Cardiac CTA
ED Patient with Chest Pain

Scan Protocol: Chest Pain Protocol w/ Calcium Score
For patients with weight over 250lbs: Use Chest Pain Protocol w/ Calcium Score - Large

ACQUISITION- Broad Beam

Non Contrast Scan-Calcium Score

<table>
<thead>
<tr>
<th>Patient Position</th>
<th>Supine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet First into Gantry</td>
</tr>
<tr>
<td></td>
<td>Heart Isocenter</td>
</tr>
<tr>
<td>Scanogram</td>
<td>AP and Lateral</td>
</tr>
<tr>
<td>Contrast</td>
<td>None</td>
</tr>
<tr>
<td>Injection Rate</td>
<td>None</td>
</tr>
<tr>
<td>Respiration</td>
<td>Breath Hold</td>
</tr>
<tr>
<td>Acquisition Spec</td>
<td>0.5 Thickness</td>
</tr>
<tr>
<td></td>
<td>0.35 Rotation</td>
</tr>
<tr>
<td></td>
<td>ECG Prospectively</td>
</tr>
<tr>
<td></td>
<td>Triggered</td>
</tr>
<tr>
<td></td>
<td>% Determined by HR</td>
</tr>
<tr>
<td>MA</td>
<td>300</td>
</tr>
<tr>
<td>kvp</td>
<td>120</td>
</tr>
</tbody>
</table>

Place and size scan over chest to include carina through bottom of heart
Broad beam max length - 16 cm
May be reduced by increments of 2 cm

ECG electrode placement as shown.
Exposure for single cardiac cycle.
Images reconstructed for single cardiac phase.
Data not available for multi-phase reconstruction.
Heart rates 30 – 70 bpm, image reconstruction programed at 75%.
Heart rate 71 – 180 bpm, image reconstruction programed at 40%.
Post processing done at workstation. See instructions below on page 2.
RECONSTRUCTION- Volumes and Images

Images from Volume 1

<table>
<thead>
<tr>
<th></th>
<th>Algorithm</th>
<th>Cardiac Ca Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Thickness</td>
<td>3 mm</td>
</tr>
<tr>
<td></td>
<td>Spacing</td>
<td>3 mm</td>
</tr>
<tr>
<td></td>
<td>FOV</td>
<td>220 mm</td>
</tr>
<tr>
<td></td>
<td>Transfer</td>
<td>ON- PACS and PCS_TS</td>
</tr>
</tbody>
</table>

Volume 2

<table>
<thead>
<tr>
<th></th>
<th>Algorithm</th>
<th>Cardiac Ca Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>Thickness</td>
<td>1 mm</td>
</tr>
<tr>
<td></td>
<td>Spacing</td>
<td>1 mm</td>
</tr>
<tr>
<td></td>
<td>FOV</td>
<td>320 mm</td>
</tr>
<tr>
<td></td>
<td>Transfer</td>
<td>OFF</td>
</tr>
</tbody>
</table>

Images from Volume 2

<table>
<thead>
<tr>
<th></th>
<th>Algorithm</th>
<th>Cardiac Ca Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A3</td>
<td>Thickness</td>
<td>3 mm</td>
</tr>
<tr>
<td></td>
<td>Spacing</td>
<td>3 mm</td>
</tr>
<tr>
<td></td>
<td>FOV</td>
<td>320 mm</td>
</tr>
<tr>
<td></td>
<td>Transfer</td>
<td>ON- PACS and PCS_TS</td>
</tr>
</tbody>
</table>

GENERATION OF CALCIUM SCORE AT THE WORKSTATION

Open the patient folder in the directory.
Click on the series ―CALCIUM SCORE Cardiac Ca Score‖. This series will have 54 images.
Click ―Load Volume‖.
In the Gallery tab click ―Pick‖ button on ―2D Vscore with Color‖.
Click on the appropriate vessel name in the left column. Use the cursor to circle calcium for each coronary vessel. Repeat this process for each axial slice of the scan.
When all calcium is identified, click on ―Snap‖. Left click to create snapshot.
Proceed to Report tab.
Send all graphs and snapshots to PACS by clicking ―Export‖ and ―Archive‖.
ACQUISITION - Broad Beam
Contrast Scan - Coronary Arteries

| Patient Position | Supine  
Feet First into Gantry  
Heart Isocenter |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanogram</td>
<td>AP and Lateral</td>
</tr>
</tbody>
</table>
| Contrast         | Visipaque 320  
Saline amount equal to contrast amount  
See weight chart |
| Injection Rate   | 5 ml / sec preferred |
| IV Size          | 18g, 20g minimum |
| Location         | RT AC preferred |
| Respiration      | Breath Hold |
| Acquisition Specs | 0.5 Thickness  
0.35 Rotation  
ECG Gated Scan |
| Dose Modulation  | None  
Turn dose modulation off by selecting CTA/CFA Cont. |
| mA               | See weight chart  
120 |
| kvp              | 120 |
| Place and size scan over chest to include carina through bottom of heart  
Scan max length - 16 cm  
May be reduced by increments of 2 cm |

Chest Pain Protocol w/ Calcium Score - Large
Use for patients with weight > 250lbs

<table>
<thead>
<tr>
<th>kvp</th>
<th>135</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma</td>
<td>510</td>
</tr>
<tr>
<td>Algorithm Smooth</td>
<td>Rotation 0.4</td>
</tr>
</tbody>
</table>

S & V slice (monitoring position) is set in the center of the scan.  
Sure Start ROI should be set on the descending aorta.  
Sure Start trigger is 200 HU.

This is a retrospectively gated scan.  
The entire R – R interval is exposed over one or more beats.  
Functional analysis data is available with this scan.  
Functional analysis data is automatically reconstructed in this protocol.
Patient weight based contrast chart

<table>
<thead>
<tr>
<th>Kilograms</th>
<th>Pounds</th>
<th>Visipaque 320</th>
<th>Saline</th>
<th>mA</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 55 kg</td>
<td>&lt; 120 lb</td>
<td>60</td>
<td>60</td>
<td>400</td>
<td>120</td>
</tr>
<tr>
<td>55 - 68 kg</td>
<td>120 - 150 lb</td>
<td>70</td>
<td>70</td>
<td>450</td>
<td>120</td>
</tr>
<tr>
<td>68 - 100 kg</td>
<td>150 - 200 lb</td>
<td>80</td>
<td>80</td>
<td>500</td>
<td>120</td>
</tr>
<tr>
<td>100 - 127 kg</td>
<td>200 - 250 lb</td>
<td>90</td>
<td>90</td>
<td>580</td>
<td>120</td>
</tr>
<tr>
<td>&gt;250</td>
<td></td>
<td>90</td>
<td>90</td>
<td>510</td>
<td>135</td>
</tr>
</tbody>
</table>

**RECONSTRUCTION- Volumes and Images**

<table>
<thead>
<tr>
<th>Images from Volume 1</th>
<th>Volume 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1 Algorithm</td>
<td>Cardiac CTA</td>
</tr>
<tr>
<td>Thickness</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>Spacing</td>
<td>0.25 mm</td>
</tr>
<tr>
<td>FOV</td>
<td>220 mm</td>
</tr>
<tr>
<td>Phase</td>
<td>70%, 72%, 76%, 78%</td>
</tr>
<tr>
<td>Transfer</td>
<td>ON- PCS_TS only</td>
</tr>
</tbody>
</table>

| A2 Algorithm          | Cardiac CTA |
| Thickness             | 1 mm        |
| Spacing               | 1 mm        |
| FOV                   | 320 mm      |
| Transfer              | OFF         |

<table>
<thead>
<tr>
<th>Images from Volume 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A3 Algorithm</td>
<td>Cardiac CTA</td>
</tr>
<tr>
<td>Thickness</td>
<td>5 mm</td>
</tr>
<tr>
<td>Spacing</td>
<td>5 mm</td>
</tr>
<tr>
<td>FOV</td>
<td>320 mm</td>
</tr>
<tr>
<td>Series Description</td>
<td>Large dfov</td>
</tr>
<tr>
<td>Transfer</td>
<td>ON- PACS and PCS_TS</td>
</tr>
<tr>
<td>Phase</td>
<td>80%</td>
</tr>
</tbody>
</table>

A1  220 dfov

A2, A3  320dfov
CARDIAC CTA IMAGE RECONSTRUCTION

Reminder: Send ECG and Exposure Screen Saves to PACS and PCS_TS

1. Reconstruction for Calcium Score—Large dfov

Click on Raw Data. Click on Patient. Select the calcium score non-contrast volume series for reconstruction. Click “OK”.

Volume Tab
- Slice thickness: 1.0
- Interval: 1.0
- Size: 320
- Transfer: OFF

Multi View Tab
- Axial
  - Slice thickness: 3.0
  - Interval: 3.0
  - Series description: Large dfov
- Transfer: ON - PACS and PCS_TS

Click "Reconstruction”. Close out of Raw Data.

2. Generating Calcium Score on the Workstation

Open the patient folder in the directory. Click on the series “CALCIUM SCORE Cardiac Ca Score”. This series will have 54 images.

Click “Load Volume”. In the Gallery tab click “Pick” button on “2D Vscore with Color”.

Click on the appropriate vessel name in the left column. Use the cursor to circle calcium for each coronary vessel. Repeat this process for each axial slice of the scan.

When all calcium is identified, click on “Snap”. Left click to create snapshot. Proceed to Report tab. Send all graphs and snapshots to PACS by clicking “Export” and “Archive” / “PACS”.

3. Reconstruction for Coronary Vessels

Click on Raw Data. Click on Patient. Select contrast volume series for reconstruction. Click “OK”.

Click “ECG Edit”. Check ECG for accurate R wave indicators. Modify as needed.

Click on “ECG Save”, Click “Save” Send this to PACS.

Click “Close”.

Transfer: ON - PCS_TS
Phases: 72%, 74%, 76%, 78% Type in individually.
4. **Reconstruction for Large dfov**

**Volume Tab**
- Slice thickness: 1.0
- Interval: 1.0
- Size: 320
- **Transfer**: OFF
- Reconstruction phase: 80%

**Multi View Tab**
- Axial
  - Slice thickness: 5.0
  - Interval: 5.0
  - Series description: Large dfov
  - **Transfer**: ON - PACS and PCS_TS

Click "Reconstruction". Close out of Raw Data.

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**CARDIAC CTA IMAGE RECONSTRUCTION** - ImageXact

**Reminder:** Send ECG and Exposure Screen Saves to PACS and PCS_TS

**Reconstruction for Coronary Vessels**

Click on Raw Data. Click on Patient.

Select contrast volume series for reconstruction. Click “OK”.
- Click “ECG Edit”.
- Check ECG for accurate R wave indicators.
- Modify as needed.
- Click on “ECG Save”, Click “Save”

**Send this to PACS**.
- Click “Close”.

Click on ImageXact

**Main Tab:**
No changes

**Detail Tab:**
- Reconstruction: "Cardiac CTA”.
- Phase Interval: 2%

Select one slice location that best demonstrates the three main coronary arteries. (About mid-heart).
- Click "Next".

This slice will be reconstructed at 2% intervals. 50 images.
Review these images to find the % that best demonstrates the coronary arteries.
Reconstruct a minimum of 3 phases - One for each major coronary artery: LAD, RCA, and Cx.
Clicking "Select Phase" will enter these in the reconstruction list.
- Click "Next".

**Transfer ON - PCS_TS**
Click “Reconstruction”.
Patient Flow Protocol for ED Patient with Chest Pain

Patient must meet stated criteria for Cardiac CTA

- Patient with chest pain felt to be low to intermediate pretest likelihood of having coronary ischemia as a cause of their chest pain
- No increased cardiac enzymes
- No acute EKG changes
- No arrhythmia
- Creatinine level < 1.8.
- **IV access:**
  - 18g preferred, 20g min
- Order of location preference:
  - Right AC
  - Right mid forearm
  - Left AC
  - Left mid forearm
- All other locations are unacceptable for contrast bolus delivery.
- Other lines or catheters must be approved by the Cardiac Imaging Team or the radiologist/resident on call.

Contraindications for Cardiac CTA

- Inability to hold breath or cooperate
- Cardiac CTA performed within the last year
- Pregnancy
- History of severe contrast reaction
- Arrhythmia
- Renal insufficiency
- Multiple myeloma
- Sickle cell anemia
- Pheochromocytoma

Emergency Department will place order in the proper ordering system

Emergency Department will contact CT charge technologist by phone

The ED will verify that the patient meets the criteria listed above and provide the following:
- Patient Name
- MR Number
- Age
- Sex
- History
- Heart Rate
- IV access location and size
- Serum Creatinine level

CT will verify the availability of the AquilionONE or the Aquilion 64.
For the Technologist

For signed contrast order and protocol:

Monday through Friday:
- 0800 - 1600 hrs- CT charge technologist will contact the Cardiac Imaging Team.
- 1600 - 0800 hrs- CT charge technologist will contact the resident on call.

Friday through Monday:
- Friday 1600hrs – Monday 0800hrs- CT technologist will contact the resident on call.

Emergency Department will administer 100mg oral beta blocker

- The ED will report to CT the time that the beta blocker was given.
- The Cardiac CTA should be done 1 hour after the patient receives oral beta blocker.
- The CT charge tech will give transport instructions.

For the Technologist and the Radiologist

- The calcium score will be generated by the technologist on the Vitrea workstation.
- The score chart and snapshots of the graphs will be transferred to PACS.
- For calcium score values above 600, the technologist will alert the cardiac team Mon – Fri, 0800 - 1600 hrs, or the radiology resident on call during all other hours.
- For calcium score values above 600, no contrast scan will be completed.
- The cardiac team or the resident on call will be responsible for notifying the ED of the order change.
- For calcium score values below 600, the contrast scan will be completed and the patient returned to the ED.
- The calcium score will be reported to the ED by the cardiac team or the radiology resident on call as per the reporting method declared below.

Results will be reported

Monday – Friday, 0800 – 1600 hrs 1 hour: full report available

Monday – Friday, 1600 – 0800 hrs 1 hour: preliminary report with calcium score*  
After 0800: full report available**

Friday 1600 hrs – Monday 0800 hrs 1 hour: preliminary report with calcium score*  
After 0800 Monday: full report available**

* The preliminary report document named “After Hours Cardiac CTA Preliminary Report” will contain the calcium score and will be faxed to the ED.
** For full report see hospital reporting system.

Appropriate Indications for Cardiac CTA

- Chest pain in low to intermediate risk patient
- Chest pain in low to intermediate risk patient with borderline or mildly abnormal ETT
- Patient with possible coronary anomaly
- Patient with need for definition of anatomy prior to EP ablation
- Patient with need for definition of anatomy prior to surgery