Transapical Placement of an Uncovered Aortic Endostent for Type A Aortic Dissection

Miralem Pasic, MD, PhD; Burkhart Zipfel, MD, PhD; Thorsten Drews, MD; Stephan Dreyssse, MD; Axel Unbehaun, MD; Semih Buz, MD; Marian Kukucka, MD; Giuseppe D’Ancona, MD, PhD; Roland Hetzer, MD, PhD

We report on transapical implantation of an uncovered aortic endostent for treatment of iatrogenic acute type A aortic dissection.

A 91-year-old female patient presented with recent onset of increasing shortness of breath and fatigue and temporary disorientation caused by severe aortic valve stenosis (Figure 1 and online-only Data Supplement Videos 1 and 2). Her medical history included cachexia (body mass index, 17.9 kg/m²; body surface area, 1.39 m²), severe spondylisis, osteochondrosis, and osteoporotic vertebral body fracture. Transcatheter aortic valve implantation (TAVI) was favored because of her frailty, poor general condition and increased risk for conventional surgery (logistic EuroSCORE, 29%; STS score, 13%). The transapical approach for TAVI was chosen because of tortuosity and atherosclerotic disease of the small iliaco-femoral arteries. The procedure was monitored by fluoroscopy, angiography, and continuous transesophageal echocardiography (TEE). After implantation of a 23-mm Edwards-Sapien valve (Edwards-Sapien THV, Edwards Lifesciences, Irvine, CA), TEE and angiography showed a new finding of dissection of the whole aorta and also excluded possible intimal tear (“entry”) in the proximal or mid ascending aorta (Figures 2 and 3 and online-only Data Supplement Videos 3–6). We closed the false lumen in the ascending aorta and aortic arch by immediate transapical implantation of an uncovered aortic endostent into the ascending aorta and aortic arch. We chose the uncovered aortic self-expandable aortic E-xl endostent (Jotec, Hechingen, Germany), 130 mm in length and with a 40-mm diameter of the proximal and distal ends (2 mm larger than the lumen of the ascending aorta). The self-expandable stent was introduced over the stiff guide wire antegrade through the apex of the heart (Figure 4 and online-only Data Supplement Video 7). Deployment of the stent was easy and uneventful. The intraoperative TEE and angiography showed no perfusion of the false lumen and excellent perfusion of the arch vessels (Figures 5 and 6 and online-only Data Supplement Videos 8 and 9). The patient was extubated and transferred to the normal ward on the first postoperative day. The postoperative course was completely uneventful (Figure 7). In repeated postoperative TEE examinations and computed tomography, the...
false lumen remained obliterated (Figure 8). The patient remained under frequent regular echocardiographic follow-up examinations with planned additional computed tomography 3 months after TAVI.

It can be expected that this iatrogenic complication can occur during all sequences of all types of TAVI procedure. The predisposing factors for iatrogenic dissection might be the presence of severely atheromatous or partially calcified aortic wall with ulcerated plaques and dilatation of the aorta with a tender and fragile wall. We believe that this particular complication was a consequence of additional manipulation with a stiff guide wire and adjustment of its position during TAVI. Possibly this complication could have been avoided by very gentle placement and very careful manipulation with the stiff guide wire, omitting unnecessary manipulation during the procedure.

Figure 2. Angiographic visualization of the ascending aorta by direct injection of the contrast medium through a pigtail catheter positioned in the ascending aorta during valve deployment (A and B) and after the valve is deployed (C). C. Contrast visualization only of the significantly narrow true lumen; there is no visualization of the false lumen by contrast medium, excluding the possibility that the intimal tear ("entry") of the dissection is in the proximal ascending aorta. Intraprocedural transesophageal echocardiography without (D) and with contrast medium (E) showing dissecting ascending aorta immediately above the new transcatheter aortic valve with floating dissecting membrane (red arrow) and false lumen (F) and true (T) lumen. The contrast is visible only in the true lumen (E) without any communication with the false lumen excluding intimal tear ("entry") in that region.

Figure 3. Intraprocedural angiography demonstrating typical findings of ascending aortic dissection. Early phase of the injection of contrast medium into the proximal ascending aorta through a pigtail catheter showed only antegrade perfusion of the true lumen and smooth walls excluding the presence of the intimal tear ("entry") in the ascending aorta (A). The late phase revealed no malperfusion of the great vessels of the aortic arch and their perfusion from the true lumen (B).
Standard treatment for iatrogenic acute type A aortic dissection during the TAVI procedure is the same as for dissection of natural origin. It consists of immediate conventional surgical therapy because of imminent danger of possible aortic rupture and pericardial tamponade and/or obstruction of the coronary artery ostia. However, the risk of conventional surgery was assessed to be very high in this 91-year-old patient. This is the first report of type A aortic dissection being treated with an uncovered aortic endostent by direct transapical implantation into the ascending aorta. The transapical approach enabled precise deployment of the aortic endostent because of the short distance from the apex of the heart to the aortic valve and the ascending aorta. It achieved immediate closure of the false lumen and eliminated possible complications.

Acknowledgments
The other members of our TAVI team are Ekatarina Ivanitskaia-Kühn, MD, Christoph Klein, MD, Alexander Mladenow, MD, Katrin Schäfer, and Natalia Solowjowa, MD. We thank Anne Gale for editorial assistance and Rosemarie Günther for secretarial help.

Disclosures
Dr Pasic, Dr Unbehaun, Dr Drews, Dr Buz, and Dr Dreyssse have been proctors to Edwards Lifesciences since July 2009. Dr Zipfel has been consultant and proctor to Jotec since September 2002.

Key Words: dissection ■ aortic dissection ■ endovascular surgery

Figure 4. Steps of the transapical introduction of the aortic uncovered endostent through the left ventricle and across the aortic valve (A through D). Note the curving of the endostent in the region of the distal part of the ascending aorta (D) that is corrected by traction on the superstiff guide wire. The guide wire is placed transapically into the descending aorta.

Figure 5. Intraoperative transesophageal echocardiography after endostent deployment demonstrating occlusion of the false lumen in the ascending aorta.
Figure 6. Intraoperative aortography with contrast injection in the proximal (A) and distal ascending aorta (B) after endostent deployment demonstrating no perfusion in the false lumen and good perfusion of the arch vessels after transapical placement of the uncovered aortic stent.

Figure 7. Postoperative chest radiograph showing the uncovered endostent in the ascending aorta and aortic arch, overstented great vessels of the aortic arch and the Edwards-Sapien prosthetic aortic valve in the aortic position.
Figure 8. Postoperative computed tomography (A and B) demonstrating uncovered endostent in the ascending aorta and aortic arch with overstenting of the origin of the arch vessels and complete closure of the false lumen (yellow arrows). The arch vessels are perfused normally (white arrows). Red arrows indicate Edwards-Sapien valve.
Transapical Placement of an Uncovered Aortic Endostent for Type A Aortic Dissection
Miralem Pasic, Burkhart Zipfel, Thorsten Drews, Stephan Dreyssse, Axel Unbehaun, Semih Buz, Marian Kukucka, Giuseppe D’Ancona and Roland Hetzer

Circ Cardiovasc Interv. 2011;4:e49-e53
doi: 10.1161/CIRCINTERVENTIONS.111.965178
Circulation: Cardiovascular Interventions is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2011 American Heart Association, Inc. All rights reserved.
Print ISSN: 1941-7640. Online ISSN: 1941-7632

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circinterventions.ahajournals.org/content/4/6/e49

Data Supplement (unedited) at:
http://circinterventions.ahajournals.org/content/suppl/2011/12/15/4.6.e49.DC1

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation: Cardiovascular Interventions can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation: Cardiovascular Interventions is online at:
http://circinterventions.ahajournals.org//subscriptions/
Transapical Placement of an Uncovered Aortic Endostent
for Type A Aortic Dissection

SUPPLEMENTAL MATERIAL

Pasic et al: Transapical Endostent for Type A Aortic Dissection

Miralem Pasic, MD PhD, Burkhart Zipfel, MD PhD, Thorsten Drews, MD, Stephan Dreysse, MD, Axel Unbehaun, MD, Semih Buz, MD, Marian Kukucka, MD, Giuseppe D’Ancona, MD PhD, Roland Hetzer MD PhD

Deutsches Herzzentrum Berlin

Berlin, Germany

Correspondence to:
Professor Miralem PASIC
Deutsches Herzzentrum Berlin
Augustenburger Platz 1
13353 Berlin
Germany
Telephone number: +49 30 4593 2108
Fax number: +49 30 4593 2018
E-mail: pasic@dhzb.de
LEGENDS FOR THE VIDEO FILES

Video 1. Preprocedural intraoperative angiography of the aortic root showing calcified aortic valve stenosis with calcification in the left ventricular outflow tract, low origin of the right coronary artery and a normal ascending aorta without any signs of aortic dissection.

Video 2. Preprocedural intraoperative transesophageal echocardiography (long axis view) showing calcified aortic valve stenosis and the normal ascending aorta without any signs of aortic dissection.

Video 3. Intraoperative transesophageal echocardiography (long axis view) after valve deployment showing new findings of dissecting ascending aorta with a floating dissecting membrane above the implanted Edwards Sapien aortic valve.

Video 4. Intraoperative transesophageal echocardiography (short axis view) after valve deployment showing the false and the true lumina with the floating dissecting membrane above the implanted Edwards Sapien aortic valve. Color Doppler demonstrating flow in the true lumen without flow communication between the lumina and excluding the intimal tear (“entry”) in the proximal or mid part of the ascending aorta. The true lumen is smaller than the false lumen and is expanded during systole.

Video 5. Intraoperative angiography after valve deployment visualizing the true lumen of the dissected ascending aorta and the aortic arch. The wall of the true lumen is smooth and there is no contrast medium in the false lumen after contrast injection above the implanted Edwards Sapien aortic valve, excluding the possibility
that the intimal tear (“entry”) of the dissection is in the proximal ascending aorta. The coronary arteries are well perfused.

**Video 6.** Intraoperative transesophageal echocardiography (short axis view) during contrast injection through the pigtail catheter above the implanted Edwards Sapien aortic valve, as shown in video 5. The contrast medium is seen only in the true lumen excluding the presence of the intimal tear (“entry”) in the proximal or mid part of the ascending aorta.

**Video 7.** Transapical introduction of an uncovered aortic endostent through the implanted Edwards Sapien aortic valve over a super-stiff guide-wire.

**Video 8.** Intraoperative transesophageal echocardiography (long axis view) after endostent deployment demonstrating occlusion of the false lumen in the ascending aorta. The proximal part of the ascending aorta is almost completely stented. The leaflet coaptation of the implanted Edwards Sapien valve is good.

**Video 9.** Angiography after endostent deployment showing stent in the ascending aorta and in the aortic arch, a completely occluded false lumen without any contrast visualization within it, and good perfusion in the arch vessels after over-stenting of their origins.