SPONTANEOUS DISSECTION OF THE CAROTID AND VERTEBRAL ARTERIES. DOPPLER ULTRASOUND DIAGNOSIS. CASE SERIES

DISECCIÓN ESPONTÁNEA DE LAS ARTERIAS CARÓTIDA Y VERTEBRAL. DIAGNÓSTICO POR ULTRASONIDO DOPPLER. SERIE DE CASOS

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SUMMARY

The carotid color Doppler ultrasound is usually the first imaging modality employed for the assessment of patients with cerebrovascular symptoms. The recognition of the distal steno-occlusive flow pattern is key for the detection of spontaneous dissection of the internal carotid and vertebral arteries in young patients who present cerebral ischaemic signs. We present six cases of patients whose diagnosis was initially suggested by carotid color Doppler ultrasound.

RESUMEN

Usualmente, el ultrasonido Doppler carotídeo es la primera modalidad de estudio para evaluar a los pacientes con sintomatología de origen cerebrovascular. El reconocimiento del patrón de flujo esteno-oclusivo distal es clave en detectar la disección espontánea de las arterias carótida interna y vertebral en pacientes jóvenes que se presentan con sintomatología de accidente isquémico cerebral. En el artículo se presentan seis casos de pacientes cuyo diagnóstico fue sugerido inicialmente por la realización de un estudio de Doppler carótido-vertebral.

Introduction

The spontaneous dissection of the carotid artery or the vertebral artery is an unusual event which causes approximately 2% of all cerebral ischaemic events. However, in young populations, this event is an important cause of this pathology, which causes between 10% and 25% of all cases(1). The distal steno-occlusive flow pattern in the carotid vertebral Doppler ultrasound is a sign which suggests the diagnosis and must be recognized, given that the ultrasound is usually available in a hospital environment. Moreover, the ultrasound is usually one of the first studies that are carried out in patients with cerebral ischaemic signs.

Following are six carotid and vertebral dissection cases, which are evaluated by this diagnostic method. In all these cases, an important hemodynamic alteration which is compatible with the steno-occlusive flow pattern is observed, which is consistent at slow speed, with an absence of flow during diastole, increased resistance and spectral widening due to turbulence (figure 1).

First Case

This case corresponds to a 23 year old man, who entered emergency care while in a drunken state. After vomiting several times and “falling asleep on a table while his neck was twisted”. When he entered, the patient showed signs of cerebral lesions in the mid right cerebral artery. The patient died after 24 hours had passed (figures 2, 3, 4, and 5).

Second Case

46 year old woman, who entered emergency care with signs of a stroke in the left part of her brain. As background information, the patient vomited the day before, probably in relation to food poisoning (figure 6 and 7).
Figure 1. Normal flow pattern in the internal carotid and vertebral compared to the steno-occlusive flow pattern. The diagram shows abundant flow in a normal artery (left) during the cardiac cycle. Visual findings are confirmed by a measurement of velocities: Peak systolic velocity and end diastolic velocity (V1 and V2, respectively). The resistance index (IR) of the carotid and normal vertebral arteries is lesser than 0.7. The absence of flow at the end of the diastole (relaxation) (V2) in case of stenosis or distal occlusion conditions the increase of IR until 1.

Figure 2. The distal steno-occlusive flow pattern in the internal carotid leads to an important alteration of the internal carotid flow spectrum, due to a high-grade obstruction (or total obstruction) of the distal vessel light with low velocity (peak systolic velocity or Vmax under 40 cm/s), absence of end of diastole flow (Ved equal to 0), increase of resistance (RI equal to 1), and turbulence with spectral widening which implies turbulent flow (arrows).

Figure 3. Tomography, sequence with information in T2 with an increase in the right frontal-parietal cortical signal.

Figure 4: ADC Map which shows the disorder affecting the right hemisphere, which respects the territory of the frontal cerebral artery.

Figure 5: Enhanced contrast tomography with an absence of signs in the right internal carotid, as well as in its anterior and middle cerebral branches (arrow points).
Third case
35-year old woman who entered emergency care due to ischemia in the area of the right lower back cerebellar artery (PICA), suffering from Wallenberg syndrome. No background information was given when she entered, except for the fact that she has vomited the previous day, probably related to food poisoning. The carotid-vertebral Doppler ultrasound showed a distal steno-occlusive pattern in the right vertebral artery. A normal study was carried out in the remaining aspects (figure 8).

Fourth Case
48 year old man who entered emergency care due to irrepressible hiccups. As background information, the patient mentioned regular physical exercise, with no recent traumatic events. The Doppler exam showed a complete lack of flow in the right vertebral artery (figure 9). The complementary enhanced contrast tomography confirmed the lack of flow in the right vertebral artery (figure 10).

Fifth Case
40 year old woman, who entered due to an ischaemic cerebrovascular occurrence in the mid-left cerebral artery. A carotid-vertebral Doppler exam was carried out, which evidenced a distal steno-occlusive pattern. The complementary trans-cranial Doppler study showed a lack of flow in the mid-left cerebral artery, with normal flow in the mid-right cerebral area. The complementary study with enhanced contrast tomography confirmed these findings (figures 11 and 12).

Sixth Case
43 year old man, maxilla-facial surgeon, who entered emergency care due to a motor aphasia after taking a shower following physical exercise. The Doppler ultrasound showed presence of echogenic under the light of the proximal internal carotid and the steno-occlusive distal flow pattern (figure 13).

Physiopathology
The spontaneous dissection of the carotid and vertebral arteries is more frequent in extra-cranial segments and more frequent than in other similar medium caliber arteries (coronary and renal), probably due to the fact that they undergo greater movement and have a higher potential of being injured by nearby bone structures (2). The dissection usually occurs as a result of the intimal rupture, which allows pressurized blood flow to produce an intra-mural hematoma, most frequently between the elastic internal and mid layer (3).
Spontaneous Dissection of the Carotid and Vertebral Arteries. Diagnosis by Doppler Ultrasound. Case Series. Ariza Á.

Figure 9. A complete lack of flow in the right vertebral artery is observed, with a suggestive image of the thrombus inside, without an intimal flap or mural hematoma. This finding is uncommon, given the fact that the thrombus is usually distal to the dissection, which occurs more frequently in segment V4 (level C1), where vessel insonation is not easy. The differential diagnosis includes the obstruction of arteriosclerotic origin, which can be suspected by observing the existing layer load in the rest of the artery tree (in this case absent).

Figure 10. Arteriography of the brachiocephalic artery, in which an absence of flow can be seen in the right vertebral artery. Only the ascending cervical artery is evident, which is a branch of the thyrocervical scapular artery (arrow). The flow of the right carotid and in the subclavian flap is normal.

Figure 11. Distal stenoo-occlusive flow pattern in the left internal carotid, compatible with the distal spontaneous dissection at the moment of interrogation. Enhanced contrast tomography which shows a lack of signs in the internal carotid (arrow), and in the territory of the left medial cerebral artery (arrow points).

Figure 12. Trans-cranial Doppler of the right medial cerebral artery with normal flow (left). The flow is absent in the left medial cerebral artery (right).
The pathogenesis of the dissection may involve predisposing factors such as artery hyper-tension, migraine, use of oral birth control or the presence of vascular artery disease, subject to the type of fibromuscular dysplasia, medial cystic necrosis or other disorders related to connective tissue (4). Moreover, surrounding factors related with the presence of a minor precipitating event which involves neck movement or background of a respiratory infection are present. The minor precipitating events include neck hyper-extension or rotation, low-impact sporting activities, cough, vomit, sneezing or having received general anesthesia or resuscitation movements. Said movements can suddenly stretch the artery and cause an injury (5). Predisposing factors that only refer to the vessel were not identified in our series; however, in all cases, precipitating events of a neck rotation or hyper-extension were detected. It is important to point out the lack of arteriosclerosis in our patients, which is a finding that is typical of spontaneous carotid or vertebral dissection.

Signs and Symptoms

The clinical spectrum of presentation is wide, and the development of non-invasive clinical techniques has allowed the detection of cases with slight manifestations and the start of early treatment, before irreversible ischaemic lesions occur.

The clinical manifestations of dissection vary, related to the affected artery and with the hemodynamic effect, due to the degree of obstruction. In serious cases, the differential diagnosis includes high degree stenosis when faced with occlusion. When the affected vessel is the internal carotid, the usual way it presents itself is pain (hemifacial, neck and tension headache), accompanied with the signs provided by a partial Horner syndrome (miosis and ptosis without anhidrosis, given that this manifestation depends on the sympathetic plexus which surrounds the external carotid). After some time has passed, cerebral ischemia is developed (3).

The dissection of the vertebral artery usually has less clear manifestations: they start with symptomatology related to nape pain and the occipital region, which are usually interpreted as having a muscular-skeletal nature. Afterwards, signs of ischemia of posterior circulation, such as Wallenberg Syndrome (dysphagia, snoring, dizziness, nausea, vomiting, nystagmus, and instability while walking) (2).

Diagnosis

The diagnosis of the dissection can be made with angiography, even though this technique has been displaced by non-invasive methods with equal diagnostic performance, such as enhanced contrast tomography and contrasted CAT scans. However, usually, one of the first diagnostic tests that the patient undergoes is the carotid-vertebral Carotid ultrasound.

Protocol of the Study

Ultrasonography exploration is carried out with lineal high frequency transducers (5-8 MHz), and allows the observance of only the first centimeters of the internal carotid and vertebral artery, in a segmented manner, through its path between the vertebral holes. During ultrasound exploration, it is uncommon to visualize the location of the dissection. The specific characteristics of dissection (such as intramural hematoma or flaps) are observed in less than 30% of cases. However, hemodynamic alterations which are consistent in a pattern of distal steno-occlusive flow, are detected in over 90% of patients.

The complementary study with trans-cranial Doppler supplies additional information for the diagnosis and follow-up of dissection, particularly due to the fact that this pathology is a dynamic process. This process has image study findings which can change in hours or days (3).

Routine, the confirming diagnosis is carried out through an angiography modality (conventional, angio-CAT scan or enhanced contrast tomography), and the Doppler can be used in its follow-up (6).

The initial recommended handling in cases of carotid-vertebral dissection is anti-coagulation, with the purpose of preventing thromboembolic issues, given the fact that most of them are spontaneously cured. Surgical or endovascular management is used only for patients who show persistent or progressive signs of ischemia, despite anti-coagulation (7, 8).

References


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