Facial nerve injury during temporal artery biopsy

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ABSTRACT

Temporal artery biopsy is considered the gold standard investigation of giant cell arteritis and is recommended in suspected cases despite a sensitivity of 81–91%. This review highlights the potential risk of facial nerve injury during temporal artery biopsy and introduces recent advances in the emerging role of imaging modalities. When these non-invasive techniques are used in conjunction with American College of Rheumatology scoring, which includes clinical features and biochemical test results, temporal artery biopsy may be avoided in selected cases.

KEYWORDS

Giant cell arteritis – Biopsy – Facial nerve – Facial nerve injury – Temporal artery

Accepted 28 May 2013

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Surgeons from a range of specialties including vascular, general and ophthalmological surgery perform temporal artery biopsies as part of the diagnostic workup of giant cell arteritis (GCA). The test has traditionally been considered the gold standard for diagnosis in all cases of suspected GCA¹ but this may be set to change given that it is not without its risks, as this article aims to highlight, and that less invasive investigations are emerging, which may be used in conjunction with biochemical markers to replace temporal artery biopsy in selected cases.

Methods

A search of the English language literature was performed on Embase™, MEDLINE® and PubMed databases including the search terms ‘temporal artery biopsy’, ‘facial nerve injury’ and ‘facial nerve palsy’.

Superficial temporal artery anatomy

GCA has a preponderance for the frontal branch of the superficial temporal artery (FBSTA). The FBSTA is most commonly palpable (if not visible) lateral to the superior orbital rim and anterior to or just within the hairline.

The temporal branch of the facial nerve (TBFN) also passes through this anatomical region (Figure 1), and innervates the frontalis and orbicularis oculi muscles of facial expression involved in raising the eyebrow on that side to furrow the brow and tightly shutting the eyelid respectively (Fig 1). The anatomical relation between the FBSTA and TBFN has been found to depend on whether the superficial temporal artery (STA) bifurcates above or below a horizontal line drawn from the superior orbital rim, giving a high

location or low location type FBSTA.² Where the FBSTA is of a low location type (64%), terminal twigs of the TBFN actually intertwine with the artery whereas for the high location type FBSTA (36%), the TBFN passes inferiorly to the artery. Anatomical studies demonstrate that over the zygomatic arch, the STA passes within the superficial temporal fascia and the TBFN passes on the undersurface of the same fascial layer.⁵

Facial nerve injury during temporal artery biopsy

The close proximity between artery and nerve puts patients undergoing temporal artery biopsy of the FBSTA at risk of TBFN damage, and this has been reported in the literature, mainly in the form of case reports and series (Table 1).^{4–8} The majority of these cases describe biopsies taken at the temporal region resulting in significant TBFN palsy with brow droop, loss of brow elevation and loss of eyelid closure that recovered at variable rates. One case in the series reported by Yoon *et al* recovered 75% at nine months and another recovered 0% in the same time interval.⁸

The only study investigating the incidence of facial nerve injury following temporal artery biopsy was a prospective analysis of 75 biopsies performed in 68 patients.⁹ All of the patients were seen 7–10 days postoperatively, at which time 12 of the 75 biopsies (16.0%) were associated with new frontalis palsies. Of these 12 patients, bilateral nerve palsy was not described in any case and complete recovery was found within 6 months in 7 cases (58.3%), within more than 6 months in 3 cases (25.0%) and no recovery by 1 year was observed in 2 cases (16.7%).

The exact location of the incisions were not described in all cases included in Table 1 although Yoon *et al* reported

Figure 1 Superficial temporal artery and seventh cranial nerve anatomy

that in all three cases of frontalis palsy following STA biopsy in the temporal region the incision was within 30mm of the lateral orbital rim.⁸ Additionally, Murchison and Bilyk found an inverse relationship between the incidence of TBFN injury and distance away of the incision from the lateral orbital rim ($p=0.0151$), with no incidences of brow ptosis following temporal artery biopsies where the incision was above the brow of greater than 35mm from both the lateral brow and the lateral orbital rim.⁹

These findings support the description of an anatomical ‘danger zone’,⁸ where TBFN injury is more likely during FBSTA biopsy. The danger zone is shown in Figure 2 and the boundaries are: the tragus of the ear (Point A), the junction of the zygomatic arch and lateral orbital rim (Point B), the area 2cm superior to the superior orbital rim (Point C), and the point superior to the tragus and in horizontal alignment with Point C (Point D).

It has been put forward that in order to avoid the danger zone, biopsy specimens should be taken, with the aid of

handheld Doppler where necessary, from the parietal branch of the STA.^{8,10} This branch travels superoposteriorly from the bifurcation of the STA and passes superior to the pinna of the ear. This method would mean avoiding the TBFN as well as producing a more preferable cosmetic outcome with a scar that is hidden from the hair-line. Unfortunately, as no data exist in the literature regarding the sensitivity and specificity of temporal artery biopsy of the parietal branch of the STA, recommendations cannot be made to perform parietal branch biopsy in all cases.

Given that GCA cannot be demonstrated definitively in a patient whose temporal artery biopsy is negative, the true sensitivity cannot be observed directly. However, Niederkohr and Levin used Bayesian analysis, a statistical method, to determine the sensitivity of a unilateral temporal artery biopsy based on data on bilateral biopsies, reporting sensitivity as between 81.8% and 91.7%.¹¹

Variation in surgical technique also has a role to play in the sensitivity of temporal artery biopsy as specimen length has been shown to correlate significantly with positive result rate of the biopsy, leading to the recommendation that specimens are at least 10mm in length.^{1,12} Nevertheless, while it would follow logically that procedures in which longer specimens are taken were associated with a greater extent of dissection and higher incidence of facial nerve injury, this was found not to be the case by Murchison and Bilyk ($p=0.680$).⁹

As patients should be started on corticosteroid treatment from the moment the diagnosis of GCA is suspected on clinical grounds, undergoing temporal artery biopsy does not introduce any delay to the commencement of treatment. Furthermore, the effect of patients being started on steroid treatment preoperatively has not been shown to have any impact on the diagnostic yield where the duration of steroid treatment before biopsy is less than four weeks.^{13,14} There are, however, no studies into whether

Table 1 Case reports and series of facial nerve injury following temporal artery biopsy

	Patient age / sex	Biopsy site	Disability	Recovery
Slavin, 1986 ⁴	55 F	Temporal	Eyebrow droop	70% at 6 months
Bhatti, 2000 ⁵	63 F	Temporal	Partial facial paralysis	0% at 1 month
Bhatti, 2001 ⁶	75 F	Temporal	Inability to move upper left forehead and slight eyebrow droop	0% at 6 months
Rison, 2011 ⁷	73 F	Superficial temporal artery	Significant limitation of left eye closure and diminished upward frowning of left brow	
Yoon, 2011 ⁸ Patient 1	78 M	Temporal	Complete loss of eyebrow elevation, brow droop and partial loss of eyelid closure	0% at 1 month
Yoon, 2011 ⁸ Patient 2	60 F	Preauricular	Complete loss of eyebrow elevation, brow droop and partial loss of eyelid closure	10% at 5.5 years
Yoon, 2011 ⁸ Patient 3	87 M	Temporal	Complete loss of eyebrow elevation, brow droop and partial loss of eyelid closure	75% at 9 months
Yoon, 2011 ⁸ Patient 4	66 F	Temporal	Complete loss of eyebrow elevation, brow droop and partial loss of eyelid closure	0% at 9 months

Figure 2 The anatomical ‘danger zone’ (Point A: the tragus of the ear; Point B: the junction of the zygomatic arch and lateral orbital rim; Point C: the area 2cm superior to the superior orbital rim; Point D: the point superior to the tragus and in horizontal alignment with Point C)

there is a relationship between length of steroid use and the rate of nerve injury or bruising and bleeding.

Impact on Management and alternative investigations

In light of these disadvantages to temporal artery biopsy, it is pertinent to examine the necessity of this test and its impact on management. Of patients with American College of Rheumatology scores of 3 or more, their temporal artery biopsy result has been reported to make a change to management in only a small proportion (less than 10%) (Table 2).^{13,15}

An algorithm for the management of suspected GCA published in guidelines by the British Society for Rheumatology recommends starting steroid therapy as soon as GCA is suspected and either gradual steroid tapering after disease control with bone protection in patients with biopsy positive disease or rapid steroid tapering within two weeks for biopsy negative cases where there is low clinical suspicion following specialist review.¹ Patients with negative biopsies for whom there is still a high clinical suspicion or ultrasonography evidence of GCA are still treated as having biopsy positive disease.

Given that this group of patients receive the same treatment despite a negative biopsy, undergoing temporal artery biopsy with its associated risks could be avoided by sufficient preoperative selection. As well as the presence of typical clinical features in combination,¹⁶ various laboratory markers (particularly, erythrocyte sedimentation rate >50mm/hour, C-reactive protein >2.45mg/dl and platelets >400,000/ μ l)^{17,18} have been reported to be highly sensitive and specific in the diagnosis of GCA.

Additionally, there is the potential for an emerging role of imaging in the management of suspected GCA. This is in the form of colour duplex sonography, where the presence of the ‘halo’ sign bilaterally has been suggested to have a sufficiently high positive predictive value and the absence of the halo sign a sufficiently high negative predictive value to negate the need for biopsy in either circumstance.^{19,20} Postcontrast high resolution magnetic resonance imaging has also shown promise in detecting (in some instances) inflammation of the occipital branches of the STA without involvement of the frontal or parietal branches.²¹

Conclusions

The TBFN runs in close proximity to the FBSTA, a segment of which is commonly dissected, ligated and excised during temporal artery biopsy, when nerve injury and its accompanying facial paresis can occur. Emerging evidence in the support of American College of Rheumatology scoring, laboratory markers and imaging techniques offers avenues of future development towards more selective use of temporal artery biopsy in the management of suspected GCA.

Table 2 American College of Rheumatology scoring criteria ¹⁴	
Criterion	Definition
Age at disease onset >50 years	Development of symptoms or findings beginning at age 50 or older
New headache	New onset or new type of localised pain in the head
Temporal artery abnormality	Temporal artery tenderness to palpation or decreased pulsation, unrelated to arteriosclerosis of cervical arteries
Elevated ESR	ESR >50mm/hour
Abnormal artery biopsy	Vasculitis, mononuclear cell predominance, granulomatous inflammation, multinucleated giant cells
ESR = erythrocyte sedimentation rate	

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