Endovascular reconstruction of primary coarctation in a 12-year-old boy technical consideration

Santosh Kumar Sinha, Puneet Aggarwal, Anupam Singh

Coarctation is a generalized disease which mainly manifests in aorta and presents as aortic coarctation. While transcatheter approaches have replaced surgery, there is still no consensus about the best among only balloon dilatation, aortic stent-grafts, self-expanding stent or balloon expandable stent. Here, we report a case of 12-year-old boy who presented with hypertension in whom severe primary coarctation of thoracic aorta was diagnosed which was successfully treated with endovascular reconstruction using self-expandable stent. Stent migration is always an issue during deployment and which is minimized with rapid pacing and bringing down the blood pressure. We successfully performed the endovascular treatment without aid of pacing thereby bringing his blood pressure to near normal level with no further catch up on follow up. Therefore, balloon expandable stent is safe, minimally invasive, and effective treatment for thoracic coarctation.

Key Words: Thoracic coarctation; Endovascular reconstruction; Self expandable stent; Stent graft; Stent migration

Catheter based angiogram was done through right radial route which showed severe CoA with profuse collaterals in its vicinity (Figures 2A and 2B).

On further pull back, it showed a gradient of 100 mmHg. Endovascular approach was planned after informed consent. Access was gained by 6F Judkins right (JR) catheter was advanced over 0.035-inch straight tip Terumo wire (Terumo Inc, Japan) and lesion was crossed (Figure 3A).

JR catheter was advanced beyond the lesion and wire was exchanged with 0.035” exchange length (260 cm) superstiff Amplatz guidewire (Meditech, USA). Predilatation was performed by 6 mm × 40 mm Mustang balloon followed by 10 mm × 40 mm Mustang balloon (Boston Scientific, USA).

Figure 1) (A) MDCT image of severe thoracic coarctation; (B) Reconstructed image post endovascular reconstruction at 9 months

Figure 2) (A, B) Catheter based angiogram through tranradial route showing severe thoracic coarctation with multiple collaterals

Figure 3) (A) Lesion crossed with judkins right catheter; (B) Stent delivered across the coarcted segment over superstiff Amplatz wire

CASE REPORT

A 12-year-old boy presented with history of exertional dyspnoea (NYHA functional class II) of nine months duration. On physical examination, the blood pressure in both arms and both legs were 192/96 mmHg and 92/60 mmHg respectively by appropriately sized cuff. There was absent pulse on tibial and femoral arteries on both legs. Radio-femoral delay was appreciable and aneurysm formation although vessel diameter increases. Therefore, stent implantation scores over balloon angioplasty alone as its radial support to the vessel wall prevents above complication, with the future option of redilatation (especially in young patients), negating the need of over sizing which further avoids any major transmural injury (3,4).

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ABSTRACT

Coarctation is a generalized disease which mainly manifests in aorta and presents as aortic coarctation. While transcatheter approaches have replaced surgery, there is still no consensus about the best among only balloon dilatation, aortic stent-grafts, self-expanding stent or balloon expandable stent. The endovascular approach for treating of both native and recurrent coarctation especially among adolescents and adults has become widely acceptable option since the mid-1990s, though optional approach still remains debatable due to lack of randomized trials between the two. Peripheral balloon angioplasty has the potential to for injury to intim and part of the media with long term potential of recoil, restenosis and aneurysm formation although vessel diameter increases. Therefore, stent implantation scores over balloon angioplasty alone as its radial support to the vessel wall prevents above complication, with the future option of redilatation (especially in young patients), negating the need of over sizing which further avoids any major transmural injury (3,4).

Catheter based angiogram was done through right radial route which showed severe CoA with profuse collaterals in its vicinity (Figures 2A and 2B).

On further pull back, it showed a gradient of 100 mmHg. Endovascular approach was planned after informed consent. Access was gained by 6F Judkins right (JR) catheter was advanced over 0.035-inch straight tip Terumo wire (Terumo Inc, Japan) and lesion was crossed (Figure 3A).

JR catheter was advanced beyond the lesion and wire was exchanged with 0.035” exchange length (260 cm) superstiff Amplatz guidewire (Meditech, USA). Predilatation was performed by 6 mm × 40 mm Mustang balloon followed by 10 mm × 40 mm Mustang balloon (Boston Scientific, USA).

Figure 1) (A) MDCT image of severe thoracic coarctation; (B) Reconstructed image post endovascular reconstruction at 9 months
Pressure gradient trans-aorta after the balloon dilatation was 60 mm Hg. Nitroglycerin infusion was started (15 mcg/min) to lower down the blood pressure. 12 mm × 60 mm Epic self-expanding stent (Boston scientific, USA) was delivered across the lesion over the wire and gradually released by pulling the lock (Figure 3B). During deployment, wire-stent assembly was held firm as stent was getting migrated. During deployment, stent was also pulled in between to keep it across the lesion and this was performed thrice before final deployment. It was further post dilated with 12 mm × 40 mm Mustang non-compliant balloon at 14 atm pressure (Figures 4A-4D).

During catheter pull back, residual gradient was 3 mm Hg. Marked improvement in his symptoms were noted. His blood pressure was 152/80 mmHg with no appreciable gradient between the upper and lower extremities. Femoral and tibial pulses were palpable on both legs. Patient was started on aspirin 75 mg once daily and was discharged with ramipril 5 mg. After 9-months’ follow-up, blood pressure was stable at 136/60 mmHg and patient was asymptomatic and MDCCT showed well deployed stent (Figure 1B).

**CONCLUSION**

The diameter and length of stent are most important factor for technical consideration as the stent must cover the affected segment, and at the same time proximal end not protruding into the left subclavian artery. The stent diameter must not exceed the diameter of the descending aorta at the level of the diaphragm which is considered as reference level in order to avoid aneurysm formation or rupture (4). Alternatively, the average diameter of the aortic isthmus (or transverse aortic arch) and the descending aorta at the level of diaphragm may also be considered. Also, the ratio of expanded stent diameter to that of coarcted segment is usually kept around 2:3.5 and should always be <3:5 to avoid aneurysm formation or dissection as stents remodel with time. The most important parameter should be relieving of pressure gradient. Therefore, endovascular reconstruction for thoracic coarctation with self-expanding stent is a safe and promising with acceptable alternative to surgical repair or balloon angioplasty alone.

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