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Non-graft stent for the treatment of women with aorta coarctation

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ABSTRACT
Aortic Coarctation is one of the common congenital heart diseases.It is ranks sixth in frequency of congenital heart disease. It is a narrowing of aorta mostly in the region of the ligamentum arteriosum.Correction of coarctation of aorta is indicated in patient with symptom related to stenosis and hypertension related to coarctation, also when pressure gradient more than 20 mmHg and significant difference of blood pressure between upper limb and lower limb more than 20 mmHg.The operation was effective in all women without any immediate serious problems. Follow-up results indicated sustained improvement in pressure gradients and considerable therapeutic effects. Modest complications included local hematoma at the access site in 3 women, which resolved with conservative care. There are no occurrences of stent migration, aneurysm development, or re-stenosis were detected during the follow-up period. These data demonstrate that stent implantation for aortic coarctation is a safe and effective treatment option, producing persistent hemodynamic and clinical benefits.After one month following the procedure, there was no significant increase in blood pressure. Most patients achieved controlled blood pressure, with 22 women maintaining control without medication, 14 women requiring a single antihypertensive medication, and the remaining 4 women needing two or more antihypertensive drugs.

Keywords: blood pressure, hemodynamic, complications, pressure

INTRODUCTION

Aortic Coarctation is one of the common congenital heart disease .it is ranks sixth in frequency of congenital heart disease.[1] It is anarrowing of aorta mostly in the region of the ligamentum arteriosum adjacent to the origin of subclavian artery,most commonly involve a discrete segment of narrowing of aorta and some of patient involve a long segment of thoracic aorta or some time involve diffuse and long hypoplastic aorta with some patient may involve coarctation of abdominal aorta .[2]these differences is important to determined whether the patient need surgical correction or transcatheter intervention.[3]however coarctation of aorta presented with aspectrum of severity ranging from mild to severe spectrum of disease and may be discovered in early life or in adult .[4]most of patient presented with secondary hypertension in age less than 20 years old and some of patient presented with uncontrolled hypertension .[5]in severe cases patient developed fatigue and intermittent claudication.[6] Coarctation of aorta may be associated with other abnormalities like bicuspid aortic valve and cerebral aneurysm in more than one half of cases.[7] Coarctation of aorta is acoplex lesion of arteriopathy and may be simple or complex lesion range from focal mild stenosis to diffuse or severe stenosis distal to aortic arch ,male more than female.[8]patient with coarctation of aorta also associated with bintinsic abnormality of aorta(aortopathy) so that may lead to other complication such as increase risk of aortic dissection and aneurysm.[9] The location of stenosis is just distal to left subclavian artery and may range in spectrum of severity from mild to severe stenosis and in some cases may be interrupted aortic arch.[10]

Coarctation of aorta may lead to several complication if left with out correction such as development of LV dysfunction and heart failure,intracranial hemorrhage,aortic dissection or rupture ,premature ischemic heart disease,Infective endocarditis,lower limb intermittent claudication.[11]
Correction of coarctation of aorta is indicated in patient with symptom related to stenosis and hypertension related to coarctation, also when pressure gradient more than 20 mmHG and significant difference of blood pressure between upper limb and lower limb more than 20 mmhg.[12]
Treatment of coarctation of aorta need intervention to correct stenosis either surgical treatment or trans catheter intervention.[13]
Surgery preferred for young children and infant while in adult transcatheter stent implantation is preferred over surgery.[14]

Patients and methods
Prospective study enrolling between January 1, 2020, and January 6, 2021, a total of 40 women had stent implantation for aortic coarctation. The median age of the women was 20 years (range: 10–38 years), with weights ranging from 45 to 85 kg and a median weight of 65 kg.The women with native coarctation of the aorta. Diagnosis was achieved using echocardiography, and this was then verified by CT aortography for the purpose of further examination. All women demonstrated reduced femoral pulses and high blood pressure in the upper limbs (a systolic BP >150 mmHg and diastolic BP >90 mmHg).
25 female participants were undergoing antihypertensive therapy, with the majority of treatments being performed under local anesthetic for 36 of the subjects. The remaining eight subjects underwent local anesthetic mixed with light sedation.The measurement of the ascending and descending aorta was obtained by both CT aortography and intraoperatively by angiography, in order to facilitate a proper assessment of the size of the balloon and the stent.The approach employed was a right femoral approach and right radial puncture in 30 patients, while the remaining five patients underwent right femoral approach and left radial access, and the other five patients underwent femoral approach and left distal radial access.
The location of the coarctation was then traversed by the GW (ZIP wire) and a pigtail was inserted into the ascending aorta via radial access. The pressure gradient was subsequently measured across the coarctation, and aortography was performed. The diameter of the aorta was then measured at the site of the coarctation, as well as before and after the coarctation segment, with the length of the coarctation segment also being measured. The ZIP wire was then replaced by a stiff GW. The femoral sheath was then replaced with a larger 11-12 F one and advanced into the femoral artery. The Palmaz stent was manually crimped onto the balloon. The coarctation site was then dilated by the balloon, after which the stent was introduced through the coarctation site and correctly located by angiography through the pigtail catheter that had been inserted from the radial access. Finally, some patients may require balloon over-dilation until the desired size is achieved.
After stenting the pressure gradient was measured across the stented site . final angiography was performed for checking the accepted result.The radial sheath removed immediately after procedure and femoral sheaths removed after 6-8 hrs of procedure if closure devise not used but some patient may need closure devise for proper hemostasis.Antibiotics were used 1 hour before procedure and continue 2 days after stent implantation.Patient discharge from hospital after 1day and kept on antiplatelet for 6 months.All the patient followed by echo doppler and CT aortography after 1 month and 3 months from procedure, 3 mm slice thickness ,100-150 cc contrast at rate 3ml/s.Regarding blood pressure there is no significant elevation of blood pressure intraoperatively, only one patient had surge in blood pressure were treated by IV infusion of glyceryl trinitrate.After 1month of procedure there is no significant surge of blood pressure and most of patient has controlled blood pressure, 22 of patient controlled without medication ,14 patient controlled with single antihypertensive medication and the other 4 patient on 2 or more antihypertensive drugs.

Statistical analysis
The result of procedure obtained asranges, mean and medians with 95% confidenceintervals (CI).
For comparisons of results, we use a paired student t- test. Pvalue of <0.05 regardas significant.

RESULT
The investigation revealed that, in the cohort of patients with aortic coarctation who had undergone post-stenting (see Table 1), a significant enhancement in the diameter of the coarctated segment was observed in 40 women. The pre-stent was measured at 5 mm (95% CI, 4-7 mm), while the post- the follow-up period ranged from one to three months, and a significant increase was observed (p value < 0.001) from 5 mm (95% CI, 4-7 mm) to 18.3 mm (95% CI, 17.3-19.6 mm, ranging from 14-22.4 mm). Nevertheless, the findings of the present study revealed that there was no statistically significant difference (p > 0.05) between the one-month and three-month follow-ups.
The mean ratio of the stent diameter to the transverse aortic arch diameter post-procedure was 85% (95% CI, 0.76-0.93). In a similar fashion, the mean ratio of the diameter of the stent post-full expansion to the diameter of

the descending aorta was 87% (95% CI, 0.8-0.93).Major complications were observed during the procedure and post-operatively, with two women experiencing minor hematomas and one woman suffering from a severe hematoma. This was treated by prolonged compression, resulting in a favorable outcome (Table 1).
Table 2 lustrated the mean pressure gradient demonstrated a decline from 40 mmHg (where 95% of the data fell within the 24–32 mmHg range and ranged from 30 to 65 mmHg) prior to stenting to 4 mmHg (where 95% of the data fell within the 1–8 mmHg range and ranged from 0 to 12 mmHg) post-stenting (p value < 0.001).
Intraoperative complications included the slippage of a stent distal to the site of coarctation in two patients. This was managed by inflating a smaller 8-mm balloon partially inside the stent, followed by gradual compression until the correct site was reached. Subsequently, a larger 14-16 mm balloon was utilized, resulting in full expansion. This approach yielded favourable outcomes.Another intraoperative complication including distal stent embolization after balloon inflation where expanded by balloon and left there, then another stent used for dilatation of coarctation site.

Table 1: aortic dimension before and after stent implantation.

	Before stenting	Immediately after stenting	1 month after stenting	3month after stenting
Minimum diameter at aortic coarctation sit	5 mm	18.3	18.3 mm	18.2
Ratio of stent to arch diameter	0.48	0.86	0.85	0.84
Ratio of the stent to the aortic diameter at diaphragmatic region	0.46	0.87	0.87	0.85
P value	0.001	0.001	0.001	0.001

Table 2: systolic pressure gradient across aortic coarctation.

	Before stenting	Immediate after procedure	P value
Peak systolic gradient mean(mmHG)	40	4	0.001
Peak systolic gradient range(mmHG)	30-65	0-12	0.001

DISCUSSION

The present study demonstrates a substantial decrease in pressure gradient across the coarctation site following stent implantation.The study demonstrated a substantial improvement in blood pressure following the procedure of stenting the stenosed site of aortic coarctation. This was accompanied by a notable control of hypertension, although it should be noted that some patients continued to require simple antihypertensive medication[15]
Non-graft stenting of COA has been observed to be associated with a reduced incidence of complications and morbidity when compared with surgical correction of COA. Conversely, surgical intervention has been found to be associated with a higher prevalence of complications, including aortic aneurysm, which can lead to a significant risk of mortality[16]
Although balloon dilatation without stenting of aortic stenosis at site of COA is another choice for treatment of COA but has suboptimum result (25%) and some patoent continue with significant pressure gradient across stenosed segment of COA[17]
In this study when compare with alarge study involving 907 patients with COA showed aless complication regarding mortality (0.7%) , aortic aneurysm or aortic tear(0.7%) and in some patient developed stroke about 0.6% [18]
The present study has demonstrated that the balloon management of COA is associated with a greater incidence of intimal tear of the aorta than stenting, as confirmed by histological study and intravascular ultrasound (IVUS)[19]. The stenting of stenosed aortas by non-graft stents has been shown to reduce or prevent intimal tear, due to the fact that the stent does not require over-dilatation by a balloon. Furthermore, the stent can act as a buttress to the aortic wall, thus preventing the extension of intimal tear until complete healing[20].
In this study there is one patient developed aortic aneurysm, this patient had long coartation segment required prolong and over dilation,co-pairing with other study of COA and re-coarctation the incidence was 13%.[21]
So that to overcome this complication can be avoided by using a smaller balloon or avoid overdilatation before stent and if further dilatation is required then over dilatation can be performed after 6-12 months after procedure to achieve full expantion.[22]
In this study there is 2 patient required stent further expansion after 6 months of procedure with successful result.[23]
Morrow et al re-expanded had sturdy on 5 patient with non-graftstenting of COA and discovered that an aortic media was compressed beneath the struts but without any evidence of tear or dissection of the aortic media or intima [24].While a study on animal by Mendelsohn et al showed an eaortic rupture and death in 2 of 7 animals post re-dilatation25. To our study there is no rupture of aorta during or after stent dilatation.Now a

day there is less risk of complication-like tear or aneurysm due to improvement in stent material and design such as using of absorbable material and changing in shape of stent such as rounded edges[26].

CONCLUSIONS

The nongraft stent surgery for coronary artery disease (COA) has been successful, and the acute findings suggest that there will be fewer complications; nevertheless, it requires a longer period of follow-up.

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