



## The impact of temporal artery biopsy on surgical practice



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### HIGHLIGHTS

- TAB remains the gold standard test for diagnosing GCA.
- This study aims to determine the impact of TAB on current surgical practice.
- TAB alone is an expensive procedure with a low positive yield.
- Recent evidence suggests promising results with USS in diagnosing GCA.

### ARTICLE INFO

#### Article history:

Received 6 July 2016

Received in revised form

16 September 2016

Accepted 18 September 2016

#### Keywords:

Temporal arteries

Giant cell arteritis

Ultrasonography

Magnetic resonance imaging

Positron-emission tomography

### ABSTRACT

**Background:** Giant cell arteritis (GCA) has the potential to cause irreversible blindness and stroke in affected patients [1–4]. Temporal artery biopsy (TAB) remains the gold standard test for GCA [6–8]. Recent literature suggests that TAB does not change management of patients with suspected GCA and that ultrasound scan (USS) may be sufficient enough alone to confirm the diagnosis [9–11,13]. The aim of this study is to therefore determine the impact of TAB on current surgical practice and emergency theatre services.

**Materials and Methods:** A retrospective clinical study was performed of patients who had undergone TAB at the Caboolture Hospital from January 2010 to September 2015. Demographic and clinical data was collected from patient's medical records in regards to GCA.

**Results:** A total of 55 TAB were performed on 50 patients. Only two TAB were positive for GCA. Thirty-eight (76%) patients had a pre-TAB ACR criteria score of  $\geq 3$ . Pre-operative corticosteroids were administered in forty-five (90%) patients, on average  $4 \pm 10$  days pre-TAB. Mean time to TAB was  $1.6 \pm 1.6$  days following their booking. Ninety-one percent of TAB were performed by surgical registrars. All TAB were performed using local anaesthesia alone.

**Conclusions:** TAB is an expensive procedure with a low positive yield. Recent evidence suggests promising results with USS in diagnosing GCA. With the exceedingly low positive TAB results found in this study, patients with suspected GCA should be investigated in accordance with the above algorithm. The routine use of USS will reduce the number of negative TAB performed.

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## 1. Background

Giant cell arteritis (GCA) is a systematic vasculitis that affects large and medium sized arteries [1,2]. It has the potential to cause irreversible blindness and stroke in affected patients who do not

receive prompt steroid therapy [3,4]. The American College of Rheumatology (ACR) criteria has 5 points, of which any 3 are required for a diagnosis of GCA to be made (Table 1) [5]. This has a sensitivity of 94% and specificity of 91%. Temporal artery biopsy (TAB), however, remains the gold standard test for GCA (specificity: 100%; sensitivity: 15–40%) [6–8].

TAB is primarily performed by the inpatient surgical team in order to confirm a histopathological diagnosis in a patient with suspected GCA. However, by the time patients are referred for a TAB, most have fulfilled  $\geq 3$  of the ACR criteria needed to clinically diagnose GCA.

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**Table 1**  
ACR criteria scoring system for diagnosis of GCA [5].

ACR criteria	Points
Age over 50 years	1
Erythrocyte sedimentation rate (ESR) > 50 mm/h	1
Superficial temporal artery tenderness	1
Temporal (lateralised) headache	1
Positive histology of a temporal artery biopsy	1

Recent literature suggests that there is now enough evidence that TAB does not change the management of GCA and that the use of imaging modalities, such as ultrasound scan (USS) and cranial magnetic resonance imaging (MRI) may be sufficient to confirm the diagnosis [9–12].

The aim of this study is to determine the impact of TAB on current surgical practice and emergency theatre services, as well as its associated procedural costs. We also explore recent evidence that is emerging in regards to the use of USS to confirm diagnosis of GCA as opposed to TAB.

## 2. Materials and Methods

A retrospective clinical study was performed by identifying patients who had undergone TAB at the Caboolture Hospital from the 1st of January, 2010 to the 30<sup>th</sup> of September, 2015. Patients were identified by the Caboolture Hospital Operating Room Management Information System co-ordinator. Cross-checking was performed with Medical Records using International Coding of Disease version 10 codes M31.5 (GCA with polymyalgia rheumatica) and M31.6 (other GCA) to identify any further patients suspected of GCA who may (or may not) have undergone TAB in order to obtain a true representation of the whole cohort of GCA patients.

All TAB were performed on the side where pathology (i.e. tenderness over the temporal artery; headache) was present. Each case was performed after obtaining informed consent from the patient in the operating theatre using local anaesthetic (1% lignocaine). On occasion, the superficial temporal artery was marked out with ultrasound in the hospital's radiology department prior to surgery. A surgical consultant (i.e. Fellow of the Royal Australasian College of Surgeons) was present as either the primary operator or first assistant to the surgical registrar (i.e. non-accredited or accredited trainee of the Royal Australasian College of Surgeons). Once the local anaesthesia was infiltrated into the skin of the temporal region (and the patient was appropriately prepped and draped), an incision was made, anterior to the tragus, in the vertical plane. Skin and subcutaneous tissue were incised until the temporo-parietal fascia was reached. The vessel was identified within this fascia and dissected to reveal 3–5 cm of the vessel. This was clamped and an appropriately sized (1–2 cm) specimen excised and sent in formalin for histopathological examination. The clamped ends were ligated with 3/0 silk ties and haemostasis was ensured. The temporo-parietal fascia was closed with 3/0 multifilament sutures and the skin closed with 3/0 monofilament subcuticular sutures.

All patients who underwent TAB were commenced on oral Prednisolone 50 mg daily upon suspicion of GCA by the treating Medical Consultant. All patients were then followed-up in the relevant Medical Consultant's Outpatient Department clinics within two weeks for review of their histopathology and response of their symptoms to the prescribed corticosteroids. Patients who had a good response (i.e. subjective relief of symptoms; improvement in inflammatory markers) to the prescribed corticosteroids and/or a positive TAB on histopathology had their therapy slowly tapered over the next 6 months. Patients who had a little or no

response to the prescribed corticosteroids and/or a negative TAB on histopathology had their therapy more abruptly ceased.

Data was collected from patient's medical records and stored on a secure and encrypted Microsoft Excel database. Patient's details including age and sex were recorded. Extensive clinical data was also obtained. This included the side the TAB was performed on, the length of the TAB specimen, erythrocyte sedimentation rate (ESR), presence of a new headache in the temporal region, and presence of tenderness over the affected temporal region (to fulfil ACR diagnostic criteria). It was also recorded whether pre-operative corticosteroids were given and for how many days prior to TAB, the dose of initial prednisolone given and subsequent regime, and whether the patients symptoms were responsive to treatment. Whether the TAB was performed by a surgical registrar or consultant surgeon was recorded. It was also noted if the TAB was performed under a local anaesthetic or a general anaesthetic. TAB specimens were examined by a senior consultant pathologist at a central laboratory.

A Kendall's tau-b correlation was performed to determine the relationship between each individual ACR diagnostic criteria and TAB results using IBM SPSS Statistics for Windows, Version 22.0 [12]. Quantitative variables were also presented to ascertain the procedural costs for performing TAB in the setting where there was not a dedicated emergency theatre service available.

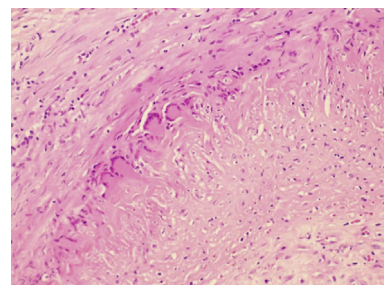
## 3. Results

A total of 55 TAB (on 50 patients) were performed from the 1st of January, 2010 to the 30th of September, 2015. The mean age was  $70 \pm 13$  years. Thirty-six (66%) TAB were performed on females, while nineteen (35%) TAB were performed on males. All patients admitted to hospital during the study period with suspected GCA underwent TAB.

Of the 55 TAB performed, only 2 (3.6%) specimens were reported as positive for GCA (both were female) (Fig. 1). Four (7.2%) specimens were reported as insufficient sample size (i.e. specimens <10 mm; three of these being from same patient), one (1.8%) specimen yielded a vein and one (1.8%) specimen yielded a peripheral nerve. The remaining 47 (86%) specimens reported as negative for GCA; four (7.2%) of which showed age-related changes, one (1.8%) showing degenerative changes.

Twenty-one (38%) TAB specimens that were above the accepted cut off length of 1–2 cm (mean TAB specimen length:  $0.9 \pm 0.5$  cm). Thirty-six (66%) TAB were taken from the left temporal artery, while nineteen (35%) TAB were taken from right temporal artery. Two (4%) patients had bilateral TAB, while the other forty-eight (96%) had unilateral TAB. One (2%) patient had three attempts at a TAB (all left-sided) that were unfortunately unable to yield representative sample size for histopathological examination (all specimens were 6 mm in length).

The mean ACR criteria score was  $3 \pm 1$ . Prior to their TAB, thirty-



**Fig. 1.** High-power view of a positive TAB specimen shows disruption of the intima with a collection of multinucleated giant cells.

eight (76%) patients had an ACR criteria score of  $\geq 3$ , ten (20%) patients had a score of 2 and two (4%) patients had a score of  $\leq 1$ . In relation to the ACR criteria, forty-nine (98%) patients were aged  $> 50$  years, forty-five (90%) had temporal (lateralised) headache, twenty-eight (56%) had superficial temporal artery tenderness, twenty-six (52%) had an ESR  $> 50$  mm/h and as mentioned previously only two (4%) had positive TAB results. Results for these are shown in [Tables 2 and 3](#).

Pre-operative corticosteroids were administered in forty-five (90%) patients undergoing TAB, on average  $4 \pm 10$  days prior to their TAB. In the other five (10%) patients, corticosteroids were administered on the first post-operative day.

All fifty patients were reviewed within two weeks by the referring medical team consultant in their outpatient's department clinic. Seven (14%) patients had a good response to the corticosteroid therapy and two (4%) patients had positive TAB on histopathology and had their therapy slowly weaned over the next six months. The remaining forty-one (82%) patients had little or no response to the corticosteroid therapy and/or negative TAB on histopathology and had their therapy rapidly weaned or ceased accordingly.

All referrals were from the inpatient medical team for TAB were seen, consented and booked on the same day that they were requested. TAB were performed on average  $1.6 \pm 1.6$  days following booking of the case on the emergency theatre. Ninety-one percent of TAB were performed primarily by surgical registrars (both accredited and non-trainees of the Royal Australasian College of Surgeons), whilst nine percent of TAB were performed primarily by a consultant surgeon. All fifty-five TAB were performed using local anaesthesia alone.

There was no significant correlation between age  $> 50$  years ( $\tau_b = 0.03$ ,  $p = 0.83$ ), ESR  $> 50$  mm/h ( $\tau_b = -0.05$ ,  $p = 0.75$ ), tenderness ( $\tau_b = -0.22$ ,  $p = 0.14$ ), or headache ( $\tau_b = 0.07$ ,  $p = 0.62$ ) and TAB results.

The current procedural cost to the Hospital of each TAB is \$452, while the cost for an USS of the temporal arteries costs the Hospital \$170.

#### 4. Discussion

This retrospective clinical study provides an extensive analysis of patients undergoing TAB in our institution. The number of positive TAB specimens was exceedingly low (2 patients; 1.8%) in the 55 TAB performed, highlighting the futility of TAB in confirming the diagnosis of GCA. However, this appears to be consistent with recently published literature reporting similarly low positive TAB

specimen rates of 7%, 18%, 16%, 31% and 34% [6,14–17]. Low positive TAB rates from our study may be due to a number of factors, such as specimen length (usual requirement is 1–2 cm), skip lesions associated with GCA and length of pre-operative corticosteroid therapy [6]. In our institution, mean specimen length was  $0.9 \pm 0.5$  cm, and the mean length of pre-operative steroid duration was  $4 \pm 10$  days, which appears again comparable with available literature [6,14–17].

Performing TAB in an institution where there is not a dedicated emergency theatre service has a significant impact on current surgical practice. TAB were usually performed within two days of being booked, however this still means that anywhere up to 72 h may pass before a roughly 20-min procedure could be performed that may not change the patient's management.

The procedural cost of TAB needs to also be taken into consideration. The current procedural cost to the Hospital of each TAB is \$450. This means that around \$25,000 could have been saved over the five years this study spans. The cost for an USS of the temporal arteries, on the other hand, costs the Hospital \$170; a significantly less expensive option than a TAB.

In mentioning the use of USS, recent evidence has surfaced in relation to its use in diagnosing GCA [9–11,13]. The 'halo sign' characterised as a hypoechoic circumferential mural thickening localised around the lumen of an oedematous wall of a temporal artery seen on USS was first described by Schmidt et al. ([Fig. 2](#)) [18]. The presence of a 'halo sign' is highly specific for GCA (unilateral – 81%; bilateral – 100%) [19,20]. The high value and validity of USS in the diagnosis has also been reported in three recently published meta-analyses and a comparative study is being performed of USS vs. TAB in the diagnosis of GCA [21–24]. There is concern, however, of the potential for variations in user proficiency and limited ultrasonographer experience in regards to appropriately identifying the presence of this disease process successfully, especially in the regional hospital setting. Referral to a specialist tertiary centre where this imaging modality is more commonly used in diagnosis of GCA may aid in improving positive TAB results.

MRI can also be used to aid in the early diagnosis of GCA. It may demonstrate stenosis of the vascular lumen with associated mural thickening and enhancement, thought to correlate with disease activity [12]. Relatively high specificity (90%) and sensitivity (80%) from a recent multicentre trial involving patients treated for 5 days or less. While, patients treated already receiving treatment for 6–14 days, reduced the sensitivity of MRI to 73% [25]. However, high costs and limited availability of MRI for such an investigation may not be available and even delay diagnosis and appropriate and timely treatment.

Conventional or computed tomography angiography and positron emission tomography (PET) are also useful in the diagnosis of GCA. Mural thickening and wall thickening seen on the venous phase of the scans are commonly seen in active disease [12,26]. Again, however, high costs and limited availability of these imaging modalities for such an investigation may delay diagnosis.

Patients with an ACR criteria score of 2 were by definition the group that required a TAB for exclusion or confirmation of a diagnosis of GCA. In our study, ten (20%) patients had an ACR criteria score of 2 prior to their TAB and hence required a TAB to confirm or exclude a diagnosis of GCA. However, the TAB histopathology results of these patients (and all patients) still did not change the overall management of patients with suspected GCA.

Previous studies have also mentioned the use of algorithms and incorporating the use of USS in these algorithms alongside TAB to help improve yield rates of TAB [16,27]. A proposed revision of these algorithms and to include USS has been included in [Fig. 3](#). This will hopefully be implemented in future practice in our institution.

**Table 2**  
Results of our study in relation to the ACR criteria scoring system.

ACR criteria	n	%
Age over 50 years	49	98
Temporal (lateralised) headache	45	90
Superficial temporal artery tenderness	28	56
Erythrocyte sedimentation rate (ESR) $> 50$ mm 1st hour	26	52
Positive histology of a temporal artery biopsy	2	4

**Table 3**  
Results of our study according to the ACR criteria scoring system.

ACR criteria score	n	%
ACR $\leq 1$	2	4
ACR = 2	10	20
ACR $\geq 3$	38	76
Total	50	100

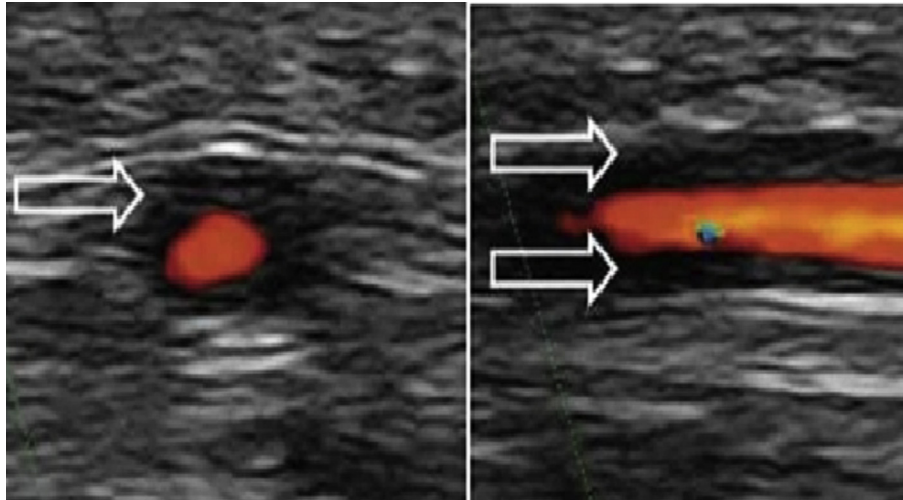


Fig. 2. USS of a TAB specimen demonstrating classical hypoechoic 'halo sign' of GCA (arrows). (Left) Cross sectional view. (Right) Longitudinal view.

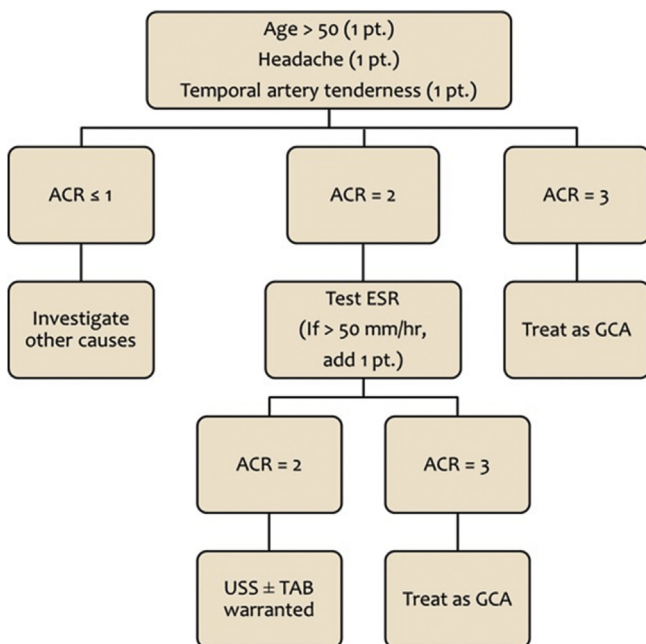


Fig. 3. A proposed revised algorithm for investigating patients with suspected GCA.

Strengths of this study include the fact that details that previously have not been noted in the literature in regards to TAB were explored, such as TAB specimen length, time taken from booking of the case to operation and whether the TAB was performed by a registrar or consultant surgeon. Procedural costs and impact on emergency theatre services have also not been discussed previously in other published literature. It is also important to note that despite the retrospective nature of this study, no patients were lost to follow-up.

Limitations include the inherent bias and retrospective nature of this study and the inability to control and standardise treatment regimens for patients being investigated for suspected GCA. However, there are standards of treatment used by the inpatient medical teams in regards to the management of GCA which restrict the influence of treatment bias on patient outcomes. Lastly, the patient sample size is relatively small, but comparable to other TAB studies [6,14–17].

Today, TAB continue to be performed in our institution upon request from inpatient medical teams. However, the use of USS in patients who are being considered for TAB is being explored to ascertain its validity. The ACR criteria is still used by both our medical specialists and surgical colleagues for both clinical and academic purposes. However, there are also plans to incorporate use of the algorithm into current practice.

GCA has the potential to cause irreversible blindness and stroke in affected patients. With the exceedingly low positive TAB results found in this study, patients should be investigated in accordance with the above algorithm in order to reduce the number of negative TAB performed.

#### Ethical approval

Ethics approval was not sought for this chart audit.

#### Funding

None.

#### Author contribution

Study design: Rasika Hendaheewa, Adam Cristaudo.

Data collections & data analysis: Adam Cristaudo, Ryo Mizumoto.

Writing: Adam Cristaudo, Ryo Mizumoto.

#### Conflicts of interest

The corresponding author is not a recipient of a research scholarship. There are no potential or real conflicts of interest. This paper has been verbally presented at the 2016 Royal Australasian College of Surgeons Annual Scientific Congress in Brisbane, Australia. This month, it will be verbally presented at the 2016 Royal Australasian College of Surgeons Neville Davis Prize Preliminary Competition in Brisbane, Australia.

#### Guarantor

Adam Cristaudo.

**Research registration unique identifying number (UIN)**

Researchregistry908.

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