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Temporal artery ultrasound		Dec 2021	1.1

Scope & purpose

Duplex ultrasound examination is used to assess the temporal arteries for the presence of inflammation suggesting possible Giant Cell arteritis (GCA) [sometimes called temporal arteritis as the temporal arteries are often inflamed].

GCA is usually diagnosed by temporal artery biopsy. Temporal artery biopsy is painful and invasive, can sometimes be inconclusive and may miss so called “skip lesions” leading to a false negative test. Biopsy of the temporal artery is currently considered the gold standard in the diagnostics of GCA. Nonetheless, the likelihood of getting a positive biopsy reduces significantly two weeks after the initiation of corticosteroids. Ultrasound is cheap and non-invasive and can lead to a positive diagnosis of GCA potentially reducing the need for biopsy. With highly trained individuals, ultrasound has been shown to have high sensitivity (88%) and high specificity (96%) for the detection of GCA (ref 1).

Common indications for the performance of this examination include (ref 2):

- Visual disturbance
- Throbbing headache (usually temples)
- Sudden permanent loss of vision in one eye
- Tenderness of the scalp or over the temporal arteries
- Jaw claudication

Personnel

Clinical vascular scientists (CVS), including trainees.

Principles / performance characteristics

To determine the presence or absence of inflammation surrounding the temporal or axillary arteries using B mode, colour and spectral Doppler.

Service users & background

Patients with a suspected temporal arteritis may be referred as part of their diagnostic work up, in conjunction with other imaging modalities. This diagnostic investigation aims to establish if temporal arteritis is a possible cause for their symptoms.

The timing of the examination must be considered when performing ultrasound for temporal arteritis. It is desirable to perform this examination before starting steroid therapy. In diverse studies, the halo sign seems to disappear within a period of 2 days to 6 months after the start of treatment with corticosteroids. In addition, the halo sign reappears in GCA patients suffering a flare. Nevertheless, the Halo sign has been said to rarely disappear before 2 months and can persist for up to 7 months in patients in remission and under steroid treatment. It has been suggested that patients with a smaller number of affected branches require less time for halo disappearance.

Considering that current guidelines are very clear about the importance of starting high-dose steroids immediately on suspicion of GCA (symptoms can be very severe, including permanent sight loss if left untreated), ultrasound must be performed immediately rather than delaying steroids while this examination is being arranged. With the literature unclear

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on how quickly the halo sign may disappear with steroid treatment, caution must be observed when using ultrasound for diagnosis in patients treated with steroids. Rapid access to ultrasound on the day of presentation would be optimum for diagnosis

Risk factors include (ref 2):

- Age - Average disease onset is ~ 70, but it rarely affects individuals younger than 50
- Gender – Women are two times more likely to develop GCA
- Northern European descent - Although GCA can affect anyone, people born in Northern European countries appear to have higher rates of giant cell arteritis. People of Scandinavian origin are particularly at risk
- Polymyalgia rheumatica - People with polymyalgia rheumatica have stiffness and aching in the neck, shoulders and hips. About 15 percent of people with polymyalgia rheumatica also have giant cell arteritis

There are few contraindications for temporal artery duplex ultrasound; however, limitations may include the following:

- Very small vessels are very difficult to image (typically temporal arteries that are less than 2mm) and can be compressed with too much probe pressure
- Very tortuous vessels
- The temporal arteries usually pass beyond the hairline, which can make imaging difficult. Copious amounts of gel may be needed in order to image the vessels
- Patients who are unable to cooperate due to reduced cognitive functions e.g. Alzheimer's or dementia and through involuntary movements
- Dressings, open wounds, staples, haematoma etc
- Patients who have been on steroids for longer than 48hrs prior to having the scan may demonstrate a false-negative result due to the possible disappearance of the halo sign with steroid treatment.

Facilities, equipment & special supplies

Duplex ultrasound machine with linear transducers available. There should be a selection of transducers with high frequencies (preferably L15-7 hockey stick transducer).

Ultrasound gel to provide a couplant between transducer and patient.

Examination couch should be height adjustable. The CVS's chair should provide good lumbar support, be height adjustable and allow for the CVS to move close to the examination couch.

Cleaning materials should be available in line with local and manufacturer's guidelines. These are available either in each procedure room or located in the laboratory store room.

Calibration

Across all sites annual calibration and safety checks of the ultrasound equipment are performed by Clinical Engineering (Trust contract with GE Healthcare).

Quality control

Second opinions from vascular scientist colleagues are requested routinely if clarification is

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sought.

Trainee vascular scientists have all temporal artery scans checked until they are signed off by a senior colleague for competency.

Environmental & safety controls

Infection control procedures followed in accordance with Trust infection control and risk assessment policies – Please see ‘Personal Protective Equipment (PPE) for infection prevention and control’ policy, ‘Hand Hygiene’ policy and ‘Staff Risk Assessments’ which are all available through the Trust Intranet.

Tristel wipes are for cleaning the ultrasound machines and probes after patient use. Universal Clinell wipes are for cleaning all other equipment. Where high risk infection presents or post-op wounds are present use probe covers with sterile gel or Tegaderm dressings, in addition to routine cleaning.

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Temporal artery ultrasound procedure (ref 2)

Preceding document: *VAS-MP-6 Patient management*

The examination would usually be bilateral and evaluation of the following arteries should be included (see diagram 1):

- Common temporal artery/superficial temporal artery
- Parietal temporal artery
- Frontal temporal artery
- Axillary artery

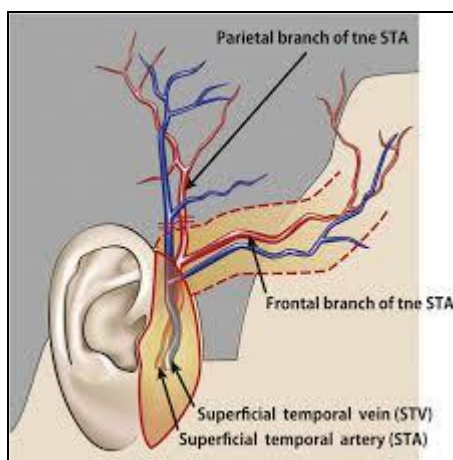


Diagram 1: Temporal artery anatomy (ref 3).

The patient is asked to remove their clothing to expose the axilla and tie back their hair to expose the temporal arteries. The patient can be examined supine with the arm raised above the head when scanning the axilla. The head can be turned to one side for examining the temporal arteries.

Any specific areas of tenderness on the scalp that are identified by the patient should also be examined for any signs of arteritis.

B-mode should be used to image the artery and assess for wall inflammation (or “Halo sign” - a dark (hypoechoic) area around the vessel lumen probably due to arterial wall oedema). The halo should be present in two planes and be circumferential (see diagram 2) and a positive compression sign must be present (see diagram 3).

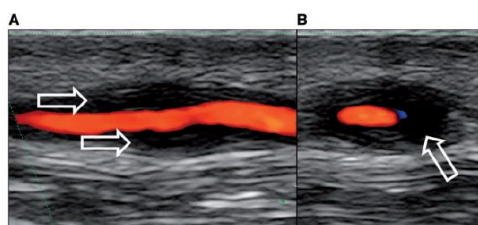


Diagram 2: ‘Halo’ sign. A=longitudinal B=transverse (ref 4).

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	<div data-bbox="280 306 662 633"> </div> <div data-bbox="707 322 1326 459"> <p>Diagram 3: Compression sign. A to B normal compression. C to D positive compression sign (ref 4).</p> </div> <p>In B-mode the intima-media thickness (IMT) should be measured and recorded. A 'Halo' thickness of <0.3mm (table 1) is considered normal in the temporal arteries. For the axillary artery an IMT thickness of <1mm is normal (table 1).</p> <p>Table 1: Cut-off values for normal IMT measurements. Table adapted from Schmidt W.A (2018) (ref 4).</p> <table border="1"> <thead> <tr> <th>Anatomical region</th><th>Cut-off value between normal IMT and vasculitis (mm)</th></tr> </thead> <tbody> <tr> <td>Common superficial temporal artery</td><td>0.4</td></tr> <tr> <td>Frontal branch</td><td>0.3</td></tr> <tr> <td>Parietal branch</td><td>0.3</td></tr> <tr> <td>Axillary artery</td><td>1.0</td></tr> </tbody> </table>	Anatomical region	Cut-off value between normal IMT and vasculitis (mm)	Common superficial temporal artery	0.4	Frontal branch	0.3	Parietal branch	0.3	Axillary artery	1.0
Anatomical region	Cut-off value between normal IMT and vasculitis (mm)										
Common superficial temporal artery	0.4										
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<p>3.</p>	<p>Colour Doppler should be used to assess for the presence/absence of flow and aid the correct positioning of spectral Doppler when quantifying stenosis. Inflammation can cause occlusion, stenosis or may not be flow limiting.</p> <p>Care should be taken when setting the colour gain, as gain too high may lead to masking of the halo.</p> <p>Spectral Doppler should be used to determine direction of flow, stenotic flow (see table 2 for grading criteria) and absence of flow. PSV should be taken and recorded. The waveform within a temporal artery is usually high resistance with low diastolic flow (the common temporal artery is a branch of the external carotid artery (ECA) and has a similar waveform).</p> <p>The machine controls should be optimised continually throughout the scan to obtain the best image to aid with diagnosis.</p>										
	<p>Subsequent documents: <i>VAS-MP-6 Patient management, VAS-MP-1 Results processing</i></p>										

Reporting

The diagrammatic report is a record and interpretation of observations made during the

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temporal artery duplex ultrasound examination; it should be written by the CVS undertaking the examination.

The report should include correct patient demographics, date of examination, examination type, the name and status of the CVS and any clinical history deemed relevant.

The report should include:

- Which arteries have been assessed commenting on the presence/absence of flow
- The presence of any wall inflammation/halo sign
- The presence of any occlusions/stenosis
- Measurements of IMT in the temporal and axillary arteries
- All measurements to be documented in millimetres
- PSV in the Common superficial temporal arteries, parietal and frontal arteries
- PSVRs for any significant stenoses identified
- Any limitations

Table 2: Arterial velocity grading criteria.

Peak Systolic Velocity Ratio (Vs/Vp)	Reported stenosis
< 2	<50% stenosis
2	~50% stenosis
2.1-3.9	50-74% stenosis
4	~75% stenosis
>4	>75% stenosis
No flow detected	Occluded

Vs = Highest PSV at site of stenosis, Vp = pre-stenosis PSV (ref 5).

Any incidental findings should be documented and further imaging recommended when clinically appropriate. If a positive result is obtained and the patient doesn't have a follow-up appointment booked, contact the referring clinician before patient leaves the department.

References

1.	Schmidt W.A., Gromnica-Ihle E., Duplex ultrasonography in temporal arteritis. Ann Intern Med, 2003, 138: 609.
2.	VAS-ED-8. Vascular Technology Professional Performance Guidelines Giant Cell Arteritis Duplex Ultrasound Examination (2021)
3.	Yamacuhi, M et al. (2012). The reverse superficial temporal artery flap from the preauricular region, for the small facial defects. Journal of Plastic, Reconstructive and Aesthetic Surgery, 65, 149-155.

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4.	Schmidt, W. A. (2018). 'Ultrasound in the diagnosis and management of giant cell arteritis', <i>Rheumatology</i> , 57(2), pp.ii22-ii31
5.	Thrush, A. & Hartshorne, T. (2010). <i>Vascular Ultrasound: How, why and when</i> , 3rd edn, Elsevier Limited: London (p.138)