CORONARY ARTERY VARIATIONS EVALUATED ON 128 SLICE CT CORONARY ANGIOGRAPHY

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ABSTRACT

Multislice CT coronary angiography has been accepted as a useful modality in evaluating coronary arteries in intermediate risk patients. It also helps to rule out congenital anomalies noninvasively in selected subjects to rule out the risk of sudden cardiac death and preoperatively before complex cardiac surgeries and hence awareness of coronary artery variations is essential in such conditions. The purpose of this study is to evaluate coronary artery variations in patients referred to our hospital for CT coronary angiography.

AIMS
To study the congenital coronary artery variations.

DESIGN
Retrospective study.

METHODS AND MATERIALS
100 patients who had undergone CT coronary angiography on 128 slice CT scanner were evaluated retrospectively for coronary arterial variations.

RESULTS
A total of hundred patients were included in the study. Among them right dominance was 82%, left dominance was 12% and co-dominance was 6%. Ramus intermedius was noted in eight patients. One patient showed early bifurcation of LMCA. High origin of coronary artery was noted in another patient. Conus artery was arising directly from aorta in 20 patients.

CONCLUSIONS
128 slice CT coronary angiography provided accurate details of coronary arterial origin, course and variations. Multislice CT coronary angiography is a viable noninvasive modality for evaluating variations of coronary arteries.

KEYWORDS
CT Coronary Angiography, Coronary Anomalies.

INTRODUCTION: Coronary arterial anomalies are an uncommon category of cardiac disease. The prevalence is around 1%.

Coronary artery variants may be insignificant or may not be symptomatic, and some variants commonly result in serious cardiovascular sequelae. Before the advent of cardiac CT, conventional angiography was considered the gold standard for evaluating coronary arteries, but now several studies have confirmed that cardiac CT is superior to conventional angiography in detection of coronary artery anomalies. Cardiac CT depicts the relationships of anomalous arteries to other mediastinal vascular structures.

SUBJECTS AND METHODS: Patients above the age 18 years who were referred for CT coronary angiogram were included in the study. A total 100 patients selected from data base were evaluated for coronary artery variations. Suboptimal studies due to technical factors were excluded. Patients with renal failure and history of severe drug reactions were excluded from the study. CT coronary angiogram was performed on 128 slice CT scanner. 60-80 mL of iohexol (350 mg) was used as a contrast media. Contrast infusion was performed using pressure injector at a rate of 5 mL/sec using bolus tracking technique. Metoprolol was used selectively to lower the heart rate and sublingual nitroglycerin was given to all patients.

RESULTS: A total of hundred patients were included in the study. Among them, right dominance was 82%, left dominance was 12% and co-dominance was 6%. Ramus intermedius was noted in eight patients. One patient showed early bifurcation of LMCA. High origin of coronary artery was

noted in another patient. Conus artery was arising directly from aorta in 20 patients.

Right dominance	82%
Left dominance	12%
Co-dominance	6%

Table 1: Dominance Pattern of Coronary Arteries

Ramus intermedius	8%
Early bifurcation of LMCA	1%
Origin of LAD and LCX directly from aorta	1%
Conus artery arising directly from aorta	20%
High origin of coronary arteries	1%

Table 2: Coronary Arterial Anatomical Variations

DISCUSSION: CT coronary angiography has revolutionised cardiac imaging. Congenital anomalies of the coronary arteries are a rare cause of chest pain and death. CT coronary angiography allows accurate and noninvasive depiction of coronary artery anomalies of origin, course, and termination. 128 slice CT coronary angiography is superior to conventional angiography in delineating the ostial origin and anomalous coronary artery course. The knowledge of the CT appearances of various coronary artery anomalies and an understanding of the clinical significance of these anomalies is essential for correct diagnosis.[1,2]

The left coronary artery arises from the left sinus and gives rise to left anterior descending artery and left circumflex artery (LCX). The left anterior descending artery courses anterolaterally and its major branches are the diagonal and septal perforating arteries. The diagonal branches course laterally whereas the septal branches course medially. Circumflex artery courses in the left AV groove and gives rise to obtuse marginal branches. The circumflex artery gives rise to posterolateral and posterior descending artery (PDA) branches. The most common variation in left coronary artery anatomy (LCA) is the presence of a trifurcation of the left main coronary artery where it trifurcates into the left anterior descending artery, circumflex arteries, and ramus intermedius artery between them.[3,4]

The right coronary artery arises from the right coronary sinus and courses in the right AV groove toward the crux of the heart and in 50%–60% of patients, the first branch is conus artery. It can also arise directly from the aorta (30%–35%). In approximately 58% of patients, the SA nodal artery arises from the right coronary artery (RCA). Largest of multiple ventricular branches arising from the RCA is called the acute marginal branch.[5] In 70% of patients, the RCA passes down the atrioventricular groove to the crux of the heart, where it gives off the posterior descending artery and posterior left ventricular branches. The coronary artery that gives rise to the PDA and posterolateral branch is referred to as dominant artery with the RCA being dominant in approximately 70% of cases. The LCA is dominant in approximately 10% of cases supplying the entire LV, accompanied by the PDA and posterolateral branches from the LCX artery. In the remaining cases, the RCA and LCA are co-dominant which means that portions of the left ventricular diaphragmatic wall are supplied by both the RCA and the LCX artery. The length of the distal RCA is inversely proportional to the length of the LCA along the inferior aspect of the heart. The RCA is typically diminutive compared with the circumflex artery in patients with left-dominant systems. Approximately, 70% of individuals have a right dominant system whereas 20% have a co-dominant system and 10% a left-dominant system.[6]

Coronary artery anomalies be can life-threatening and occur in approximately 1% of patients. The prevalence of the coronary arterial anomalies is in the range of 0.3%–1% of healthy individuals. The coronary artery anomalies can be classified into anomalies of origin, course, and of termination. Coronary artery anomalies may also be classified as either hemodynamically significant or insignificant. Hemodynamically significant anomalies of the coronary arteries cause abnormalities of myocardial perfusion which lead to an increased risk of ischemia or death.[7] These anomalies include an anomalous origin of either the left coronary or the right coronary from the pulmonary artery, an anomalous course between the pulmonary artery and the aorta of either the right coronary artery arising from the left sinus of Valsalva or the left coronary artery arising from the right sinus of Valsalva, myocardial bridging, and congenital coronary artery fistula. High take-off refers to the origin of either the right coronary or the left coronary above its sinus. High take-off of the coronary arteries may cause difficulty in cannulating the vessels during coronary arteriography. In multiple ostia, RCA and the conus branch arise separately. A single coronary artery may follow the pattern of a normal RCA or LCA.[8] Although a single coronary artery may be compatible with a normal life expectancy, patients are at increased risk for sudden death if a major coronary branch crosses between the pulmonary artery and the aorta. Anomalous origin of the coronary artery from the pulmonary artery is one of the most serious congenital coronary artery anomalies. It has a prevalence of one in 300,000 live births. Most affected patients show symptoms in infancy and early childhood. Most commonly, LCA arises from the pulmonary artery and the RCA arises normally from the aorta. Patterns of an anomalous origin of a coronary artery including origin from the opposite or non-coronary sinus are, the RCA arising from the left coronary sinus, the LCA arising from the right coronary sinus and the left or right coronary artery arising from the non-coronary sinus. Coronary arteries arising from the opposite or non-coronary sinus can take interarterial, retroaortic, prepulmonic, or septal course. Although retroaortic, prepulmonic, and septal courses seem to be benign, an interarterial course carries a high risk for sudden cardiac death. Anomalies of course includes myocardial bridging which is caused by a band of myocardial muscle overlying a segment of a coronary artery. Duplication of the LAD artery has been reported to occur in 0.13%–1% of the general population. Duplication of the LAD artery consists of a short LAD artery and a long LAD artery. Coronary artery fistula is a communication between one or two coronary

arteries and a cardiac chamber, the coronary sinus, the superior vena cava. It more commonly involves the RCA (60% of cases) than the LCA (40%).[9,10]

CONCLUSION: Knowledge of the appearance of congenital coronary anomalies origin is important. Most of these anomalies are benign, but a small number, especially those with interarterial course are associated with myocardial ischaemia and even death.

REFERENCES:
1. O'Brien JP, Srichai MD, Hecht EM, et al. Anatomy of the heart at multidetector CT: What the radiologist needs to know. Radiographics 2007;27(6):1569-1582.
2. Jaydip Datta, Charles S White, Robert C Gilkeson, et al. Anomalous coronary arteries in adults: depiction at multi-detector row CT angiography. Radiology 2005;235(3):812-818.
3. Hyun Woo Goo, In-Sook Park, Jae Kon Ko, et al. CT of congenital heart disease: normal anatomy and typical pathologic conditions. Radiographics 2003;23:S147-S165.
4. So Yeon Kim, Joon Beom Seo, Kyung-Hyun Do, et al. Coronary artery anomalies: classification and ECG-gated multi-detector row CT findings with angiographic correlation. Radiographics 2006;26(2):317-334.
5. Jabi E Shriki, Jerold S Shinbane, Mollie A Rashid, et al. Identifying, characterizing, and classifying congenital anomalies of the coronary arteries. Radiographics. 2012;32:453-468.
6. Zeina AR, Blinder J, Sharif D, et al. Congenital coronary artery anomalies in adults: non-invasive assessment with multidetector CT. Br J Radiol 2009;82(975):254-261.
7. Hye-Jeong Lee, Young Jin Kim, Jin Hur, et al. Coronary artery anomalies: detection on coronary artery calcium scoring scan. AJR Am J Roentgenol 2010;194(5):W382-387.
8. Sunil Kini, Kostaki G Bis, Leroy Weaver. Normal and variant coronary arterial and venous anatomy on high-resolution CT angiography. AJR Am J Roentgenol 2007;188(6):1665-1674.
9. Jonathan D Dodd, Maros Ferencik, Richard R Liberthson, et al. Congenital anomalies of coronary artery origin in adults: 64-MDCT appearance. AJR Am J Roentgenol 2007;188(2):W138-146.
10. Young PM, Gerber TC, Williamson EE, et al. Cardiac imaging: part 2, normal, variant, and anomalous configurations of the coronary vasculature. AJR Am J Roentgenol 2011;197(4):816-826.