

Transcranial Direct Current Stimulation and vasomotor reactivity in basilar artery stenosis: a case report

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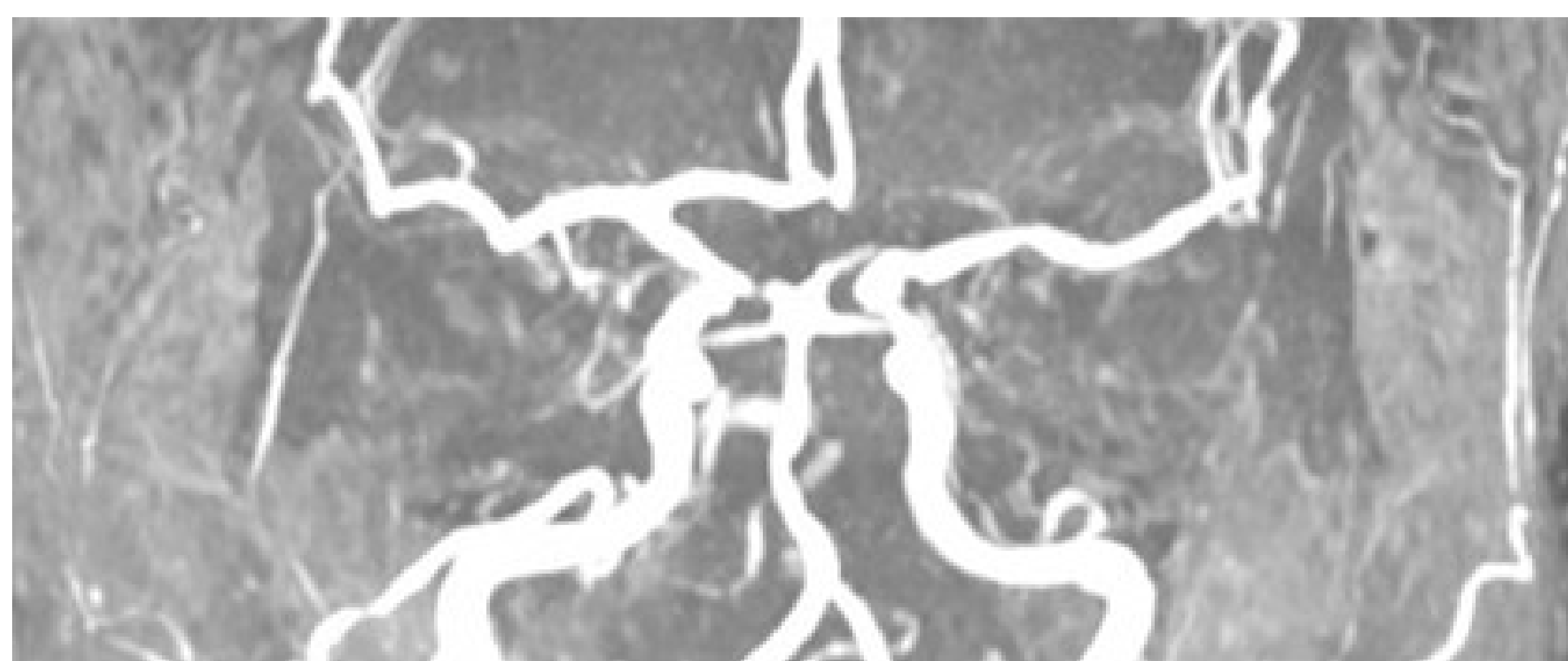
Objective: to present a case of basilar artery (BA) stenosis and investigate Transcranial Direct Current Stimulation (tDCS)-effects on cerebral blood flow.



RMN: FLAIR, BA stenosis



RMN: FLAIR, BA post-stenosis



RMN TOF: BA stenosis

Materials and methods: A 79 year-old woman was admitted to our hospital for gait disturbance and several falls occurred in the last week. Her medical history mentioned hypertension, diabetes and migraine. Patient underwent brain Magnetic Resonance Imaging (MRI) with time-of-flight (TOF) sequences that showed basilar artery stenosis with apex ectasia. We performed Transcranial Doppler Ultrasound (TCD) examination to evaluate cerebral hemodynamic changes.

Patient underwent a single tDCS session. Stimulation duration was 20 minutes and intensity 1,5 mA. Current was delivered through the anode positioned over the posterior parietal region and the cathode over the right occipital area.

Trans cranial Doppler Ultrasound examination was performed immediately before and after tDCS stimulation in order to examine effects of tDCS on BA and Posterior Cerebral Artery (PCA).

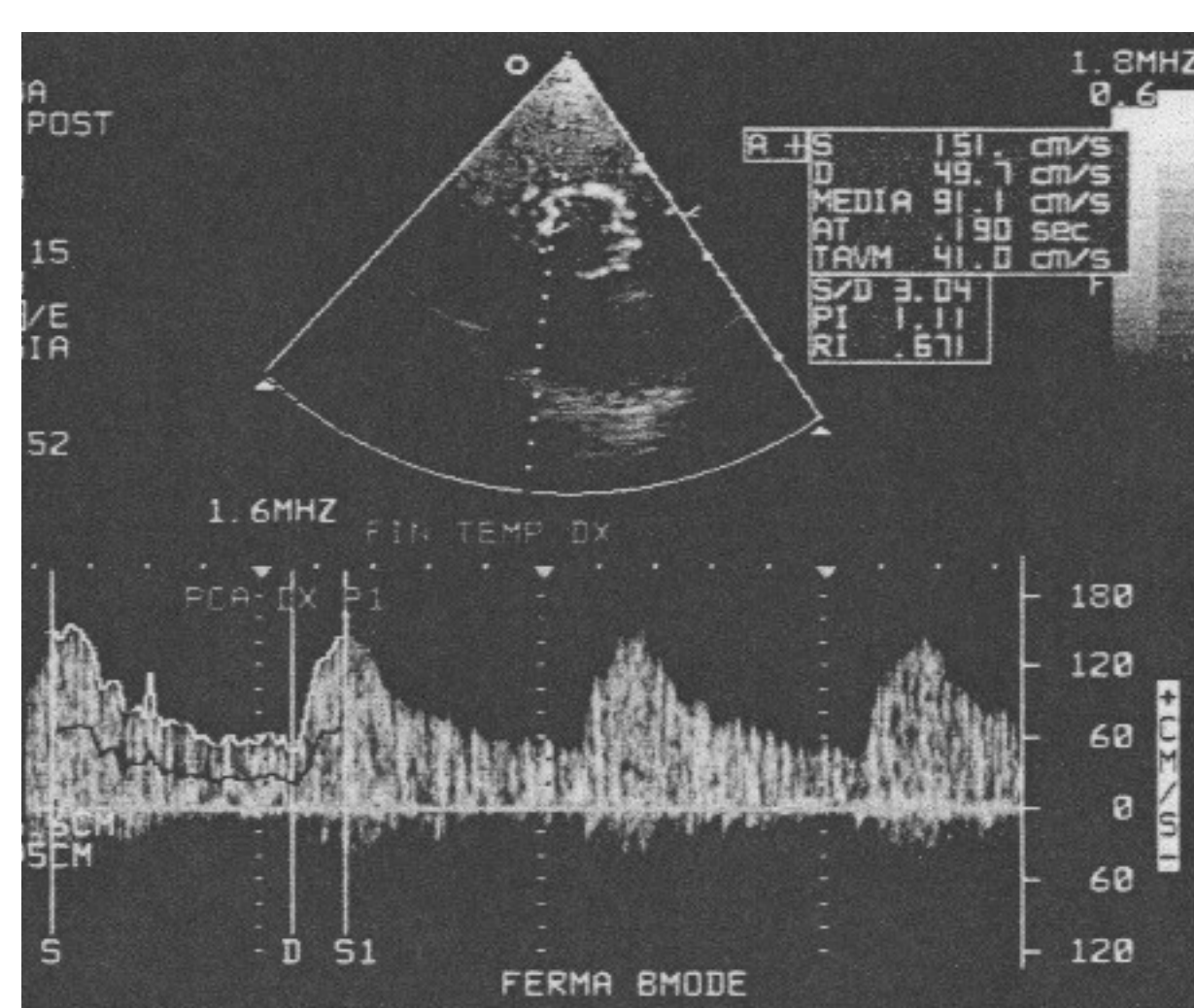
Results

Stimulation was well tolerated and no adverse events were observed.

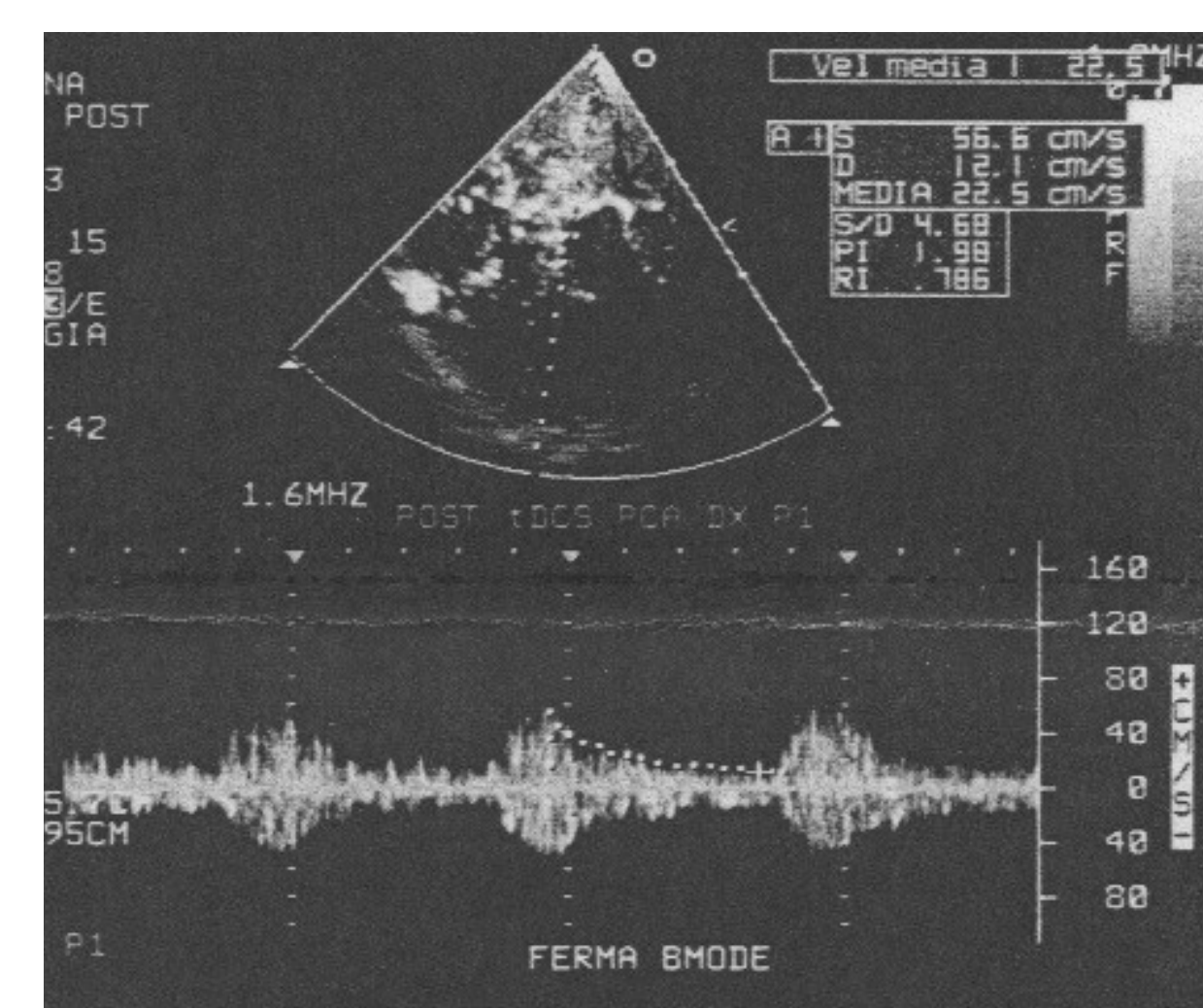
•Before tDCS session, TCD examination detected raised peak systolic velocity in proximal BA (159 cm/s) and right PCA (151 cm/s).

•After stimulation, peak systolic velocity in BA (63,1 cm/s) and right PCA (56,6 cm/s) decreased.

Discussion: Direct currents have been shown to modulate neural activity, which is considered closely related to cerebral blood flow (CBF). A study in rat model reported that anodal tDCS leads to an increase of CBF, whereas cathodal tDCS leads to a decrease¹. Recently, tDCS was applied in healthy subjects, showing polarity-specific bilateral effect on cerebral vasomotor reactivity with consensual changes in heart rate variability². Authors proposed that these effects were the result of interactions between cortical excitability and autonomic system. When an occlusion occurs in proximal BA, a pressure gradient develops between anterior and posterior circulation, so that PCA and posterior vessels may recruit Posterior Communicating Artery and deliver blood from the carotid system³. In these cases by tDCS stimulation an increase in CBF might be evoked. We hypothesize that these effects may promote collateral vessels recruitment.



TC Doppler: PRE-STIMULATION



TC Doppler: POST-STIMULATION

Conclusion: Our findings confirm that tDCS might modulate cerebrovascular flow. We propose that this technique may be used, coupled with TCD, as an additional tool in the assessment of patients with intracranial artery stenosis.

References

¹Wachter D, Wrede A, Schulz-Schaeffer W, Taghizadeh-Waghefi A, Nitsche MA, Kutschenko A, Rohde V, Liebetanz D. "Transcranial direct current stimulation induces polarity-specific changes of cortical blood perfusion in the rat". *Exp Neurol*. 2011 Feb; 227(2):322-7;

²Vernieri F, Assenza G, Maggio P, Tibuzzi F, Zappasodi F, Altamura C, Corbetta M, Trotta L, Palazzo P, Ercolani M, Tecchio F, Rossini PM. "Cortical neuromodulation modifies cerebral vasomotor reactivity" *Stroke*. 2010 Sep;41(9):2087-90;

³Guan J, Zhang S, Zhou Q, Li C, Lu Z. "Usefulness of transcranial Doppler ultrasound in evaluating cervical-cranial collateral circulations". *Interv Neurol*. 2013 Oct; 2(1):8-18.