ACTA MEDICA LITUANICA. 2010. Vol. 17. No. 1–2. P. 71–76
DOI: 10.2478/v10140-010-0009-5

The diagnostic value of ultrasound examination in temporal arteritis

Jolanta Dadonienė[1, 2],

Dalius Jatužis[2],

Arvydas Laurinavičius[2, 3]

[1] *Institute of Experimental and Clinical Medicine at Vilnius University*

[2] *Vilnius University Medical Faculty*

[3] *National Center of Pathology*

Introduction. Temporal arteritis (TA) is usually diagnosed according to clinical criteria, and temporal artery biopsy is considered as a golden standard for the diagnosis. Temporal artery biopsy is a surgical intervention on a head site and is not well-tolerated by the patients. As an alternative for temporal artery investigation, ultrasound examination may be used. The aim of this pilot study was to evaluate the performance of ultrasound examination of a temporal artery of patients with and without TA, but with similar clinical findings.

Materials and results. Thirteen patients seen at Vilnius University Hospital Santariškių Klinikos during 2006–2009 with suspicion of TA were included into this study, and ultrasound examination of their both right and left superficial temporal arteries was performed. Eight patients were diagnosed with TA according to clinical criteria, and 5 patients had headaches of another origin. Two patients had a biopsy-proven diagnosis. The thickened wall ("halo" sign) and / or stenosis / occlusion were found on ultrasound examination in three patients. The presence of abnormality was found in five patients from the setting of TA patients, and no abnormalities were detected in the control group. Although the groups were very small and the data scanty, we consider the sensitivity of the abnormalities detected by ultrasound to be 62.5%, and the specificity was close to 100% in this pilot study.

Conclusions. Authors recommend bilateral ultrasound examination of temporal arteries for patients with suspicion of giant cell arteritis (temporal arteritis). Our pilot study showed a sufficient sensitivity of this diagnostic test, although it greatly depends on the experience and skills of the performer.

Key words: temporal arteritis, ultrasound examination

INTRODUCTION

Temporal arteritis is a rare and challenging disease for both rheumatologists and neurologists. Usually, it is diagnosed according to clinical criteria, but the diagnosis takes time because a detailed differential diagnosis is needed (1). The biopsy of the temporal artery, though not mandatory, is often requested to confirm the lesions of the temporal artery and is considered to be highly specific and sensitive (2). Moreover, it is often needed to have a biopsy-proven diagnosis of temporal arteritis in the case doubts about the diagnosis would occur in future (3). The biopsy of temporal artery is considered as a minor intervention, but the patients are reluctant to take it, mostly because the site of the procedure is the face. Complications including skin necrosis, facial nerve damage may occur. With the development of radiological equipment, the ultrasound technique became more easily applicable, and the precision of this technique made it possible to evaluate even thin layers of vessels and very small structures (4). Ultrasound scanning is non-invasive, safe and may be applied repeatedly without limitations. Changes of the vascular inflammatory process may be observed over time. The aim of this pilot study was to evaluate the performance of ultrasound examination of temporal artery in patients with temporal arteritis and without it, but with similar clinical findings.

Correspondence to: Jolanta Dadonienė, Institute of Experimental and Clinical Medicine at Vilnius University, Žygimantų 9, LT-01102 Vilnius, Lithuania. E-mail: Jolanta.dadoniene@ekmi.vu.lt

PATIENTS AND METHODS

Thirteen patients seen at the Vilnius University Hospital Santariškių Klinikos during 2006–2009 with suspicion of temporal arteritis were included into this study, and ultrasound examination of both right and left superficial temporal arteries was performed. After a thorough examination, eight patients were classified as being ill with giant cell arteritis (temporal arteritis) (TA) according to American College of Rheumatology (ACR) criteria. The American College of Rheumatology requires three of the following five criteria to meet for TA diagnosis: age >50 years, a new onset of localized headache, temporal artery tenderness or decreased pulse, erythrocyte sedimentation rate >50 mm/h and histological findings (5). None of them is mandatory. Two out of eight TA patients underwent the ultrasound examination of superficial temporal artery (STA) after 1 to 4 years of having been ill with this disease and already taking steroids for months. Another six patients were examined at the beginning of the disease. In this subgroup, ultrasound scanning of STA was performed relatively early on both sides, and steroids were started in parallel. Another five patients (control group) were admitted to the hospital with suspicion of TA, however, after examination two of them were discharged with the diagnosis of tension headache and another three were diagnosed with relapsing polychondritis, rheumatic polymyalgia and arthritis. Steroids were prescribed to all three.

The ultrasound examination of STA was performed by the same investigator with comparable ultrasound machines (Vivid 4, Logiq 7 and Logiq 6S; GE Medical systems) and uniform settings using a high resolution linear 10 MHz probe (10L; GE Medical systems).

We examined both common superficial temporal arteries (CSTA) and their parietal (STA-P) and frontal (STA-F) branches in longitudinal and transverse planes according to the previously described methodology and standardized adjustments of the ultrasound machine (6). According to our protocol, ultrasound evaluation of temporal arteries included presence of stenosis (the narrowing of the vessel lumen with the blood flow velocity increased more than twice the rate recorded in the area before the stenosis, and turbulence) or occlusion (delineated temporal artery with absence of colour and wave Doppler signals in it); presence of hypoechoic, circumferential wall thickening around the lumen of the temporal artery ("halo" sign); measurements of the systolic blood velocity in and the systolic diameter of the temporal artery, including three layers (intima, media, adventitia) at three defined points on each side of the head.

Temporal artery biopsies were performed in two cases. Lesions relevant to TA were diagnosed if there was vasculitis with a predominance of mononuclear cell infiltration or granulomatous inflammation with or without giant cells.

The SPSS statistical package was used for statistical analysis. The continuous clinical data and the measurement of the arteries and their branches were tested for normality applying the Kolmogorov–Smirnov Z test; not any of them violated the normal distribution of the data, so for comparison of the two groups the independent samples t test was employed for continuous and the chi- square test for nominal data.

The demographic and clinical characteristics of patients with TA and the controls are presented in Table 1. All the patients were aged between 57 and 88 year. As expected, the C reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were considerably higher in the TA group than in controls but did not reach the statistical level.

RESULTS

Table 2 presents data on measuring blood flow velocity and the diameter of the arteries in three earlier defined points by applying ultrasound examination. No statistically significant difference was found between the two groups in any of the

Table 1. **The demographic and clinical characteristics of 13 patients that underwent ultrasound examination of temporal artery**

	Patients with temporal arteritis (n = 8)	Patients without temporal arteritis (n = 5)
Female / Male	2 / 6	3 / 2
Age, years	73.0 (57.0–88.0)	71.0 (57.0–80.0)
Hemoglobin, g/l	123.0 (106.8–151.0)	140.0(107.5–150.5)
CRP, mg/ml	56.6 (2.0–170.7)	14.7 (1.2–63.3)
ESR, mm/hr	52.0 (3.0–120.0)	36.0 (12.0–81.0)

Median values (min–max) are presented.

Table 2. **Measurements of superficial temporal arteries and their branches in patients with and without temporal arteritis (TA)**

	Patients with TA (n = 8)	Patients without TA (n = 5)
Common superficial temporal artery		
BFV, cm/s	67.9 ± 22.1 (44.0–100.5)	75.7 ± 10.4 (63.5–87.5)
Diameter, mm	2.69 ± 0.52 (2.20–3.40)	2.33 ± 0.26 (2.10–2.75)
Parietal ramus		
BFV, cm/s	60.5 ± 16.5 (32.0–77.5)	65.5 ± 14.2 (55.0–85.0)
Diameter, mm	1.85 ± 0.23 (1.60–2.15)	1.80 ± 0.30 (1.50–2.10)
Frontal ramus		
BFV, cm/s	73.2 ± 23.0 (54.5–122.0)	68.6 ± 13.8 (55.5–84.0)
Diameter, mm	2.05 ± 0.37 (1.60–2.60)	1.86 ± 0.13 (1.65–2.00)

Superficial temporal arteries on both sides were evaluated. Mean values ±SD (min–max) are presented. BFV – blood flow velocity.

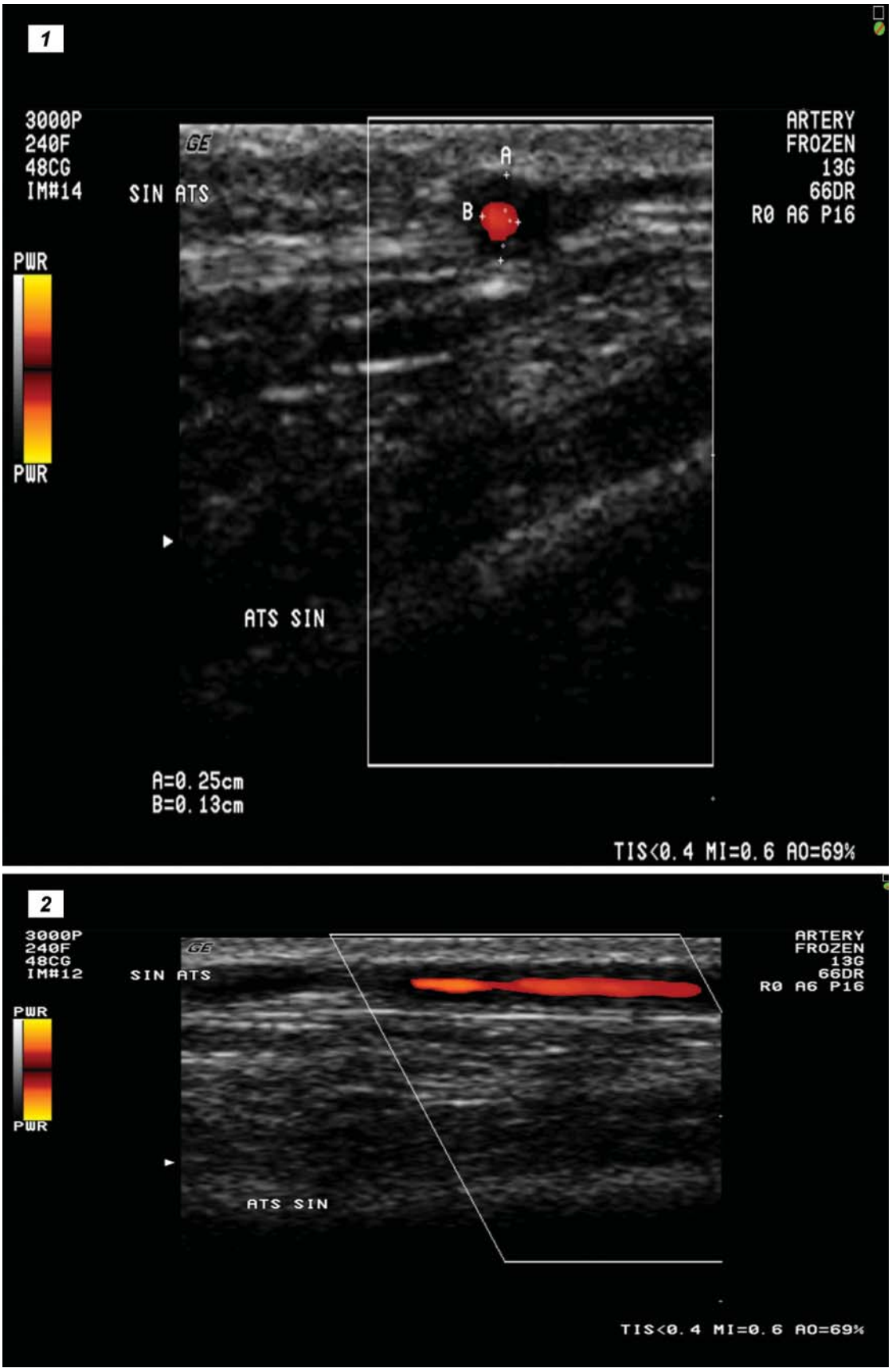

Figure. *1* – ultrasound picture of "halo" sign in the superficial temporal artery of a patient with temporal arteritis (transverse plane), *2* – ultrasound picture of the lumen narrowing and wall thickening of the superficial temporal artery of a patient with temporal arteritis (longitudinal plane)

measurements, although the mean values of systolic diameters of the arteries of TA patients in three different points were considerably higher. The blood flow velocity rates did not follow any tendency since it changed in different ways in TA and control groups in each artery measured. It can be assumed that the diameter of each of the arteries increase because of the wall thickening and infiltration of the inflammatory cells along with the narrowing of the diameter of the artery. The thickening of the wall together with the hypoechoic area called "halo" and the narrowing of the lumen can be seen in the ultrasound pictures (Figure, 1 *a*, *b*). The thickened wall ("halo" sign) and stenosis / occlusion were found in three patients, but not necessarily both abnormalities in each of the patient. The presence of any of the latter abnormalities was found in five patients from the setting of TA patients and none in the control group. Although the groups are very small and the data are few, we can conclude that the sensitivity of the abnormalities detected by ultrasound was 62.5%, and the specificity was about to reach 100% in this pilot study (Table 3).

Table 3. **Abnormal ultrasound findings in patients with and without temporal arteritis (TA)**

	Patients with TA (n = 8)	Patients without TA (n = 5)
Wall thickening ("halo" sign)	4 (50.0%)	0 (0%)
Stenosis / occlusion	3 (42.9%)	0 (0%)
Any abnormality of above	5 (62.5%)	0 (0%)

DISCUSSION

Ultrasound assessment of STA appears to be a comparatively new and modern investigative technique for TA diagnosis. First described in 1995, with increasing application in other rheumatic diseases, it is expected to be as informative as the histological confirmation of the disease (7). This small study is a first attempt to describe the yield of ultrasound examination for Vilnius University Hospital-based patients with TA diagnosed according to ACR criteria. TA has always been a diagnostic challenge for practitioners, first because of being a rare disease and not well-described in our geographical area, and secondly, due to difficulties in discriminating from other diseases occurring in senior population (8, 9). TA is generally considered a chronic granulomatous vasculitis of unknown aetiology occurring in the elderly. It affects the cranial branches of the arteries originating from the aortic arch and is usually associated with markedly elevated acute-phase reactants. New-onset of headache, scalp tenderness, jaw claudication, temporal artery abnormalities on physical examination, visual symptoms and associated polymyalgia rheumatica represent the most typical and frequent manifestations of the disease. Common systemic and nonspecific manifestations of this disease include fever, anorexia and weight loss; they occur in a half of all TA patients. The diagnosis is relatively straightforward in the presence of typical cranial manifestations, but it may be challenging in the case of a normal ESR and / or atypical signs of presentation. In 1990, the American Rheumatology College (ARC) provided TA diagnostic criteria; nevertheless, the temporal artery biopsy still represents the key stone for the diagnosis (10). It also greatly depends on the biopsy technique as not each segment obtained from the temporal artery area may contain granulomatous lesions, and granulomas are considered to be the golden standard for the diagnosis of this disease (1, 10). The sensitivity and specificity of the pathological markers found in biopsy can vary within 70–90% and are considered to be high and satisfying for the practical needs. Despite the clinical relevance and practical needs, both patients and physicians are often reluctant to undertake this surgical procedure (11). Evolving vascular imaging techniques such as duplex ultrasound, computer tomography (CT), magnetic resonance imaging (MRI) and fluorine-18-desoxyglucose positron emission tomography (18F-FDG-PET) have greatly improved the ability to detect and study arterial changes in large-artery vasculitis (12). Among them, colour-coded sonography of the temporal artery has gained utmost attention. If experienced ultrasound examiners are available, the diagnosis of giant cell arteritis can be made solely on sonographic findings, in particular from the presence of a perivascular hypoechogenic "halo" sign (13). According to the study Schmidt et al. published in "The New England Journal of Medicine" in 1997, patients with typical signs of TA and a clear "halo" on ultrasonography might be treated without biopsy, unless there is a reason to suspect another form of vasculitis (6).

Other imaging techniques such as CT, MRI and 18F-FDG-PET are also increasingly discussed lately, but so far no agreement exists on the accuracy of these applications in the diagnosis of TA. Most likely, these imaging techniques should be saved for evaluation of lesions in the aorta and the branches as possible complications of TA while ultrasound scanning is less limited with its low cost of application.

Until now, up to thirty studies of different quality with about 2500 patients included for temporal artery assessment using ultrasound technique have been published. The studies differ according to the diagnosis, number of patients, ultrasound patterns examined and quality of ultrasound performance. A metaanalysis of the studies on the performance of ultrasound was published in 2005 by Karassa et al. in "Annals of Internal Medicine" (15). They reviewed 23 studies referred in the MEDLINE database up to April 2004. The lowest number of participants in these studies was five and the highest was 751. The ultrasound patterns analysed in the quoted metaanalysis were halo, stenosis and occlusion. In the majority of studies, the sensitivity and specificity of these patterns were measured for the university hospital-based patients with suspected TA in comparison to the biopsy data and ACR criteria. Only a few studies had control groups for comparison. The weighted sensitivity and specificity of the halo sign were 69%

and 82%, respectively, if compared with TA biopsy, and 55% and 94%, respectively, if compared with ACR criteria. Stenosis or occlusion of STA branches was an almost equally sensitive marker as a halo sign. The authors of this metaanalysis have concluded that ultrasound may be helpful in diagnosing TA, but it greatly depends on interpretation, skills and the ultrasound technique available. The diagnostic studies of ultrasound performance are continued to be published, although the data of metaanalysis were already announced. The recent study, coming from Spain, focused on a wide range of ultrasound test validity values. Comparing with histological confirmation, the sensitivity of the ultrasound test was 80%, its specificity being 92%, positive predictive value 80%, negative predictive value 92% and global value 88%. Authors considered STA sonography as a good screening test (16). Another study from Italy compared the diagnostic values of MRI and ultrasound and showed that ultrasound (66.7% for sensitivity and 77.7% for specificity) was much better than MRI (17). The authors have not excluded the diagnostic role of higher resolution MRI, however. Currently, the common understanding is that the diagnostic power of high resolution MRI and colour coded duplex sonography in detecting TA are comparable. Either of these noninvasive techniques may be of reasonable value in the evaluation of patients with suspected TA, and decisions as to which technique should be used may depend on the clinical setting (18).

We showed the sensitivity of 62.5% and a much higher (near 100%) specificity of STA sonography applied to patients with TA diagnosed according to ACR criteria in our setting. It can be assumed that the convergence between these two values occurred because of the low number of patients in the study, and the sensitivity is expected to become better in case more patients are included. Not only the halo or stenosis may be important, but also the wall thickening tends to be higher in numbers if compared to controls. The blood flow velocity values were not of clinical use in our setting of patients, however.

In conclusion, according to the data gained in this small setting of TA patients, we recommend a bilateral ultrasound examination of temporal arteries for patients with suspicion of giant cell arteritis (temporal arteritis). Our pilot study yielded sufficient sensitivity of this diagnostic test. Relatively cheap, widely available and safe ultrasound assessment may replace the biopsy procedure, especially when surgery is not applicable, though it greatly depends on the experience and skills of the performer.

Received 16 November 2009
Accepted 19 February 2010

References

1. Cantini F, Niccoli L, Nainini C, Bertoni M, Salvarani C. Diagnosis and treatment of giant cell arteritis. Drugs Aging. 2008; 4: 281–97.
2. Lie JT. Biopsy diagnosis of systemic vasculitis. Baillieres Clin Rheumatol. 1997; 11: 219–36.
3. Genereau T, Lortholary O, Pottier MA, Michon-Pasturel U, Ponge T, de Wazieres B et al. Temporal artery biospy: a diagnostic tool for systemic necrotizing vasculitis. French vasculitis Study group. Arthritis Rheum. 1999; 12: 2674–81.
4. Schmidt WA. Technology Insight: the role of color and power Doppler ultrasonography in rheumatology. Nature Clin Pract. 2007; 3: 35–42.
5. Hunder GG, Bloch DA, Michel BA. The American Colege of Rheumatology 1990 criteria for the classification of giant cell arteritis. Arthritis Rheum. 1990; 33: 1122–8.
6. Schmidt WA, Kraft HE, Vorpahl K, Volker L, Gromnica-Ihle EJ. Color duplex ultrasonography in the diagnosis of temporal arteritis. N Engl J Med. 1997; 337: 1336–42.
7. Schmidt WA, Kraft HE, Vorpahl K, Volker L, Gromnica-Ihle EJ. Color Doppler sonography to diagnose temporal arteritis. Lancet. 1995; 345: 866.
8. Dadoniene J, Kirdaite G, Mackiewicz Z, Rimkevicius A, Haugeberg G. Incidence of primary systemic vasculitides in Vilnius: a university hospital population based study. Ann Rheum Dis. 2005; 2: 335–6.
9. Nordborg E, Bengtsson BA. Epidemiology of biopsy proven giant cell arteritis. J Intern Med. 1990; 227: 233–6.
10. Lie JT. Temporal artery biopsy of giant cell arteritis: lessons from 1109 biopsies. Anat Pathol. 1996; 1: 69–97.
11. Aquirre Errasti C, Alvarez Blanco A. Indications and limitations of temporal artery biopsy in Horton arteritis. Rev Clin Esp. 2001; 6: 327–9.
12. Tao F, Hoffman U. Giant cell arteritis: a systemic vascular disease. Vasc Med. 2008; 13: 127–40.
13. Reinhard M, Schmidt WA, Hetzel A, Bley TA. Imaging techniques for giant cell arteritis. Ultrasound and MRI. Z Rheumatol. 2009; 68: 108–16.
14. Pipitone N, Versari A, Salvarani C. Role of imaging studies in the diagnosis and follow-up of large vessel vasculitis: an update. Rheumatology. 2008; 47: 403–8.
15. Karassa FB, Matsagas MI, Schmidt WA, John P. A. Ioannidis JPA. Meta-analysis: test performance of ultrasonography for giant-cell arteritis. Ann Int Med. 2005; 142: 359–69.
16. Zaragozá García JM, Plaza Martínez A, Briones Estébanez JL, Martínez Parreño C, Gómez Palonés FJ, Ortiz Monzón E. Value of the Doppler-ultrasonography for diagnosis of the temporal arteritis. Med Clin (Barc). 2007; 129: 451–3.
17. Ghinoi A, Zuccoli G, Nicolini A, Pipitone N, Macchioni L, Bajocchi GL, Nicoli F, Silingardi M, Catanoso MG, Boiardi L, Salvarani C. 1T magnetic resonance imaging in the diagnosis of giant cell arteritis: comparison with ultrasonography and physical examination of temporal arteries. Clin Exp Rheumatol. 2008; 26(3 Suppl 49): S76–80.
18. Bley TA, Uhl M, Markl M, Frydrychowicz A, Langer M. MRI in giant cell (temporal) arteritis. Rofo. 2007; 179: 703–11.

Jolanta Dadonienė, Dalius Jatužis,
Arvydas Laurinavičius

ULTRAGARSINIO TYRIMO REIKŠMĖ SERGANT TEMPORALINIU ARTERITU

S a n t r a u k a

Įvadas. Temporalinis arteritas (TA) dažniausiai diagnozuojamas vadovaujantis klinikiniais kriterijais, tarp jų ir histologine diagnoze. Smilkinio arterijos histologinis įvertinimas yra laikomas ligą patvirtinančiu „auksiniu standartu“, tačiau jį ne visada įmanoma atlikti iš dalies ir dėl pacientų priešiško nusiteikimo šios procedūros atžvilgiu. Kaip alternatyvus ištyrimo būdas galėtų būti taikomas paviršinės smilkinio arterijos (PSA) tyrimas ultragarsu. Šios studijos tikslas – nustatyti PSA ultragarsinio tyrimo reikšmę TA sergantiems pacientams.

Medžiaga ir rezultatai. Ištirta trylika pacientų, gydytų Vilniaus universiteto ligoninės Santariškių klinikose nuo 2006 iki 2009 metų; iš jų aštuoniems patvirtinta TA diagnozė, penki skundėsi galvos skausmais dėl kitų priežasčių. Dviem iš aštuonių pacientų diagnozė patvirtinta histologiškai. Atliekant ultragarsinį PSA tyrimą, trims pacientams nustatyta sustorėjusi hipoechogeniška sienelė („halo“), kitiems trims pacientams rasta kraujagyslės spindžio stenozė ar okliuzija. Apskritai PSA pakitimai rasti penkiems pacientams, ir tai sudarė 62,5 %. Tiriant kraujagyslę ultragarsu kontrolinės grupės pacientams pakitimų nerasta. Mūsų studija patvirtina šio tyrimo jautrumą tiriant pacientus, kurių liga diagnozuota pagal klinikinius kriterijus.

Išvados. Šis sąlyginai nebrangus tyrimo metodas leidžia įvertinti PSA pakitimus be chirurginės procedūros, tačiau tam būtina tyrėjo patirtis.

Raktažodžiai: temporalinis arteritas, ultragarsinis tyrimas