Balloon Angioplasty for Adult Coarctation of Aorta: A Six-Month Follow-up Study

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Abstract

Objectives- Balloon angioplasty of aortic coarctation has been growing in recent years. In this study, we reviewed and evaluated results of balloon angioplasty of aortic coarctation in nine adults 6 months after operation.

Methods- Nine documented coarctation cases with an average age of 23 years were chosen. Eight cases were male and one case was female. Balloon angioplasty of the aorta was performed with number 15 pulmonary balloons. The patients were followed up for 6 months with echocardiography in order to document residual gradients and possible complications.

Results- Balloon angioplasty was performed without any acute vascular complication. After six months, the patients were re-evaluated for complications. Fluctuations in blood pressure levels were also taken into consideration. Average systolic blood pressure dropped immediately from 180 ± 20 to 127 ± 8 (mmHg). Average diastolic blood pressure decreased from 110 ± 10 to 86 ± 7 (mmHg). Average systolic and diastolic blood pressures were 120 ± 10 and 85 ± 3 mmHg after six months. Coarctation gradients dropped immediately from 60 ± 15 mmHg to 13 ± 5 (mmHg) after balloon inflation. Average gradient was 16 ± 5 (mmHg) after six months. All the patients were free of anti-hypertensive drugs at the end of the follow-up.

Conclusion- Balloon angioplasty of aortic coarctation without stents could be performed in adults with acceptable results without significant vascular complications and excellent blood pressure control after six months' follow-up ***(Iranian Heart Journal 2004; 5(3):30-33).***

Key words: aortic coarctation ■ balloon angioplasty ■ hypertension

Congenital narrowing of the aorta may occur at any level of the thoracic or abdominal aorta.[1]

It is usually found just beyond the origin of the left subclavian artery or distal to the insertion of the ligamentum arteriosum.[1] the coarctation can be localized or diffuse.[1] Operative treatment of coarctation and its associated anomalies may reduce the mortality rate.[1] Hypertension present in the arms with weak or absent femoral pulses is a classic feature of coarctation. The pathogenesis of the hypertension may be more complicated than simple mechanical obstruction.[2]

The lesion can be detected by two-dimensional echocardiography and aortography can prove the diagnosis. The obstruction should be corrected in early childhood either by surgery or by angioplasty.[4] Immediately after operation, whether surgery[3] or angioplasty, blood pressure may transiently rise even further (from baseline). These changes may reflect very high levels of renin-angiotensin and catecholamine.[1]

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Controversy exists about the role of balloon angioplasty with or without balloon-expandable stents in the treatment of native coarctation, especially in neonates.[5-6]

Occasionally in older children, a stent can be placed if the balloon dilation fails to persistently increase the luminal diameter. In selected older children and adults, this has been very successful with an average reduction in the gradient from 25 to 5 mmHg in 32 patients at Boston children's Hospital.[8] Although aneurysms-usually small- have been reported at the site of dilation in about 5 percent of cases, complications usually have been related to associated diseases.[8]

Large catheters are necessary, and trauma to the femoral artery is not uncommon.[7]

Patients whose coarctations have been repaired should be followed indefinitely. Significant recoarctation occur in patients with a systolic blood pressure difference of 20 (mmHg) or more between the upper and lower extremities.

Balloon angioplasty and/or stent placement is recommended for patients with significant recoarction.[7]

Methods

Nine cases with aortic coarctation documented by transthoracic echocardiography or aortography were chosen for this study. All of the patients were above the age of twenty. Eight cases were male and one case was female. The average of their ages was 23 years (Table I). They all were hypertensive with variable peripheral symptoms such as claudication, fatigue, etc.

Table I. Demographic and hemodynamic data

Mean age	23
Sex (Male to Female)	8 to 1
Gradient Pressure Preproc.	60 ± 15
BP preproc.	180 ± 20 / 110 ± 10
Mortality	None
Acute Success	All *
Vascular Complication	None
Gradient postproc. (Acute)	13 ± 5
Gradient 6 months later	16 ± 5
BP postproc. (Acute)	127 ± 8 / 86 ± 7
BP 6 months later	120 ± 10 / 85 ± 3

* Immediate residual gradient less than 20 mmHg

The study was performed from 2001 to 2003 in the catheterization department at our center. After initial dilations with peripheral balloons, number 15 pulmonary balloons were used as the final method.

Results

Coarct gradient abruptly dropped to less than 20 mmHg in the catheterization lab. No case of dissection or pseudoaneurysm was seen. There was no need to use stents in any of the cases.

Patients left the catheterization lab without any early vascular complications and with BP ranging 127 ± 8 in systole and 86 ± 7 (mmHg) in diastole. They were followed up 6 months after the procedure.

Systolic gradient in coarct area, 60 ± 15 (mmHg) before angioplasty, dropped immediately to 13 ± 5 (mmHg) after the operation. After six months, systolic gradient was 16 ± 5 mmHg (Fig.1).

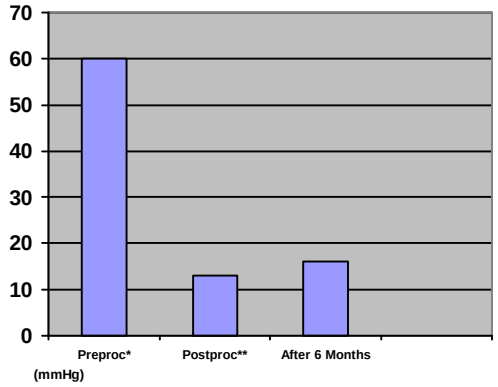

Fig. 1. Changes in systolic gradient proximal and distal to coarctation area. * Pre-procedure **Post-procedure

Evaluating the outcome, we also considered blood pressure response immediately and 6 months later. Patients were observed for early and intermediate complications such as dissection, aneurysm and sustained HTN. We were able to taper and discontinue anti-HTN drugs at the end of 6 months in all the cases. Average systolic blood pressure dropped from 180 ± 20 to 127 ± 8 immediately and to 120 ± 10 six months later. Diastolic blood pressure changed from 110 ± 10 to 86 ± 7 (mmHg) acutely after the procedure and to 85 ± 3 six months later (Fig. 2).

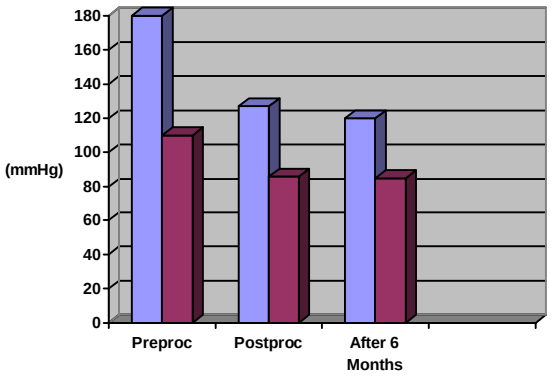

Fig. 2. Changes in systolic and diastolic blood pressures during the study. * Pre-procedure **Post-procedure

Discussion

Congenital coarctation of aorta, because of its complications, needs to be addressed. The conventional method for adult patients has been surgery, with acceptable outcomes. Because such serious surgery and cardiopulmonary bypass are followed by common complications, and also because of economic problems, angioplasty of coarctation of aorta in adults has been growing recently. Using aortic stents should always be considered. A study done by Suarez de Lezo et al. evaluated the feasibility and immediate results of balloon-expandable stent implantation in 10 patients with severe coarctation of aorta. All their patients had an unfavorable anatomy for balloon angioplasty; 9 had isthmus hypoplasia. The angiographic stenosis disappeared in 7 patients and was markedly reduced in 3.[10] In a study conducted by Mendelsohn et al., 59 children underwent balloon angioplasty of a native coarctation. It concluded that balloon angioplasty provides an effective initial treatment strategy for native coarctation in most children aged more than 12 months.[11]

In this study, we followed the hypothesis that it is not always necessary to use aortic stents. While stents were deemed a worthy standby in all cases, we used only balloon angioplasty. There were no early complications and no need to use stents. Patients were followed up for six months for vascular complications and also for blood pressure evaluation.

Transthoracic echocardiography 2D and Doppler were performed; no evidence of re-coarct was seen at the end of six months (recoarctation is interpreted as more than 20 mmHg recurrence of gradient at the procedure site).[1] This method was also curative for secondary HTN in all the cases. Final blood pressure of 110 ± 10 (mmHg) in systole and 85 ± 3 (mmHg) is interpreted normal or pre-hypertensive by the Joint National Committee.[7,8]

Aortic decoarctation in adult patients with PTA and stenting is a promising alternative of treatment that can be safely accomplished. This procedure has a very low morbidity and high success rate in terms of reduction of hypertension and normalization of hemodynamic parameters. This may eventually contribute to the reduction of the left ventricular mass after a successful intervention. Engles et al. report their preliminary experience in 15 patients in whom PTA alone was successful in 3 out of 6 of the patients and PTA with additional stenting did better in terms of

gradient relief (9 patients out of 9).[9] Balloon angioplasty offers a satisfactory alternative to surgery for recurrent coarctation; both results and complications compare favorably with surgical therapy. [12]

Conclusion

Using number 15 pulmonary balloons, without stents, successfully managed native coarctation. Results were excellent without vascular complications. This convenient and less expensive method gives us great hope to treat coarctations and prevent irreversible damage to young patients, who have their whole lives ahead of them.

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References

1. Braunwald E, Zipes DP, Libby P (eds.), Heart Disease: A Textbook of Cardiovascular Medicine. 6th ed., Philadelphia, W. B. Saunders Co., 2001: p. 965.

2. Ross RD, Clapp SK, Gunther S, Paridon SM, Humes RA, Farooki ZQ, Pinsky WW. Augmented norepinephrine and renin output in response to maximal exercise in hypertensive coarctectomy patients. Am Heart J 1992; 123: 1293-1299.

3. Stewart AB, Ahmed R, Travill CM, Newman CG. Coarctation of the aorta: life and health 20-44 years after surgical repair. Br Heart J 1993; 69: 65-70.

4. deGiovanni JV, Lip GY, Osman K, Mohan M, Islim IF, Gupta J, Watson RD, Singh SP. Percutaneous balloon dilatation of aortic coarctation in adults. Am J Cardiol 1996; 77: 435-439.

5. Fletcher SE, Nihill MR, Grifka RG, O'Laughlin MP, Mullins CE. Balloon angioplasty of native coarctation of the aorta: midterm follow-up and prognostic factors. J Am Coll Cardiol 1995; 25: 730-734.

6. Cheung YF, Sanatani S, Leung MP, Human DG, Chau AK, Culham JA. Early and intermediate-term complications of self-expanding stents limit its potential application in children with congenital heart disease. J Am Coll Cardiol 2000; 35: 1007-1015.

7. Fuster V, Alexander RW, O'Rourke RA, Wellens JJ (eds.). Hurst's The Heart. 10th ed. New York, McGraw-Hill, 2001: p. 1865.

8. Lock JE, Keane JF, Perry SB. Diagnostic and Interventional Catheterization in Congenital Heart Disease. 2th ed. Kluwer Academic Publishers, 1999: p. 221.

9. L. Anglese, et al. Endovascular treatment of aortic coarctation in adults. The basic course on revascularization. Euro PCR 2001: 385-390.

10. Suarez de Lezo J, Pan M, Romero M, Medina A, Segura J, Pavlovic D, Martinez C, Tejero I, Perez Navero J, Torres F, et al. Balloon-expandable stent repair of severe coarctation of aorta. Am Heart J 1995; 129: 1002-1008.

11. Mendelsohn AM, Lloyd TR, Crowley DC, Sandhu SK, Kocis KC, Beekman RH 3rd. Late follow-up of balloon angioplasty in children with a native coarctation of the aorta. Am J Cardiol 1994; 74: 696-700.

12. Hellenbrand WE, Allen HD, Golinko RJ, Hagler DJ, Lutin W, Kan J. Balloon angioplasty for aortic recoarctation: results of Valvuloplasty and Angioplasty of Congenital Anomalies Registry. Am J Cardiol 1990; 65: 793-797.