

3D geometry of coronary arteries to predict late clinical events after the arterial switch for transposition of the great arteries

Batteux C., Abakka S., Raimondi F., Bonnet D.

M3C-Necker Enfants malades, Université Paris Descartes, Paris, France

Background

Predicting late coronary events after the arterial switch operation (ASO) for TGA remains challenging. Screening all patients for late coronary obstruction is questionable in patients with no pre- or per-operative risk factors. Acquired coronary anatomy after the transfer during ASO might be a predictor of coronary events.

Objective

To describe 3D geometric characteristics of the acquired coronary anatomy after ASO for TGA and to identify acquired courses of coronary artery associated with coronary events.

Method

We retrospectively reviewed coronary CT performed at a median age of 5 years after ASO: 100 were from random free-from-coronary-event patients and 21 were from asymptomatic patients who had a coronary event during follow-up (5 right coronary artery, 16 left coronary artery). Using 3D modeling software, we defined and measured 6 geometric criteria for each coronary artery: the clockwise position of the ostium in the aortic root, the angle of coronary stem's first centimeter with the ostium, the height of reimplantation of the coronary ostium, the distance separating coronary ostium and first centimeter from pulmonary artery, and the coronary minimal angulation with the aortic wall.

Results

None of the geometric parameters studied for the right ostium was associated with coronary events. Four/6 criteria measured on left coronary artery were statistically associated to coronary events: the clockwise position of the left ostium $> 67^\circ$ ($p < 0.001$) (A), the minimal angle with the aortic wall in 3D $< 39^\circ$, $p = 0.003$ (B), the angle of coronary stem first centimeter with the ostium $> 62^\circ$, $p < 0.01$ (C), the distance separating coronary ostium from pulmonary artery < 10 mm, $p = 0.03$ (D).

When combining the geometric characteristics, the association of anterior position of the left ostium $> 67^\circ$ and minimal angle in 3D $< 39^\circ$ had a 88% sensitivity and a 81% specificity to predict coronary events (ROC curve; 0.847, IC 95% (0,74; 0,95)), $p < 0,001$.

Conclusion

Efficiency of screening for coronary anomalies after the ASO is limited due to the rarity of late events. Imaging 3D acquired anatomy of coronary arteries might however be useful to select patients at risk of events and to tailor follow-up.

