Coronary Artery Disease in Patients With Buerger's Disease

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Buerger's disease (thromboangiitis obliterans) is a small- and medium-vessel vasculitis that predominantly involves the distal extremities. Coronary involvement in Buerger's disease is very unusual and rarely reported. We describe the unusual coronary angiogram findings of a 61-year-old Caucasian male with Buerger's disease who underwent cardiac catheterization for preoperative cardiac risk stratification prior to a carotid endarterectomy. Following the case presentation, we review the pathology, pathogenesis, and diagnostic criteria for Buerger's disease, and also include a review of the existing literature on coronary involvement in Buerger's disease.

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Key words: Buerger's disease • Thromboangiitis obliterans • Coronary artery disease • Coronary angiogram

Buerger's disease (thromboangiitis obliterans) is small- and medium-vessel vasculitis that predominantly involves the distal extremities.[1] Coronary involvement in Buerger's disease is very unusual and rarely reported.[2] In this article, we report the unusual coronary angiogram findings of a patient with Buerger's disease. Following the case presentation, we review the pathology, pathogenesis, and diagnostic criteria for Buerger's disease, and include

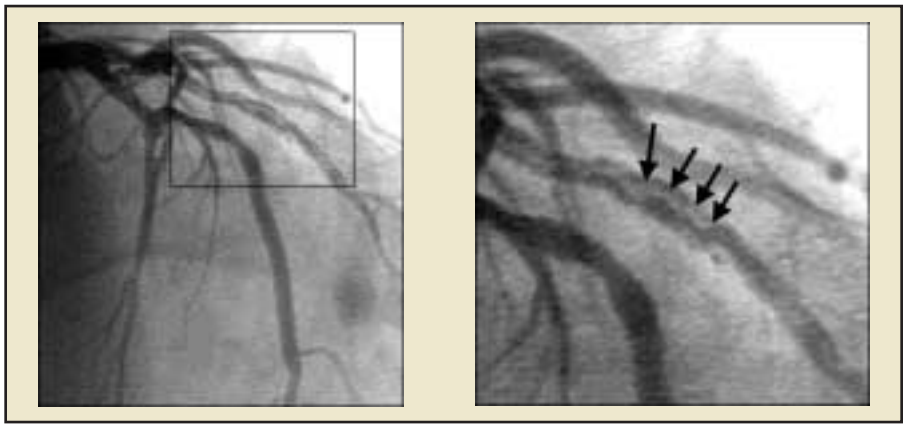


Figure 1. *Left coronary artery in the right anterior oblique projection with cranial angulation demonstrating multiple filling defects in the diagonal artery. (Close-up view of the diagonal artery on the right.)*

a review of the existing literature on coronary involvement in Buerger's disease.

Case Presentation

JB, a 61-year-old Caucasian male with Buerger's disease, was referred for a positive stress test. The patient was first diagnosed with Buerger's disease at age 29 when he had multiple surgeries including amputation of 4 toes in the left foot, amputation of the right-hand fingers, right below-the-knee amputation, and sympathectomies of both his upper and lower extremities. At age 52, he had a left above-the-elbow amputation. At age 56, he had a cerebrovascular attack and subsequently underwent a right carotid endarterectomy. Unfortunately, his right carotid artery re-occluded 1 year after surgery.

Though the patient had no new symptoms, a carotid Doppler ultrasound was performed that revealed a 95% stenosis in the left carotid artery. In anticipation of a left carotid endarterectomy, a myocardial perfusion scan was performed that demonstrated reversible ischemia in the inferior wall.

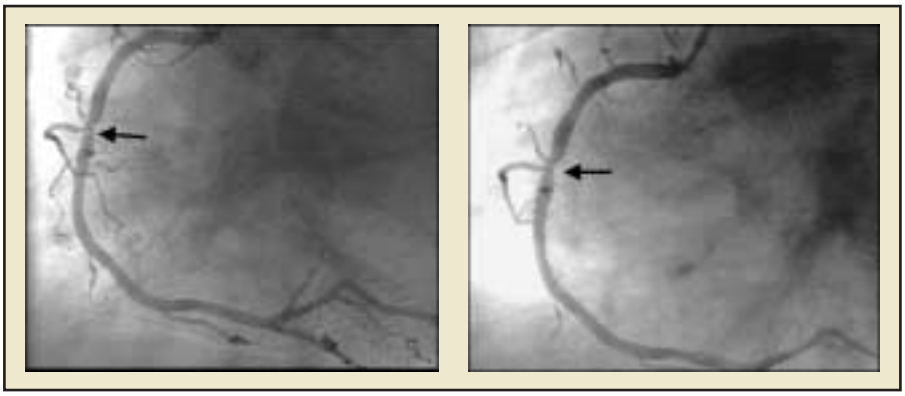
Upon presentation, the patient had no chest discomfort or respiratory difficulties. He had no prior history of hypertension, hypercholesterolemia, or diabetes mellitus. His medications included aspirin and warfarin. He was an active smoker with a 50 pack/year history of tobacco use. His father died of a myocardial infarction in his 70s.

His physical examination on presentation revealed: body weight 204.5 kg, blood pressure 150/80 mm Hg, heart rate 54/min, respiratory rate 16/min, and temperature normal. The lungs were clear to auscultation. The jugular veins were not visualized. The carotid arteries were faint with bilateral bruits. Upon palpation, the point of maximal impulse was not displaced. Upon auscultation, the heart was in a regular rate and rhythm with an S4 gallop, but no murmurs. His right femoral pulse was not palpable, his left femoral pulse was brisk, his left politeal pulse was faint, and his left pedal pulses were not palpable. His right radial pulse was also not palpable.

His 12-lead electrocardiogram revealed normal sinus rhythm, left axis deviation and Q-waves in the lateral leads.

Because of his abnormal myocardial perfusion scan, a coronary angiogram was performed that revealed no significant narrowing of the left main artery or left anterior descending artery (Figures 1 and 2). However, in the first diagonal artery, there were multiple, sequential, intraluminal filling defects in a beaded pattern. The left circumflex artery had a 40% stenosis in its proximal portion with 2 filling defects at the onset of the first obtuse marginal artery. The right coronary artery had a focal 60% stenosis in its mid portion with an overlying filling defect resulting in a 90% stenosis. Non-selective carotid angiography revealed a 70% stenosis of the left internal carotid artery, 90% stenosis of the left external carotid artery, and total occlusion of the right internal carotid artery.

Figure 2. *Right coronary artery in the left anterior oblique projection initially demonstrating a stenotic lesion in the mid portion with an overlying filling defect (left). On the follow-up angiogram (right), the overlying filling defect has resolved.*



The procedure was then concluded and the patient was discharged. He resumed his outpatient medications including aspirin and warfarin. After 2 months, a repeat coronary angiogram was performed. The findings in the left coronary artery were unchanged; however, the filling defect previously overlying the right coronary artery lesion was no longer present (Figure 2). Assessment using fractional flow reserve demonstrated that this lesion was not hemodynamically significant. The procedure was then concluded, and 2 weeks later, the patient underwent left carotid endarterectomy without any perioperative cardiovascular complications.

Buerger's disease is a nonatherosclerotic inflammatory disease of the small and medium-sized vessels characterized pathologically by occlusive, inflammatory, intraluminal thrombus with relative sparing of the vessel wall.

Discussion

Buerger's disease (thromboangiitis obliterans) is a nonatherosclerotic inflammatory disease that primarily involves the small and medium-sized arteries and veins of the extremities. Typically, the disease occurs in young male smokers with the onset of symptoms before age 40, usually due to ischemia of the distal extremities.[3]

The histological findings of Buerger's disease vary with the duration of the disease.[4] Early lesions are most likely to be diagnostic and are characterized by an occlusive thrombus accompanied by prominent neutrophilic infiltration involving the thrombus and to a lesser extent, the vessel wall. Microabscesses may also be present at this early stage. Subacute and chronic lesions are characterized by progressive organization of the thrombus with predominantly mononuclear infiltration (including multinucleated giant cells and epithelioid cells) and fibrosis of the vessel wall. Regardless of the stage of the disease, the normal structure of the vessel wall generally remains intact, a feature that can distinguish Buerger's disease from atherosclerosis as well as other forms of vasculitis.[5]

As mentioned previously, the disease appears to occur more commonly in males, with the onset of symptoms before the age of 40 years. Though the prevalence of Buerger's disease is low in the United States and Europe, it remains a major cause of peripheral vascular disease in the Middle East and Far East.[6,7] The specific cause of Buerger's disease is unknown; however there is an extremely strong association between the use of tobacco and development of the disease. The role that exposure to tobacco plays in the pathogenesis of Buerger's disease is unclear. Tobacco exposure may provide a trigger that initiates a hypersensitivity reaction in genetically susceptible individuals that may contribute to the expression of disease. Furthermore, the manifestations of disease can frequently improve after cessation of smoking.[3]

Typically, Buerger's disease begins with ischemia of the distal small arteries and veins with progressive involvement of the more proximal vasculature. Patients may present with claudication of the feet, legs, hands, or arms. As the disease progresses, superficial thrombophlebitis, Raynaud's phenomenon, calf claudication, pain at rest, and ischemic ulcerations on the toes, feet, or fingers may also develop.[3]

There are no specific laboratory tests to aid in the diagnosis of Buerger's disease. Pathologic findings in the acute phase can be pathognomonic; however at more advanced stages unequivocal pathological findings are rarely present. As a result, biopsy as a diagnostic procedure is limited by the scarcity of surgical specimens with acute phase lesions.[8] Arteriography can be helpful in ruling out a source of emboli and can also demonstrate the typical angiographic findings of Buerger's disease, including tapering

Table 1
Criteria for the Diagnosis of Buerger's Disease

Shionoya and colleagues[10]	Olin and colleagues[5]
1. Smoking history	1. Smoking history
2. Onset before the age of 50 years	2. Onset before the age of 45 years
3. Infrapopliteal arterial occlusions	3. Distal-extremity ischemia
4. Upper limb involvement or phlebitis migrans	4. Consistent arteriographic findings
5. Absence of other atherosclerotic risk factors	5. Exclusion of autoimmune diseases, hypercoagulable states, diabetes mellitus, and proximal source of emboli

or abrupt occlusion of small and medium-sized vessels, "corkscrew collaterals," and absence of proximal arterial involvement.[9] Although these findings may be helpful, they are not unique to Buerger's disease and may be seen in collagen-vascular diseases and antiphospholipid antibody syndrome.

Several groups of investigators have proposed criteria for the diagnosis of Buerger's disease (Table 1); however there are no universally accepted diagnostic criteria. One example is Shionoya's clinical criteria[10] which are: (1) smoking history, (2) onset before the age of 50 years, (3) infrapopliteal arterial occlusions, (4) either upper limb involvement or phlebitis migrans, and (5) absence of atherosclerotic risk factors other than smoking. Similarly, the clinical criteria proposed by Olin[5] are: (1) age less than 45 years, (2) current (or recent) history of tobacco use, (3) the presence of distal-extremity ischemia (indicated by claudication, pain at rest, ischemic ulcers, or gangrene) documented by noninvasive vascular testing, (4) exclusion of autoimmune diseases, hypercoagulable states, and diabetes mellitus by laboratory testing and exclusion of a proximal source of emboli by echocardiography and arteriography, and (5) consistent arteriographic findings in the clinically involved and noninvolved limbs.

Although Buerger's disease generally involves the distal extremities, it has been reported in other vascular beds, including the coronary arteries. Mautner and colleagues[2] reviewed 13 published cases of Buerger's disease in which the coronary arteries were studied histologically. In their analysis, severe narrowing of a major coronary artery was present in 11 of 12 cases where information was available. Most of the patients had findings consistent with atherosclerosis; however 3 of the patients had histopathology consistent with Buerger's disease. "Old thrombi" or "multiluminal channels" were described in 8 out of 13 cases and "recent thrombi" were noted in 5 out of 13 cases. Therefore, although atherosclerosis is the predominant pathologic finding of the coronary arteries in these patients, in a minority of cases, Buerger's disease may be present as well.

The coronary angiogram in our patient demonstrated a first diagonal artery with multiple filling defects in an unusual linear, beaded pattern, a left circumflex artery with several intraluminal filling defects, and a right coronary artery with a moderately stenotic lesion and an overlying filling defect that was no longer present on a repeat coronary angiogram performed 2 months later. Although atherosclerosis is very likely present, the unusual nature of these angiogram findings suggests that Buerger's disease with involvement of the coronary arteries may also be present. Because the filling defect initially overlying the stenotic lesion in the right coronary artery resolved without any additional therapy, it likely represented a recent thrombus that resolved with continued aspirin and warfarin. The multiple, intraluminal filling defects seen in the diagonal artery likely represented older, organized, recanalized thrombus, and may have represented a more chronic stage of the disease. Although the findings in the diagonal artery could also be suggestive of dissection, this is unlikely because the linear filling defect seen with coronary dissection of this length would generally occur with a spiral-

The unusual nature of the angiogram findings suggests that Buerger's disease with involvement of the coronary arteries may also be present.

Main Points

- Buerger's disease (thromboangiitis obliterans) is small- and medium-vessel vasculitis that predominantly involves the distal extremities. Coronary involvement in Buerger's disease is very unusual and has only rarely been reported.
- The specific cause of Buerger's disease is unknown; however there is an extremely strong association between the use of tobacco and development of the disease. The manifestations of disease can frequently improve after cessation of smoking.
- The authors present a patient with Buerger's disease and a coronary angiogram demonstrating multiple, intraluminal filling defects in the left and right coronary arteries with complete resolution of a filling defect in the right coronary artery within 2 months.
- Although atherosclerosis was likely present, the unusual nature of the angiogram findings suggests that Buerger's disease of the coronary arteries may have been present as well.

ing pattern. Furthermore, spontaneous dissection of the coronary arteries is extremely rare.

Coronary angiography in patients with Buerger's disease has been previously reported.[11-17] Of note, Ohno and colleagues[11] described a 32-year-old male with an acute myocardial infarction. Coronary angiography revealed a 70% narrowing in both the distal right coronary artery and the proximal left anterior descending artery with findings suggestive of thrombus. After intracoronary injection of urokinase, the stenosis in the left anterior descending artery decreased to 30%, whereas the stenosis in the right coronary artery remained unchanged. A repeat angiogram performed 4 weeks after the myocardial infarction demonstrated resolution of the thrombi and normal appearing coronary arteries. Mautner and colleagues[2] described a 34-year-old male with a non ST-segment elevation myocardial infarction who received intravenous streptokinase. Subsequent coronary angiography revealed "up to 75% diameter reduction" of the proximal left circumflex artery. Hoppe and coworkers[14] described a 39-year-old female who presented with an acute myocardial infarction. Coronary angiogram revealed a "proximally occluded left anterior descending coronary artery…a 50% proximal left circumflex coronary artery stenosis with prestenotic ectasia, and a dominant right coronary artery that had proximal to mid-vessel beaded irregularities" (*Catheter Cardiovasc Interv.* 2002;57:363-364). After coronary artery bypass surgery, histologic examination of the left internal mammary artery demonstrated findings consistent with Buerger's disease. Becit and coworkers[15] reported a 36-year-old male with "total occlusion of the proximal segment of the left anterior descending coronary artery as a long segment…total occlusion of the proximal segment of the right coronary artery." After coronary artery bypass graft surgery, histologic examination of an endarterectomy specimen showed "specific features of thromboangiitis obliterans" (*Heart Vessels.* 2002;16:201-202). Finally, in the Japanese literature, Umami and coworkers[16] described findings similar to ours in a 63-year-old male with a coronary angiogram that showed "a long lesion (which) seemed rosary in the left anterior descending (artery)" (*Kyobu Geka.* 1999;52:455).

In summary, Buerger's disease is a nonatherosclerotic inflammatory disease of the small and medium-sized vessels characterized pathologically by occlusive, inflammatory, intraluminal thrombus with relative sparing of the vessel wall. Although the predominant pathologic coronary findings in Buerger's disease are atherosclerosis, Buerger's disease with coronary involvement has rarely been reported. We present a patient with Buerger's disease and a coronary angiogram demonstrating multiple, intraluminal filling defects in the left and right coronary arteries with complete resolution of a filling defect in the right coronary artery within 2 months. The resolving filling defect initially present in the right coronary artery represented recent thrombus, whereas the unchanging filling defects in the left coronary artery likely represented older, recanalized thrombus. Although atherosclerosis was likely present, the unusual nature of the angiogram findings suggests that Buerger's disease of the coronary arteries may have been present as well. To our knowledge, our report is the first in the English literature to report such unusual coronary angiographic findings in a patient with Buerger's disease. ■

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