Covered stents in aortoiliac occlusive disease

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DOI:
10.1016/j.ejvs.2014.08.009
10.1016/j.jvir.2015.04.007

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Document Version
Publisher's PDF, also known as Version of record

Publication date:
2015

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

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Download date: 08-10-2023
CHAPTER 1.

Introduction, aim and outline of the thesis
INTRODUCTION

Aortoiliac occlusive disease (AIOD) includes narrowing or occlusion of the distal aorta and/or iliac arteries. It causes arterial insufficiency, which may lead to impaired walking (intermittent claudication), continuous ischemic rest pain or even tissue/limb loss.

Etiology

Ninety percent of chronic AIOD is caused by atherosclerosis. The most important risk factors include diabetes mellitus, smoking, hypertension and hyperlipidemia. Nonatherosclerotic causes include fibromuscular dysplasia (most commonly in the external iliac arteries), atypical aortic coarctation, arteritis (especially Takayasu’s disease), hypoplasia of the aorta and arterial dissection. Acute AIOD is rare and about 12-fold less frequent than chronic AIOD, and is usually caused by thrombosis (90%) and/or embolism (10%). Usually the source of embolism is cardiac because of atrial fibrillation, recent myocardial infarction, valvulopathy, or myxoma. Thrombotic AIOD may depend on pre-existing atherosclerotic lesions (80%), hypercoagulable state (13%) and acute occlusion of small aortic aneurysms (7%). Traumatic etiology is reported but very infrequent.

Epidemiology

In patients with peripheral arterial occlusive disease, the infrarenal aorta and iliac arteries are the sites most commonly affected by atherosclerosis. Frequently the lesions are asymptomatic and therefore the true prevalence of AIOD is unknown. In approximately 55% of patients affected by symptomatic coronary artery disease, stenoses or occlusions of the aortoiliac tract are present. The treatment of AIOD represents about 48% of all peripheral artery interventions, and 55% in patients younger than 40 years old. About 5-10% of the patients have lesions limited to the infrarenal aorta and common iliac arteries. These patients are relatively young, heavy smokers and present a minor prevalence of diabetes and hypertension. Among them hyperlipidemia is frequent and there is no difference between male and female gender.

In 5-10% of the patients the infrarenal aorta, iliac and femoral arteries are very small, defined as small aortic syndrome or hypoplastic aortoiliac syndrome. This syndrome almost always occurs in women who are usually about 50 years old and heavy smokers having a high aortic bifurcation, straight iliac arteries (less than 7mm diameter), and/or an aortic diameter of less than 14mm. Collaterals are usually poorly developed and
therefore symptoms are more severe than expected from the angiographic pattern.\textsuperscript{2,5} 25\% of the patients have lesions extending to the external iliac arteries and in 65\% of the patients lesions extend into the infra-inguinal arteries. These patients are older, usually diabetic and hypertensive, and have multilevel atherosclerotic disease. Males are involved six-fold more frequently than females.\textsuperscript{2}

\textbf{Treatment of AIOD}

Aortoiliac arterial occlusive disease (AIOD) was firstly described by the surgeon John Hunter in the late 1700s. His dissection specimens and anatomical drawings were fundamental for later studies on the implications, etiology and treatment of the disease.\textsuperscript{1} The groundwork for the treatment of AIOD was performed by Leriche. He started his vascular school in Strasbourg to educate the pathophysiology and treatment of arterial diseases in the 1930s. Famous pupils were DeBakey, Fontaine and Kunlin. Leriche described the syndrome of bilateral claudication, sexual impotence and absent common femoral artery pulses, based on the occlusion of the distal aorta. He treated the syndrome with lumbar sympathectomies, with or without excision of the occluded segment. He thought proper treatment would consist of resection of the occluded aortic segment and replacement with an arterial substitute, however this was not available at the time.\textsuperscript{6}

One of his pupils, Dos Santos, performed the first successful thromboendarterectomy in 1947, using an ophthalmic spatula and a gallstone scoop. Wylie was the first to describe thromboendarterectomy of the aortic bifurcation in 1952.\textsuperscript{3,5,6} In the years thereafter resection of the diseased segment and replacing it was the treatment of choice. Oudot and DeBakey described replacement with an arterial allograft. These allografts however were hard to obtain and surgery was often complicated by late aneurysms and fibrotic occlusions. Therefore synthetic grafts were developed by Voorhees. First, parachute fabric was used, later (in the 1950s) he described the use of
vinyon-N tubes. In the same decade, DeBakey introduced knitted Dacron. In the 1960s bypass grafting of the aorta to the external iliac arteries increased in popularity. Later, Moore, Perdue and Baird proved superior long-term results of grafting to the common femoral arteries instead of the external iliac arteries.

In the 1990s aortobifemoral bypass grafting was performed less frequently, due to the upcoming percutaneous interventions and the recognition that claudication is generally a benign disease.5

With the introduction of percutaneous angioplasty by Dotter and Gruntzig and later the introduction of commercially available stents by Palmaz, the endovascular treatment modalities for AIOD expanded.7,8 Drawbacks from endovascular interventions are the recurrence of disease by elastic recoil, arterial remodeling and re-stenosis, as well as the occurrence of distal embolization. The covering of stents with polytetrafluoroethylene is thought to prevent tissue ingrowth through stents interstices, reduce intimal hyperplasia and reduce risk of distal embolization.9-12 Therefore these stents could introduce a new era of endovascular treatments for patients suffering from AIOD.
AIM AND OUTLINE

In this thesis we would like to address the use of polytetrafluoroethylene covered balloon expandable stents (CBES) in the treatment of aortoiliac arterial occlusive disease (AIOD) by answering the following questions:

- What are the current treatment modalities for AIOD and what are the results? (Chapter 2/3)

- What are the results of the use of CBES in AIOD compared to the use of bare metal stents? (Chapter 3)

- Is the use of CBES safe and effective in isolated infrarenal aortic disease, in mono-iliac disease and in the kissing stent configuration? (Chapter 4/5/6)

- What is the Covered Endovascular Reconstruction of the Aortic Bifurcation (CERAB) technique? (Chapter 7)

- What are the differences in geometry between the kissing stent configuration and the CERAB configuration? (Chapter 8)

- Is the CERAB technique safe and effective? (Chapter 9)
REFERENCES


