

## ORIGINAL PAPER

doi: 10.5455/medarch.2021.75.184-187

MED ARCH. 2021 JUN; 75(3): 184-187

RECEIVED: MAR 19, 2021

ACCEPTED: JUN 15, 2021

# Adult Aorta With Coarctation - One Year Follow Up

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### ABSTRACT

**Background:** Coarctation of the aorta (CoA), is a congenital disease in which the aorta is tightening, which occurs most commonly post to the ductus arteriosus. Also, coarctation can define as constriction of the aorta of different degrees that may occur at any part from the transverse arch of the aorta to iliac bifurcation but most commonly appear just below the beginning of the subclavian artery. **Objective:** The aim of the study is to evaluate mortality and morbidity rate among patients use uncover stents in treating adult coarctation of the aorta and short-term outcomes. **Methods:** During the period from February 2018 to February 2020 patients with aortic coarctation who is age above 16 years old have been selected to enter this study. Patients were selected from patients visiting adult cardiology consultation rooms in Najaf cardiac center or from private clinics visiting patient, at the end of two years only 75 patients with Coarctation of the aorta has the eligibility to enter this study. **Results:** All patients stent by uncovering stent including for 2 cases with interrupted coarctation, immediately after stent pressure gradient fall to less than 10 mmHg in almost all our patient then follow up 6 months, 1 year by angiography assessment with CT chest shows no stent fracture or aneurysm in the aorta at the stent site. **Conclusion:** Uncover stent appears to be safe in treating coarctation of the aorta with less morbidity and mortality

**Keywords:** coarctation of the aorta, adult congenital heart disease, hypertension, interventional cardiology.

## 1. BACKGROUND

Coarctation of the aorta (CoA), is a congenital disease in which the aorta is tightening, which occurs most commonly post to the ductus arteriosus. Also coarctation can define as constriction of the aorta of different degrees that may occur at any part from the transverse arch of the aorta to iliac bifurcation but most commonly appear just below the beginning of the subclavian artery (1, 2).

This constriction of the aorta may lead to a total cut of the aorta with fibrous remnant which is called interrupted coarctation of aorta or may lead to just narrowing of aorta which is called uninterrupted coarctation of aorta, with variable degree of construction from mild without hemodynamic consequence to severe with hemodynamic consequence and this usually measure by invasive hemodynamic measurement (3). On embryonic base coarctation of aorta classify to post ductal and preductal according to the presence of construction pre or post to a subclavian artery (4, 5). It may be a part of the manifestation of Turner syndrome, and in 70% of patients is associated with bicuspid aortic valve also it may be associated with mitral valve anomalies and the presence of sub aortic stenosis characteristic for the presence of coarctation (6). Physiologically coarctation of the aorta leads to development of the collateral flow that leads to passing blood from up to down and bypass the contraction (7, 8).

In infancy, it usually asymptomatic while in childhood and adolescence may complain from the weakness of pain in the leg related to motion (9). Usually, untreated coarctation of the aorta may lead to renal, vascular and cardiac complications that start to appear at the beginning of the fourth decade of life (10-13).

## 2. OBJECTIVE

The aim of the study was to evaluate mortality and morbidity rate among patients use uncover stents in treating adult coarctation of the aorta and short-term outcomes.

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### 3. PATIENTS AND METHODS

During the period from February 2018 to February 2020 patients with aortic coarctation who is age above 16 years old has been selected to enter in this study and this patient was selected from patients visiting adult cardiology consultation rooms in Najaf cardiac center or from private clinics visiting patients, at the end of two years only 75 patients with coarctation of aorta has the eligibility to enter in this study. For all patients with coarctation of the aorta history has been taken and data collection then laboratory test have been done to glucose, kidney function, lipid condition, then echocardiographic examination have been done to confirm coarctation and find the gradient across the aorta and if there is the concomitant bicuspid aortic valve, then patient was sent for a CT scan with an angiography to localize the site of coarctation or differentiate if it as an atretic coarctation with total cut, then if the patient is eligible to enter this study they undergo catheterization and this done by doing femoral and radial access.

Femoral access done by use modify Seldinger technique where sheath 6 Fr used after local anesthesia giving with the xylocaine 10 cc, after sheath has been completed then use multipurpose catheter with the aid of the guide wire ascending through the aorta to reach the Coarctation from downside. After that radial access is also done by modify Seldinger technique with the use 6 Fr sheath after local anesthesia giving with the xylocaine 2 cc then use of pigtail catheter with the guide wire to reach the Coarctation from upside through the brachiocephalic branch to enter the arch of aorta. At that time pressure gradient across the Coarctation can be measure by measuring blood pressure from the pigtail and the multipurpose catheter and if it gradient more than 20 mmHg so the patient is eligible for intervention. Intervention Done initially by balloon dilation of the Coarctation then stenting by palmaz stent and checking if need for post dilatation at the end of a procedure pressure gradient calculated across the Coarctation and if it is less than 10 mmHg or residual stenosis less than 50% so the procedure is success, then patient send for CCU for monitoring and measuring blood pressure, follow up done at one month ,six month, one year for all patients doing intervention for Coarctation of aorta, the follow up is done by either direct contact with the patient or by phone calling for blood pressure monitoring while do CT scan angiography for aorta for follow up if

sex	30 Male (40%)	45 Female (60%)
age	16-41	25.7 years (SD ±6.6)
hypertension	75 patients	
diabetic	3 patients	
smoker	5 patients	
Previous surgical correction	0	
Interrupted CoA	2	
Previous stenting	0	
Associated bicuspid aortic valve	51 patients	
Renal impairment	0	
stroke	1	
Left ventricular hypertrophy	59 patients	

**Table 1. Demographic data**

Blood pressure	Pre stenting (n=75)	Post stenting (n=75)	
Pre coarctation systolic blood pressure (mmHg)	159.80± (20.5)	120.87± (31)	P value < 0.0001
Post coarctation systolic blood pressure (mmHg)	97 ± (14.6)	121.5 ± (24.7)	P value < 0.0001
Average difference in systolic blood pressure pre and post coarctation	38 ± (12)	2 ± (3)	P value < 0.0001

**Table 2. Comparison in mean systolic blood pressure measurement by catheterization before and immediately after stenting**

No. of patients	Immediate Post intervention	6 month follow up	1 year follow up	
On follow up				
Blood Pressure Measurement (mmHg)				
Normotensive	74(98.7%)	61 (88.4%)	45 (84.9%)	
Hypertensive	1(1.3%)	8 (11.6%)	8 (15.1%)	
Total	75(100%)	69(92%)	53(70%)	P value<0.0001

**Table 3. Comparison between blood pressure reading at immediate and 6 month and 1 year after intervention**

here is stent fracture or slipped stent or restenosis in 6 month and 1 year after intervention.

#### Indication for intervention

Patient with hypertension and Coarctation of aorta with invasive pressure gradient across the stenosis more than 20 mmHg or stenosis of the Coarctation more than 75%

#### Exclusion criteria

- Pregnancy;
- Aneurysm of aorta;
- Patient refuse;
- Invasive pressure gradient less than 20 mmHg.

#### Statistical analysis

For continuous variables we use mean, standard deviation as descriptive statistics, for categorical variables we use number, percentage, as descriptive statistics, for analysis we use paired t test for continuous variables and

chi square for categorical variables, all calculations done by EXCEL Microsoft 2016 software.

#### 4. RESULTS

In this single arm cohort study 75 patients with Coarctation have been enrolled whose include 45 (60%) women and 30 (40%) men the age ranges from 16 years to 41 years with the mean age 25,7(SD+6.6) (Table 1).

Then follow up for complication during one year find that no stent fracture or slip stent as confirmed by CT scan study and no immediate death after intervention while blood pressure response was variable as initial blood pressure may increase slightly as seen in 15% of the patient then return to its basil and with continuous monitor blood pressure start to decrease where around 85% of the patient get control the blood either with a stop medication or with using single medication where they previously used multiple medication to control blood pressure and generally the mean systolic blood pressure after intervention is lower than systolic blood pressure before intervention (from 159.80±20.5 to 120.87±31 mm Hg), (95% confidence interval of this difference From 30.5 to 47.4) (P value is less than 0.0001) (Table 2).

And as seen in Table 3 blood pressure response after six months and one year from intervention we can see that the blood pressure decreases by the end of the year for more than 85% of the patient participate in this study as compared to the 88% patient get improve blood pressure at the end of the six-month follow up. 69 patients (92% of those who had a stent implanted) returned for the 6-month follow-up evaluation, 53 patients (70% of those who had a stent implanted) returned for the 1-year follow-up evaluation , at 6 month and 1 year for patient return for follow up CT angiography done in 39/69 patients (52% of those who had a stent implanted) at 6 month and in 18/53 patients (24% of those who had a stent implanted) at 1 year show no aortic wall injury or aneurysm development, and at 1 yr. follow-up no mortality occur as seen in Algorithm 1 (Figure 1).

#### 5. DISCUSSION

Hypertension caused by genetic and environmental factors and lead to significant mortality and morbidity (14-16) on the patient with the Coarctation have both this mortality and morbidity and if not treated until the adulthood lead to development multiple complications related to hypertension (16-22).

So, this study Focus on benefit of correction the Coarctation of aorta where there is reduce in mortality and morbidity as the hypertension well-controlled during the first year of follow up and this finding is in concordance with Costa 2 Trail (23-25). Also, this study focuses on benefit of using Palmaz stent as no case of a

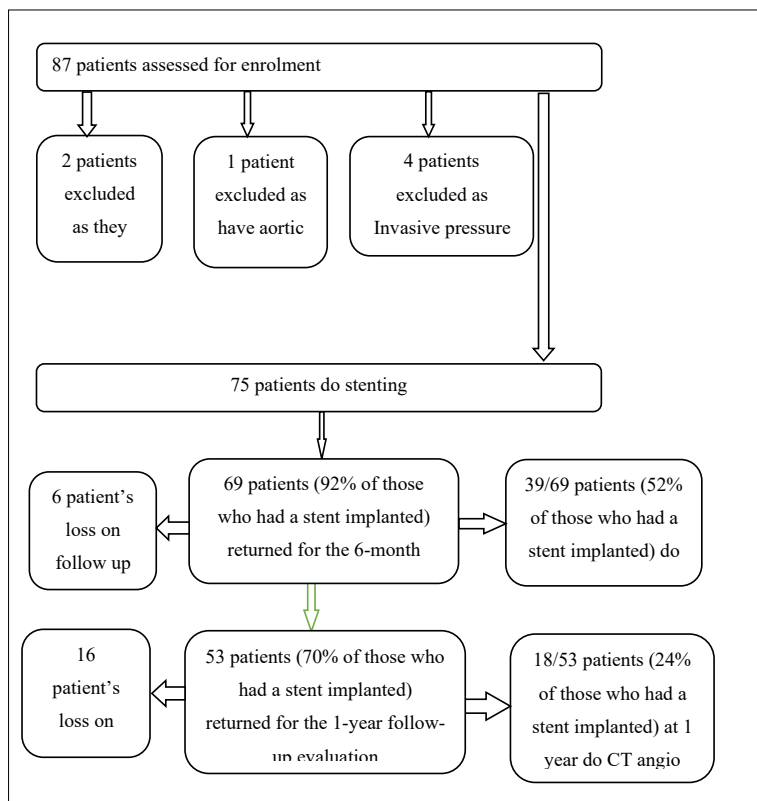


Figure 1. Patients flow diagram

fracture or slips stent didn't develop one year of follow up.

#### 6. CONCLUSION

Uncover a stent in Coarctation or aorta appears to be safe in treating the stenosis with no complication and also have advantage of no loss in side branch. Uncover the stent need a small femoral sheath so less access site complication.

- **Authors contribution:** Both authors were involved in all steps of preparation of this article. Final proofreading was made by the first author.
- **Conflict of interest:** None declared.
- **Financial support and sponsorship:** Nil.

#### REFERENCES

1. Forbes TJ, Kim DW, Du W, Turner DR, Holzer R, Amin Z, Hijazi Z, et al. Comparison of surgical, stent, and balloon angioplasty treatment of native coarctation of the aorta: an observational study by the CCISC (Congenital Cardiovascular Interventional Study Consortium). *J Am Coll Cardiol.* 2011 Dec 13; 58(25): 2664-2674. doi: 10.1016/j.jacc.2011.08.053.
2. Butera G, Manica JL, Marini D, Piazza L, Chessa M, Filho RI, et al. From bare to covered: 15-year single center experience and follow-up in trans-catheter stent implantation for aortic coarctation. *Catheter Cardiovasc Interv.* 2014; 83: 953-963. doi: 10.1002/ccd.25404.
3. Ringel RE, Vincent J, Jenkins KJ, Gauvreau K, Moses H, Lofgren K, et al. Acute outcome of stent therapy for coarctation of the aorta: results of the Coarctation of the Aorta Stent Trial. *Catheter Cardiovasc Interv.* 2013; 82: 503-510. doi: 10.1002/ccd.24949.
4. Ringel RE, Gauvreau K, Moses H, Jenkins KJ. Coarctation

- of the Aorta Stent Trial (COAST): study design and rationale. *Am Heart J.* 2012 Jul; 164(1): 7-13. doi: 10.1016/j.ahj.2012.04.008.
5. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics.* 2004 Aug; 114(2 Suppl 4th Report): 555-576.
  6. Holzer R, Qureshi S, Ghasemi A, Vincent J, Sievert H, Gruenstein D, et al. Stenting of aortic coarctation: acute, intermediate, and long-term results of a prospective multi-institutional registry: Congenital Cardiovascular Interventional Study Consortium (CCISC). *Catheter Cardiovasc Interv.* 2010; 76:553-563. doi: 10.1002/ccd.22587.
  7. Qureshi AM, McElhinney DB, Lock JE, Landzberg MJ, Lang P, Marshall AC. Acute and intermediate outcomes, and evaluation of injury to the aortic wall, as based on 15 years experience of implanting stents to treat aortic coarctation. *Cardiol Young.* 2007; 17: 307-318. doi: 10.1017/S1047951107000339.
  8. Chessa M, Carrozza M, Butera G, Piazza L, Negura DG, Bussadori C, et al. Results and mid-long-term follow-up of stent implantation for native and recurrent coarctation of the aorta. *Eur Heart J.* 2005; 26: 2728-2732. doi: 10.1093/eurheartj/ehi491.
  9. Hamdan MA, Maheshwari S, Fahey JT, Hellenbrand WE. Endovascular stents for coarctation of the aorta: initial results and intermediate-term follow-up. *J Am Coll Cardiol.* 2001 Nov 1; 38(5):1518-1523. doi: 10.1016/s0735-1097(01)01572-8.
  10. Chakrabarti S, Kenny D, Morgan G, Curtis SL, Hamilton MC, Wilde P, et al. Balloon expandable stent implantation for native and recurrent coarctation of the aorta—prospective computed tomography assessment of stent integrity, aneurysm formation and stenosis relief. *Heart.* 2010; 96: 1212-1216. doi: 10.1136/hrt.2009.170928.
  11. Johnston TA, Grifka RG, Jones TK. Endovascular stents for treatment of coarctation of the aorta: acute results and follow-up experience. *Catheter Cardiovasc Interv.* 2004; 62: 499-505. doi: 10.1002/ccd.20071.
  12. Presbitero P, Demarie D, Villani M, Perinetti EA, Riva G, Orzan F, et al. Long term results (15-30 years) of surgical repair of aortic coarctation. *Br Heart J.* 1987; 57: 462-467. doi: 10.1136/hrt.57.5.462
  13. Hager A, Kanz S, Kaemmerer H, Schreiber C, Hess J. Coarctation Long Term Assessment (COALA): significance of arterial hypertension in a cohort of 404 patients up to 27 years after surgical repair of isolated coarctation of the aorta, even in the absence of restenosis and prosthetic material. *J Thorac Cardiovasc Surg.* 2007; 134: 738-745. doi: 10.1016/j.jtcvs.2007.04.027.
  14. Brown ML, Burkhart HM, Connolly HM, Dearani JA, Cetta F, Li Z, et al. Coarctation of the aorta: lifelong surveillance is mandatory following surgical repair. *J Am Coll Cardiol.* 2013; 62: 1020-1025. doi: 10.1016/j.jacc.2013.06.016.
  15. Zanjani KS, Sabi T, Moysich A, Ovroutski S, Peters B, Miera O, et al. Feasibility and efficacy of stent redilatation in aortic coarctation. *Catheter Cardiovasc Interv.* 2008; 72: 552-556. doi: 10.1002/ccd.21701.
  16. Bruckheimer E, Dagan T, Amir G, Birk E. Covered Cheatham-Platinum stents for serial dilation of severe native aortic coarctation. *Catheter Cardiovasc Interv.* 2009; 74: 117-123. doi: 10.1002/ccd.21923.
  17. Thanopoulos BD, Giannakoulas G, Giannopoulos A, Galdo F, Tsaoussis GS. Initial and six-year results of stent implantation for aortic coarctation in children. *Am J Cardiol.* 2012; 109: 1499-1503. doi: 10.1016/j.amjcard.2012.01.365.
  18. Butera G, Gaio G, Carminati M. Redilatation of e-PTFE covered CP stents. *Catheter Cardiovasc Interv.* 2008; 72: 273-277. doi: 10.1002/ccd.21609.
  19. Mullins CE. Inappropriate stents: primary cause of failure of stent redilatation in coarctation of the aorta. *Catheter Cardiovasc Interv.* 2008; 72: 557-558. doi: 10.1002/ccd.21786.
  20. Morgan GJ, Lee KJ, Chaturvedi R, Bradley TJ, Mertens L, Benson L. Systemic blood pressure after stent management for arch coarctation implications for clinical care. *JACC Cardiovasc Interv.* 2013; 6: 192-201. doi: 10.1016/j.jcin.2012.10.009.
  21. Vohra HA, Adamson L, Haw MP. Does surgical correction of coarctation of the aorta in adults reduce established hypertension? *Interact Cardiovasc Thorac Surg.* 2009; 8: 123-127. doi: 10.1510/icvts.2008.185736.
  22. McElhinney DB, Marshall AC, Schievano S. Fracture of cardiovascular stents in patients with congenital heart disease: theoretical and empirical considerations. *Circ Cardiovasc Interv.* 2013; 6: 575-585. doi: 10.1161/CIRCINTERVENTIONS.113.000148.
  23. Tanous D, Benson LN, Horlick EM. Coarctation of the aorta: evaluation and management. *Curr Opin Cardiol.* 2009; 24: 509-515. doi: 10.1097/HCO.0b013e328330cc22.
  24. Sohrabi B, Jamshidi P, Yaghoubi A, Habibzadeh A, Hashemi-Aghdam Y, Moin A, Kazemi B, et al. Comparison between covered and bare Cheatham-Platinum stents for endovascular treatment of patients with native post-ductal aortic coarctation: immediate and intermediate-term results. *JACC Cardiovasc Interv.* 2014; 7: 416-423. doi: 10.1016/j.jcin.2013.11.018.
  25. Meadows J, Minahan M, McElhinney DB, McEnaney K, Ringel R. Intermediate Outcomes in the Prospective, Multicenter Coarctation of the Aorta Stent Trial (COAST). *Circulation.* 2015; 131: 1656-1664. doi: 10.1161/CIRCULATIONAHA.114.013937