rhéaume¹, Meriem Belhocine¹, Michelle Goulet¹, Guillaume Febrer²,
Anne-Marie Mansour¹, Yves Troyanov³, Tara Starnino³, Rosalie-Sélène Meunier¹, Isabelle
Chagnon¹, Nathalie Routhier¹, Valérie Bénard¹, Stéphanie Ducharme-Bénard¹, Carolyn Ross¹ and
Jean-Paul Makhzoum¹

1- Vasculitis Clinic, Department of Medicine, Hôpital du Sacré-Coeur de Montréal,
University of Montreal, Montreal, Quebec, Canada

2- Division of Vascular Surgery, Department of Surgery, Hôpital du Sacré-Coeur de
Montréal, University of Montreal, Montreal, Quebec, Canada

3- Division of Rheumatology, Department of Medicine, Hôpital du Sacré-Coeur de Montréal,
University of Montreal, Montreal, Quebec, Canada

ORCiD:

Farah Zarka: 0000-0003-4374-546X
Carolyn Ross: 0000-0002-2891-3245
Jean-Paul Makhzoum: 0000-0003-4523-8525

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**Corresponding author:**

Farah Zarka, MD

Vasculitis Clinic

Department of Medicine

Hôpital du Sacré-Coeur de Montréal

5400 boul. Gouin O.

Montreal (Qc) H4J1C5

Canada

farah.zarka@umontreal.ca

ORCID: 0000-0003-4374-546X

**Running head:** Ultrasound in GCA

**Abbreviations:**

CDUS (color doppler ultrasonography)

CRP (C-reactive protein)

ENT (ear, nose, throat)

ESR (erythrocyte sedimentation rate)

GCA (giant cell arteritis)

GCAPS (giant cell arteritis probability score)

LLV (large-vessel vasculitis)

NPV (negative predictive value)

PPV (positive predictive value)

Se (sensitivity)

Sp (specificity)

TAB (temporal artery biopsy)

TIA (transient ischemic attack)
Abstract

Objectives. To compare accuracy of color doppler ultrasonography (CDUS) and temporal artery biopsy (TAB) to establish the final diagnosis of GCA and to determine how the giant cell arteritis probability score (GCAPS) performs as a risk stratification tool.

Methods. Descriptive statistics were performed on a retrospective cohort of patients referred to our vasculitis referral center between July 1st, 2017 and October 1st, 2020 for suspected GCA. CDUS, TAB, center-specific TAB (vasculitis center vs. referring hospitals) and GCAPS were compared against the final diagnosis of GCA as determined by a GCA expert; CDUS was also compared to TAB results.

Results. Data from 198 patients were included: 60 patients with GCA and 138 patients without GCA. Sixty-two patients had a TAB. Using the final diagnosis by a GCA expert as a reference, sensitivity (Se), specificity (Sp), positive predictive value (PPV) and negative predictive value (NPV) were 93.3%, 98.5%, 96.6%, 97.1% for CDUS; and 69.2%, 100%, 100%, 81.8% for TAB. The false negative rate was 6.7% for CDUS and 30.8% for TAB. False negative TAB mostly occurred when performed in referring hospitals (57.1%) as opposed to our vasculitis center (21.1%). With a cut-off at 9.5 points, Se for GCAPS was 98.3% while Sp was 74.3%.

Conclusion. CDUS of the temporal and axillary arteries showed a high sensitivity and specificity and helped to diagnose GCA in patients with negative TAB. We validated that GCAPS is a useful clinical tool with a score < 9.5 making the diagnosis of GCA improbable.

Keywords: Giant Cell Arteritis, Color doppler ultrasonography, Temporal arteries, Probability score
Key messages

1- CDUS is a highly effective tool when performed by a skilled ultrasonographer.

2- CDUS has a better sensitivity than TAB for the diagnosis of GCA.

3- GCAPS is a useful risk stratification tool for the diagnosis of GCA.

Introduction

Giant cell arteritis (GCA) is the most common primary systemic vasculitis, affecting more women than men. Incidence increases with age, almost exclusively occurring in patients over the age of 50. Higher incidence rates have been reported in populations of Northern European descent. [1] Patients can present with a range of non-specific symptoms and the heterogeneous clinical phenotypes make its diagnosis challenging. Significant morbidity can be associated with GCA, particularly if permanent vision loss occurs. This highlights the need for prompt diagnosis and the necessity of a reliable diagnostic tool. In the past, temporal artery biopsy (TAB) was the only diagnostic tool at our disposal; however, it entails undergoing an invasive procedure with possible false negatives. There is also important heterogeneity in how TAB is performed, including biopsy length, number of specimen sections, pathologist’s experience, surgical skill and center expertise. All these variables have the potential to influence TAB result.

In recent years, some non-invasive imaging modalities have shown superior results. Several studies have suggested that color doppler ultrasonography (CDUS) of the temporal and axillary arteries is a useful tool to diagnose GCA. [2,3,4] The 2018 EULAR recommendations for the use of imaging in large vessel vasculitis (LVV) identify CDUS as the first-line imaging modality to
diagnose GCA. These recommendations also state that a patient with a high clinical suspicion and a positive imaging test could forego TAB. [5,6]

Fast-track clinics for the diagnosis of GCA are being implemented in different countries to rapidly identify GCA and decrease associated complications. A study in Norway demonstrated that a fast-track outpatient approach with CDUS is associated with an 88% decrease in permanent visual impairment in patients with GCA when compared with a conventional referral route. [7] Reliability of the CDUS is crucial in these programs and predicts their success. Thus, it is imperative to assess the performance and accuracy of ultrasonographers, and to assess inter-reader variability.

The new GCA probability score (GCAPS) is intended to risk-stratify patients with suspected GCA into low and high probability categories. When using a cut-off point of 9.5, the sensitivity and specificity are reported to be of 95.7% and 86.7% respectively. Items making up this probability score include demographics (age and sex), onset of symptoms, CRP level, symptoms (headache, polymyalgia, constitutional and ischemic symptoms), visual signs (anterior ischemic optic neuropathy, central and branch retinal artery occlusion, field loss and relative afferent pupillary defect), arterial abnormalities (temporal and extra-cranial arteries) and presence of an alternative diagnosis. Each item is attributed points between -3 and 3. Final scores can range between 0 and 32, with a higher score associated with a higher clinical probability of GCA [8] This study was completed in a single center in the United Kingdom and its external validity needs to be evaluated before GCAPS can be reliably used in other GCA fast-track centers.
The objective of this study is to compare CDUS and TAB to the final diagnosis of GCA in a Canadian vasculitis referral center; to compare rates of false negative TAB according to the center it was performed (our vasculitis center with a dedicated experienced surgeon vs. referring hospitals), and to validate the usefulness of the GCAPS in patients with suspected GCA.

Materials and methods

Study design and population
We conducted a retrospective study of all adult patients referred to our department with suspected GCA and who had a CDUS performed as part of their clinical evaluation. Patients were identified from the CAPHECO-GCA (Characteristics, Phenotypes and Complications of patients with GCA) database, which includes all patients referred with suspected GCA in our vasculitis referral center (Hôpital du Sacré-Cœur de Montréal, Université de Montréal).

Inclusion criteria
Consecutive adult patients referred to our GCA ultrasound clinic for suspected GCA between July 1st, 2017 and October 1st, 2020.

Exclusion criteria
Patients who had a CDUS performed to evaluate disease recurrence and those without a comprehensive clinical assessment by one of our vasculitis experts were excluded.
GCA assessment and clinical data

Data collected included patient characteristics, clinical presentation, physical examination, CDUS of the temporal (superficial, frontal, parietal branches), and axillary arteries, TAB results, bloodwork and GCAPS. Normocytic anemia was defined as a hemoglobin level below 140 g/L for men and 120 g/L for women, with a mean corpuscular volume between 80 and 100fL. Thrombocytosis was defined as platelets over 400 x10⁹/L and leukocytosis as a white blood cell count above 10x10⁹/L. A CRP level greater than 5 mg/L was considered elevated as well as ESR values above 10 mm/h and 20 mm/h for men and women, respectively using the Wintrobe method.

CDUS was performed by the same ultrasonographer using the Zonare Z One Ultra Ultrasound System™ with a linear array 14L5 probe or the Canon Xario™ 200 Platinum series with an 18L7 probe. The ultrasonographer was trained in the use of CDUS for the diagnosis of GCA and had four years of experience. Longitudinal and transverse planes were obtained, and compression was applied on all temporal artery branches (common superficial, frontal and parietal branches). A positive CDUS result was defined by a hypoechoic circumferential intima-media thickening (halo sign) in at least two arterial segments and/or the presence of stenosis or thrombosis. These findings were then confirmed with a positive compression sign (inability to compress the hypoechoic vessel wall edema). [9-11]

Data on TAB performed in both our vasculitis center and referring hospitals were collected. In our center, biopsies were performed by a single skilled vascular surgeon and analyzed by the same experienced pathologist. Biopsies done in referring hospitals were performed by different surgery subspecialties (general surgery, ophthalmology, otorhinolaryngology or plastic surgery). Neither
the ultrasonographer, the surgeon or the pathologist were blinded to the patient’s clinical characteristics or laboratory results.

If GCAPS was not specifically documented in the database, it was retrospectively calculated when all the required items were available. The final diagnosis as determined by the vasculitis specialist 6 months following the initial assessment was considered the gold standard for the diagnosis of GCA.

**Statistical analysis**

Analyses were performed using IBM SPSS, version 25.0. They included sensitivity, specificity, positive predictive value and negative predictive value for CDUS, TAB, center-specific TAB (dedicated vasculitis center vs. referring hospitals) and GCAPS compared with the final diagnosis by a GCA expert. Although TAB is not the gold standard for the diagnosis of GCA, CDUS was also compared to TAB as a reference test. A receiver operator characteristic (ROC) curve was plotted for GCAPS against the final diagnosis of GCA.

Categorical variables were presented as proportions (percentages), and continuous variables as mean values (standard deviation (SD)) for normally distributed variables, or medians (interquartile range (IQR)). The $\chi^2$-test was used to compare categorical variables and Fisher’s exact when appropriate. Independent-samples T test was used for the comparison of continuous variables within 2 groups. A P value of <0.05 was considered statistically significant.
Ethics and approval committee

This retrospective study was approved by the research ethics board of the Centre Intrégré Universitaire de santé et de services sociaux du Nord-de-l’Île de Montréal (study number 2019-1754). No modifications have been made to the research protocol and approval was renewed annually.

Results

A total of 206 consecutive patients referred for suspected GCA were identified. Eight were excluded leaving 198 patients included in the study. (Figure 1) Sixty patients had a final diagnosis of GCA as determined by the vasculitis expert, while 138 patients had an alternative diagnosis. (Supplementary Table S1, available at Rheumatology Advances in Practice online) The main clinical characteristics of patients referred for suspected GCA are presented in Table 1. The mean age of patients diagnosed with GCA was 75.2 ± 7.3 years and 70% were females. In patients with GCA, CRP was elevated in 95% of patients (mean value of 81.4 mg/L) while ESR, when performed, was elevated in 46.7% of patients (mean value of 45.3 mm/h). Common clinical manifestations reported by patients with GCA were headaches (81.7%) and constitutional symptoms (55.0%). New visual symptoms were reported by 36.7% of patients with GCA. On the initial assessment, none of the patients with GCA suffered from stroke or TIA. Clinical features strongly associated with GCA included the presence of jaw claudication (LR = 28.9; p < 0.001), and abnormal temporal artery on physical examination (LR = 50.88; p <0.001). Normocytic anemia, leucocytosis, thrombocytosis, and elevated CRP were more often present in patients with GCA. (Table 1)
All 198 patients included had a CDUS performed, while 62 patients had a TAB. Using the final diagnosis as determined by the vasculitis expert as a reference, sensitivity, specificity, positive predictive value, negative predictive value were 93.3%, 98.5%, 96.6%, 97.1% for CDUS; and 69.2%, 100%, 100%, 81.8% for TAB, respectively. (Table 2) False negative rate of CDUS was 6.7% as opposed to 30.8% for TAB. Two of the four patients with a diagnosis of GCA with a negative CDUS had a positive TAB. Negative TAB was observed in 8 of the 26 patients with GCA who had undergone TAB, all of which had a positive CDUS except for one. Two false positive results were observed with CDUS while none were documented with TAB. When TAB was used as a reference for the diagnosis of GCA, CDUS had a sensitivity, specificity, positive predictive value and negative predictive value of 88.9%, 79.1%, 64% and 94.4% respectively. (Supplementary Table S2, available at Rheumatology Advances in Practice online) GCA was diagnosed in 42 patients when TAB was either negative or not performed. (Supplementary Table S3, available at Rheumatology Advances in Practice online, for their baseline characteristics.)

Mean TAB specimen length was 1.68 cm and 1.53 cm \((p = 0.172)\) in the GCA group and the non-GCA group, respectively. TAB specimens sampled in our vasculitis center were longer than those performed in referring hospitals, with an average length of 1.66 cm versus 1.30 cm \((p = 0.014)\). The false negative rate of TAB performed in our vasculitis center was 21.1% as opposed to 57.1% for those performed in the referring center. (Table 2)

Patients were on a glucocorticoid regimen for a median of 2 days (IQR 0.00-7.50) before they were referred to our ultrasound clinic and 7 days (IQR 4.75-13.50) before TAB was performed. Patients with a positive TAB were on glucocorticoids for a median of 9 days (IQR 4.00-21.50)
before TAB was performed versus 7 days (IQR 4.00-13.00) when TAB was negative (p = 0.771).

Patients with a TAB performed in our vasculitis center tended to have a longer treatment course of glucocorticoid before TAB (median of 11.00 days (IQR 4.00-20.00)) compared to patients from referring hospitals (median of 5.00 days (IQR 5.00-7.00)), however this difference was not found to be statistically significant (p = 0.053).

With a cut-off of 9.5 points for the GCAPS, sensitivity, specificity, positive predictive value and negative predictive value was 98.3%, 74.3%, 62.0% and 99.0%, respectively (Table 3). The area under the ROC curve for the 194 patients with a calculated GCAPS was 0.927 (95% CI [0.892-0.961]. The optimal cut-off point for the curve was 9.5 points (Figure 2).

Discussion

Increasing evidence in recent years indicate that CDUS is a helpful diagnostic tool for GCA. Our study demonstrated that CDUS has an excellent sensitivity and specificity when performed by a trained sonographer, and performs better than TAB.

A wide range of sensitivities and specificities for CDUS have been reported, with superior results when performed by a trained sonographer using high resolution equipment. [3,12,13] Many studies have shown that TAB is less sensitive than CDUS. [14] For instance, The Role of Ultrasound Compared to Biopsy of Temporal Arteries in the Diagnosis and Treatment of Giant Cell Arteritis (TABUL) study demonstrated that CDUS had a better sensitivity for the diagnosis of GCA as well as being a cost-effective approach, while the sensitivity of TAB was reported as low as 39%. The specificity of CDUS was reported to be inferior to that of the TAB group, but these results were affected by the lack of experience of most sonographers. [4] A previous study suggested that the
overall sensitivity and specificity of temporal artery ultrasound was > 90% compared with the clinical diagnosis as established by the treating physician based on standard diagnostic criteria. [3] CDUS has also been proposed as a tool for the follow-up of patients with GCA, however, a previous study demonstrated no added value to this approach. [15]

There are several advantages to CDUS, including the absence of radiation and procedural risks, easy access, rapid results, low cost and to identify skip lesions missed by TAB (Figure 3). Skip lesions have been reported to occur between 8.5% and 28% of TAB in patients with GCA. [16-18] The rate of false negative TAB is reported to be as high as 15 to 60%. [19] We found similar data in our study, with a TAB false negative rate of 30.8%. When TAB was performed in our vasculitis center, false negative rate was 21.1% compared to 57.1% in referring hospitals, respectively.

TAB performed in our center has a false negative rate in the lower range of that reported in the literature. [14] One explanation may be that in our center, TAB is performed by a dedicated, experienced vascular surgeon and interpreted by a single pathologist. Most TABs in our center were performed after CDUS, with specific request as to which temporal side and arterial segment to biopsy, whereas TABs outside our center had been done without such guidance. Finally, TAB specimens were longer in our center than those performed in referring hospitals, which likely enhances the diagnostic yield. TAB length was previously shown to be an important predictor of histopathologic diagnosis; for every increase in biopsy length of 0.5 cm, there was an increase in the odds ratio for positive TAB up until 2.0 cm. [20] Overall, this highlights the importance of having a skilled surgeon perform TAB and an experienced pathologist analyzing the tissue sample. Interestingly, a retrospective Canadian study collected data on TAB performed by 11 different
subspecialties, each with varying level of experience depending on geographic location. The number of TAB done per specialty during a 10-year time frame ranged between 1 (emergency medicine) and 3791 (general surgery). [21]

GCAPS is an interesting tool for the risk stratification of patients with suspected GCA, particularly to exclude the diagnosis. The sensitivity of GCAPS in our study (with a cut-off of 9.5 points) was similar (98.3%) to the original publication (95.7%) but had a lower specificity of 74.3 % vs. 86.7%, respectively. In the previous study, 88.4% of patients were accurately classified using GCAPS, whereas 79.5% of our patient population was correctly categorized. This could be explained by the nature of our study, with certain GCAPS being calculated retrospectively. The ROC curve for GCAPS demonstrated an optimal cut-off point of 9.5 points, identical to what was previously reported. [8]

Two patients in our study had a false positive CDUS (1.47%), similarly to what was observed in previous studies. [22] The first patient had a recent acute otitis media with mastoiditis; he had been referred to our clinic to rule out GCA as his inflammatory markers remained elevated despite the infectious episode presumably being resolved. Further investigations demonstrated an invasive ENT (ear, nose and throat) infection with endovasculitis. The second patient was referred with a high clinical probability of GCA (GCAPS= 17), with headaches, visual and constitutional symptoms, abnormal temporal artery exam and elevated inflammatory markers. CDUS was positive on temporal and axillary arteries. GCA was diagnosed but the patient did not improve with glucocorticoids. Subsequent large vessel computed tomography (CT)-angiography revealed an aortic lesion compatible with angiosarcoma which was confirmed on biopsy.
Four patients with GCA had a false negative CDUS. Three of these four had a prolonged course of glucocorticoids before CDUS (ranging from 30 to 480 days before CDUS); GCA was confirmed with either TAB or extra-cranial large vessel imaging. The fourth patient was one of the first CDUS performed at our center. He had been on corticosteroids for 5 days prior to ultrasound and had a positive TAB. These cases highlight that CDUS accuracy decreases with glucocorticoid use. [4,23] TABUL study described optimal results when CDUS was performed on patients within 7 days of the start of glucocorticoids and ideally after they had received only a single dose of glucocorticoids. Additionally, vasculitides are heterogeneous diseases that can present with a range of symptoms with many common diseases mimicking primary vasculitides. [24,25]

This study has several strengths. Patients were consecutively included, and most were assessed by a GCA specialist. The database was thorough, and we demonstrated that CDUS is highly performant in our referral center, similarly to previous studies published by CDUS pioneers. Although many factors influence TAB results, our study raises the question of whether having a consistent experienced surgical specialist and pathologist may improve the yield of TAB.

Our study has several limitations. The study was retrospective and the ultrasonographer was not blinded to the patient’s characteristics, physical exam and laboratory values. However, the final diagnosis was confirmed 6 months after the original assessment. The external validity of our results might be affected by the fact that CDUS was performed by the same ultrasound expert and by the single center design of the study.
Conclusion

CDUS of the temporal and axillary arteries showed a high sensitivity and specificity, and is a useful tool for the diagnosis of GCA when performed by an experienced sonographer. Good quality TAB performed by a skilled surgeon and interpreted by an experienced pathologist may help to reduce the rate of false negative TAB. The GCAPS is a useful clinical tool in our cohort of patients, with a score < 9.5 points making the diagnosis of GCA unlikely.
Acknowledgements

We would like the Canadian Network for Research on Vasculitides (CanVasc) for the support provided for this study. We gratefully thank our research coordinator, Ms. Guylaine Marcotte, for her involvement throughout the study. We also thank Dr Alexandra Mereniuk for reviewing the manuscript.

Author Contributions:

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be published.

Study conception and design: Dr Makhzoum, Dr Ross

Acquisition of data: Dr Zarka, Dr Makhzoum

Analysis and interpretation of data: Dr Zarka, Dr Ross, Dr Makhzoum

Funding: Funding was provided by CanVasc (Canadian network for research on vasculitides) to initiate the CAPHECO-GCA database.

Conflicts of interest: J-P.M. reports personal fees from Hoffmann-La Roche and GlaxoSmithKline outside the submitted work. The remaining authors have declared no conflicts of interest.

Data availability: The database used in this study is available from the corresponding author upon reasonable request. Dr Zarka and Dr Makhzoum had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
Table 1. Baseline characteristics and initial presentation

<table>
<thead>
<tr>
<th>Clinical features, n (%)</th>
<th>GCA (n = 60)</th>
<th>No GCA (n = 138)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>49 (81.7)</td>
<td>94 (68.1)</td>
<td>4.03 (0.045)</td>
</tr>
<tr>
<td>Scalp tenderness</td>
<td>21 (35.0)</td>
<td>28 (20.3)</td>
<td>5.63 (0.060)</td>
</tr>
<tr>
<td>Jaw claudication</td>
<td>20 (33.3)</td>
<td>6 (4.3)</td>
<td>28.94 (&lt; 0.001)</td>
</tr>
<tr>
<td>Visual symptoms</td>
<td>22 (36.7)</td>
<td>30 (21.7)</td>
<td>5.06 (0.073)</td>
</tr>
<tr>
<td>Polymyalgia rheumatica</td>
<td>18 (30.0)</td>
<td>28 (20.3)</td>
<td>2.60 (0.273)</td>
</tr>
<tr>
<td>Constitutional symptoms</td>
<td>33 (55.0)</td>
<td>28 (20.3)</td>
<td>24.66 (&lt; 0.001)</td>
</tr>
<tr>
<td>Abnormal TA on exam</td>
<td>29 (48.3)</td>
<td>7 (5.1)</td>
<td>50.88 (&lt; 0.001)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laboratory values, n (%)</th>
<th>LR (P value)</th>
</tr>
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<tbody>
<tr>
<td>Normocytic anemia a</td>
<td></td>
</tr>
<tr>
<td>Elevated WBC b</td>
<td></td>
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<tr>
<td>Thrombocytosis c</td>
<td></td>
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<tr>
<td>Elevated CRP d</td>
<td></td>
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<tr>
<td>Elevated ESR e</td>
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</table>

<table>
<thead>
<tr>
<th>Inflammatory markers level</th>
<th>P value</th>
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<tbody>
<tr>
<td>ESR (mm/h), mean (± SD)</td>
<td></td>
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<tr>
<td>CRP (mg/L), mean (± SD)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temporal artery biopsy</th>
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<tbody>
<tr>
<td>Length (cm), mean (± SD)</td>
</tr>
<tr>
<td>Median glucocorticoid use before CDUS (days), (IQR)</td>
</tr>
<tr>
<td>Mean cumulative dose of glucocorticoids before CDUS (mg), (± SD)</td>
</tr>
</tbody>
</table>

a Hemoglobin < 140 g/L for men and < 120 g/L for women with a mean corpuscular volume between 80-100fL
b White blood cells > 10x10^9/L
c Platelets > 400x10^9/L
d C-reactive protein > 5 mg/L
e Erythrocyte sedimentation rate (Wintrobe method) > 10 mm/h for men and > 20 mm/h for women
CRP C-reactive protein, ESR Erythrocyte sedimentation rate, GCA Giant cell arteritis, TA Temporal artery, TIA Transient ischemic attack, WBC white blood cell
### Table 2. Comparison of results obtained by CDUS and TAB

<table>
<thead>
<tr>
<th></th>
<th>GCA (n=60)</th>
<th>No GCA (n=138)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CDUS, n = 198</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive CDUS a</td>
<td>56/60 (93.3)</td>
<td>2/138 (1.4)</td>
</tr>
<tr>
<td>Negative CDUS</td>
<td>4/60 (6.7)</td>
<td>134/138 (97.1)</td>
</tr>
<tr>
<td>Inconclusive CDUS b</td>
<td>0/60 (0.0)</td>
<td>2/138 (1.4)</td>
</tr>
<tr>
<td><strong>TAB, n = 62</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive TAB</td>
<td>18/26 (69.2)</td>
<td>0/36 (0.0)</td>
</tr>
<tr>
<td>Negative TAB</td>
<td>8/26 (30.8)</td>
<td>36/36 (100.0)</td>
</tr>
<tr>
<td><strong>TAB performed in our vasculitis center, n = 40</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive TAB</td>
<td>15/19 (78.9)</td>
<td>0/21 (0.0)</td>
</tr>
<tr>
<td>Negative TAB</td>
<td>4/19 (21.1)</td>
<td>21/21 (100.0)</td>
</tr>
<tr>
<td><strong>TAB performed in referring hospitals, n = 22</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive TAB</td>
<td>3/7 (42.9)</td>
<td>0/15 (0.0)</td>
</tr>
<tr>
<td>Negative TAB</td>
<td>4/7 (57.1)</td>
<td>15/15 (100.0)</td>
</tr>
</tbody>
</table>

a 56 patients with positive CDUS: 55 patients with positive CDUS of the temporal arteries, 12 patients with positive CDUS of axillary arteries, including 1 patients with positive isolated axillary arteries CDUS without temporal artery involvement.

b The ultrasound was either technically difficult to interpret or showed mild thickening of the intima-media complex at the upper limit of normal.

*CDUS* Color doppler ultrasound, *GCA* Giant cell arteritis, *GCAPS* Giant cell arteritis probability score, *LVV* Large vessel vasculitis, *TAB* Temporal artery biopsy
Table 3. GCAPS comparison between patients with and without a diagnosis of GCA

<table>
<thead>
<tr>
<th></th>
<th>GCA (n=60)</th>
<th>No GCA (n=138)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCAPS points, mean (± SD)</td>
<td>14.3 (2.9)</td>
<td>8.1 (3.1)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Patients with &gt; 9.5 points on GCAPS (%)</td>
<td>57/58 (98.3)</td>
<td>35/136 (25.7)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Patients with &lt; 9.5 points on GCAPS (%)</td>
<td>1/58 (1.7)</td>
<td>101/136 (74.3)</td>
<td></td>
</tr>
</tbody>
</table>

GCA Giant cell arteritis, GCAPS Giant cell arteritis probability score

Figure legends

Figure 1. Flowchart of patients included in the study. CDUS Color doppler ultrasound, GCA Giant cell arteritis

Figure 2. Receiver operating characteristic curve for GCAPS. The area under the ROC curve for the 194 patients with a calculated GCAPS was 0.927 (95% CI [0.892-0.961]). The optimal cut-off point for the curve was 9.5 points. GCAPS Giant cell arteritis probability score.

Figure 3. Color doppler ultrasound of the temporal arteries. A) Longitudinal view of a normal intima-media complex of the left frontal branch of the temporal artery (arrow). B) Longitudinal view of a hypoechoic thickening of the intima-media (halo sign) of the left parietal branch of the temporal artery (arrow). C) Transverse view of a halo sign using color doppler (green arrow) and positive compression sign in that location (red arrow).
References:


2- Duftner C, Dejaco C, Sepriano A, Falzon L, Schmidt WA, Ramiro S. Imaging in the diagnosis, outcome prediction and monitoring of large vessel vasculitis: a systematic literature review and meta-analysis informing the EULAR recommendations. RMD Open 2018;4: e000612.


**Figure 1.** Flowchart of patients included in the study

206 patients referred for suspected GCA at our GCA CDUS clinic

Excluded:
- 6 patients with known GCA evaluated for disease recurrence
- 2 patients with no comprehensive clinical assessment by our vasculitis expert

60 patients with a diagnosis of GCA as determined by the GCA expert

138 patients with no evidence of GCA as determined by the GCA expert

*CDUS* Color doppler ultrasound, *GCA* Giant cell arteritis
Figure 2. Receiver operating characteristic curve for GCAPS

![ROC Curve](image)

The area under the ROC curve for the 194 patients with a calculated GCAPS was 0.927 (95% CI [0.892-0.961]). The optimal cut-off point for the curve was 9.5 points.
Figure 3. Color doppler ultrasound of the temporal arteries

A) Longitudinal view of a normal intima-media complex of the left frontal branch of the temporal artery (arrow). B) Longitudinal view of a hypoechoic thickening of the intima-media (halo sign) of the left parietal branch of the temporal artery (arrow). C) Transverse view of a halo sign using color doppler (green arrow) and positive compression sign in that location (red arrow).