

Poster presentation

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Diagnosis of coarctation with MR using carotid-subclavian artery index

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Introduction

Aortic coarctation is a common condition defined as the narrowing of the aorta, usually just distal to the origin of the left subclavian artery, and often associated with other conditions such as bicuspid aortic valve or ventricular septal defect [1]. Dodge-Khatami, et al. introduced the use of carotid-subclavian artery index as an alternative way of predicting coarctation independent of other variables in neonates and infants [2]. The index's validity with modalities other than echocardiography and in adults has not been explored, however.

Purpose

In this study, we test the hypothesis that the carotid-subclavian artery index can be used with MR in adults to predict the presence of aortic coarctation.

Methods

Patients and controls were selected retrospectively from the database at NMH according to IRB-approved protocols. We identified and selected patients who had a diagnosis of aortic coarctation or history of coarctation repair and underwent contrast enhanced magnetic resonance angiography (CE-MRA) between 2006 and 2009. Patients with comparable age-distribution and normal MR images of their aortas were chosen from the same database as controls. The MR imaging protocol has been previously published [3]. For each subject, we measured the following aortic dimensions on user-defined multiplanar reformats (MPR) and thin MIPs: distance between the origin of the brachiocephalic trunk and the origin of the left carotid artery (d1), distance between the origin of the left carotid

artery and the origin of the left subclavian artery (d2), the aortic arch diameter at the origin of the left carotid artery (d3), and the descending aorta diameter (d4). The carotid-subclavian artery index is defined as the ratio of d3 to d2.

Results

The carotid-subclavian artery index is significantly smaller in the coarctation group compared to the control. The data suggest that a cutoff of 1.5 for using the carotid-subclavian artery index to diagnose coarctation provides the best sensitivity and specificity simultaneously. The area under the ROC curve is 0.955, suggesting that the carotid-subclavian artery index has excellent accuracy. See figures 1 and 2 and Tables 1, 2 and 3

Conclusion

We have demonstrated that the carotid-subclavian artery index is a useful tool for diagnosing aortic coarctation in adults with MRA. With a cutoff value of 1.5, the index provides high sensitivity and specificity. It can lead to early diagnosis of mild coarctation and other congenital conditions such as bicuspid aortic valve.

Table 1: Demographic Data of Coarctation Patients and Controls

	Coarctation Patients (n = 28)	Controls (n = 26)
Male/Female	14/14	14/12
Median age (yrs)	33	31.5
Mean age (yrs)	35.4	35.6
Standard deviation (yrs)	11.7	12.3

Table 2: Aortic Dimensions and Carotid-Subclavian Artery Index: Comparison. Mean(Standard Deviation)

	Coarctation Patients (n = 28)	Controls (n = 26)	p value
CSAI (d3/d2)	1.08 (0.33)	3.45 (2.61)	<0.00001
d1(cm)	1.22 (0.29)	0.40 (0.07)	<0.00001
d2(cm)	2.03 (0.62)	0.81 (0.12)	<0.00001
d3(cm)	1.82 (0.20)	2.31 (0.07)	0.000012
d4(cm)	2.24 (0.31)	1.91 (0.05)	0.0056

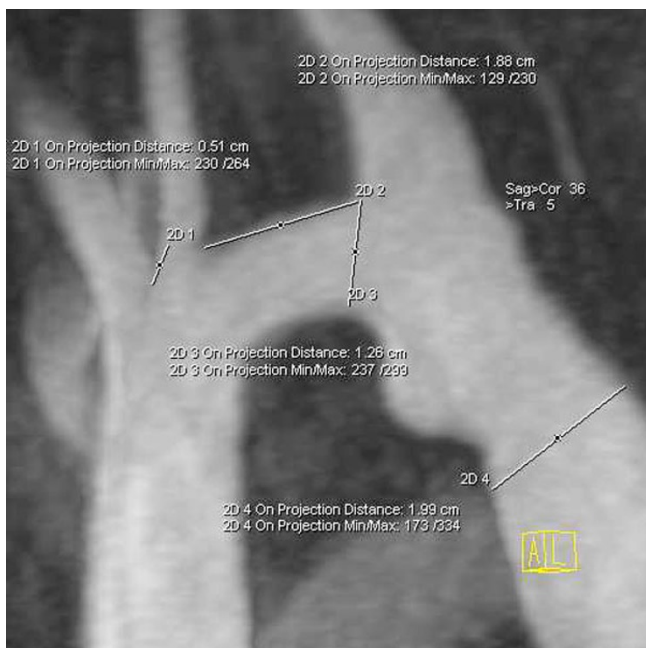


Figure 1
Measurements of Aortic Dimensions.

Table 3: Sensitivity and Specificity Values for Various Cutoffs.

CSAI-Cutoff	1.0	1.3	1.5	1.7	2.0
Sensitivity %	53.57	78.57	82.14	85.71	85.71
Specificity %	100.00	100.00	100.00	96.15	76.92
PPV %	100.00	100.00	100.00	96.00	80.00
NPV %	66.67	81.25	83.87	86.21	83.33

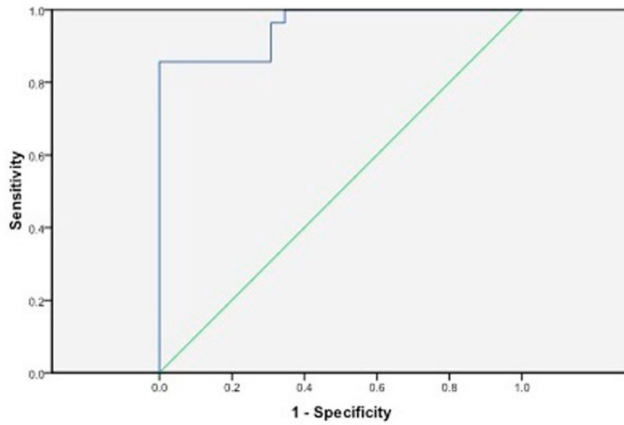


Figure 2
ROC Curve.

References

1. Secchi F, et al.: 2009.
2. Dodge-Khatami A, et al.: 2005.
3. Bireley WR, et al.: 2007.

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