Review Article

Coronary Artery Ectasia

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Abstract

This review on coronary artery ectasia (CAE) explores what is currently known about its classification, etiology and pathogenesis, clinical manifestations, methods of diagnosis, treatment and prognosis. CAE is not a rare coronary anomaly. Its prevalence is about 0.3–12% in autopsies and during coronary angiography or multidetector computed tomography (MDCT). Its etiology is varied and its pathophysiology is not completely understood. More than half of CAE cases is due to coronary atherosclerosis, and the right coronary artery is most commonly affected. Angina pectoris is the most common clinical manifestation. Unstable angina, acute myocardial infarction, heart failure, ventricular tachycardia/fibrillation, and sudden death have also been reported. Myocardial ischemia is possibly caused by coexisting significant coronary stenosis, slow flow, microvascular dysfunction, thrombus formation, coronary spasm or spontaneous coronary dissection. Coronary angiography, intravascular ultrasound, and MDCT are the current major diagnostic tools for CAE. The prognosis of CAE has shown improvement when it is treated with aggressive medical therapy, modern revascularization techniques, and state-of-the-art equipment. [Tzu Chi Med J 2008;20(4):270–274]

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1. Introduction

Coronary artery ectasia (CAE) has been observed by pathologists and cardiologists for more than two centuries. This coronary anomaly was first described by Morgagni in 1761 [1]. Bourgon was the first to describe the postmortem finding of right coronary artery (RCA) dilatation in a patient who experienced sudden death in 1812 [2]. The term ectasia was first used by Bjork in 1966 to describe dilated coronary arteries [3]. The literature prior to this date consisted of only postmortem reports. Coronary angiography and new diagnostic tools have enabled clinicians to discover more cases of ectasia. However, not all patients with ectasia are symptomatic and receive coronary angiography examination; hence, the real incidence is unknown. The reported incidence is between 0.3% and 4.9% at autopsy and during coronary angiography [4–6]. Zeina et al determined that the prevalence of CAE in consecutive participants who underwent coronary multidetector computed tomography (MDCT) was 8% [7]. Sharma et al found an incidence as high as 12% in an Indian population [8], which may have different demographic characteristics.

There is a male preponderance, with a male-to-female ratio of 3:1 [5,9,10]. The proximal and middle parts of the RCA are most commonly affected by ectasia, although the reasons for this are not clear.
Involvement of the left anterior descending artery and left circumflex artery is variable. The left main coronary artery is less commonly involved. Most cases of CAE involve only a single vessel. Disturbance in blood flow filling and washout are major characteristics of CAE. Delayed antegrade filling, a segmental back flow phenomenon, and local deposition of dye (stasis) in the dilated coronary segment have been observed during imaging (11,12).

2. Definition and classification

There are various methods for defining CAE. Hartnell et al defined CAE as an arterial segment with a diameter at least 1.5 times the diameter of the adjacent normal coronary artery (6). Markis et al provided the following classification of CAE based on the extent of coronary involvement: type I, diffuse ectasia of two or three vessels; type II, diffuse disease in one vessel and localized disease in another vessel; type III, diffuse ectasia of one vessel only; and type IV, localized or segmental ectasia (9). This classification is used extensively. Plehn et al preferred to use the term coronary artery aneurysm for segmental ectasia, reserving the term ectasia for diffuse vessel involvement (13). They classified aneurysms as small (<5 mm), medium (5–8 mm), or giant (≥8 mm). In addition, coronary artery aneurysm has been classified as the fusiform or saccular type based on the anatomic shape of the ecstatic segment. There is no general concept concerning the critical diameter required for the development of rupture.

To date, only a few reports have described the anatomic changes that occur in CAE over time. Plehn et al reported a patient who developed coronary artery aneurysm after percutaneous coronary intervention (PCI). Chiu et al reported a patient who developed coronary artery aneurysm after successful stent implantation for a chronic totally occluded lesion (25). Interestingly, the aneurysm spontaneously regressed a few months later without further intervention. It was thought that the most likely mechanism for this was shear stress inducing vessel positive remodeling after an intervention procedure, with subsequent negative remodeling when the shear stress returned to baseline.

Lamblin et al found that patients with CAE had a higher percentage of the 5A/5A polymorphism of metalloproteinase-3 (MMP-3), which is actively involved in the proteolysis of extracellular matrix proteins (26). The levels of inflammatory markers such as plasma interleukin-6, C-reactive protein, V-CAM, I-CAM and E-selectin are elevated in CAE patients (27–30). This suggests a role for the inflammatory process in this setting.

Pinar et al determined that CAE was associated with the classical cardiovascular risk factors except for diabetes, which was rare in patients with isolated CAE (31). This negative correlation between diabetes and CAE has also been reported by others. Williams et al found impaired nitric oxide-mediated vasodilation in patients with non-insulin-dependent diabetes (32). However, Zeina et al demonstrated that there was no apparent correlation between CAE and hypertension, hyperlipidemia, diabetes, smoking and a family history of coronary artery disease (7). The actual relationship between CAE and traditional cardiovascular risk factors still needs to be clarified by further study.

Considering all of the above findings, Manginas and Cokkinos speculated that CAE occurs due to two
different mechanisms in two distinct patient groups: (1) commonly in patients with concomitant coronary artery disease due to severe and chronic arterial inflammation; and (2) rarely in subjects without coronary atherosclerosis as a result of exogenous interstitial nitric oxide vascular overestimation [12].

4. Clinical manifestations

Although it has been shown that more than half of patients with CAE have underlying coronary artery stenosis, the symptoms do not directly correlate with the degree of stenosis. Sayin et al postulated that CAE subjects patients to a higher risk of myocardial ischemia irrespective of the extent of stenosis [33]. On the contrary, the Coronary Artery Surgery Study database showed no difference in 5-year survival for patients with both CAE and coronary artery disease compared with those with only coronary artery disease [5].

Angina is the most common symptom in patients with CAE; ST-elevation myocardial infarction, non-ST-elevation myocardial infarction, heart failure, and severe arrhythmias such as ventricular tachycardia and fibrillation have also been reported. Bove and Vlietstra demonstrated that ectatic arteries are prone to spasm [34]. Suzuki et al used computer analysis to evaluate the effects of ergonovine- and acetylcholine-induced spasm [35]. They found that the actual narrowing induced by these agents usually occurred adjacent to the ectatic portion and less commonly within the ectatic area. Perlman and Ridgeway documented a large, left anterior descending artery thrombus in a patient with triple vessel coronary artery ectasia [36]. Huikuri et al reported a case of large spontaneous dissection of an ectatic right coronary artery in a patient with out-of-hospital cardiac death [37]. Tomaru et al described a patient who presented with sudden onset of shortness of breath followed by respiratory arrest, in whom coronary angiography showed type I CAE and two-vessel disease [21]. Gore et al reported a case of congenital coronary artery aneurysm in which the patient presented with dyspnea and syncope [38]. Tuzun et al found that stiffness parameters in the aorta are impaired in patients with CAE as well as in those with coronary artery disease [39]. The increased stiffness may be responsible for left ventricle diastolic dysfunction, which is very important because it might play a key role in the development of heart failure. CAE has been reported to be associated with aortic aneurysm and patients present with abdominal pain. In a retrospective study by Stajduhar et al, 20.8% of patients who underwent operations for abdominal aneurysm had CAE [40]. Some patients with CAE are asymptomatic and the disease is found incidentally during catheterization.

5. Diagnostic methods

Coronary angiography is now the criterion standard for diagnosing CAE. Coronary angiography offers a detailed definition of coronary anatomy, making it possible to characterize the distribution and size of coronary aneurysms and also to detect coronary stenosis. A treadmill exercise test and thallium-201 myocardial perfusion scan can be used to evaluate myocardial ischemia caused by CAE. Intravascular ultrasound can be used to assess the luminal size and condition of the arterial walls, and also to differentiate true from false aneurysms caused by plaque rupture [41]. Magnetic resonance imaging has been successfully used to assess coronary anatomy in patients with CAE. Greil et al reported a small series of adolescents and young adults with Kawasaki disease, who were diagnosed by coronary magnetic resonance angiography [42]. MDCT is one of the newest tools used to diagnose CAE, and it is not invasive like coronary angiography. Zeina et al found a high prevalence (8%) of CAE when using MDCT as a diagnostic tool [7]. The first congenital CAE diagnosed by MDCT was reported by Ayusawa et al in 2008 [43].

6. Treatment

CAE is not a benign coronary anomaly. Sorrel et al suggested treating CAE patients with: (1) anticoagulation therapy, utilizing chronic warfarin therapy to offset the risk of thrombus formation and to keep the international normalized ratio at around 2.0–2.5; (2) antiplatelet therapy, utilizing aspirin (80–360 mg/day) to minimize platelet aggregation; and (3) antispasms therapy, utilizing calcium-channel blockers [24]. Nitrates could also be used, but added care should be emphasized to provide a nitrate-free “holiday” and prevent chronic exposure to these agents.

Therapy should be tailored to each individual patient because of the serious bleeding complications associated with warfarin use. Tuncer et al reported two cases of CAE, one in a patient with myocardial infarction and one with unstable angina [44]. A large thrombus was seen in both patients and they were treated with aspirin, warfarin and metoprolol. One patient received MDCT after follow-up, which revealed that the thrombus had almost completely dissolved after 3 months. Warfarin was then discontinued in both cases and clopidogrel was given. But these treatment strategies have not been studied prospectively. Heparin and thrombolytic therapy have been successfully used for recanalization. For patients with coexisting obstructive lesions and refractory angina despite medical treatment, PCI can be performed. But there can be difficulties during stent deployment because the ectatic arteries are usually much larger than normal.
arteries. Selection of a stent of adequate size and its expansion are very important, and can be determined by intravascular ultrasound. Rha et al reported a challenging case of implantation of two 3.5 x 18 sirolimus-eluting stents parallel to each other in a large ectatic coronary artery (45). They suggested that in lesions which have a large reference diameter, the clinician can consider parallel stenting using drug-eluting stents as a new intervention strategy. CABG has been used for many years for the treatment of significant coronary artery disease coexisting with CAE, and the post-operative outcome is uniformly good.

In our opinion, treatment should be tailored according to clinical manifestations and the number and involvement of the coronary arteries. Medical therapy is recommended for patients with symptomatic non-obstructive CAE. Surgery (CABG, aneurysm ligation, or aneurysmorrhaphy) is a better choice for patients who are refractory to coronary medical therapy and not suited for PCI.

7. Prognosis

There are different opinions about the prognosis of CAE (9,46–48). Markis et al reported an annual mortality rate of 15% during a mean follow-up period of 24 months (9). Baman et al reported a significant adverse outcome among the 276 CAE patients they studied, with a 5-year mortality rate of 29.1% (47). Recently, because the techniques and equipment for revascularization have significantly improved, the prognosis of CAE seems to be better. Valente et al reported that the prognosis of CAE was good with a low mortality rate (2%) (48), possibly because their patients with ST-elevated myocardial infarction and acute coronary syndrome all underwent PCI and the most severe cases with coexisting coronary stenosis underwent CABG.

8. Conclusion

CAE is worth closer study, as the different etiologies and complicated pathophysiology are still not completely understood. With the use of different modern treatment strategies, the prognosis seems to be improving gradually. But these therapeutic modalities need large-scale, randomized, controlled studies to prove their long-term effectiveness.

References


