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Giant Cell (Temporal) Arteritis: The Rate and Clinical Predictors of Histopathological Diagnosis

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Abstract

Purpose: To determine the rate of histopathological diagnosis by Temporal Artery Biopsy (TAB) and the predictive clinical features of TAB positivity in patients with Giant Cell Arteritis (GCA).

Methods: The records of patients who underwent TAB with pre diagnosis of GCA between January 2006 and May 2020 were retrospectively reviewed. The demographic characteristics, symptoms, clinical and laboratory findings, TAB data and the medications of the patients were recorded. The patients were divided into two groups as TAB negative and TAB positive and compared clinically. Factors affecting TAB positivity were determined.

Results: TAB confirmed the diagnosis of GCA in 48% of our cases. The median fixed TAB specimen length was 1.7 (0.5-4.0) mm. TAB positivity increased with age (74 *vs.* 66 years, p=0.027) and was more common in women (91.7% *vs.* 38.5%, p=0.019). Jaw claudication (66.7% *vs.* 15.4%, p=0.027) and decreased pulse of the TA (58.3%*vs.* 7.7%, p =0.022) were more in the TAB positive group than in the TAB negative. The median C Reactive Protein (CRP) level was statistically higher in the TAB positive group compared to the TAB negative (37 mg/L *vs.* 12.6 mg/L, p=0.039). The univariate logistic regression analysis revealed female gender (OR (95% CI): 2.9 (1.7-181.3), p=0.016), presence of jaw claudication (2.4 (1.6-75.5), p=0.015), decreased TA pulse (2.8 (1.6-174.5), p=0.018) and Erythrocyte Sedimentation Rate (ESR) (0.03 (1.0-1.1), p=0.049) as factors associated with TAB positivity.

Conclusion: The rate of TAB positivity was 48%. Older age, female gender, the presence of jaw claudication and decreased pulse of TA, high ESR and CRP values are predictive features of TAB positivity and GCA diagnosis.

Keywords: Giant cell arteritis; Temporal arteritis; Temporal artery biopsy; Predictive factors; Vasculitis

Introduction

Giant Cell Arteritis (GCA) is a vasculitis in which granulomatous changes are seen in large and medium sized vessels. The aorta and extracranial branches of the external carotid arteries are most commonly affected [1]. It is the most common form of systemic vasculitis seen in people over the age of 50 [2]. Although the exact etiology and pathogenesis of GCA are not fully understood, aging, genetics and infections are thought to play a role [3].

Patients with GCA have a wide range of symptoms and clinical findings related to the involved arteries [4,5]. Headache, temporary and permanent vision loss, jaw claudication, scalp tenderness and polymyalgia rheumatica are common symptoms [6,7]. There may also be general complaints such as fatigue, fever and weight loss. Visual symptoms and signs may include unilateral or bilateral partial or complete vision loss, diplopia, amaurosis fugax, ischemic optic neuritis and optic atrophy. Erythrocyte Sedimentation Rate (ESR) and C Reactive Protein (CRP) are usually high, but may be normal in a small number of patients. In addition, laboratory changes such as normochromic normocytic anemia, increased thrombocyte count and elevated liver enzyme levels can be seen [8,9].

Temporal Artery Biopsy (TAB) is the gold standard in the diagnosis of GCA, but may not always support the diagnosis because of the segmental involvement of the disease [10-12]. The characteristic TAB findings of GCA are vasculitis in which mononuclear cells predominate in the inner elastic lamina or segmental and focal panarteritis with granulomatous inflammation. Sometimes it can cause a blockage of the blood vessel or weakening of the vessel wall followed by rupture [13]. This study was planned to evaluate the rate of histopathological diagnosis by TAB and its relation with symptoms and clinical findings in patients with GCA.

Materials and Methods

This study was approved by the local Research Ethics Committee and was performed according to the principles of declaration of

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Helsinki. The records of patients who underwent TAB with pre diagnosis of GCA at Ondokuz Mayis university medical faculty hospital between 01.01.2006 and 01.06.2020 were retrospectively reviewed.

Patients who were diagnosed as GCA with clinical and laboratory findings, who underwent TAB for the confirmation of GCA diagnosis, who were treated with the diagnosis of GCA and who were followed up for at least 3 months after treatment were included in the study. Among these patients who with the follow up less than 3 months and patients with incomplete data were excluded from the study.

The demographic characteristics of the patients; complaints during the admission to the hospital; clinical findings and laboratory data during diagnosis and follow up; imaging results, if any; TAB data were recorded. The presence of headache, vision loss, fever fatigue, weight loss, polymyalgia rheumatica and jaw claudication were investigated among the symptoms of the patients. On examination, the presence of tenderness to palpation or decreased pulse of the Temporal Artery (TA) was investigated. The ophthalmological findings of patients with ischemic optic neuropathy at the presentation, after the treatment and at the follow up were recorded. Among the blood tests, ESR, CRP, hemoglobin, White Blood Cells (WBCs), platelet, Fasting Plasma Glucose (FPG), Aspartate Aminotransferase (AST), Alanine Aminotransferase (ALT), Alkaline Phosphatase (ALP), Blood Urea Nitrogen (BUN), creatinine and fibrinogen values were recorded. The application time, macroscopic and microscopic findings of TAB were examined. The time of TAB was evaluated in 3 categories: Before the initiation of the treatment, within the first 7 days after the initiation of the treatment and after the 7th day of the treatment.

The patients were divided into two groups as TAB negative and TAB positive and compared clinically. Patients were classified as TAB negative if they had no biopsy findings consistent with GCA and fulfilled the 1990 American College of Rheumatology (ACR) criteria for the classification of GCA. Factors affecting TAB positivity were determined.

Statistical analysis

The statistical analysis was carried out using V22 Statistical Package for the Social Sciences software (SPSS Inc., Chicago, IL, USA). The compliance of the data to normal distribution was evaluated with the Shapiro Wilk test. Non parametric tests were used because the data are not normally distributed. The Mann Whitney U test was used for continuous independent variables and *chi-square* test used for categorical variables. For these tests, p values of <0.05 were considered to be statistically significant. The results were given as median (minimum-maximum) and frequency (%). Univariate and multivariate regression analyzes were performed to determine the factors associated with TAB positivity.

Results

Demographics

TAB had been performed in 41 patients with a pre diagnosis of GCA at Ondokuz Mayis university medical faculty hospital between 01.01.2006 and 01.06.2020. Data of 25 patients who met the inclusion and exclusion criteria of the study were analyzed. There were 16 (64%) females and 9 (36%) males with a median age of 70 (51-83) years in the study. It was determined that TAB positivity increased with age (74 years in TAB positive group *vs.* 66 years in TAB negative group, p=0.027) and was more common in women (91.7% in TAB positive group *vs.* 38.5% in TAB negative group, p=0.019) (Table 1). Eighteen (72%) patients had hypertension, 11 (44%) patients had diabetes mellitus, 9 (36%) patients had cardiovascular disease, 3 (12%) patients had chronic renal failure and 2 (8%) patients had multiple myeloma.

Complaints and signs

Headache was the most common complaint at presentation and was present in 24 (96%) patients. This was followed by vision loss in 14 (56%) patients, jaw claudication in 10 (40%), fever and fatigue in 5 (20%) and weight loss in 3 (12%). Nine (36%) patients had polymyalgia rheumatica. On examination, tenderness to palpation of the TA was detected in 11 (44%) patients and decreased pulse of the TA in 8 (32%) patients. Jaw claudication (66.7% *vs.* 15.4%, p=0.027) and decreased pulse of the TA (58.3% *vs.* 7.7%, p=0.022) were more in the TAB positive group than in the TAB negative group. There was no statistically significant difference between the groups in terms of other complaints and signs (Table 1).

Charecteristics	Total n=25	Biopsy positive n=12	Biopsy negative n=13	p
Age				
Median (minimum-maximum), years	70 (51-83)	74 (53-83)	66 (51-80)	0.027*
Gender				
Male/Female, n (%)	9 (36)/16 (64)	1 (8.3)/11 (91.7)	8 (61.5)/5 (38.5)	0.019*
Headache				
Yes, n (%)	24 (96)	12 (100)	12 (92.3)	1
Vision loss				

Yes, n (%)	14 (56)	7 (58.3)	7 (53.8)	1
Fever fatigue				
Yes, n (%)	5 (20)	3 (25)	2 (15.4)	0.92
Weight loss				
Yes, n (%)	3 (12)	1 (8.3)	2 (15.4)	1
Polymyalgia rheumatic				
Yes, n (%)	9 (36)	6 (50)	3 (23.1)	0.325
Jaw claudication				
Yes, n (%)	10 (40)	8 (66.7)	2 (15.4)	0.027*
Tenderness to palpation of the TA				
Yes, n (%)	11 (44)	7 (58.3)	4 (30.8)	0.325
Decreased pulse of the TA				
Yes, n (%)	8 (32)	7 (58.3)	1 (7.7)	0.022*
ESR				
High, n (%)	23 (92)	12 (100)	11 (84.6)	0.497
Median, mm/h	77	88	74	0.053
CRP				
High, n (%)	20 (80)	10 (83.3)	10 (76.9)	1
Median, mg/L	18.7	37	12.6	0.039*
Hemogloglobin				
Low, n (%)	21 (84)	11 (91.7)	10 (76.9)	0.647
Median, g/dL	11.2	11.05	11.2	0.624
WBCs				
High, n (%)	9 (36)	5 (41.7)	4 (30.8)	0.891
Median, 10^3/μL	8.28	9.06	8	0.446
Monocyte				
High, n (%)	7 (28)	5 (41.7)	2 (15.4)	0.309
Median, 10^3/μL	0.51	0.53	0.5	0.479
Neutrophil				
High, n (%)	8 (32)	5 (41.7)	3 (23.1)	0.571
Median, 10^3/μL	6.08	6.81	4.4	0.165
Platelet				
High, n (%)	7 (28)	4 (33.3)	3 (23.1)	0.901
Median, 10^3/μL	314	344	313	0.384
FPG				

High, n (%)	13 (52)	4 (33.3)	9 (69.2)	0.163
Median, mg/dL	118	100.5	126.8	0.301
AST				
High, n (%)	1 (4)	0	1 (7.7)	1
Median, U/L	20	22.6	18.6	0.724
ALT				
High, n (%)	3 (12)	2 (16.7)	1 (7.7)	0.941
Median, U/L	16	18.5	14	0.399
ALP				
High, n (%)	5 (45.5)$^{\alpha}$	4 (50)$^{\alpha}$	1 (33.3)$^{\alpha}$	1
Median, U/L	115	124	100	0.683
BUN				
High, n (%)	7 (28)	3 (25)	4 (30.8)	1
Median, mg/dL	19.6	17.6	19.7	0.414
Creatinine				
High, n (%)	7 (28)	3 (25)	4 (30.8)	1
Median, mg/dL	0.84	0.8	0.84	0.496
Fibrinogen				
High, n (%)	4 (100)$^{\alpha}$	3 (100)$^{\alpha}$	1 (100)$^{\alpha}$	-
Median, mg/dL	648	757	587	0.18
TAB performing time n (%)				
Before the treatment	12 (48)	4 (33.3)	8 (61.5)	0.369
In the first 7 days of the treatment	8 (32)	5 (41.7)	3 (23.1)	
After the 7th day of the treatment	5 (20)	3 (25)	2 (15.4)	
TAB specimen length				
Median, mm	1.7	2.1	1.4	0.149

Note: TA: Temporal Artery; ESR: Erythrocyte Sedimentation Rate; CRP: C-Reactive Protein; WBCs: White Blood Cells; FPG: Fasting Plasma Glucose; AST: Aspartate Aminotransferase; ALT: Alanine Aminotransferase; ALP: Alkaline Phosphatase; BUN: Blood Urea Nitrogen; TAB: Temporal Artery Biopsy; α: Is the ratio within the patients who had test; *: Statistically significant result

Table 1: Clinical and laboratory findings of the patients.

Ophthalmic signs

Ischemic optic neuropathy was detected in 14 (56%) patients during ophthalmic examination. The right eye was involved in 8 (57.1%) patients and the left eye in 6 (42.9%) patients. In the follow up of 5 (35.7%) patients, it was observed that the second eye was also involved. The initial median Visual Acuity (VA) was 0.005 (0.00-0.20) Snellen's line. There was no difference between the TAB-positive and TAB-negative groups in terms of baseline VA (p=0.844) Laboratory findings The elevation of ESR and CRP were detected in 23 (92%) and 20 (80%) patients, respectively. Twenty one (84%) patients had normocytic normochromic anemia. Nine (36%) patients had high WBC, of which 8 had an increase in neutrophils and 7 had an increase in monocytes. Platelet level was high in 7 (28%) patients, AST level in 1 (4%) and ALT level in 3 (12%). High FPG was found in 13 (52%) patients, 11 of whom were previously diabetic. High BUN and creatinine were found in 7 (28%) patients, 2 of whom had previous renal failure. ALP level was found to be high in 5 (45.5%) of 11 (44%) patients whose ALP was examined. Fibrinogen level was found to be high in all (100%) of the 4 (16%) patients whose fibrinogen was examined. The median CRP level was statistically higher in the TAB positive group compared to the TAB

TAB negative group (37 mg/L *vs.* 12.6 mg/L, p=0.039). There was no significant difference between the groups in terms of the abnormality rate and levels of other laboratory findings.

Biopsy findings

TABs were applied before the initiation of the treatment in 12 (48%) patients, within the first 7 days after the initiation of the treatment in 8 (32%) and after the 7th day of the treatment in 5 (20%). TABs were performed unilaterally in all patients, from the sides of the patient's symptoms or abnormal examination findings. The whole arterial segment was taken for tissue examination of TA. Multiple sections were taken at 3 mm-4 mm intervals and vertically embedded in paraffin blocks. Then, Hematoxylin Eosin stained sections were prepared with at least 20 sections of 4 micron thickness from each block. Median fixed TAB specimen length was 1.7 (0.5-4.0) mm. Although the median fixed TAB specimen length was longer in the TAB positive group than the TAB negative group, the difference was not statistically significant (2.1 *vs.* 1.4 mm, p=0.149). TAB revealed normal TA in 4 (16%) patients, mononuclear cells infiltration with or without giant cells or fibrinoid necrosis in the vessel wall compatible with the GCA in 12 (48%), fibrointimal thickening in the vessel wall in 5 (20%) and medial calcific sclerosis in the vessel wall in 4 (16%).

Nine (36%) patients received TA Ultrasonography (US) and an increase in arterial wall thickness consistent with GCA was detected in 3 (33.3%) of them.

Regression analyzes

In the univariate logistic regression analysis, female gender (OR (95% CI): 2.9 (1.7-181.3), p=0.016), presence of jaw claudication (OR (95% CI): 2.4 (1.6-75.5), p=0.015), decreased pulse of TA (OR (95% CI): 2.8 (1.6-174.5), p=0.018) and ESR (OR (95% CI): 0.03 (1.0-1.1), p=0.049) were determined as factors associated with the TAB positivity. The relationship of these factors with TAB positivity could not be confirmed by multivariate logistic regression analysis.

Discussion

Histopathological findings considered as TAB positive GCA (mononuclear cells infiltration with or without giant cells or fibrinoid necrosis in the vessel wall) was detected in 48% of cases in our study. Although this rate is low, there are studies reporting TAB positivity below 20% in the literature [14]. A meta-analysis by Rubenstein, et al. showed that the rate of TAB positivity in GCA cases ranged between 50% and 95% and the overall pooled rate was 77.3% [15]. In a recently published study presenting real life data, it was reported that 85% of the patients with GCA underwent TAB and similar to our result, the TAB confirmed the diagnosis in 54.5% of the patients [16]. We found that the median fixed TAB specimen length was 1.7 (0.5-4.0) mm and was longer in the TAB positive group than in the TAB negative group, although this was not statistically significant. Mahr, et al. reported that a fixed TAB specimen length of at least 0.5 cm may be sufficient for histopathological diagnosis of GCA. In the diagnosis of GCA, it is also thought that the length of the TAB specimens does not have an important impact on TAB positivity [17]. Due to the segmental involvement of the disease, we need to examine different levels of the artery. However, Chakrabarty, et al. suggested that also the number of examined sections of TAB specimen had no major impact on the diagnostic value of biopsy [18]. When GCA is suspected, corticosteroid therapy should be started without delay. TAB should be performed as soon as possible, as corticosteroid therapy may affect the biopsy result. However, it has been reported that delaying TAB for 14 days or longer may not affect the accuracy of the biopsy result and that even within 4 weeks of starting high dose corticosteroid therap, TAB maintains its diagnostic value [19,20]. In 80% of our patients, the time for TAB administration was before the treatment or within the first 7 days after the initiation of the treatment. TAB was performed between the 7th and 14th days of treatment in only 20% of the patients and was not performed later than 14th days in any of our patients. Therefore, we think that the time of biopsy did not affect the positivity rate.

We determined that TAB positivity increases with age and is more common in women. Similar to our observation, there are studies reporting a higher mean age in TAB positive patients than in TAB negative patients and that ≤ 70 years should downgrade the level of suspicion for GCA [21,22]. On the contrary, there are publications in the literature reporting that age is not associated with TAB positivity [23,24]. It has been reported that women are 2 or 3 times more likely to have positive TABs than men. We also found that the probability of TAB positivity in women was 2.9 times higher. Headache was present in 96% of our patients and was the most common symptom at presentation. Although headache is reported in the temporal region with a rate of 70%-80%, it is important in prompting suspicion rather than its diagnostic value in GCA [25]. A recent meta-analysis suggested that jaw claudication, limb claudication, temporal artery abnormalities and anterior ischemic optic neuropathy are the features that should raise the level of suspicion for GCA. We found that the presence of jaw claudication and decreased pulse of the TA on examination were more in TAB positive patients than in TAB negative patients. Ischemic optic neuropathy was observed in 56% of our patients. Visual manifestations can be found in 9.6%-61.1% of patients with GCA. However, we did not find a relationship between TAB positivity and ischemic optic neuropathy. Gonzalez-Gay, et al. determined that a history of constitutional syndrome, presence of visual problems and an abnormal temporal artery on examination may predict TAB abnormality. Selby, et al. stated that scalp tenderness is a significant predictor of a positive TAB. We showed that the factors associated with TAB positivity were female gender, the presence of jaw claudication and decreased pulse of TA by univariate logistic regression analysis [26-28].

In recent study, high ESR was detected in 92% of the patients and high CRP in 80%. In addition, 84% of the patients had normocytic normochromic anemia, 36% of the patients had leukocytosis and 28% of the patients had thrombocytosis. Of these laboratory findings, only the CRP level was higher in TAB positive patients. In addition, ESR was also determined to be associated with TAB positivity in univariate logistic regression analysis. Anemia, leukocytosis, thrombocytosis, high CRP and ESR levels are frequently detected in laboratory examinations of patients with GCA. However, inflammatory markers may be normal in some patients with GCA [26]. A recent systematic review and meta-analysis revealed that presence of a platelet count of $> 400 \times 10^3/\mu L$ and an ESR>60 mm/h in laboratory findings are features that should raise the level of suspicion for GCA. Selby, et al. found that CRP and platelets were significant predictors of a positive TAB in a veteran population. Kermani, et al. stated that CRP is a more sensitive marker than ESR for a positive TAB in patients with GCA, but it would be useful to evaluate both tests together in the evaluation of patients with suspected GCA [29].

Conclusion

In only 33.3% of our patients who underwent TA US, an increase in arterial wall thickness consistent with GCA was found. This rate was lower than the rate of TAB positivity. Therefore, it was thought that TA US was not an alternative to biopsy in the diagnosis of GCA. The relationship between US findings and TAB positivity was not evaluated, since USG was performed in a small number of our patients. Imaging techniques, especially TA duplex US have been increasingly used for the early diagnosis of GCA. In acute GCA, US shows an incompressible, hypoechoic, most commonly concentric arterial wall thickening, called the 'Halo' sign. It has been emphasized in the literature that the advantage of TA US may be that it provides cost and time savings and reduces the number of TABs.

The limitations of the study are its retrospective nature and a relatively small sample of patients that admitted to a single tertiary referral center, although we have scanned for a period of approximately 15 years. However, this study provides useful information for clinical practice by detecting clinical and laboratory features associated with TAB positivity in patients with GCA. It can be predicted in which patients the probability of positive TAB is increased and GCA diagnosis is more likely to be made. According to the results of our study, although this could not be confirmed by multivariate logistic regression analysis, older age, female gender, the presence of jaw claudication and decreased pulse of TA, high ESR and CRP values are predictive features for TAB positivity and GCA diagnosis.

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Disclosure Statements

The authors report there are no competing interests to declare.

Data Availability Statement

The first version of our manuscript has been posted on Research Square as a preprint.

Ethics Approval

This study was performed in line with the principles of the declaration of Helsinki. approval was granted by the Ondokuz Mayis university clinical research ethics committee (12 November 2020/ OMU KAEK 2020/627).

Authorship

All authors contributed to conception and design of the study, acquisition or analysis and interpretation of data. The first draft of the manuscript was written by Ozlem Eski Yucel and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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