Endovascular repair of aortic pseudoaneurysms: four years experience

Poster No.: C-0592
Congress: ECR 2014
Type: Scientific Exhibit
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Keywords: Pathology, Outcomes, Aneurysms, Stents, Catheters, Arterial access, CT-Angiography, Catheter arteriography, Interventional vascular, Arteries / Aorta
DOI: 10.1594/ecr2014/C-0592

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Aims and objectives

Pseudoaneurysms are a rare variety of aortic disorders. Although mostly asymptomatic, they represent potentially fatal conditions that are traditionally treated surgically. Pseudoaneurysms of aorta are usually a late complication of previous surgical procedure especially reconstructive surgery[1], trauma[2], atherosclerosis and rarely infection[3-7]. Surgical management is often complicated by poor outcomes with high morbidity and mortality. Endovascular treatment has been promising options for aortic diseases with fewer complications[8-10]. In this article, we present our experience with endovascular therapy for aortic pseudoaneurysm in 84 patients and to investigate the feasibility, effectiveness, and outcome of endovascular therapy for aortic pseudoaneurysm.
Methods and materials

Patient Data

Between February 2009 to March 2013, 84 patients (65 men, 19 women) with a mean age of 55.1±12.7 years (range: 25-81) underwent endovascular therapy at AnZhen Hospital (Beijing, China) due to aortic pseudoaneurysm diagnosed with computed tomography angiography (CTA) or magnetic resonance imaging (MRI) (Fig. 1 on page 6). There were 74 thoracic aortic pseudoaneurysms, 9 abdominal aortic pseudoaneurysms (7 in the intrarenal abdominal aorta and 2 at the supraceliac level) and 1 aortic arch pseudoaneurysm. The causative etiology can be attributed to trauma (n=23), previous aortic surgery (n=6), previous SG implantation (n=16), atherosclerosis (n=22), infection (n=10) and unclear reason (n=7). Twelve were asymptomatic (the false aneurysms were discovered at physical examination imaging) while 40 had thoracic back pain or distress, 7 had dysphonia, 10 had hemoptysis or hemosputum, 7 had recurrent cough with or without fever and 8 had abdominal or flank pain. Comorbidities are listed in Table 1.

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>40</td>
<td>47.6%</td>
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<tr>
<td>High Blood Pressure</td>
<td>56</td>
<td>66.7%</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>8</td>
<td>9.5%</td>
</tr>
<tr>
<td>Cardiac arrhythmia</td>
<td>2</td>
<td>2.4%</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>7</td>
<td>8.3%</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>1</td>
<td>1.2%</td>
</tr>
<tr>
<td>Pemphigus</td>
<td>1</td>
<td>1.2%</td>
</tr>
<tr>
<td>Behçet disease</td>
<td>2</td>
<td>2.4%</td>
</tr>
<tr>
<td>Cerebralvascular diseases</td>
<td>5</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

Table 1 Comorbidities for all patients

Endovascular Stent Grafting

All endovascular procedures were performed in an operating theatre equipped with a mobile C-Arm or in a hybrid operating room with a fixed biplanar device (Axiom Artis, Siemens, Erlangen, Germany) under total (4 patients) or local (80 patients) anesthesia. Endovascular stent graft repair was always performed by an interdisciplinary team, which included anesthesiologists, surgeons, and interventional radiologists.
Treatment decisions and planning of the access site, were based upon the preoperative CT scan in all patients. Treatment in an emergent setting was performed in 13 patients (group A) with pseudoaneurysm rupture while selective procedures for all the others(group B).Digital subtraction angiography(DSA) of the whole aorta was performed before and after SG implantation( Fig. 2 on page 6 and Fig. 3 on page 7 ).The diameter of SG was calculated from the largest diameter of the anchoring zone based upon the DSA and an oversizing factor of 10-20%.

Twelve interventions were performed via a percutaneous transfemoral approach using the pre-close technique. Two 6-F ProGlide systems (Abbott Vascular Devices, Redwood City, Calif, USA) were placed through the main access site as described[11]. Seventy-two interventions were performed through surgical cutdown to expose the common femoral artery for direct needle puncture. Proximal and distal control of the vessel was obtained with vessel loops and vascular clamps. After the sheath was removed, the artery was repaired with fine polypropylene sutures.

Implanted stent grafts were Zenith TX2(Cook Medical Inc., Bjaeverskov, Denmark) for 35 cases, Valiant (Medtronic Inc., Minneapolis, USA) for 15 cases, Relay#Bolton Medical Inc., Barcelona, Spain#for 11 cases#Hercules#MicroPort Medical Co., Ltd, Shanghai, China#for 9 cases, Grikin#GRIKIN Advanced Materials Co., Ltd, Beijing, China#for 5 cases, E-vita for 2 cases#JOTEC Gmbh., Hechingen , Germany#, Aegis#MicroPort Medical Co., Ltd, Shanghai, China#for 3 cases, Powerlink (Endologix Inc., Irvine, Calif, USA) for 2 cases, Endurant (Medtronic Inc., Minneapolis, USA) for 1 case and Zenith fenestrated (William A. Cook Australia Pty. Ltd., Brisbane, Australia) for 1 case.

For patients with insufficient proximal landing zone, a hybrid surgical procedure of supraortic debranching and revascularization(n=3),LSA chimney graft technique(n=4), isolated coverage the orifice of LSA(n=7) and renal artery fenestrated graft techniques (n=1) were performed.

For one anastomotic pseudoaneurysm associated with coarctation of the aorta. An occluder(Shanghai Shape Memory Alloy Co., Ltd., Shanghai, China) for patent ductus arteriosus(PDA) was deployed in the distal native segment of coarcted aorta to prevent antegrade filling of the pseudoaneurysm. Subsequently, the pseudoaneurysm was excluded using a stent-graft landed on the LSA-to-descending Dacron graft[12]. For one case with aneurysmal sac connecting with LSA, the procedure consisted of stent-graft placement and embolization of the LSA with an PDA occluder (Starway Medical Technology, Inc., Beijing, China) and detachable coiling through gap between the aortic wall and the SG.
Follow Up

All the patients underwent imaging before discharge. Afterwards, they were included in a follow-up protocol requiring a CTA or MRI scan at 1, 3, 6 and 12 months and every year thereafter to monitor stent-graft patency, thrombosis and size of the pseudoaneurysm, the size of the aorta, and any complications (Fig. 4 on page 8).

Statistical Analyses

All analyses were performed with SPSS version 17.0 software (SPSS Inc, Chicago, IL). Continuous variables were expressed as means and ± standard deviation and were analyzed by the Student t test. Categorical variables were analyzed by the $\chi^2$ test. The difference between the emergent and the elective group was tested with Fisher exact test or continuity correction test. A value of P<0.05 was considered significant.
**Fig. 1:** Aortic CTA showed pseudoaneurysm of the descending aorta

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**Fig. 2:** Posterior-anterior descending aortic angiogram demonstrated pseudoaneurysm of the descending aorta

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**Fig. 3:** Left anterior oblique thoracic aortic angiogram after stent-graft implantation showed total exclusion of the pseudoaneurysm

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Fig. 4: Postoperative aortic CTA showed complete thrombosis of the aneurysm

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Results

Stent-grafts were deployed successfully for all cases. The technical success rate was 100% (n=84). For 74 thoracic and 1 aortic arch pseudoaneurysm, all but 11 patients required a single device and 86 tubular SGs were implanted. For 9 abdominal pseudoaneurysms, we implanted 2 tubular, 5 unibody bifurcated, 1 separated bifurcated and 1 fenestrated SG. Postoperative DSA showed completely exclusion for all pseudoaneurysms without serious endoleak. Clinical symptoms, such as thoracic pain and hemoptosis, improved remarkably. The hospital stay was 1-63 days.

Morbidity and Mortality

During the perioperative period, 2 patients died. One died due to hemorrhagic shock and another died of heart failure. Perioperative mortality was 2.4% (2/84). Complications included stroke in 1, encapsulated effusion requiring surgical treatment in 1, left arm ischemia in 4 with 2 necessitating LSA bypass. Perioperative morbidity was 9.5% (8/84). There was significant statistical difference between group A and B regarding perioperative mortality (15.4% versus 0%, P=0.022) and morbidity (38.5% versus 4.2%, P <0.001). Perioperative outcomes for group A and B were listed in table 2.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Group A (n=13)</th>
<th>Group B (n=71)</th>
<th>Total (n=84)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>53.1±13.5</td>
<td>56.7±13.3</td>
<td>55.1±12.7</td>
<td>NS</td>
</tr>
<tr>
<td>In-hospital death</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0.022</td>
</tr>
<tr>
<td>Stroke</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Left arm ischemia</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>NS</td>
</tr>
<tr>
<td>Encapsulated effusion</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>NS</td>
</tr>
<tr>
<td>Overall Complications</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 2 Perioperative outcomes for group A and B

NS#P#0.05#there is no significant statistical difference.

Follow-up ranged from 6 to 46 months. During follow-up, 11 patients died; 1 patient with recurrent abdominal aortic infection required ligation and debridement followed by
bilateral axillofemoral bypass because of not adhere to taking antibiotic medicine after discharge; 1 patient suffered from stroke and had a good recovery after drug therapy. Complete thrombosis of the aneurysm occurred in all the other patients. Mortality and Morbidity during follow-up was 13.4% (11/82) and 15.9% (13/82). Four-year cumulative survival rate was 84.5%.
Conclusion

Endovascular therapy for aortic pseudoaneurysm is a feasible and effective approach, with encouraging short- and mid-term result. Perioperative mortality and morbidity is high for patients with unstable hemodynamics. Consideration of this form of therapy as the first-time treatment is warranted in anatomically acceptable candidates.
Personal information

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References


