Cardiac CT Techniques in Neonates (and infants)

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Disclosures

• None
Objectives

• To describe technical aspects of cardiac CT for optimal image quality at low radiation dose

• Review practical tips to avoid pitfalls
Background

- Echocardiography
- CT Angiography
- MRI
Background

- CT Angiography
  - High spatial resolution
  - Accessible
  - No sedation!
  - No breath hold!
Trends in Cardiovascular CT

Monthly Imaging Trends at Texas Children's Hospital

- CT
- MRI
- Total Studies

Year | CT | MRI | Total Studies
---|---|---|---
2009 | 6 | 50 | 56
2010 | 20 | 52 | 72
2011 | 36 | 55 | 91
2012 | 40 | 48 | 88
2013 | 48 | 58 | 106
2014 | 56 | 56 | 112
2015 | 60 | 54 | 112
2016 | 68 | 56 | 124
2017 | 72 | 66 | 138
2018 | 84 | 65 | 149
Potential/Perceived Detractors of CTA

- Radiation
- Post-processing
- Need support team for a successful program
CTA Protocol Considerations

Individualization

- Patient
- Indication
CTA Protocol Considerations

- ECG Gating
- Sedation
- Contrast
- Helical vs. Volumetric
- Breath Hold
- kV, mA
- IV Access
CTA Protocol: ECG Gating

- Prospective
CTA Protocol: ECG Gating

- Prospective
ECG Gating: Target mode

40% Target mode prospective gating without padding

75% Conventional prospective gating with padding
CTA Protocol: ECG Gating

- Retrospective - some coronary imaging
CTA Protocol: IV Access

- Peripheral IV
- Gauge
- Location
  - Lower extremity
  - Right>Left upper
- Power (pressure) injector
- Saline test bolus
CTA Protocol: Contrast

- Non-ionic, iodinated
- Saline flush
- Volume of contrast
  - Weight-based
  - Typically 1.5-2.5 mL/kg
- Rate
CTA Protocol: Coverage

- 320 Detector allows 16cm Z-axis coverage
- 0.35-0.50 Seconds / gantry rotation
CTA Protocol: Sedation

• Dependent on:
  • Scan time
  • Indication
  • Anesthesia availability

http://www.texaschildrensblog.org
CTA Protocol: Bolus Timing

- Automated
  - Bolus Tracking
- Manual
  - Visual
CTA Protocol: Radiation Dose Parameters

- ALARA, Image Gently
- kV, mA
- Indication based
- New generation scanners
- Iterative reconstruction

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Images courtesy of Dr. Prakash Masand

CT Denoising with AIDR
CTA Indications: Anatomy

- Pulmonary arteries
- Vascular ring/sling
- Pulmonary veins
- Aorta
- Stent / conduit / shunt / LVAD
- Systemic veins
- Coronary arteries

3D printing
CTA Indications: Function

- Dynamic:
  - Airway
  - Pulmonary vein stenosis
CTA Indications: Function

- Dynamic:
  - Airway
  - Pulmonary veins
CTA Indications: Other

• Contraindication to MRI
  • Pacemaker
  • Renal failure
Take home points

- Cardiac CTA in pediatric CHD:
  - Volume is increasing
  - Provides surgical roadmap
- Newer generation scanners allow dose reduction
- Individualized approach
- Support team is critical
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