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VIBRATION TRAUMA AS A CAUSATIVE FACTOR OF INTERNAL CAROTID ARTERY DISSECTION

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Abstract

Vibration trauma serves as a potential yet not recognized in large clinical series risk factor of cervical artery dissection. We present case report of a young male patient who developed internal carotid artery dissection as a result of prolonged drilling.

Key words: vibration trauma, dissection of internal carotid artery

Introduction

Cervical artery dissection (CAD), including internal carotid artery dissection and cervical vertebral artery dissection, is responsible for approximately 2% of all ischemic stroke cases. In the group of young patients aged 18-50 years CAD is, however, one of the main etiological factors of ischemic stroke, accounting for 20% of stroke cases. The annual incidence rate is 2-4 / 100000. However, it should be mentioned that the disorder may have a minor-symptom course making proper diagnosis difficult (1).

CAD pathophysiology is still not fully understood. It is assumed that in addition to genetic predisposition and biomechanical factors, environmental factors, namely neck injuries, play a key role. In the group of patients with severe, dull carotid artery injury, dissection occurs in 1-2% of cases. More often, the nature of the injury is so mild that the dissection is classified as spontaneous (2). The mechanism of injury usually consists of a hyperextension, rotation, lateral neck flexion or an increase in pressure inside the chest. Systematic reviews of literature mention various types of neck injuries: sports activity with strong neck rotation, manual treatments on the cervical spine, fall with head injury, road collision with the bending-deflection injury of the spine, lifting heavy objects, several hours of work with a supported

head or prolonged delivery (1, 2). Despite the potential importance of vibration trauma, they do not constitute a significant percentage of the described CAD case series.

A case report

A 25-year-old patient, without any vascular risk factors, admitted to the Neurology Clinic of the Independent Public Clinical Hospital No. 4 in Lublin to diagnose the cause of obstruction of the right internal carotid artery. The obstruction was diagnosed in other hospital wards. Prior to the disease, the patient was working on the construction site and was drilling using a hammer drill. Due to the inconvenient position, the patient rested the drill on the neck (being right-handed he helped himself with the right side of the neck). After the end of work, the next day patient felt a strong, sudden headache in the right frontotemporal region, also located behind the right eyeball. It was accompanied by the transient right-site vision loss and right-site Horner syndrome. Doppler ultrasound examination of the carotid artery showed obstruction of the right internal carotid artery (Fig. 1), in the absence of atherosclerotic lesions in the examined vessels and normal blood flow in the left internal carotid artery (Fig. 2). The transcranial ultrasound examination showed a delay in the peak systolic velocity in the right medial cerebral artery (dullness of the flow) with the inclusion of collateral circulation through the anterior communicating artery left-to-right, through the right posterior communicating artery connecting the right posterior cerebral artery to the right internal carotid artery and through the ophthalmic artery (connections to the branches of the external right carotid artery). The MRI study of the head and neck in T1-dependent sequences with suppression of the fat signal (FATSAT) showed the presence of intramural hematoma within the right internal carotid artery, extending from the bifurcation of the right common carotid artery (Fig. 3). The patient remained in a good general condition and no signs of focal damage

to the central nervous system were observed. Warfarin was used in the treatment, they recommend maintaining the INR index in the range of 2-3.

Discussion

The described case draws attention to the importance of vibration trauma as potential CAD causes. In many professions, employees are currently exposed to oscillatory movements (vibrations) that did not occur before the era of industrialization. Vibrations transmitted from hand tools (hand-transmitted vibration) and whole body vibrations (e.g. from car seat movements) can cause malaise, injury, and illness. The syndrome of disease symptoms is referred to as the "vibration syndrome", which mainly includes disorders of the circulatory system, the peripheral nervous system, and the skeletal system. It has been known since the beginning of the 20th century when the paroxysmal paleness of the fingers of miners (3, 4) was noted. The consequence of vibration trauma is underlined by the development of European safety standards for exposed workers (5). Nevertheless, it should be emphasized that in the described case the vibration trauma was not cumulative, but it resulted from the direct transmission of vibrations to the area of the internal carotid artery during drilling.

In CAD, strokes reach as much as 70% of cases, while transient neurological symptoms develop in another 13% of patients (1). The primary mechanism of stroke in CAD is arterial-arterial embolism (damage to the vascular wall results in thrombus formation which, when detached, moves with the bloodstream, closing the peripheral vessels) or less often in the mechanism of cerebral perfusion decline in sluggish collateral circulation. Almost all patients with internal carotid artery dissection are affected by the stroke in the vascularisation area of the central cerebral artery (6). CAD is one of the main causes of stroke in young patients, whereas in the elderly population it is exceptionally present. This is most likely due to the

progressive hardening of the vascular wall and the presence of atherosclerotic lesions among older patients.

Diagnosis of carotid dissection is currently based on magnetic resonance imaging (MR) in T1-dependent spin echo (SE) sequences with fat signal saturation (FATSAT), which can be used to visualize the presence of an intramural hematoma. Suppression of the fat signal is necessary to differentiate the hyper-intensive methemoglobin signal of the intramural hematoma from the surrounding adipose tissue (7). In addition, MR angiography and ultrasound allow assessing the effect of dissection on hemodynamics of the cerebral circulation. A special role of transcranial Doppler ultrasonography is the assessment of collateral circulation efficiency.

CAD treatment in the acute phase consists of the use of unfractionated or low molecular weight heparin followed by anticoagulant treatment (warfarin, acenocoumarol) for 3-6 months. The prognosis is successful because in most cases the vessel recanalizes within one month. After a year of observation, about 60% of patients have complete recanalization, 22% have a vascular obstruction, while the remaining group has different degrees of stenosis (8).

Among the postulated factors affecting the possibility of internal carotid artery dissection are now also local conditions including the length of the styloid process and its distance from the internal carotid artery, as well as the distance between the hyoid bone and the internal carotid artery (9, 10). In the case of vibration trauma, the proximity of the bone elements may contribute to the injury of the vascular wall, leading to dissection.

Conclusions

Vibratory trauma is a potential cause of carotid artery dissection. The preventive activity understood as compliance with work safety rules with devices generating strong vibrations, is

of particular importance. In addition, a key element in the elimination of complications (mainly stroke) is the rapid diagnosis and implementation of proper treatment.

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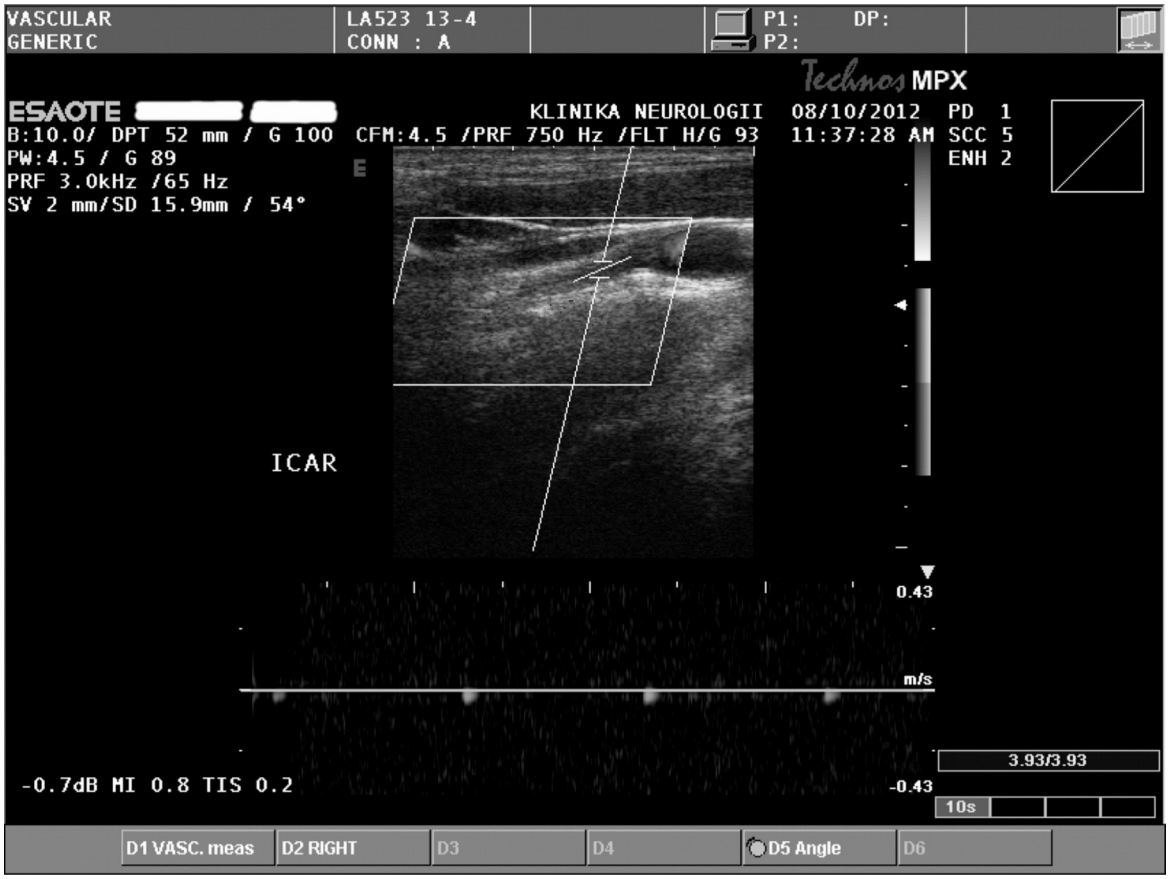
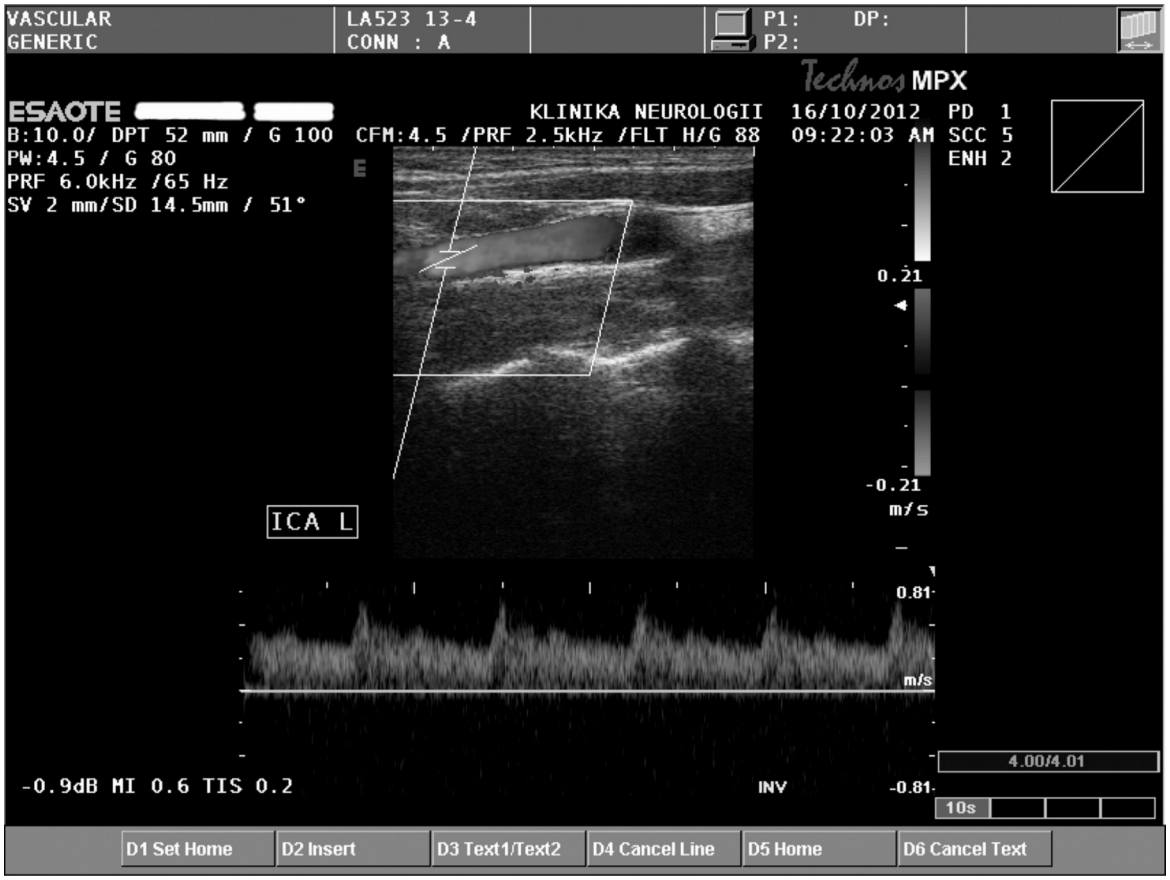
Figure 1



Doppler Duplex USG test result: Occlusion of the right internal carotid artery.

Figure 2



Doppler Duplex USG test result: correct flow and morphology of the right internal carotid artery.

Figure 3

Intramural hematoma of of the right internal carotid artery on MR (the FATSAT option).