Anatomical Assessment of the Aortic Arch: Relationship between Arch Anatomy and Age

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**Background**
- Octogenarians have been shown to be at increased risk of complications while undergoing carotid stenting.
- Risk is thought to be related to changes in Aortic Arch anatomy.

**Hypothesis**
- Aortic Arch anatomy will change with time in a manner which increases risk with carotid stenting.

**Objective**
- Perform an Evaluation of the Aortic Arch Anatomy with High-resolution MRA.
- Assess the Changes that Occur in the Aortic Arch with Aging

**Method**
- 350 consecutive patients undergoing CT or MR angiography of the aortic arch.
- Gadolinium-enhanced chest MRA (3T Scanner).
- Blinded analysis with Osirix Imaging Software.
- Data recorded.
- Congenital Arch Anomalies.
- Arch Type.
- Arch Radius of Curvature.
- Branch Vessel Angles and Diameters

**Results**

2. **Radius of Curvature**

- The arch conformation and the breadth of the arch can be quantified by placing an oscillating circle over the region of maximum curvature, then calculating the radius of this curvature.

3. **Arch type**

- Type I: 58%
- Type II: 24%
- Type III: 18%

4. **Results: Branch Vessel Angles**

- **<60ys**
  - Innominate: 61°
  - Left Common Carotid Artery (LCCA): 74°
  - Left Subclavian Artery (L SCA): 57°

- **>60yr**
  - Innominate: 52°
  - Left Common Carotid Artery (LCCA): 54°
  - Left Subclavian Artery (L SCA): 60°

5. **Age and Aortic Diameters**

- **ASC. DIAM.**
  - ASC. DIAM. = 1.39 + 0.012 Age, P<0.001

- **ASC. DIAM.**
  - ASC. DIAM. = 1.96 + 0.0185 Age, P<0.001

- **DESC. DIAM.**
  - DESC. DIAM. = 0.27

- **R**
  - R² = 0.25

6. **Multi-variable Analysis**

- **Hypercholesterolemia**
  - 0.968
- **Hypertension**
  - 0.050
- **Coronary artery disease**
  - 0.189
- **Cardiac Arrhythmia**
  - 0.124
- **Stroke**
  - 0.998
- **Peripheral arterial disease**
  - 0.716
- **Weight**
  - 0.028
- **Diabetes**
  - 0.908
- **Age**
  - <0.001
- **COPD**
  - 0.094

**Conclusion**

- High resolution MRA can provide objective quantification of morphologic changes occurring in the aortic arch with age.
- Patients aged >60yrs have increased tendency for complex aortic arch anatomy: increased type III arch, increased ROC and increased vessel angulation.
- These anatomic factors may relate to poorer outcomes in older patients undergoing endovascular interventions.

**Future directions**

- Evaluate force vectors throughout the arch to predict or explain the changes observed, and correlate with hemodynamic data (ie: HTN).
- Assess changes throughout different sections of arch (ie: are vessels tethered/fixed by arch vessels).
- Correlate arch anatomy to neurologic complications or procedural times.