Intermittent flow reversal in the aortic arch

Sir,

Significant diastolic flow reversal in the aortic arch is abnormal, and an important indicator of certain pathophysiological states. It denotes an aortic runoff proximal to the aortic arch as in aortic regurgitation, truncus arteriosus, aortopulmonary window, anomalous origin of the right or left pulmonary artery from the aorta, vein of Galen malformation, or other upper body systemic-to-pulmonary artery fistulae. It has also been described with severe pulmonary hypertension and a patent ductus arteriosus with inadequate left ventricular output as in patients with severe aortic stenosis, or aortic atresia, and in neonates with persistent pulmonary hypertension.[1-3] In a fetus, the retrograde flow in the aortic arch might be a poor prognostic sign.[4] Therefore, the presence of flow reversal in the aortic arch alerts the pediatric cardiologist to the possibilities of some definite abnormalities. We recently came across a 7-month-old child with transposition of great vessels, ventricular septal defect, patent ductus arteriosus, and pulmonary hypertension. The left and right ventricular function was normal. As the child was being evaluated for definitive surgery, he developed chest infection and worsened. A repeat echo showed a flow reversal in the aortic arch [Figure 1a and Supplementary Video 1], and therefore, further evaluation to rule out some of the disorders described above was done. The ultrasound of the cranium and a computed tomography angiogram of the brain did not show vein of Galen malformation. Furthermore, no systemic-to-pulmonary collateral or fistula was found. It was then recognized that the flow reversal is intermittent [Figure 1b and Supplementary Video 2] and was present when the child was sicker and hypoxic. The arterial saturation fluctuated from 58% (with reversal) to 77% (with no reversal). Even when the child cried, the reversal was present that disappeared subsequently.

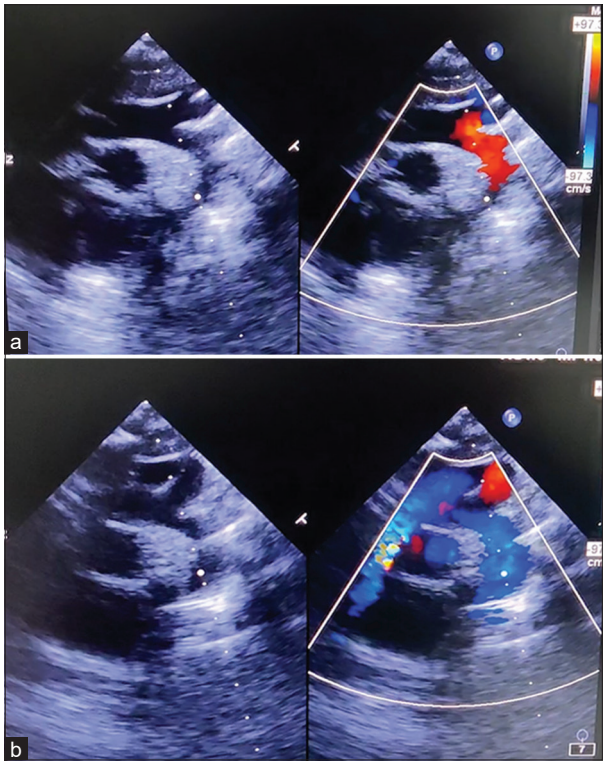

Figure 1: Suprasternal view of aortic arch color Doppler showing arch reversal (a), and no arch reversal (b)

The exact cause of intermittent flow reversal in the aortic arch in our case is not clear. In previous reports of flow reversal with pulmonary hypertension and a ductus, the systemic ventricle output was compromised and the reversal was not intermittent. We hypothesize that it was possibly due to hypoxia and cerebral vasodilatation. Each time when the child was sicker, the flow reversal was found, and it disappeared when the saturations were better. We did not do arterial blood gas at that point in time, but the noninvasive saturation fluctuated significantly as described above. Why such a flow reversal is not more commonly seen with hypoxia remains speculative, nevertheless it seems the most plausible explanation for the intermittent runoff seen in this patient. Chronic hypoxia might be associated with hypocarbia that might balance the effects on cerebral blood flow. Aortic flow reversal with systemic hypercarbia has previously been described[5] but has not been widely recognized. In fact, even in the previous reports of flow reversal due to pulmonary hypertension, the patients with flow reversal were significantly hypoxic.[2,3] Awareness of this entity would avoid unnecessary investigations, and a reappraisal of flow reversal should be done in sick babies after correction of hypoxia or hypercarbia. We cannot ascertain with certainty whether other mechanistic reasons for flow reversal with crying are there or not, as detailed echo during crying was not possible. It is worthwhile to remember that the flow reversal in the aortic arch could be intermittent under some circumstances.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to

be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Shyam S. Kothari, Nihar Lalitkumar Pathak, Nayan Banerji, Bhavik Champaneri

Department of Cardiology, U. N. Mehta Institute of Cardiology and Research Centre, Ahmedabad, Gujarat, India.
E-mail: kothariss100@gmail.com

Submitted: 28-Jun-2023 **Revised:** 05-Nov-2023
Accepted: 18-Nov-2023 **Published:** 01-Apr-2024

REFERENCES

1. Khongphatthanayothin A, Lane J, Wong PC, Acherman RJ. Severe pulmonary hypertension as a cause of reverse aortic arch flow in the neonate: Report of two cases. J Am Soc Echocardiogr 1996;9:915-7.
2. Lane J, Acherman RJ, Khongphattanayothin A, Luna C, Ramanathan R, Wong PC, *et al.* Reverse aortic arch flow secondary to severe pulmonary hypertension in the neonate. Am J Perinatol 1999;16:143-9.
3. Pinello G, Geraci L, Rinaudo G, Rosella V. An unusual neonatal case of reverse flow in the aortic arch and persistent pulmonary hypertension. Echocardiography 2021;38:351-3.
4. La Verde M, Savoia F, Riemma G, Schiattarella A, Conte A, Hidar S, *et al.* Fetal aortic isthmus Doppler assessment to predict the adverse perinatal outcomes associated with fetal growth restriction: systematic review and meta-analysis. Arch Gynecol Obstet 2023. doi: 10.1007/s00404-023-06963-4. Epub ahead of print. PMID: 37072584.
5. Upponi A, Rakhecha A, Gibbs JL. Reversal of flow in the descending aorta associated with hypercapnoea. Cardiol Young 2008;18:350.

Videos available on: https://journals.lww.com/aopc

Access this article online

Quick Response Code:

Website: https://journals.lww.com/aopc

DOI: 10.4103/apc.apc_101_23

How to cite this article: Kothari SS, Pathak NL, Banerji N, Champaneri B. Intermittent flow reversal in the aortic arch. Ann Pediatr Card 2023;16:385-6.