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Case report - Vascular thoracic

Multilayer stents in the treatment of thoraco-abdominal residual type B dissection

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Abstract

Multilayer stents are already being used for the treatment of peripheral aneurysms. In France, they are currently under evaluation in the treatment of thoraco-abdominal aneurysms. We have used multilayer stents to treat aneurysmal evolution of thoraco-abdominal residual type B dissection. Third month computed tomography (CT)-scan showed a false channel no longer patent. Multilayer stents are promising but it is too soon to draw conclusions on the use of this device in the treatment of patent false channels.

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Keywords: Aortic dissection; Computed tomography; Endovascular procedures/stents, except PCI

1. Introduction

The goal of endovascular treatment of thoraco-abdominal residual type B dissection with aneurysmal evolution is to close the patent false lumen [1]. The INSTEAD study [2] shows a beneficial impact of stent grafts on aortic remodeling after type B dissection that has the potential to reduce adverse events in the long-term. This remodeling is often prevented by numerous re-entries allowing communication between true and false lumen. The usual presentation consists of a main tear close to the subclavian artery. Re-entries are difficult to identify precisely because, as long as the main tear is not covered, blood flow through the re-entries is very poor due to an equalization of pressures due to the main tear. In most cases, when the main tear is covered with a covered stent, re-entries become functional again and prevent the thrombosis of the false channel. Additionally, these re-entries are mostly located either next to or even within dissected visceral arteries (Fig. 1). We have learnt, thanks to open surgery in type B aortic dissection, that re-entries were multiple and gathered ladder-like on the intima separating the two channels. These features make the endovascular treatment difficult as the visceral arteries cannot be closed.

The multilayer stent (Fig. 2, bottom) (Cardiatis, Isnes, Belgium) provides a new approach to the treatment of thoraco-abdominal aneurysms and, in the present case, to type B chronic aortic dissection with aneurysmal evolution. 3D structure stents are made up of several layers braided

together, creating a configuration of multiple interlocked layers. Experimental assessment of multilayer stent confirmed the optimal flow modulation through the layers was reached with a 65% mean porosity. Secondary to this porosity level, when bridging an aneurysm or false dissection lumen, the stent laminates the blood flow by pressure drop. The flow velocity outside the multilayer stent is then reduced up to 90% creating an organized thrombus while preserving the laminar flow in the collateral arteries.

2. Case report

In 2006, a 69-year-old male was operated on in our department for an acute type A aortic dissection. The treatment consisted of a replacement of the ascending aorta extended to the aortic arch, with reimplantation of the innominate artery in the 30 mm tube. The postoperative computed tomography (CT)-scan performed before discharge showed a patent false lumen beginning at the level of the left subclavian artery, and a malperfusion of the left kidney. A stent was placed in the dissected left renal artery with a good result. Postoperative course was uneventful and the patient was discharged at postoperative day 8. The patient had a CT-scan six months after, and then each year after that. Aneurysmal dilatation progressed over time to reach 59 mm in February 2010. There were at least three re-entries feeding the false channel (Fig. 2, left-hand side): 1) in the left subclavian artery, 2) at the middle part of the descending thoracic artery, and 3) at the origin of the visceral arteries. The procedure was performed in March 2010. Two overlapped stents (each, respectively 150 and 120 mm long, 28 and 35 mm wide) were implanted through a femoral approach using a 20 Fr introducer. The femoral

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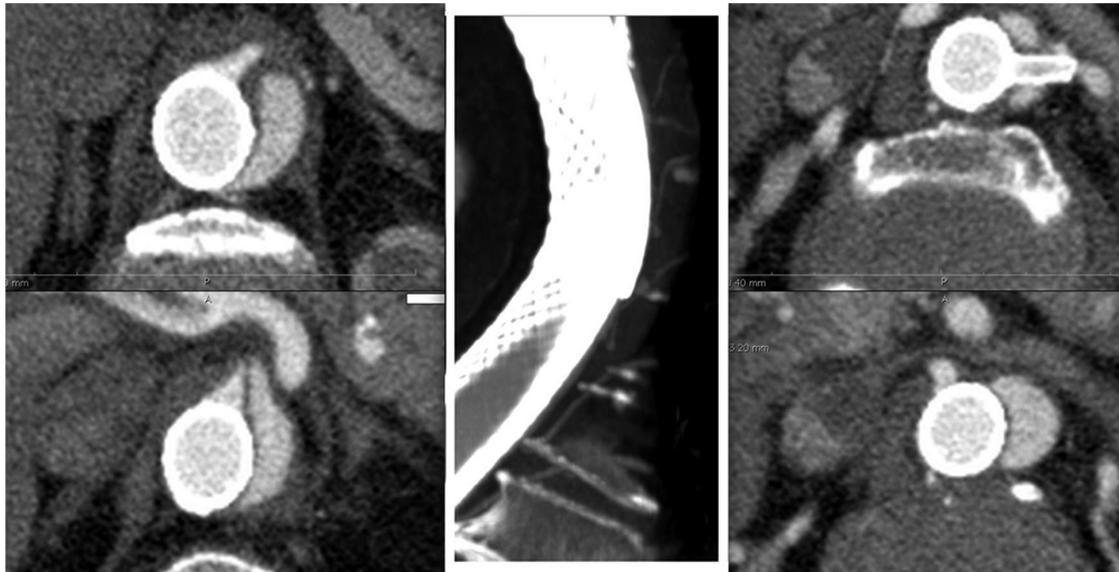


Fig. 1. Postoperative CT-scan showing the visceral and intercostal arteries. Upper left: celiac trunk, bottom left: superior mesenteric artery whose origin is dissected, upper right: left renal artery stented for malperfusion in 2006, bottom right: right renal artery, middle: patent intercostal arteries. CT, Computed tomography.

access, as well as the delivery system, are similar to those of covered stents. The aorta was covered from the left subclavian artery to the abdominal aorta under the renal arteries. The tear, located in the middle part of the left subclavian artery, was treated with a small multilayer stent (length: 80 mm, diameter: 10 mm). A CT-scan performed one month later showed a reduced, but nonetheless patent flow in the false lumen. The CT-scan performed three months later showed that the thoracic false lumen was no longer patent (Fig. 2, right-hand side). There still is a false lumen in the abdominal aorta. The maximal diameter at this level is 36 mm and therefore requires no immediate treatment. The patient will have a CT-scan yearly to follow the evolution.

3. Comment

Multilayer stents are already being used for the treatment of peripheral aneurysms. For aortic implantation, diameters from 22 to 44 mm are available. In France, they are currently under evaluation in the treatment of thoraco-abdominal aneurysms (AFSSAPS, protocol# 2008-A01396-49/A). It is the first time a multilayer stent was used to treat type B aortic dissection.

We could have treated this patient through other means: 1) open surgery, 2) debranching and covered stent [3], 3) fenestrated covered stent [4]. Fenestrated covered stent was not applicable to this patient due to the dissected upper mesenteric artery (Fig. 1, bottom left-hand side). Our experience with using multilayer stents in thoraco-abdominal aneurysms has told us they preserve the flow in the collateral arteries. This is confirmed by the CT-scan showing that the four visceral arteries and the intercostal arteries as well are all patent (Fig. 1). In case of failure i.e. persistence of a patent false channel, we could use one of the remaining two treatments. By resorting to multilayer stent for the treatment of thoraco-abdominal

aneurysms, we assume that it rechannels blood flow changing turbulent into laminar flow, and therefore causing the aneurysm thrombosis. The same reasoning applies to chronic aortic dissection. The multiple re-entries are often small, and the flow through the re-entries is then likely to be

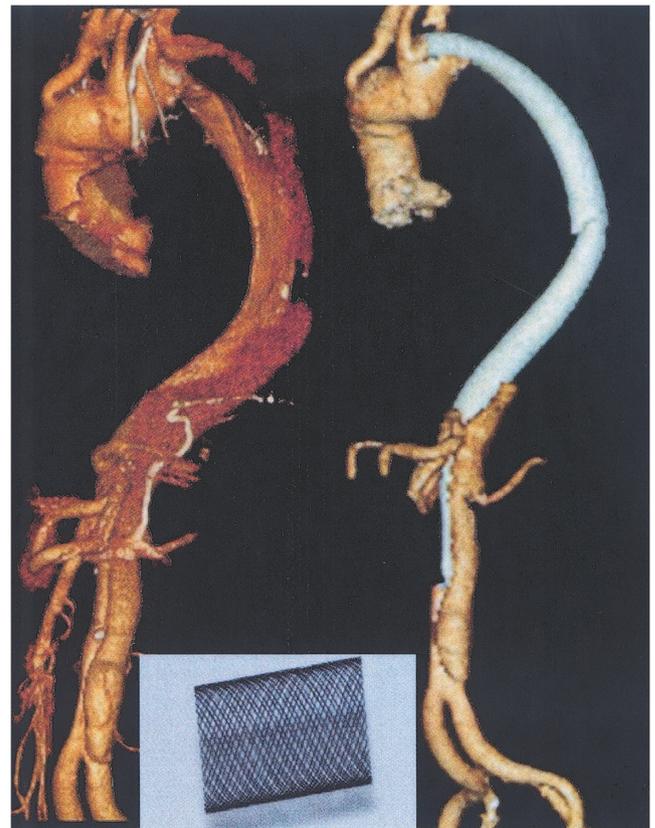


Fig. 2. Left: preoperative CT-scan reconstruction. Right: postoperative month 3 CT-scan reconstruction: the thoracic false lumen is no longer patent. Bottom: multilayer stent photograph. CT, Computed tomography.

turbulent. Conversely, large re-entries may have a laminar flow, and using multilayer stent possibly may not be relevant in such cases. Multilayer stents are promising but it is too soon to know what is in store for such a device in the treatment of patent false channel. We need more extensive experience with this device to draw conclusions.

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