Cardiac MRI
Anatomy Localization
2004
Disclaimers

- The information in this presentation is strictly educational and is not intended to be used for instruction as to the practice of medicine.

- Healthcare practitioners reading this presentation must use their own learning, training, and expertise in dealing with their individual patients.
CONTENTS

Cardiac Anatomy
- Location in Body
- Pulmonary & Systemic Circulation
- Gross Anatomy
- Electro Physiology
- Coronary Anatomy

Cardiac Localization
- Chambers & Great Vessels
- Valves
- Coronary Arteries
Cardiac Anatomy
Location in Body

Slightly Left of Midline
Halfway from Notch to Xyphoid
Cardiac Anatomy
Pulmonary & Systemic Circulation

- Pulmonary Circulation (Right Heart)
  - Removes metabolic waste products from lung

- Systemic Circulation (Left Heart)
  - Delivers oxygen and nutrients to body

- Circulating Blood Volume (Total)
  - 6-8% of body weight
  - Approx 6 liters/minute
Cardiac Anatomy
Pulmonary & Systemic Circulation

- Pulmonary artery
- Superior vena cava
- Inferior vena cava
- Pulmonary vein
- Aorta
- Systemic (Left Heart)
- Pulmonary (Right Heart)
Cardiac Anatomy
Basic Gross Anatomy

- Right Atrium
- Right Ventricle
- Left Atrium
- Left Ventricle
Cardiac Anatomy
Detailed Gross Anatomy
Cardiac Anatomy
Electro Physiology

Primary nerve fibers within heart that stimulate cardiac muscle:

- SinoAtrial Node (SA)
- AtrioVentricular Node (AV)
- Bundle of HIS
- Purkinje Fibers
Cardiac Anatomy
Coronary Anatomy

Coronary arteries supply heart muscle with oxygen-rich blood.

Left Coronary Artery (LCA)
- Left Anterior Descending (LAD)
- Circumflex Artery (RCX)

Right Coronary Artery (RCA)
Cardiac Anatomy
Coronary Anatomy (anterior views)

Right Coronary Artery

Left Coronary Artery
Cardiac Anatomy
Coronary Anatomy (side views)

Right Coronary Artery

Left Coronary Artery
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Cardiac Localization
- Chambers & Great Vessels
- Valves
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Cardiac Localization
Multi-Plane Scout

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SAG
Cardiac Localization
Pseudo 2-Chamber Vertical Long Axis

Preliminary localization:
1. Parallel to ventricular septum in transverse view
2. Bisect LV chamber
3. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Optimized 2-Chamber Vertical Long Axis

Optimal localization using the 3-Point Tool:

1. LV apex in 4 chamber view
2. Mid mitral valve in 4 chamber view
3. Mid LV chamber in short axis view
4. Parallel to ventricular septum
5. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy 2-Chamber Vertical Long Axis

Anterior Wall
Left Ventricle
Left Atrium
Mitral Valve
Posterior Wall
Cardiac Localization
Pseudo Short Axis

Preliminary localization:
1. Perpendicular to long axis on 2 chamber view
2. Cover from Base to Apex
3. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Optimized Short Axis

Optimal localization perpendicular to all 3 long axis views:

1. 4 chamber horizontal long axis
2. 3 chamber LV outflow tract
3. 2 chamber vertical long axis
4. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy Short Axis

- Right Ventricle
- Ventricular Septum
- Left Ventricle
- Left Ventricular Outflow Tract
- Papillary Muscles
Cardiac Localization
Optimized 4-Chamber Horizontal Long Axis

Optimal Localization:
1. Parallel to long axis in 2 chamber view
2. Through RV apex and mid LV chamber in short axis view (white arrow)
3. Avoid LV outflow tract in short axis view (orange arrow)
4. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy 4-Chamber Horizontal Long Axis

- Right Ventricle
- Right Atrium
- Tricuspid Valve
- Atrial Septum
- Ventricular Septum
- Left Ventricle
- Mitral Valve
- Left Atrium
Cardiac Localization
Optimized 3-Chamber Left Ventricular Outflow

Optimal Localization:
1. Parallel to long axis and through LV apex in two views
2. Bisect LV outflow tract in short axis view (orange arrow)
3. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy 3-Chamber Left Ventricular Outflow

- Ascending Aorta
- Aortic Valve
- Cordae Tendineae
- Left Atrium
- Mitral Valve
- Left Ventricle
Cardiac Localization
Optimized Aortic Outflow

Optimal Localization:
1. Position through LV outflow tract on 3-chamber view
2. Bisect aortic valve (red arrow)
3. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy Aortic Outflow

- Ascending Aorta
- Right Atrium
- Right Ventricle
- Pulmonary Artery
- Aortic Valve
- Papillary Muscle
- Left Ventricle
**Cardiac Localization**

**Optimized Right Ventricular Inflow**

**Optimal Localization:**

1. Position parallel to septum and through tricuspid valve in 4 chamber view
2. Bisect right ventricle RV outflow tract in short axis views (white arrow)
3. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy Right Ventricular Inflow

- Ascending Aorta
- Superior Vena Cava
- Right Atrium
- Tricuspid Valve
- Pulmonary Artery
- Pulmonary Valve
- Right Ventricle
- Posterior RV Wall
Cardiac Localization
Optimized Right Ventricular Outflow

Optimal Localization:
1. Position through pulmonary artery on transverse view (red arrow)
2. Bisect pulmonary valve on right ventricular inflow view (orange arrow)
3. Use large enough FOV to avoid wrap in phase direction
Cardiac Localization
Anatomy Right Ventricular Outflow
Cardiac Localization

Valves

Aortic Valve

Mitral Valve

Tricuspid Valve

Pulmonary Valve
Cardiac Localization
Aortic Valve

Position across aortic valve in LVOT & aortic views
Cardiac Localization
Anatomy Aortic Valve

- Right Ventricle
- Right Cusp
- RVOT
- Tricuspid Valve
- Comissure
- Right Atrium
- Left Cusp
- Posterior Cusp
- Aorta Descendens
- Left Atrium
- Comissure
Cardiac Localization
Mitral Valve

Position across mitral valve in 2-chamber, 3-chamber, & 4-chamber orthogonal views

Closed
Open
Cardiac Localization
Anatomy Mitral Valve

- Pulmonary Valve
- Anterior Leaflet
- Right Atrium
- Vena Cava Inferior
- Comissure
- Posterior Leaflet
Cardiac Localization
Tricuspid Valve

Position across tricuspid valve
in RV inflow and 4-chamber
orthogonal views
Cardiac Localization
Anatomy Tricuspid Valve

Right Leaflet

Tricuspid Valve Orifice

Posterior Leaflet

Mitral Valve

Left Leaflet
Cardiac Localization
Pulmonary Valve

Position across pulmonary valve in RVOT view
Cardiac Localization
Anatomy Pulmonary Valve

Ascending Aorta
Right Atrium
Left Atrium
Pulmonary Valve
Descending Aorta
1. Acquire a stack of 2D axial localizers from a coronal localizer.
2. Use 3-point tool (red x) to create slab orientation along RCA from base to apex.
3. Again Use 3-point tool to fine tune the location of the slab.
4. Resulting images should lay out RCA in-plane.
Cardiac Localization
Left Anterior Descending Artery (LAD)

1. Acquire a stack of 2D coronal localizers through aortic root.
2. Position axial oblique slab along LAD from its origin toward the apex.
3. Use 3-point tool to identify the origin and distal points along the LAD.
4. Resulting images should lay out LAD in-plane.
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