

Images in Congenital Cardiac Disease

Cite this article: Agarwal A, Barr LL, and Steiner MB (2021) Severe coarctation of the aorta without a severely elevated echocardiographic pressure gradient: a case highlighting the importance of aortic Doppler flow profile. *Cardiology in the Young* 31: 1500–1501. doi: 10.1017/S1047951121002390

Received: 13 April 2021
 Revised: 26 May 2021
 Accepted: 26 May 2021
 First published online: 21 June 2021

Keywords:
 Aorta; coarctation; Doppler; ultrasound; child

Author for correspondence:
 Ankit Agarwal, MD, Department of Pediatrics, The Studer Family Children’s Hospital at Ascension Sacred Heart, 1 Bubba Watson Dr, Pensacola, FL 32504, USA.
 Tel: +1 (850) 716-0358; Fax: +1 (850) 416-1523.
 E-mail: ankit.agarwal@peds.ufl.edu

Severe coarctation of the aorta without a severely elevated echocardiographic pressure gradient: a case highlighting the importance of aortic Doppler flow profile

Ankit Agarwal¹ , Lori L. Barr² and Matthew B. Steiner³

¹Department of Pediatrics, The Studer Family Children’s Hospital at Ascension Sacred Heart, University of Florida, Pensacola, FL, USA; ²Department of Pediatric Radiology, Radiology Associates of Florida, Radiology Partners, Pensacola, FL, USA and ³Division of Pediatric Cardiology, University of Florida Congenital Heart Center, The Studer Family Children’s Hospital at Ascension Sacred Heart, Pensacola, FL, USA

Abstract

An asymptomatic 5-year-old male was diagnosed with severe coarctation of the aorta despite normal peak flow velocity with pathology identified on the basis of Doppler flow profile.

A 5-year-old asymptomatic male patient was referred for outpatient echocardiography secondary to a heart murmur.

Aortic arch contour was abnormal and appeared to taper at the isthmus. Doppler velocity at the isthmus was within normal limits (1.1 m/s), but a pathologic flow profile with continuation through diastole was noted (Fig 1). Lack of pulsatility and low-velocity continuous flow was found on abdominal descending aorta interrogation (Fig 2). Exam revealed the absence of distal

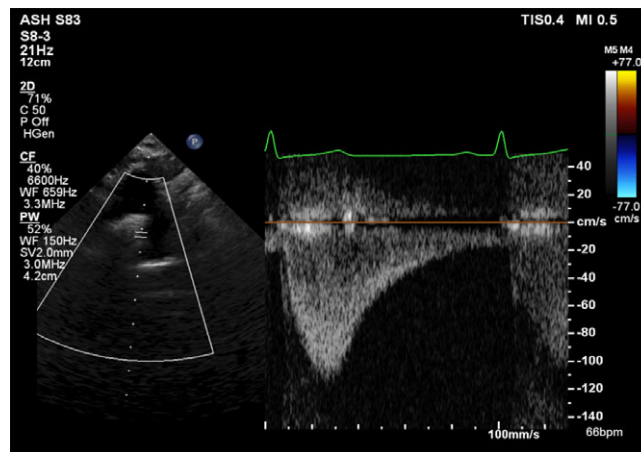


Figure 1. Pathologic Doppler profile in the distal aortic arch showing a “diastolic tail” – flow continuation through diastole. Peak velocity (1.1 m/s) is within the normal range.

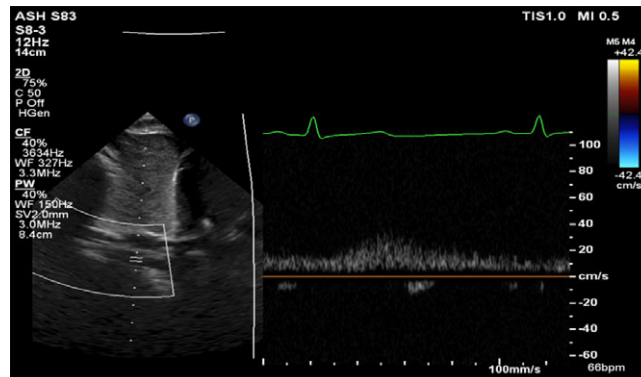


Figure 2. Subcostal duplex Doppler showing lack of pulsatility in the abdominal descending aorta. Low-velocity continuous flow is similar to a venous flow profile.

© The Author(s), 2021. Published by Cambridge University Press. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.



Figure 3. CT angiogram showing severe short segment juxtaductal coarctation of the aorta with the luminal diameter measuring 1×1 mm with well-formed collateral circulation supplying the descending thoracic aorta through the paravertebral arteries.



Figure 4. Excised aortic isthmus with a luminal diameter of less than 1 mm.

pulses and upper extremity hypertension (139/87 mmHg) with a significant gradient to the lower extremity (72/48 mmHg). CT angiogram confirmed the suspected diagnosis of coarctation of the aorta (Fig 3) and showed extensive vertebral collateralisation supplying the descending aorta. He underwent successful surgical coarctectomy with a luminal diameter of the excised aortic isthmus found to be less than 1 mm diameter (Fig 4).

Transthoracic echocardiography is the principal imaging modality for suspected coarctation of the aorta as it is readily available, safe, and offers measurement of coarctation gradient using

Doppler, and can assess for associated functional or structural intracardiac abnormalities. CT and cardiac MRI have emerged as second-line advanced imaging modalities, by providing high spatial resolution imaging for intracardiac and extracardiac structures and allows multidimensional reconstruction of vascular anatomy.^{1,2}

We often grade the severity of obstruction by reporting Doppler-derived pressure gradients, and high-velocity flow through the isthmus is expected in severe coarctation. But, a basic tenet of echocardiography is that flow is required to produce a high gradient. When the coarctation has been longstanding and severe, the presence of collateral flow through the vertebral arteries may diminish flow across the coarctation and the Doppler-derived gradient may be less severe than expected for the degree of obstruction.³ This case elegantly highlights the significance of Doppler flow profile in making the diagnosis – tracings with continuous antegrade diastolic flow in the arch and low amplitude continuous undulating flow in the abdominal descending aorta are pathologic, and provide important indirect evidence for aortic coarctation.^{1,2,4–6}

Acknowledgements. None.

Financial support. This research received no specific grant from any funding agency, commercial, or not-for-profit sectors.

Conflict of interest. None.

Ethical statement. The authors assert that all procedures contributing to this work comply with the ethical standards.

References

1. Dijkema EJ, Leiner T, Grotenhuis HB. Diagnosis, imaging and clinical management of aortic coarctation. *Heart* 2017; 103: 1148–1155. doi: [10.1136/heartjnl-2017-311173](https://doi.org/10.1136/heartjnl-2017-311173). Epub 2017 Apr 4. Erratum in: *Heart*. 2019 Jul; 105(14):e6.
2. Diagnosis, imaging and clinical management of aortic coarctation. *Heart* 2019; 105: e6. doi: [10.1136/heartjnl-2017-311173corr1](https://doi.org/10.1136/heartjnl-2017-311173corr1). Erratum for: *Heart*. 2017 Aug; 103(15): 1148–1155.
3. Houston AB, Simpson IA, Pollock JC, Jamieson MP, Doig WB, Coleman EN. Doppler ultrasound in the assessment of severity of coarctation of the aorta and interruption of the aortic arch. *Br Heart J* 1987; 57: 38–43. doi: [10.1136/hrt.57.1.38](https://doi.org/10.1136/hrt.57.1.38).
4. Shaddy RE, Snider AR, Silverman NH, Lutin W. Pulsed Doppler findings in patients with coarctation of the aorta. *Circulation* 1986; 73: 82–88. doi: [10.1161/01.cir.73.1.82](https://doi.org/10.1161/01.cir.73.1.82).
5. Tan JL, Babu-Narayan SV, Henein MY, Mullen M, Li W. Doppler echocardiographic profile and indexes in the evaluation of aortic coarctation in patients before and after stenting. *J Am Coll Cardiol* 2005; 46: 1045–1053. doi: [10.1016/j.jacc.2005.05.076](https://doi.org/10.1016/j.jacc.2005.05.076).
6. Doshi AR, Chikkabyrappa S. Coarctation of aorta in children. *Cureus* 2018; 10: e3690. doi: [10.7759/cureus.3690](https://doi.org/10.7759/cureus.3690).