

# Total occlusion of the abdominal aorta and the severity of angiographically-proven coronary artery disease

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## ABSTRACT

**Introduction:** Total occlusion of the abdominal aorta is unusual, posing diagnostic and therapeutic problems. The outcome of surgery involving the abdominal aorta depends upon the presence of coronary artery disease (CAD). Hence, the purpose of this study was to determine the prevalence of CAD in patients with total occlusion of the abdominal aorta.

**Methods:** 74 patients presenting with claudication of both the lower limbs and having bilaterally absent femoral pulsations were subjected to abdominal aortography. Patients who were found to have total occlusion of the abdominal aorta were included in the study. Coronary angiography was done in all the patients.

**Results:** 47 patients were found to have total occlusion of the abdominal aorta. The mean age was 55 years. 37 patients were male and ten were female. All were smokers, 37 were hypertensive and four were diabetic. 11 (23.4 percent) patients were found to have CAD. Single vessel disease was present in eight patients, two-vessel disease in two patients and three-vessel disease in one patient.

**Conclusion:** The study shows that approximately one-fourth of the patients with total occlusion of the abdominal aorta had CAD. A majority of these patients had single vessel disease.

**Keywords:** abdominal aorta, atherosclerosis, coronary artery disease, total arterial occlusion

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## INTRODUCTION

Atherosclerosis is a systemic disease with the potential to involve multiple vascular beds. Progressive atherosclerotic disease is relatively common in the distal abdominal aorta. The specific association of coronary artery disease (CAD)

and peripheral vascular disease (PVD) is well established. The prevalence of associated CAD in patients with PVD may exceed 50%, and there is an increased prevalence of cerebrovascular disease as well.<sup>(1)</sup> Patients undergoing reconstructive surgery for PVD and have associated CAD, are at an increased risk, as the prognosis of surgery depends upon the severity of the associated CAD. Cardiac death is responsible for about 50% of early deaths in patients undergoing reconstructive surgery for PVD.<sup>(2,3)</sup> Late mortality also depends upon the associated CAD. The Reduction of Atherothrombosis for Continued Health (REACH) registry entered outpatients with CAD, PVD, cerebrovascular disease or at least three major risk factors for vascular disease. They were being treated at 5,587 physician practices in 44 countries, over a six-month period ending in mid-2004. The one-year rate of cardiovascular death, myocardial infarction or stroke doubled if there was an associated disease in any of the vascular beds, as compared to those who had multiple risk factors.<sup>(4)</sup> In the study by Crawford et al, the five-year survival rate in patients undergoing surgery for aortic aneurysm or aortic occlusion was 84%–89% in patients without clinical CAD and only 54% in patients with clinical CAD.<sup>(5)</sup> Similar results were shown by Hertz et al.<sup>(6)</sup> Total occlusion of the abdominal aorta (TOAA) is a severe form of atherosclerosis and presents with claudication in both the lower limbs. Hence, the determination of the extent and severity of CAD is important in the management of these patients.

## METHODS

This study was prospective. Over a five-year period, 74 consecutive patients presenting with claudication of both the lower limbs and having bilaterally absent femoral pulsations on clinical examination were studied. The patients were either referred to us from the community or came directly to our hospital, mostly referred by general surgeons or physicians. All the patients were subjected to abdominal aortography using a pigtail catheter through the brachial or radial artery puncture, in the cardiac catheterisation laboratory. Patients with TOAA constituted the study group. Distal vessels filling through the collateral were traced. Coronary angiography was done

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**Table I. Patient characteristics.**

Demographics	No. (%) of patients
Gender	
Male	37 (78.72)
Female	10 (21.27)
Total	47
Mean age $\pm$ standard deviation (years)	54.91 $\pm$ 9.24
Smoker	47 (100)
Hypertensive	37 (78.72)
Diabetic	4 (8.51)
Coronary artery disease	
Family history	0
Known cases	1 (2.56)
Gangrene/non-healing ulcer	5 (10.6)

**Table II. Coronary artery disease in total occlusion of the abdominal aorta.**

Type of coronary artery involvement	No. (%) of patients
Total no. of patients	47
Normal coronaries	36 (76.60)
Coronary artery disease	11 (23.40)
Single vessel disease	8 (72.72)
Two-vessel disease	2 (18.18)
Three-vessel disease	1 (9.09)
Total lesions	15
Left anterior descending	2
Left circumflex	4
Right coronary	9

**Table III. Filling of distal vessels in total occlusion of the abdominal aorta through collaterals.**

Filling of distal vessels	No. (%) of patients
Both common iliacs	6 (12.77)
Both external iliacs	4 (8.51)
Both femorals	17 (36.17)
Both profunda femoris	1 (2.13)
One common iliac and other femoral	1 (2.13)
One external iliac and other femoral	2 (4.26)
One femoral, none on other side	7 (14.89)
No well-formed distal vessels	9 (19.15)

with right and left Judkin's catheters. Vessels showing  $\geq 50\%$  stenosis in at least one of the coronary arteries were labelled to have CAD. The exclusion criteria were patients younger than 35 years of age, with acute embolic occlusion, and fulfilling the criteria for aortoarteritis or collagen disorders.

## RESULTS

Of the 74 patients who were subjected to abdominal aortogram, 47 were found to have TOAA below the renal arteries. 37 were male and ten were female. The mean age was  $54.9 \pm 9.2$  years. Table I shows the patient

characteristics. Table II shows the details of the coronary artery involvement in the patients. 11 (23.4%) were found to have CAD and 36 had normal coronary arteries. The filling of the distal vessels was studied. Nine patients showed only collateral but no well-formed distal vessels. Both common iliac arteries were filling through collaterals in six patients, both external iliac arteries in four patients and both femoral arteries in 17 patients. In all these patients, there was a large tortuous collateral vessel entering the pelvis to feed the pelvic organs. Three patients showed stenosis of one renal artery each. Table III shows the details of filling of distal vessels through the collaterals.

Three patients showed that after filling of the femoral arteries through the collaterals, one of the femoral arteries again showed total occlusion and filling of the popliteal artery through collaterals. One common feature of all the patients with TOAA was that a large collateral originated from the distal part of the aorta or rarely from one renal artery, and it entered the pelvis and gave multiple branches to the pelvic organs. To the best of our knowledge, this artery has not been described in the literature. This artery was present in all the cases irrespective of the presence of collaterals to the lower limbs (Fig. 1), although most of the cases showed three large collaterals, one entering the pelvis and one each entering each lower limb to fill the distal vessels (Fig. 2 a–c).

## DISCUSSION

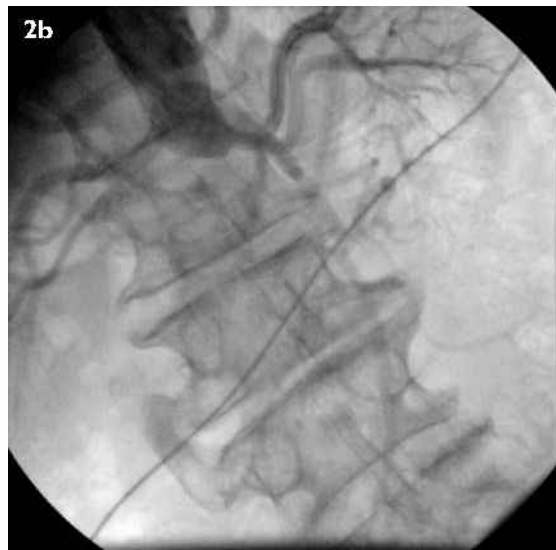
Aortic occlusion is rare and potentially dangerous. Most of the time, it occurs in patients with advanced atherosclerosis and can cause severe ischaemic manifestation in the lower extremities, spinal cord, intestine and kidney, depending on the site of the obstruction. Acute occlusion of the abdominal aorta has a high early mortality.<sup>(7)</sup> It is caused either by embolic occlusion or acute thrombosis. Thrombosis mostly occurs in severe atherosclerotic disease. Some cases are due to hypercoagulable states and cause thrombosis of aneurysm of the abdominal aorta.<sup>(8)</sup> In a study by Tapper et al, approximately 12% of the cases of occlusion of the abdominal aorta were located in the suprarenal region.<sup>(9)</sup> More than two-thirds of this group had chronic atherosclerotic disease of the infrarenal aorta, with superimposed thrombus formation, which extended proximally to involve the suprarenal aorta. A simple, readily-available and noninvasive method for early diagnosis is duplex scanning and ultrasonography, with a sensitivity of around 91% and specificity of 93%.<sup>(10)</sup> However, until recently, our radiology department had no facility for peripheral Doppler ultrasonography; hence most of our patients with TOAA underwent angiography. Two surgical modalities exist for the management of



**Fig. 1** Anteroposterior abdominal aortogram shows a large collateral entering the pelvis. This was found to be a constant finding in total occlusion of the abdominal aorta.

suprarenal aortic occlusion. For those with a short life-expectancy, with near normal renal functions and controlled blood pressure, axillary bi-femoral bypass is the treatment of choice.<sup>(11)</sup> Others will require aortic reconstruction and thrombectomy of the juxtarenal segment.<sup>(11,12)</sup> The operative mortality in chronic infrarenal aortic occlusion is approximately 5%,<sup>(13)</sup> and in chronic supra renal aortic occlusion, it is 23%.<sup>(9)</sup> In some patients, aortic stents can be implanted.<sup>(14)</sup>

In most cases of severe chronic aortoiliac atherosclerotic occlusive disease, good collaterals develop;<sup>(15)</sup> this may maintain adequate basal perfusion of the intestines and lower extremities for a long time, although they have claudication of the lower limbs on exertion. This was seen in most of our patients, and only nine of our patients did not have well-formed distal vessels. In spite of our patients having TOAA, only five had signs of acute ischaemia in the form of gangrene or non-healing ulcers. All the other patients presented with claudication. The prevalence of CAD has been reported to be high in patients with PVD. Hertz et al performed elective coronary angiography in 1,000 consecutive patients considered for elective peripheral vascular reconstruction. CAD was found in 56% of the patients who had ischaemia of the lower limbs. Only 10% of these patients had normal coronaries.<sup>(6)</sup> In contrast, in another study on the prevalence of CAD in patients with symptomatic PVD, only 15% of the patients had CAD.<sup>(16)</sup> Ishida et al found the prevalence of CAD, by coronary angiography, in 69% of the patients for elective repair of aortic aneurysm. They also found that contrast-enhanced magnetic resonance imaging had an accuracy of 88% in



**Fig. 2 (a–c)** Anteroposterior abdominal aortogram shows the total occlusion of the abdominal aorta below the renal arteries. Three collaterals are arising from the distal part of the aorta, one of which will enter the pelvis to supply the pelvic organs and one each will feed the limb vessels. Both renal arteries are normal.

the detection of significant CAD in patients with aortic aneurysm.<sup>(17)</sup> Nunes et al found the prevalence of PVD in patients referred for coronary angiography to be 34.3%.<sup>(18)</sup>

Chronic TOAA is a severe form of atherosclerosis, and we expect an even higher prevalence of CAD in these patients. However, we found that only approximately 25% of the patients with TOAA had CAD and that approximately three-quarters had normal coronary arteries. Even in those with CAD, approximately three-quarters had single vessel disease. We could not find any angiographical data for the association between TOAA and CAD in the literature. All the patients who had TOAA were smokers and most were hypertensive and male. In conclusion, approximately three-quarters of the patients with TOAA were found to have normal coronaries, though both are atherosclerotic in origin, suggesting that there may be some unidentified factors which determine the involvement of a particular vascular bed. Male gender, hypertension and smoking are the major risk factors. The majority of the patients presented with claudication rather than acute ischaemia, in spite of having TOAA, due to well-formed collaterals and graftable distal vessels.

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