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Can postnatal aortic arch morphology predict neonatal coarctation of the aorta following prenatal diagnosis?

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Introduction: Antenatal diagnosis of coarctation is associated with false positive diagnoses. Postnatal assessment involves an extended neonatal hospital admission whilst awaiting ductal closure to confirm or refute a coarctation. In fetuses with an antenatal suspicion of coarctation, can the first postnatal echocardiogram predict which patients will develop neonatal coarctation?
Methods: The last 37 cases of prenatally suspected coarctation with normal connections diagnosed at our institution were reviewed. Neonatal echocardiograms performed within 24 hours of birth were analysed. Maximal systolic measurements of the aortic arch were taken. The distal arch index (ratio of distance between left common carotid artery to left subclavian artery/distal arch diameter prior to the left subclavian artery) was calculated. Measurements were made blinded to the neonatal outcome. Published z scores (Detroit) based on weight were used. Mann Whitney and Fisher's exact test were used for analyses.
Results:
14/37 neonates developed neonatal coarctation requiring surgical repair. The arterial duct was patent in all patients at the time of echocardiogram. Mean weight was similar in in the coarctation and non-coarctation groups (p=0.975). There was no significant association of bicuspid aortic valve or ventricular septal defect with development of coarctation (p=0.080; p=0.086, respectively).
The median transverse arch and isthmus z scores were below the normal range in both the coarctation and non-coarctation groups. However, transverse arch diameter, transverse arch z score, isthmus diameter and isthmal z scores were significantly smaller in neonates who developed coarctation. The distal arch index and duct:isthmus ratio were significantly larger in those who developed coarctation. Table 1 denotes p values.
A distal arch index of greater than 1.5 is associated with coarctation (p=0.001), odds ratio: 18 (95% CI: 3–107). Sensitivity: 73%, specificity: 87%. A transverse arch z score of less than -4 is associated with development of coarctation (p=0.0001). Sensitivity for coarctation: 100%, specificity: 83%.
Conclusions:
As expected, in these groups of neonates, the arch measurements are below the normal range. However, they are significantly smaller in those who develop neonatal coarctation. A distal arch index >1.5 and transverse arch z score < -4 should further raise the suspicion of development of coarctation.

*Table 1: Measurements of cardiac structures in neonates who develop coarctation following an antenatal diagnosis of coarctation. Values are expressed as median (range). * indicates p<0.05.*

Echocardiographic feature	Coarctation	Normal	*P* value
Presence of ventricular septal defect	9/14	7/23	*0.086*
Bicuspid aortic valve	5/14	2/23	*0.080*
Common origin of innominate and left common carotid artery	6/14	13/23	*0.508*
Aortic valve z score	-2.2 (-5.9 to +1.2)	-1.9 (-4.3 to +1.1)	*0.598*
Transverse arch diameter (mm)	3.3 (2.9 - 3.0) *	4.7(3.6 - 6.2)	*< 0.0001*
Transverse arch z score	-5.7 (-6.7 to -4.1)*	-3.4 (-5.3 to -1.6) *	*< 0.0001*
Arch diameter at left common carotid artery/isthmus	1.2 (0.7 – 2.1)	1.1 (0.5 - 1.4)	*0.251*
Distal arch index	2.2 (0.8 – 3.4) *	0.8 (0 – 4.4)	*0.0005*
Isthmus diameter (mm)	2.2 (1.7 – 4.4) *	3.6(1.9 - 6.8)	*0.001*
Isthmus z score	-5.6 (-7.4 to -1.3) *	-2.3 (-6.2 to +1.8)	*0.001*
Duct diameter (mm)	5.0 (3.1 – 6.3)	4.7 (2.0 – 7.3)	*0.633*
Duct/isthmus	1.9 (1.1 – 3.2) *	1.2 (0.4 - 2.5)	*0.006*