Coronary Anatomy and Normal Variants

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Objectives
- Understand and recognize normal and variant coronary artery anatomy.
- Understand coronary artery dominance.
- Understand coronary artery segmentation

Anatomy: Aortic Valve
- Semilunar valve
- Consists of an annulus, cusps, and commissures
- Posterior to each aortic valve cusp is an outpouching of the aorta referred to as an aortic sinus
- Coronary arteries arise from the aortic sinuses

Anatomy: Right Coronary Artery
- Arises from the right aortic sinus and travels in the right atrioventricular groove
- Branches:
  - Conus branch
  - SA nodal branch (60% of the time)
  - Acute marginal branches
  - Posterior descending artery (if right dominant)
  - Posterolateral branch (if right dominant)
  - AV nodal branch (if right dominant)

Anatomy: Left coronary artery
- Arises from the left aortic sinus and travels between the main pulmonary artery and left atrium
- Branches:
  - Left anterior descending artery
  - Circumflex artery

Understand coronary artery segmentation

Coronary arteries arise from the aortic outpouc
Posterior to each aortic valve cusp is an commissures
Consists of an annulus, cusps, and Semilunar valve
Arises from the right aortic sinus and travels Arises from the right aortic sinus and of the aorta referred to as an aortic sinuses
Coronary arteries arise from the aortic sinuses

Anatomy: Aortic Valve
- Aortic sinuses are named for the coronary artery that arises from it
  - Right aortic sinus
  - Left aortic sinus
  - Noncoronary aortic sinus

Anatomy: Right Coronary Artery
- Arises from the right aortic sinus and travels in the right atrioventricular groove
- Branches:
  - Conus branch
  - SA nodal branch (60% of the time)
  - Acute marginal branches
  - Posterior descending artery (if right dominant)
  - Posterolateral branch (if right dominant)
  - AV nodal branch (if right dominant)
Anatomy: Left anterior descending
- Travels in the anterior interventricular groove
- Branches:
  - Diagonal branches
  - Septal perforators

Anatomy: Circumflex
- Travels in the left atrioventricular groove
- Branches:
  - Oblique marginal branches
  - Posterior descending artery (in left dominance)
  - Posterolateral branch (in left dominance)

Coronary artery dominance
- Right coronary artery dominance
  - Posterior descending artery (PDA) and posterolateral branch (PLB) arise from the right coronary artery
- Left coronary artery dominance
  - PDA and PLB arise from the circumflex artery

Coronary artery dominance
- Codominance
  - Scenario 1: PDA arises from the RCA and the PLB arises from the circumflex
  - Scenario 2: There are two PDAs, one arising from the RCA and the other from the circumflex
  - AV nodal artery
    - Arises from the dominant coronary artery

Coronary artery segmentation
- Coronary artery segmentation separates coronary arteries into segments
  - For example, the LAD is segmented into proximal, mid and distal segments
- Segmentation of the coronary arteries is useful for description and communication of findings

Coronary artery segmentation
- American Heart Association segmentation was initially proposed in 1975, and adapted by the Society of Cardiovascular Computed Tomography into an axial based version for coronary artery CT
Coronary artery variant anatomy
- Multiple coronary ostia
- SA nodal branch
- Ramus intermedius
- Wraparound LAD
- Variant coronary course – Shepard’s crook
  RCA, myocardial bridge, intracavitary course
- Duplicated LAD
- High coronary artery origin

Variant Anatomy: Multiple Ostia
- Multiple coronary ostia
  - Right – occurs when the conus branch arises directly from the right aortic sinus rather than from the RCA
  - Left – occurs when there is no left main coronary artery present and the left anterior descending artery and circumflex arise from separate ostia from the left aortic sinus

Variant Anatomy: SA Nodal branch
- SA nodal branch
  - Arises from the right coronary 60% of the time
  - 40% of the time comes off the circumflex

Variant Anatomy: Ramus Intermedius
- This occurs when the left coronary trifurcates instead of bifurcates
- The third branch arising in between the LAD and the circumflex arteries is the ramus intermedius

Variant Anatomy: Wraparound LAD
- The LAD wraps around the apex of the heart and continues into the posterior interventricular groove

Variant Anatomy: Variant Course
- Shepard’s crook RCA
  - Tortuous course of the right coronary artery
- Myocardial Bridge
  - Coronary artery dives from the epicardial fat into the myocardium
- Intracavitary Course
  - Coronary artery courses through a cardiac chamber
Variant Anatomy: Duplicated LAD

- The left anterior descending artery is duplicated
- Multiple courses are possible

Variant Anatomy: High Coronary Artery Origin

- Rather than arising from the aortic sinus, the coronary artery arises above the level of the sinuses from a point off of the ascending aorta

Summary

- Knowledge of coronary anatomy and variant anatomy is important in localizing pathology and for the planning of potential interventions.
- SCCT coronary artery segmentation nomenclature is useful in the description and communication of coronary artery findings.

References

- Allen, H. et al. Moss and Adams’ Heart Disease in Infants, Children, and Adolescents: Including the Fetus and Young Adults.