Objectives

• Understand the important role of Cardiac CT in the evaluation of coronary anatomy
• Recognize the normal and anatomic variants in coronary anatomy
• Understand the importance of some variants as they relate to surgical or percutaneous intervention

Role of Cardiac CT in Evaluation of Coronary anatomy

• Cardiac computed tomography (CCT) has became modality of choice for evaluation of coronary anatomy.
  – A higher sensitivity for detection of coronary anomalies is achieved, compared to conventional angiography.
  – The entire arterial and coronary arterial tree is opacified with a single administration of contrast.
  – Other mediastinal vascular anomalies are detected as well as the relationship between the coronary arteries and other vascular structures.
Conus branch-separate orifice

Right coronary artery

RCA

Conus branch

Sx nodal branch

Left Coronary Artery
3-D Anatomy:
**DOMINANCE**

- 85% right
- 7.5% left
- 7.5% co-dominant

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**Abbreviation**

- LCA: Left coronary artery
- LAD: Left anterior descending artery
- LCx: Left circumflex artery
- RCA: Right coronary artery
- OM: Obtuse marginal branch
- PDA: Posterior descending artery
- PLL: Posterior left lateral branch
- PLB: Posterior lateral branch
- PLV: Posterior left ventricle
- SVG: Superior vena cava

**Description**

- **LM**: Left main coronary artery
- **LAD 1**: Left anterior descending artery, segment 1
- **LAD 2**: Left anterior descending artery, segment 2
- **LAD 3**: Left anterior descending artery, segment 3
- **LAD 4**: Left anterior descending artery, segment 4
- **LCA**: Left coronary artery

**Cardiothoracic Imaging**

- USC School of Medicine
- Dashed lines represent borders between the left atrium and left ventricle.
- Dashed lines represent borders between the left atrium and left ventricle.
Variant Anatomy

Classification Scheme for Anomalies

- Normal (minor) variants (separate conus branch, ramus intermedius, often ignored).
- Abnormal number of coronary arteries (absence or duplication).
- Abnormal origin
- Abnormal course (often includes origin).
- Abnormal termination (anything other than the myocardium).

Non-atherosclerotic diseases:

- Variants.
- Anomalies.

Scheme

- Potentially Hemodynamically significant:
  - Atresia.
  - Shunts: ALCAPA, fistulae, etc.
  - Course: Interarterial variant.
- Non-hemodynamically significant:
  - Lots of these and finding more every day.....
Non-atherosclerotic diseases:

Significant. Incidental.

Classification of anomalies, variants:

Normal (minor) variants:
- Separate conus branch (~35%).
- Absence of LMCA (with separate CFX and LAD) (~2%).
- SA nodal branch from CFX (~20%).
- Ramus intermedius (~25%).

Conus branch:
- No independent clinical significance.
- Some argue that this artery should be selectively catheterized.
- Variety of names:
  - Adipose, infundibular, third coronary artery.

Ramus intermedius:
- Separate artery between LAD and CFX (trifurcation of LMCA).
- Not significant.
- Variable in size.
- Usually has some inverse relationship with diagonal arteries.

“Absent” LMCA:
- Separate origins of the LAD and CFX.
- Not significant, but may necessitate separate catheterization of ostia.

Absent/Atretic LMCA:
- Rare variant.
- ~20 cases in the literature.
- May be under-recognized.
- Usually significant, with RCA to left collaterals forming, which are usually not sufficient to LVs oxidative demands.
Coronary Artery Duplication

- Duplication of a coronary artery is an uncommon finding.
- The LAD is the most commonly duplicated artery, although duplication of other coronary arteries has been reported.
- Variants of coronary artery duplication are usually not hemodynamically significant.
Duplication of the LAD:

DUAL LAD

Diagonal branch supplies LAD distribution

DUAL LAD

Conus branch supplies LAD distribution

High origin:

• 1 cm above sinotubular junction.
• Usually the RCA.
• Not hemodynamically significant.
• May complicate percutaneous interventions and surgery.
• Uncommon.
• Association with bicuspid aortic valve.

High RCA origin:

Normal RCA origin

High RCA origin:
Classification of anomalies, variants:
Anomalies of course:
- A (Anterior to right ventricular outflow tract)/Prepulmonic.
- B (Between aorta and pulmonary trunk)/Interarterial.
- C (Through the Crista supraventricularis)/Transseptal.
- D (Dorsal to the aorta)/Retroaortic.
- Intramyocardial course (myocardial bridging).
- Shepherd’s crook RCA.

LAD Bridge
Common variant
15-20% of patients
Thought to be incidental, difficult to identify on cath

Bridge
- Rarely significant
- Narrowing greater in systole than diastole
- Sparing of atheromatosis
- Deeper bridging may be more significant (> 2.3mm below surface)
- Difficult to identify arteries during coronary artery bypass surgery

Right Coronary Bridge
Extracardiovascular Coronary Artery Termination

- Coronary artery termination on non-cardiac and non-vascular structures.
- Coronary artery may give off branch to supply extracardiac structure.
- Difficult to identify on CCT due to small caliber of vessels.
- May be normal connections between coronary vasculature and bronchial or other arterial systems. (Greenberg)
- Pathways may be accentuated in the presence of atherosclerosis when a significant pressure gradient is present between the two vascular systems. (Moberg)

Shepherd’s crook RCA:

- Usually an excessively tortuous RCA.
- The curvature makes catheterization and subsequent instrumentation somewhat difficult.
- There are classification systems, but the important details are the location of the “crook” and the acuity of the curvature.

SHEPHERD’S CROOK

Angioplasty and Stenting may be problematic
Coronary May Traverse Chambers

- Right coronary through the right atrium

Conclusion

- Important to be familiar with normal anatomy, variant anatomy, and nomenclature
- Some variants are clinical relevant while others are thought to be relatively benign
- Variants are often important in surgical or interventional planning
- CCTA reveals 3D relationships more readily than angiography

Resources