Correspondence to 'Slope sign': a feature of large vessel vasculitis?

We have read with great interest the observation of Dasgupta *et al.*¹ We would like to propose an extended definition of slope sign in giant cell arteritis (GCA) formerly named slide sign,^{2,3} and present our method of assessing it by using the anteromedial ultrasound examination method of the large supraaortic vessels.⁴

Slope sign is a pathologically increased intima-media thickness (IMT)⁵ that spreads over a long arterial segment and slides down to a normal brachial artery where a normal intima-media structure (double line) is observed. This definition contains a description of pathological findings in the axillary artery—a typical location for vasculitis in GCA, contrasting with normal findings in brachial artery—which is usually not involved by vasculitis.⁶ Slope sign may not be limited to the place of arterial bifurcation of the subscapular artery, which is a typical location of atherosclerotic plaque. A transition zone should be observed between the involved axillary artery and the uninvolved brachial artery to generate the slope sign. Consequently, visualisation of this zone in a single image helps to conclude on the presence of pathological IMT compared with the nearby normal vessel (figure 1). In addition to thickness, wall structure should be assessed: in a normal brachial artery intima-media appears as a double line, which disappears due to the inflammation in the axillary artery.⁷ Thus, the slope sign

Figure 1 Tapering IMT leading to normalisation of vasculitic changes at the brachial artery at the point indicated by arrows.

Figure 2 Performance of axillary to brachial IMT ratio for the diagnosis of axillary arteritis. ROC, receiver operating characteristic.

Table 1 Cut-off values for slope sign (axillary to brachial IMT ratio) and increased IMT in the axillary artery (GCA patients vs controls)

	Area under the curve	Optimal cut-off	Sensitivity (%)	Specificity (%)
Slope sign (axillary to brachial IMT ratio)	0.883	2.05	87.0	88.9
Increased IMT (axillary artery)	0.969	0.81 mm	87.0	93.7

Maximal IMT value from bilateral ultrasound measurements was chosen. Minimal difference between sensitivity and 1–specificity was chosen for optimal IMT cut-off values for vasculitis.

GCA, giant cell arteritis; IMT, intima-media thickness.

is best-observed at a long longitudinal view that avoids skipping areas or inadequate imaging from a series of short scans.

The statement that the slope sign ‘may help to differentiate vasculitis from arteriosclerosis and other causes of arterial wall thickening’¹ requires some attention. Lack of slope sign is well recognisable in the cases of general arterial wall thickening, for example, calciphylaxis or amyloidosis.⁸ However, the visualisation of a short transition zone may not be enough to differentiate the edge of vasculitis from non-calcified atherosclerotic plaque. Atherosclerosis is common and sometimes involves the axillary artery at the level of bifurcation of the subscapular artery (a region of turbulent flow predisposing to atherosclerosis). Yet, this is also a typical location of the slope sign in vasculitis. Therefore, we recommend examining the long course of axillary artery (both proximal and distal part) by using the anteromedial method (continuous ultrasonographic examination of the large supraaortic vessels), as vasculitis usually spreads along the whole arterial region of the axillary artery, up to the subclavian artery in contrast with atherosclerosis. The length of the slope in vasculitis is usually long, while atherosclerosis presents with a short slope.

Validation of the slope sign in 214 consecutive patients referred to fast track GCA clinic in Szczecin between 2011 and 2015 was performed. Out of 81 patients diagnosed with GCA axillary vasculitis was found in 23. In 50 patients, isolated PMR was diagnosed. In 83 patients, another diagnosis was confirmed and they served as controls. Lack of healthy controls is consistent with a real-life scenario but might had impact on results. In all patients with axillary vasculitis, slope sign was present. We calculated the slope sign reference range defined as axillary to brachial IMT ratio (figure 2). Statistical analyses were performed with STATA software (version 12.0; StataCorp). The area under the curve for the slope sign ratio was smaller compared with increased axillary IMT consistent with vasculitis (table 1).

Consequently, we think that the definition of the ultrasonographic slope sign should be descriptive and we agree with Dasgupta *et al* that slope sign is a helpful feature for large vessel GCA diagnosis.

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REFERENCES

- 1 Dasgupta B, Smith K, Khan AAS, *et al.* 'Slope sign': a feature of large vessel vasculitis? *Ann Rheum Dis* 2019;78:1738.
- 2 Milchert M, Diamantopoulos A, Brzosko M. *Atlas of ultrasound application in large vessel arteritis: giant cell arteritis and Takayasu arteritis*. Szczecin, Poland: Wydawnictwo Pomorskiej Akademii Medycznej, 2016: 1–155.
- 3 Milchert M, Brzosko M. Slide sign: a novel sonographic sign of extracranial giant cell arteritis [abstract]. Third International Symposium and Workshop on GCA, PMR and LVV; Southend-on-Sea, Essex, UK, 2016.
- 4 Diamantopoulos A, Haaversen AB. 085. The anteromedial ultrasound examination of the large supraaortic vessels identifies higher rates of large vessel involvement than previous reported in patients with giant cell arteritis. *Rheumatology* 2019;58:kez058.025.
- 5 Chrysidis S, Duftner C, Dejaco C, *et al.* Definitions and reliability assessment of elementary ultrasound lesions in giant cell arteritis: a study from the OMERACT large vessel vasculitis ultrasound Working group. *RMD Open* 2018;4:e000598.
- 6 Grayson PC, Maksimowicz-McKinnon K, Clark TM, *et al.* Distribution of arterial lesions in Takayasu's arteritis and giant cell arteritis. *Ann Rheum Dis* 2012;71:1329–34.
- 7 Sundholm JKM, Pettersson T, Paetau A, *et al.* Diagnostic performance and utility of very high-resolution ultrasonography in diagnosing giant cell arteritis of the temporal artery. *Rheumatol Adv Pract* 2019;3:rkz018.
- 8 Modesto KM, Dispenzieri A, Gertz M, *et al.* Vascular abnormalities in primary amyloidosis. *Eur Heart J* 2007;28:1019–24.