Carotid artery stenosis and coronary artery disease coincidence

Vahid Shojaee (MD)\textasteriskcentered, Mostafa Dastani (MD)\textasteriskcentered, Alireza Abdolahi (MD)\textasteriskcentered, Hamid Reza Rahimi (MD)\textasteriskcentered

\textsuperscript{1}Department of Cardiology, Ghaem Hospital, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
\textsuperscript{2}Department of Modern Sciences & Technologies, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

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\textbf{ABSTRACT}

Cerebrovascular event is one of the important causes of death in the world. Carotid artery stenosis is one of main risk factors of cerebrovascular events. Risk factors for atherosclerosis are found in carotid artery stenosis. Thus, coincidence of coronary artery disease and carotid artery stenosis were observed. In an individual with high risk of coronary artery plaque formation, peripheral artery stenosis is imaginable. Histological morphology and plaque formation in coronary artery disease and carotid artery stenosis are similar and they occur together most of the time. Although many similar findings were shown in coronary artery disease and carotid artery stenosis, carotid artery stenosis is associated with more severe stenosis compare with coronary artery disease. Carotid artery stenosis does not have exact similar biological activity with coronary artery disease. Some invasive and non-invasive diagnostic methods are established for carotid artery stenosis detection. Same medical and surgical treatment techniques could be used for carotid artery stenosis management that vary due to patient-to-patient specific conditions.

\textbf{Introduction}

Carotid artery disease is thought to be a risk factor for neurological complications, which leads to disability and death (1-3). Cardiovascular and cerebrovascular events happened due to the atherosclerosis are the causes of more than 50% of deaths in developed countries (3,4).

The progressive concurrent increase of carotid artery stenosis prevalence with coronary artery stenosis have increased the speculations of a common mechanism of stenosis in both carotid and coronary arteries (5).

It has been shown that the coincidence of >50 percent of carotid stenosis (CS) in patients with coronary artery disease (CAD) is 14.5% which is 8.7% and 5.0% in patients with >70% and >80% CS, respectively (6).

Atherosclerosis is a diffuse vascular disease, which may have a common mechanism of stenosis in both carotid and coronary arteries (4,7,8).

Although the correlation between CAD and atherosclerosis factors such as hypertension, diabetes, smoking and hyperlipidemia has been shown in different studies, this correlation with carotid artery stenosis were contradictory (5-17).

Nevertheless, identifying the risk factors that correlate with CS may result in more cost-effective screening for patients with asymptomatic carotid artery diseases.

In this review, atherosclerotic risk factors that correlate with CS will be considered. In addition, the differences and similarities between CAD and carotid artery disease will be reviewed based on their symptomatology, pathomechanism of the conditions and their risk factors.

*Corresponding author: Vahid Shojaee,
Department of Cardiology, Ghaem Hospital, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran
E-mail: shojaee891@mums.ac.ir
Tel: 051-38551538

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**Literature review**

**Coronary artery disease**

CAD is defined by the accumulation of lipids in the intima of coronary arteries. It is associated with mononuclear cell infiltration and smooth muscle proliferation (18). Every year 1.5 million patients with chest pain are referred to emergency room in USA and most of these cases are due to myocardial ischemia and CAD (19).

Several factors such as traditional risk factors of cardiovascular disease, chronic inflammation, drugs using in treatment strategies, and sedentary life style play an important role in increasing risk of CAD (20).

Diet can significantly improve the serum T cell-mediated immune response while it has no effect on B-cell function or production of pro-inflammatory mediators (21).

Cytokines play a major role in the activation of adhesion molecule and chemokine expression involved in lymphocyte/monocyte recruitment, endothelial adhesion, and migration into the inflamed vessel wall (22).

This chronic, progressive inflammation continue in all medium to the large vessels, thus coincidence of coronary sclerosis and peripheral artery stenosis can be detected in a patient (23).

**Diagnosis and treatment of Coronary artery disease**

CAD diagnosis is divided into invasive, minimal invasive, and non-invasive methods (24). Gold standard for angiographic positive subjects is coronary traditional angiography. However, in this method more than 50% occlusion of coronary artery lumen is considered as significant occlusion.

Computerized tomography angiography (CT-angiography) is another technique for detecting coronary artery lumen occlusion (25). This method has specificity and sensitivity 94% and 92% respectively versus traditional angiography (26).

Some other methods such as myocardial perfusion imaging, exercise treadmill test, positron emission tomography (PET scan), and dobutamine stress echocardiography have some advantages or disadvantages in comparing with traditional angiography (27).

Pharmacological treatment, percutaneous intervention, and coronary artery bypass grafting are acceptable treatments of CAD; according to the personal conditions and medical history these methods can be changed (28).

**Carotid artery disease**

Annually, around 1 million strokes and 300,000 transient ischemic attacks occur in the USA (29). Azarpazhooh and his research team found that the incidence of stroke [616 (95% CI, 567 to 664) for ischemic stroke] was higher in Iran than most of western countries (30). Therefore, the second cause of death belongs to the stroke (31). In developed countries, more that 50% of deaths are due to cardiovascular and cerebrovascular diseases (4,5).

Carotid artery disease and CS are the most common reasons of cerebrovascular events (3,4).

According to the medical evidence, a great positive relationship was found between CAD and CS (5). Therefore, it is better to say that atherosclerosis is a diffuse vascular disease of medium to the large arteries (32).

According to the Solberg et al. study, carotid artery disease occurs later than CAD in lifetime (33). However, the same plaque histopathology and anatomical location are in CAD and CS (34).

Although CAD and CS have some similarity, differences are found between them. For example, severity of stenosis in CS is associated with further events compared with CAD patients (5).

High sensitive C reactive protein (hs CRP) has been introduced as a marker for vascular inflammation. Moreover, it has recently been indicated that CRP are involved in the initiation, progression, and complications (e.g. destabilization) of atherosclerosis (35). It has been suggested that hs-CRP plays a direct and significant pathophysiological role in the progression of atherosclerosis (36). Therefore, most of the studies showed positive correlation between CAD and hs CRP in CAD patients, while controversial data were collected in carotid artery disease (5).

Adhesion molecule (intercellular adhesion molecule-1 (ICAM)) plays an important role in the erythrocyte-leukocyte adherence, endothelial injury and plaque instability due to vascular media inflammation (37). In CAD patients, ICAM serum levels is associated with plaque instability, but opposite evidences were found in carotid artery disease (5).

**Atherosclerosis risk factors**

Risk factors for atherosclerosis include age, sex (male gender), family history of CAD, hypertension (HTN), dyslipidemia, smoking, diabetes mellitus, and obesity (38).

CAD and carotid artery disease have same risk factors, which are divided to the modifiable and non-modifiable risk factors (39).

Patients could modify their life style, diet and have a close observation on some medical diseases such as diabetes mellitus and HTN (40).

Some conditions could accelerate carotid artery disease such as head and neck radiotherapy or Kawasaki disease (41,42). Overall, CAD and CS have similar occlusion timing.

**Diagnosis of carotid artery disease**

Carotid artery disease could detect with invasive
or non-invasive techniques, spiral CT angiography (43), magnetic resonance angiography (MRA) (44), ultrasonic pulsed doppler duplex (45), and traditional contrast arteriography (5).

Nowadays, minimal invasive or non-invasive techniques are more acceptable than invasive methods, thus MRA and color Doppler are common in carotid artery detection.

**Treatment of Carotid artery disease**

In acute ischemic stroke, tissue plasminogen activator (tPA) could be effective treatment, but it should be administrated at the first 60 minutes after event (5,46). Stenting balloon angioplasty or endarterectomy are other treatment options (47,48).

As medical treatments, anticoagulation therapy, and antiplatelet therapy are recommended for future ischemic events in preventive medicine (49).

**Conclusion**

Most of the time, CAD is associated with peripheral artery stenosis. Carotid artery is one of the most important arteries that influences on the mortality and morbidity of atherosclerosis. CS is associated with cerebrovascular events.

Histological morphology and plaque formation in CAD and CS are similar and they occur together most of the time. Some invasive and non-invasive diagnostic methods are established for CS detection. Same medical and surgical treatment techniques could be used for CS management, however, patient-to-patient specific conditions should be considered.

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**Conflict of Interest**

The authors declare no conflict of interest.

**References**


