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Late Transverse Aortic Stent Fracture in Adolescent with Coarctation of the Aorta. Treatment of the Complication with Covered Stent Insertion with in the Fractured Stent

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Abstract

Male adolescent fourteen years old with Coarctation diagnosed at the age of eleven. He underwent cardiac catheterization with percutaneous balloon dilation and stent implantation. The immediate result was satisfactory but three years later a transverse fracture of the stent was detected on cardiac Magnetic Resonance Imaging with findings of moderate restenosis. This complication was treated with percutaneous implantation of a covered stent.

The case of this adolescent is interesting because late fracture of aortic stent is a rare complication and covered stent implantation is a sufficient treatment whether or not there is recoarctation.

Keywords: Coarctation; Aortic stent; Fracture

Introduction

Coarctation angioplasty with stent implantation in children older than six, adolescents and adults is adequate treatment of native coarctation with immediate and long-term results comparable with surgical repair [1,2].

Fracture of the stent is a rare complication and occurs typically when implanting it, automatically with time, or at the effort of redilating it in order to adapt the stent to the physical growth of the patient [3]. It can be considered 'nightmare' of interventional pediatric cardiology [4].

This complication can be treated by implanting covered stent which completely covers the inner lumen of the original one, preventing this way possible erosion of the inner aortic wall by the sharp ends of the fractured stent [5].

Case Description

We describe the case of a fourteen year old adolescent who was found to have coarctation at the age of eleven. He had hypertension on examination for participation in sports. He then underwent angioplasty with the catheter Z-MED 14 mm/3 cm and a Palmaz Genesis Stent (PG 2910 XD) was implanted with very good results. Chest X Ray one and six months after implantation showed good position of the stent and no fracture.

Three years after stenting he developed severe hypertension needing triple medication. Echocardiography revealed moderate restenosis of the stent. This finding was confirmed with cardiac MRI which also revealed fracture in the middle of the stent, obvious in plain X-Ray (Figure 1).

Angioplasty was then performed with the catheter Z-MED 16 mm/4 cm by placing the covered stent Cheatham Platinum (CP 8Z34) within the original stent which covered the entire length of the PG stent (Figure 2).

The immediate result was good by eliminating the pressure gradient along the stent and significant reduction of the arterial pressure (Figure 3). During cardiac catheterization ascending aortic pressure before covered stent implantation was (systolic-diastolic-mean) 137 mmHg-70 mmHg-98 mmHg, while descending thoracic aortic pressure was 102 mmHg-66 mmHg-68 mmHg. After implantation, pressures were similar in ascending and descending thoracic aorta: 134 mmHg-86 mm Hg-109 mmHg.

Patient is on echocardiographic follow-up. Two years later the initial results are preserved. Peak pressure gradient along the stent, estimated by continuous Doppler imaging, is 12 mmHg while mean pressure gradient is 7 mmHg.

Discussion

In infants and small children, surgery is treatment of choice in native coarctation of the aorta [6]. In older children, adolescents and adults, angioplasty with stent implantation has similar results [1].

Complications of the angioplasty with stent implantation are

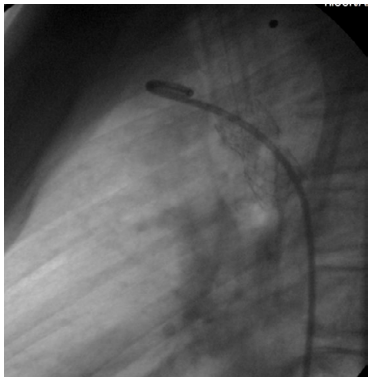

Figure 1: Palmaz Genesis Stent in Aorta, with transverse fracture obvious in plain X-Ray (arrows).Joints have been fractured in the middle of the stent that has been cut in tow approximately equal parts.

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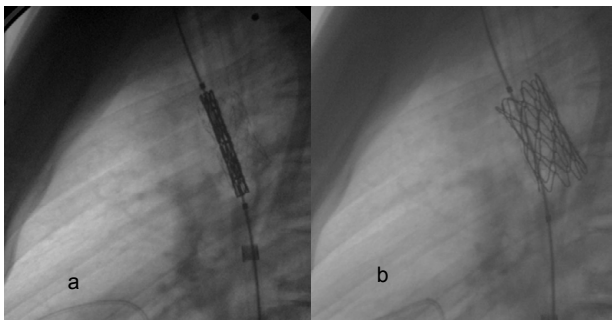

Figure 2: Covered stent Cheatham Platinum insertion within the original stent, before (a) and after (b) deployment.

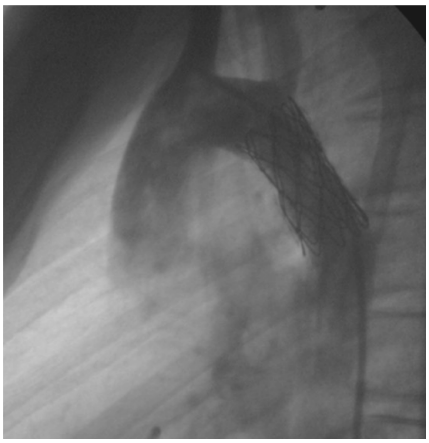

Figure 3: Arteriography of the Aortic Arch immediately after covered stent implantation.

associated with suboptimal placement of the stent, dissection or rupture of the aortic wall, or restenosis due to intimal proliferation within the stent [7].

Palmaz Genesis XD stent that was used initially is laser cut from stainless steel tubing and is a closed cell design. The laser cut produces small 's' or 'omega' hinges between each circular row of diamond cells (Figure 1) [8].

Early fracture of the stent can occur with placement due to overdilation and overexpansion of the stent, so that the internal diameter exceeds 12 mm. The link between filaments is unable to withhold high tension and ultimately fractures [9].

Late stent fracture at this location has rarely been reported in the literature. [5] Possible reasons for fracture include: [5]

1. The mechanical stress exerted on the stent during implantation in an extremely narrow and tortuous aorta.

2. Stress arising from the high pulsatility of aortic blood flow, which weakens the structure of the stent.

3. Location of the stent at the point where a mobile portion (ascending aorta and aortic arch) joins a fixed segment (distal descending aorta).

4. Late balloon overdilation of the stent when the child is grown up.

Implanting a covered stent inside the previous one is a reasonable treatment for stent fractures. This stabilizes any fragments resulting from the fracture and so prevents dissection, rupture or aneurysm formation [5].

The covered Cheatham Platinum stent is manufactured from wire of a platinum-iridium alloy with gold joints. The wire is bent and welded to a cylindrical meshwork, forming the stent. It is available with an expanded polytetrafluoroethylene (PTFE) membrane, which is attached to the outer side of the stent. It can be dilated to an internal diameter up to 24 mm [10].

Hemodynamic results in the present case are similar with those reported in the literature in children [11] and adults [12]. Long term follow up after stenting, using integrated arch imaging techniques, are recommended [13].

Covered stent may interrupt blood flow in aortic branches and for this reason precise placement is essential. Special attention should be paid to avoid occlusion of cervical branches or branches to spinal cord [14].

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