Carotid Web: Current Understanding of Diagnosis and Treatment

João Victor Fragoso Dorea Silva
3rd year Medical Student, Escola Bahiana de Medicina e Saúde Pública, Bahia; Applied Regional Anatomy Academic Monitoring, Brazil

Júlia Galvão Reis Silveira
3rd year Medical Student, Escola Bahiana de Medicina e Saúde Pública, Bahia; Applied Regional Anatomy Academic Monitoring, Brazil

Lara Barbosa Teles de Menezes
3rd year Medical Student, Escola Bahiana de Medicina e Saúde Pública, Bahia; Applied Regional Anatomy Academic Monitoring, Brazil

Leonardo Novaes Freitas
3rd year Medical Student, Escola Bahiana de Medicina e Saúde Pública, Bahia; Applied Regional Anatomy Academic Monitoring, Brazil

Pedro Henrique Massi
3rd year Medical Student, Escola Bahiana de Medicina e Saúde Pública, Bahia; Applied Regional Anatomy Academic Monitoring, Brazil

Talita Cristina Cruz Paulino
3rd year Medical Student, Escola Bahiana de Medicina e Saúde Pública, Bahia; Applied Regional Anatomy Academic Monitoring, Brazil

Raimundo Nonato de Sousa Andrade
Professor, Escola Bahiana de Medicina e Saúde Pública, Bahia, Brazil; General e Thoracic Surgeon, Member of Brazilian Society of Thoracic Surgery, Brazil

Wagner Ramos Borges
Professor, Escola Bahiana de Medicina e Saúde Pública, Bahia; PhD in Medicine, vascular surgeon, Member of Brazilian Society of Angiology e Vascular Surgeon and Brazilian College of Surgeon, Brazil

Abstract

The Carotid Web (CaW) is a projection of the intimal layer of the internal carotid artery on the posterior wall into the lumen, with no evidence of calcification. Its prevalence in the general population still lacks more relevant data and studies in the clinical aspect. However, there is a correlation with patients suffering from ischemic stroke, presenting a 1.2% frequency. The literature also reveals the CaW, as a cause of cryptogenic stroke (25% of cases). The CaW can cause hemodynamic changes within the vessel, predisposing to platelet aggregation and increase the chance of thromboembolism and stroke events.

Introduction

The carotid web consists of a thin, linear fibrous membrane that, in the region of the carotid bifurcation, extends from the posterior surface of the bulb of the internal carotid artery to the lumen.[1] Histologically, it is believed to be a rare variant of fibromuscular dysplasia (DFM), also known as intimal variant FMD.[2] The occurrence of this condition is associated with ischemic cerebrovascular accidents (CVA). However, its presentation is commonly asymptomatic, which makes screening, diagnosis and management difficult.[3] The literature points to the carotid web as an underdiagnosed cause of cryptogenic ischemic stroke events, as the web can serve as a device for thrombus formation.

It is important, therefore, to know the typical radiological presentation of the carotid web in the face of other pathologies located in the same region, such as
arterial dissection, non-calcified atherosclerotic plaque and intraluminal thrombus.[3] Ideally, a histological study is performed for confirmation.

**Methodology**

This is a descriptive review of the current diagnosis and treatment of carotid web. The collection of articles was carried out through a bibliographic survey in the Scielo, Pubmed database, using the descriptors: carotid web, stroke web, obtaining 23 articles in Portuguese. Initially, the free access full text filter was applied, later the filter for the last ten years was used. Next, the last 4 publications were excluded because they were outside the context of this work, totaling 19 articles.

**Results and Discussion**

The first description of FMD of the carotid intimal variant was made by Rainer et al in 1967 through the publication of a case report on fibromuscular hyperplasia of the carotid artery as a cause of a transient ischemic attack. [4] The histological study confirmed the variant component of the intimal layer due to the formation of excess fibrous tissue interspersed with the carotid muscle cells. A fibroelastic thickening was identified along the posterior margin of the carotid bulb. Studies based on case reports indicate that symptomatic patients with carotid web (n=135) are mostly female (67%), with an average age of 46 years old, considering a population between 29-85 years. [2,5]

Regarding ethnicity, several literatures suggest a high frequency of CaW in people of African descent (58%), followed by Asians (25%) and Caucasians (13.8%). [2] However, the etiology of this variable has not yet been reported. The Carotid Web is a DFM responsible for forming a network of membranous filaments that projects into the lumen of the artery in the posterior region of the carotid bulb.6,7 Practice and literature indicate some variables and factors that predominate CaW.

A 12-month observation identified 7 patients, whose average age was 50 years, with ischemia resulting from carotid occlusion, with a female predominance. [7,8] The precise etiology of the prevalence of cases in women is uncertain, however, they are considered genetic factors, hormonal influence and use of oral contraceptives.

The results of a retrospective analysis carried out by two research centers, “Grady Memorial Hospital” and “Emory University Hospital” were consistent. 66 patients were identified, all between 42 and 57 years old, 74% female, 83%

black people and 52% had hypertension.10 Although this new variable was identified in this study, other articles report that vascular risk factors such as hypertension, diabetes and dyslipidemia are uncommon in people with carotid web. [9,10,11]

The nature of CaW, congenital versus acquired, is still a matter of debate. Pathological examinations demonstrate the dysplasia of the lesion in the fibromuscular tissue of the intimal layer of the carotid artery, which differs from the typical FMD of the renal artery, characterized by involvement of the tunica media. FMD in the carotid region is a idiopathic, non-atherosclerotic and non-inflammatory lesion, therefore, not commonly associated with vascular risk factors. [12] Histologically, proliferation of spindle-shaped fibrous structures and myxoid degeneration are observed. [8] Microscopic analysis suggests the absence of tissue necrosis, macrophage cells or cholesterol-rich nuclei, favorable factors in the diagnosis of carotid web.

The accentuated fibrous thickening in the intima that projects into the lumen appears as filling defects due to the reduced space of blood circulation in the carotid artery. [9] As a result of the septum formed, the blood flow appears turbulent or in stasis, allowing the formation of thrombi that can come off in pistons. The displacement to cerebral arteries explains the association between CaW and cases of ischemic stroke.6 The hypothesis of Choi et al explains that “the existence of turbulence and stasis in a cul-de-sac upstream of the network can potentially create a thrombogenic environment”. [8,13]

Although there are studies on carotid web, it is essential to expand knowledge about its clinical manifestations. Therefore, it is suggested that stasis. Blood flow contributes to the formation of a thrombogenic site, resulting in an embolus, responsible for a cryptogenic stroke, which has no identified cause. The clinical manifestations manifested by patients are based on weakness of the upper and lower limbs and the hemiface, ipsilateral to the injury. In view of this, there is a probable ischemic pattern in the carotid territory, mainly involving the middle cerebral and anterior cerebral arteries.

The carotid network is a rare condition, but it manifests changes hemodynamic, being related to thrombosis and recurrent stroke episodes [3,14]. As it is a rare pathology, its diagnosis is difficult, as it can easily be confused with arterial dissection, non-calcified atherosclerotic plaques and intraluminal thrombus. In radiological modalities, the carotid web visualized as a shelf-shaped focus, originating from the posterior wall of the carotid bulb.

Given the lack of consensus in the literature, the diagnosis can be made using angiography, computed tomography angiography (CTA), magnetic resonance angiography (MRA) and vascular ultrasonography (UV). [15] On angiography, the carotid web is seen as a linear, shelf-shaped projection located in the bulb of the internal carotid artery. It is a reliable method for
diagnosis, however invasive and does not allow a large variation in anatomical positions, making diagnosis difficult, since the mesh is located in the wall posterior of the artery. [15]

Described as the preferred modality for diagnosing carotid web, TCA has the advantages of high resolution, the possibility of image reconstruction at various angles, allowing differentiation of CaW from other pathologies, in addition to be able to identify the presence of calcium. [15] The detection rate of TCA for carotid web varies between 78 and 93%, however the use of ionizing radiation may limit the use of this modality for some patients.

The shape of the carotid web in RMA is similar to TCA; according to a case report, the network is observed on RMA as isointense on T1 and with high signal on T2. RMA also has the advantage of not using ionizing radiation, in addition to being able to capture hemodynamic information about the composition of the vessel wall and having high resolution. RMA is an alternative to TCA for pregnant patients and those with renal failure. However, there are few studies confirming the effectiveness of RMA in diagnosing the carotid network. [15]

On US, the carotid web appears isoechoic or hypoechoic, and Doppler can be used to observe blood flow in the web region. Despite being a cheap and non-invasive safe test, alone it is not as relevant for the diagnosis of the carotid network, as it can lead to the interpretation of other differential diagnoses, being used as an aid to other methods. However, more advanced technologies in this modality, such as 3D ultrasound, may be relevant for this diagnosis. [15]

Although TCA is most recommended for the diagnosis of CaW, it is essential to combine other imaging methods in order to learn more about the carotid network. [16]

The treatment for patients with carotid web is still uncertain, requiring further studies on the subject. Current treatments for the condition are antithrombotic drug therapy - antiplatelet or anticoagulant therapy - and surgical intervention. [17–19]

Conclusions

Regarding surgical treatments, the literature shows greater effectiveness compared to drug therapies, so that carotid endarterectomy and stent placement are reported, both of which have beneficial results in reestablishing the hemodynamic homeostasis of the carotid network, but there are divergences in the literature regarding which best option, some studies point to the risk of restenosis with stent placement, while others show favorable results for this procedure.

Conflict of interests

No conflict of interest.

References


