Patient preparation and coronary CTA techniques

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Overview

1. Patient preparation
2. Scanning techniques
Patient preparation

- Preparation related to any contrast CT examination
- Preparation specific to coronary CTA
Exclude contraindications

- Patient safety
- Study quality
Contraindications: patient safety

- Contrast
  - renal insufficiency
  - allergy (anaphylaxis)
- Radiation
  - pregnancy
  - radiation dose/age
- Claustrophobia
- Medically unstable
Contraindications: patient safety

- **Contrast**
- **renal insufficiency**

<table>
<thead>
<tr>
<th>GFR (ml/min/1.73 m²)</th>
<th>Risk of contrast induced nephrotoxicity</th>
<th>Intravenous iodinated contrast media</th>
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- Contrast
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**Methods to protect against contrast induced nephropathy**

- Non-ionic contrast agents
- IV saline before and after exam [1]
- Acetylcysteine [2]
- Hemodialysis [3]
Contraindications: patient safety

- Radiation
- pregnancy
- radiation dose/age
Contraindications: patient safety

- Claustrophobia
- Diazepam 5 mg oral*
- Medically unstable

*Dose adjustment needed specific conditions
Contraindications: study quality

- Motion
  - Breath hold
  - Gating
- Artifact
  - Inability to raise arms
- Metal
- Obesity
Contraindications: study quality

- Motion
- Breath hold (7-12 sec @ 64 slice)
- 270 ms acquisition dual source
Contraindications: study quality

- Motion
- Gating
- atrial fibrillation or frequent PVCs
Contraindications: study quality

- Artifact
- Inability to raise arms
- Metal
- Obesity
The ideal patient

- HR < 65, sinus
- Calm
- Thin
- Large veins
- Pearl diver (able to hold breath)
- Able to follow commands
Preparation: 24-1 hr pre-exam

- No caffeine (24 hrs)
- No viagra (24 hrs)
- No “energy supplement” (24 hrs)
- No food (4 hrs)
- No liquid (1 hr)
Cardiac medications should not be suspended!

Preparation: 24-1 hr pre-exam
Non-anaphylactic contrast reaction

- 50 mg prednisone @ 13, 7, 1 hrs before exam
- Oral Benadryl 1 hour before exam
Preparation: 1 hr pre-exam

- IV access
- 18 - 20 gauge needle
- Right arm
Preparation: 1 hr pre-exam

Satisfactory IV access
Contraindications excluded / mitigated

Proceed to HR control
Preparation: 1 hr pre-exam
Satisfactory IV access
Contraindications excluded / mitigated

Proceed to HR control
Preparation: 1 hr pre-exam

**Oral metoprolol (50 mg tabs)**
- 50-100 mg
- Wait 90 minutes, check BP/HR
- Consider additional 50 mg

**IV metoprolol (5 mg)**
- Give 5 mg IVP
- Wait 20 minutes, check BP/HR
- Consider additional 5 mg x 2

**Contraindications**
- Metoprolol allergy
- Bronchospastic disease (asthma)
- Aortic valve disease
- Worsening heart failure
- Heart block
**Preparation:** 1 hr pre-exam

<table>
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<tr>
<th>CLINICAL SETTING</th>
<th>ASSESSMENT</th>
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<tr>
<td>emergency department</td>
<td>assume safe to administer beta blockers if negative chart review/interview</td>
</tr>
<tr>
<td>outpatient</td>
<td>patient is taking beta blockers</td>
</tr>
<tr>
<td>inpatient</td>
<td>referring clinician denies contraindication</td>
</tr>
<tr>
<td></td>
<td>ask team to administer beta blockers</td>
</tr>
</tbody>
</table>
Preparation: 1 hr pre-exam

Beta blocker contraindication?
Consider oral Verapamil
Preparation: 1 hr pre-exam

HR < 65 bpm

Proceed to Ca++ score
Examination: patient positioning

- Center heart in scanner
Examination: patient positioning

- Center heart in scanner = Lowest noise
Examination: patient positioning

- Center heart in scanner

= Lowest noise
Examination: Ca++ score
Examination: Ca++ score

Voxels are 3 x 1.3 x 1.3 mm non-overlapping

Threshold of 130 H.U.

Agatston volume mass score
Examination: Ca++ score

= 0 - CAD unlikely

> 400-1000 - high risk of stenosis

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<tr>
<th>Ca++ Score</th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tr>
<td>&gt;1</td>
<td>92%</td>
<td>75%</td>
</tr>
<tr>
<td>&gt;100</td>
<td>73%</td>
<td>90%</td>
</tr>
<tr>
<td>&gt;1000</td>
<td>30%</td>
<td>98%</td>
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Low false negative
No false positive
Low sensitivity on CTA
Examination: Ca++ score

0 < Agatston score < 400-1000

Proceed to CTA planning
Examination: gating

Retrospective
- no modulation
- with modulation

Prospective
Rate < 70
no function
no calcium
Age < 40

Rate > 70
function
calcium
Age > 40

A-fib

Prospective

Retrospective
Modulation

Retrospective
No modulation
Examination: CTA coverage

Coronary CTA coverage (retrospective)

Ca++ score coverage

Top slice with CA

Bottom slice with CA
Examination: CTA coverage

Coronary CTA coverage (prospective)
Ca++ score coverage
Examination: dose

- Set kVp and MAS.
- Automatic exposure control
  - set desired held soon in its standard deviation
  - set upper and lower limits to avoid spikes in current due to hardware
- Weight table
Examination: dose

<table>
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<th>Body Weight (KG)</th>
<th>Tube Current (MA)</th>
<th>Tube Voltage (KVP)</th>
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<td>225</td>
<td>120</td>
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<td>250</td>
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</tr>
<tr>
<td>75-80</td>
<td>400</td>
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Participate in dose related QA
Examination: contrast

- 80 ml, 5 ml/s: 100%
- 40 ml, 4 ml/s: 40% (60%)
- 50 ml, 4 ml/s: 100%
Examination: nitroglycerin

Contraindications
- Head trauma/bleed
- Systolic BP < 100
- Nitrate Allergy
- Phosphodiesterase inhibitors

Adverse
- Headaches - 50%
Examination: nitroglycerin

4 minutes
Examination: nitroglycerin

4 minutes elapsed

Proceed to CTA scanning
Examination: scanning
Examination: reconstruction

Main reconstruction for 3D station

Thin section (0.625 mm) axial cardiac kernal
< 32cm FOV
50% overlap
Examination: reconstruction

Additional reconstruction for 2D station

- Axial 2.5 mm, lung kernel, lung FOV
- Axial 2.5 mm, body kernel, body FOV
- Coronal/sagittal, body kernel
Conclusions

- Exclude contraindications related to patient safety or exam quality
- Ensure proper patient preparation for contrast exam
- Control heart rate with beta blocker
- Calcium scoring is used to plan CTA or terminate exam
- Scanner gating is one of the most effective ways to reduce dose
- Utilize automatic exposure control when possible
Thank you