



The ONE Guides

***Aquilion ONE***

**Pediatric Protocols**

# Aquilion ONE



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## Introduction



Over the last decade, CT has become a widely used imaging modality for a variety of pediatric examinations. However, there are many differences between children and adults that make pediatric imaging a uniquely challenging endeavor. Anatomical differences such as lower bone density, smaller vessels, and significantly less fat surrounding organs result in different image quality requirements. Dynamic factors such as high heart rates, difficulty in breath-holding, and crying during the examination can also make imaging a challenge. Children also face a greater risk from medical radiation as compared to adults because growing children's cells are more sensitive to radiation damage.

It is important to balance the potential risks of a CT examination against the expected clinical benefits. The dose used in a given examination must be high enough to ensure sufficient image quality to answer the clinical question but as low as possible to minimize the risk to the patient. This approach is known as the ALARA (as low as reasonably achievable) principle.

The most effective method for dose reduction in pediatric patients is to limit the scans to only those that are appropriate. Furthermore, it is important to limit scanning to the target area. In most pediatric examinations, only one imaging phase is needed to obtain sufficient clinical information.

In order to ensure the appropriate radiation dose in each individual patient, automated exposure modulation software such as <sup>SURE</sup> Exposure measures the size and attenuation of the

patient and adjusts the radiation dose to obtain the required level of image quality. Using an automatic, individualized protocol ensures that a uniform level of image quality can be maintained in every patient at the lowest possible dose. Each of these protocols is further refined based on patient weight, with slightly different noise targets and upper and lower mA limits.

The Aquilion ONE scanner, with its wide 16 cm coverage, allows many pediatric chest or abdomen scans to be performed in just one rotation without moving the patient couch. Since this eliminates the need for helical overlap and over-scanning, the radiation dose is reduced in most pediatric cases with no loss of image quality.

However, radiation is not the only risk to pediatric patients undergoing a CT examination. It is often necessary to sedate children to minimize motion and obtain an adequate study. One US survey concerning the use of sedation in pediatric imaging reported that some form of light or deep sedation is employed in more than 55% of all pediatric CT examinations\*. Sedation is not without risk and complications. In order to minimize the risk to pediatric patients, it is necessary not only to reduce the radiation dose but also to minimize the need for sedation. Single-rotation volume scanning with Aquilion ONE can greatly reduce and possibly eliminate the need for sedation because data acquisition can be completed in as little as 0.35 seconds, which virtually eliminates the effects of patient motion during scanning.

Finally, thanks to the significant dose reduction possible with Aquilion ONE, the overall acute and long-term risk to patients from CT examinations is minimized.

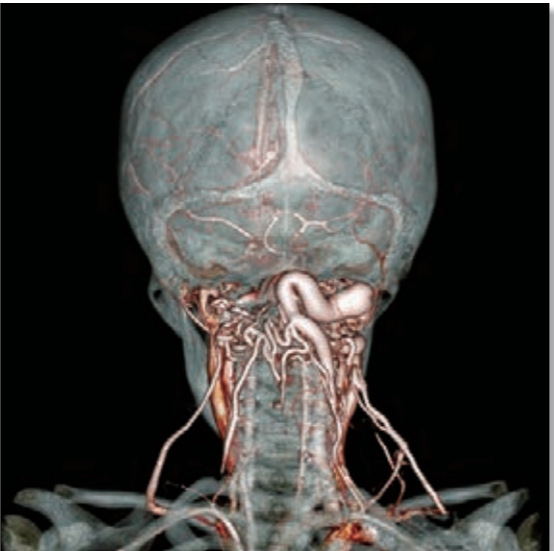
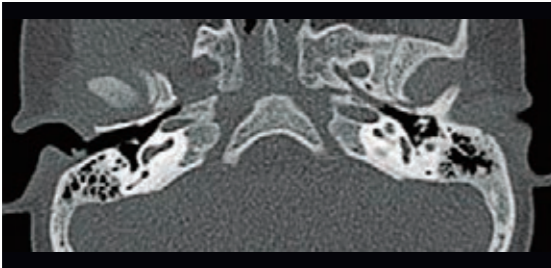
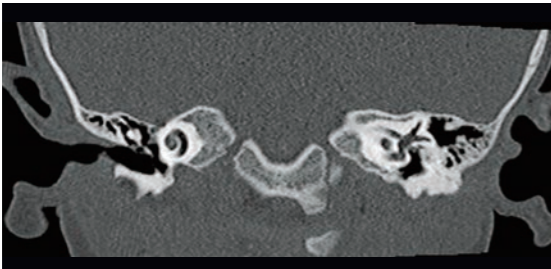
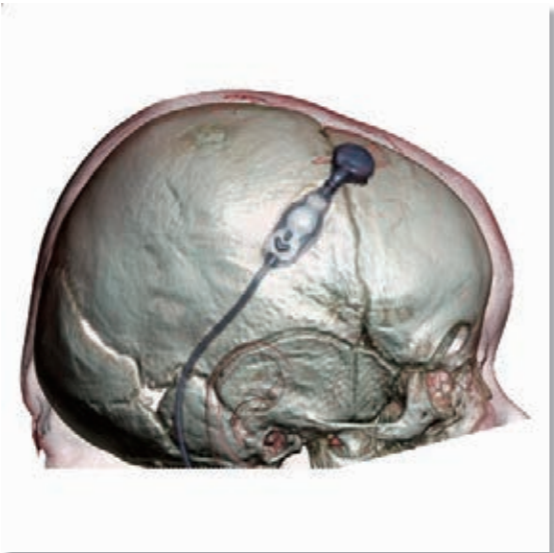
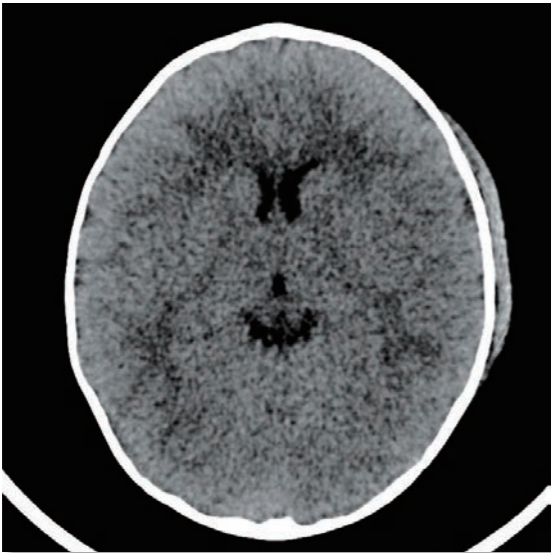
These protocols provide a guide for performing pediatric examinations with Aquilion ONE while adhering to the ALARA principle and ensuring acceptable image quality for a wide range of pediatric examinations.

\* Cravero J, Blike G, Beach M, et al, Pediatric Sedation Research Consortium. 2006, Incidence and Nature of adverse events during pediatric sedation/anesthesia for procedures outside the operating room: report from the Pediatric Sedation Research Consortium. Pediatrics: 118(3:1087-96)

Mather R, Aquilion ONE: Pediatric Imaging, White Paper, 2009



CT Head & Neck



CT Head & Neck - Brain

Patient Positioning:

Supine, Head First  
Wrap infant in blanket, use head straps on child

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	kV	mA	Rotation Time
Brain Infant 0-2 yrs	Volume	0.5 mm	100	350	0.5 s
Brain Child 3-5 yrs	Volume	0.5 mm	120	400	0.5 s
Brain Child 6-12 yrs	Volume	0.5 mm	120	400	0.75 s

Scan Range:

Start	1 cm below base of skull
End	Above vertex
Plane	Parallel to OM baseline or to avoid the eyes

Image Reconstruction:

Volume	Pediatric Brain
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Reformatting:

Multiview	Axial	Coronal	Sagittal
Start	Inferior	Anterior	Left
End	Superior	Posterior	Right
Slice Thickness	5 mm	5 mm	5 mm
Spacing	5 mm	5 mm	5 mm

Comments:

IAC reformations can be generated with this protocol.

CT Head & Neck - IAC

Patient Positioning:

Supine, Head First  
Wrap infant in blanket, use head straps on child

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	kV	mA	Rotation Time
IAC Child	Volume	0.5 mm	100	150	0.5 s

Scan Range:

Start	Below mastoid tip
End	Above superior mastoid air cells
Plane	Parallel to OM baseline

Image Reconstruction:

Volume 0.5SR	Bone Sharp
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Reformatting:

Multiview	Axial	Coronal
Start	Inferior	Anterior
End	Superior	Posterior
Slice Thickness	0.5 mm	0.5 mm
Spacing	0.5 mm	0.5 mm

CT Head & Neck - Sinuses

Patient Positioning:

Supine, Head First  
Wrap infant in blanket, use head straps on child

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	kV	mA	Rotation Time
Sinuses Child	Volume	0.5 mm	100	100	0.5 s

Scan Range:

Start	Below maxillary sinuses
End	Above frontal sinuses
Plane	Parallel to hard palate

Image Reconstruction:

Volume	Bone Sharp
Volume	Pediatric Body

Reformatting:

Multiview	Axial	Coronal
Start	Inferior	Anterior
End	Superior	Posterior
Slice Thickness	1 mm	1 mm
Spacing	1 mm	1 mm

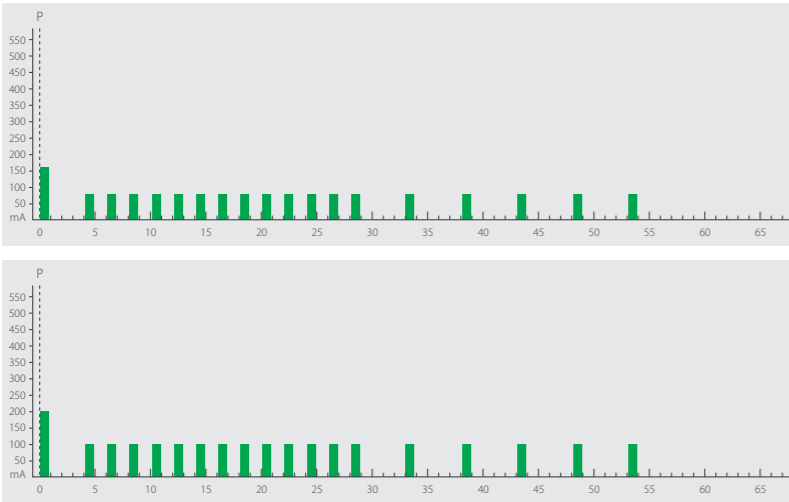
If the patient is not straight, manual reformatting may need to be performed to ensure correct anatomical position.

CT Head & Neck - 4D Brain Perfusion

Patient Positioning:

Supine, Head First  
Wrap infant in blanket, use head straps on child

Scan Protocol:



Neuro ONE Brain Perfusion Infant

Neuro ONE Brain Perfusion Child

Scan Range:

Start	1 cm below base of skull
End	Above vertex
Plane	Parallel to OM baseline or to avoid the eyes

Note: We recommend referring to our Aquilion ONE 4D Neurological Imaging Guide for detailed instructions for performing these studies.

Contrast:

Single-phase contrast injection protocol

Phase 1	30 mL @ 3 mL/s
Phase 2 (Saline)	30 mL @ 3 mL/s

Based on a concentration of 300 mgI/mL

Image Reconstruction:

Volume	4D CBP
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CT Head & Neck / Cervical Spine

Patient Positioning:

Supine, Head First

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	Pitch	kV	mA	Rotation Time
Neck Child <15 kg	Volume	0.5 mm	n/a	80	<sup>SURE</sup> Exposure <15 kg (Neck)	0.35 s
Neck Child 15-30 kg	Volume	0.5 mm	n/a	100	<sup>SURE</sup> Exposure 15-30 kg (Neck)	0.35 s
Neck Child 31-45 kg	Helical	0.5 mm	Detail	100	<sup>SURE</sup> Exposure 31-45 kg (Neck)	0.5 s
Neck Child 46-60 kg	Helical	0.5 mm	Detail	120	<sup>SURE</sup> Exposure 46-60 kg (Neck)	0.5 s
Neck Child >60 kg	Helical	0.5 mm	Detail	120	<sup>SURE</sup> Exposure >60 kg (Neck)	0.5 s

Scan Range:

Start	Above pituitary fossa
End	Aortic arch
Plane	Straight gantry

Contrast:

Volume	2 mL/kg
Delay	30 s

Based on a concentration of 300 mgI/mL

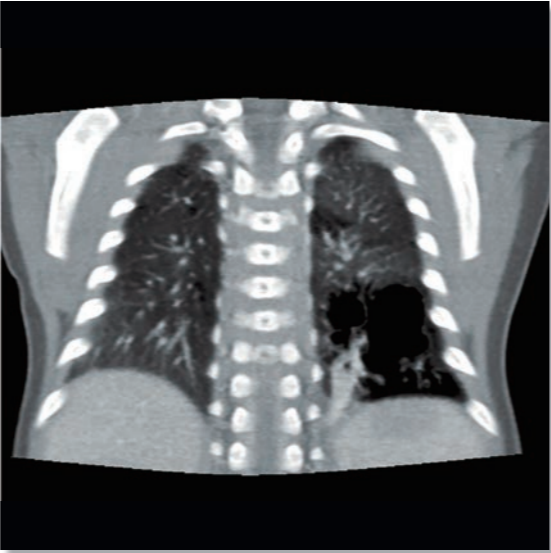
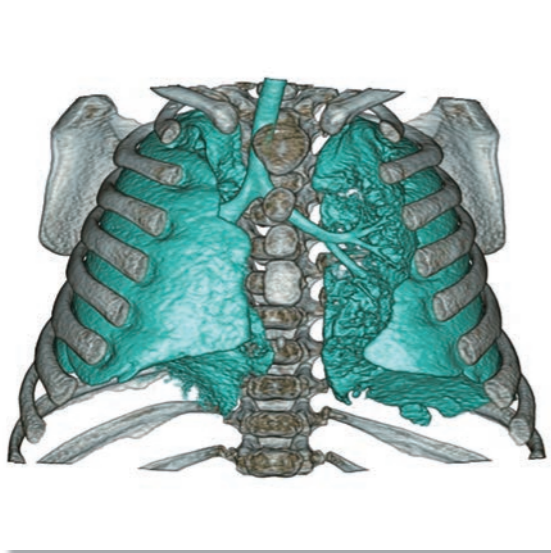
Image Reconstruction:

Volume	Pediatric Neck
Volume	Bone Sharp

Reformatting:

Multiview	Axial	Coronal	Sagittal
Start	Superior	Anterior	Left
End	Inferior	Posterior	Right
Slice Thickness	2 mm	2 mm	2 mm
Spacing	2 mm	2 mm	2 mm

CT Body



CT Body - Chest

Patient Positioning:

Supine, Feet First  
Arms above head

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	Pitch	kV	mA	Rotation Time
Chest Infant <15 kg	Volume	0.5 mm	n/a	80	<sup>SURE</sup> Exposure <15 kg	0.35 s
Chest Child 15-30 kg	Volume	0.5 mm	n/a	100	<sup>SURE</sup> Exposure 15-30 kg	0.35 s
Chest Child 31-45 kg	Helical	0.5 mm	Standard	100	<sup>SURE</sup> Exposure 31-45 kg	0.5 s
Chest Child 46-60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure 46-60 kg	0.5 s
Chest Child >60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure >60 kg	0.5 s

Scan Range:

Start	Above lung apices
End	Below adrenal glands
Plane	Straight gantry

Contrast:

Volume	2 mL/kg
Delay	30 s

Based on a concentration of 300 mgI/mL

Image Reconstruction:

Volume	Pediatric Body
Volume	Pediatric Lung

Reformatting:

Multiview	Axial	Coronal
Start	Superior	Anterior
End	Inferior	Posterior
Slice Thickness	3 mm (2 mm <15 kg)	3 mm (2 mm <15 kg)
Spacing	3 mm (2 mm <15 kg)	3 mm (2 mm <15 kg)

CT Body - High-Resolution Chest

Patient Positioning:

Supine, Feet First  
Arms above head

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	Pitch	kV	mA	Rotation Time
Chest Infant <15 kg	Volume	0.5 mm	n/a	80	<sup>SURE</sup> Exposure <15 kg	0.35 s
Chest Child 15-30 kg	Volume	0.5 mm	n/a	100	<sup>SURE</sup> Exposure 15-30 kg	0.35 s
Chest Child 31-45 kg	Helical	0.5 mm	Standard	100	<sup>SURE</sup> Exposure 31-45 kg	0.5 s
Chest Child 46-60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure 46-60 kg	0.5 s
Chest Child >60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure >60 kg	0.5 s

Scan Range:

Start	Above lung apices
End	Below adrenal glands
Plane	Straight gantry

Image Reconstruction:

Volume	Pediatric Body
Volume	Pediatric Lung

Reformatting:

Multiview	Axial	Coronal
Start	Superior	Anterior
End	Inferior	Posterior
Slice Thickness	1 mm	1 mm
Spacing	1 mm	1 mm

CT Body - Abdomen

Patient Positioning:

Supine, Feet First  
Arms above head

Oral Contrast Guideline:

Mix iodinated contrast medium with drink (eg. Juice/milk)  
Administer for 2-3hrs prior to scan.

Age	Drink	Contrast
<6 months	50 mL	2 mL
6-18 months	150 mL	6 mL
3-12 years	350 mL	14 mL
>12 years	500 mL	20 mL

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	Pitch	kV	mA	Rotation Time
Abdomen Infant <15 kg	Volume	0.5 mm	n/a	80	<sup>SURE</sup> Exposure <15 kg	0.35 s
Abdomen Child 15-30 kg	Volume	0.5 mm	n/a	100	<sup>SURE</sup> Exposure 15-30 kg	0.35 s
Abdomen Child 31-45 kg	Helical	0.5 mm	Standard	100	<sup>SURE</sup> Exposure 31-45 kg	0.5 s
Abdomen Child 46-60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure 46-60 kg	0.5 s
Abdomen Child >60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure >60 kg	0.5 s

Scan Range:

Start	Top of higher hemidiaphragm
End	Below ischium
Plane	Straight gantry

IV Contrast:

Volume	2 mL/kg
Delay	60 s

Based on a concentration of 300 mgI/mL

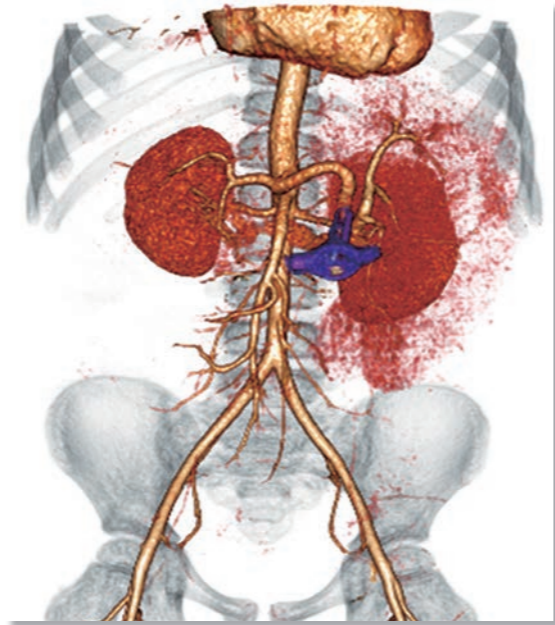
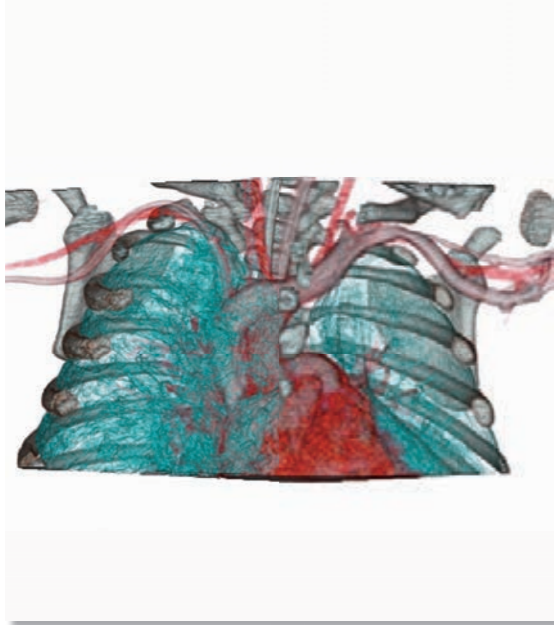
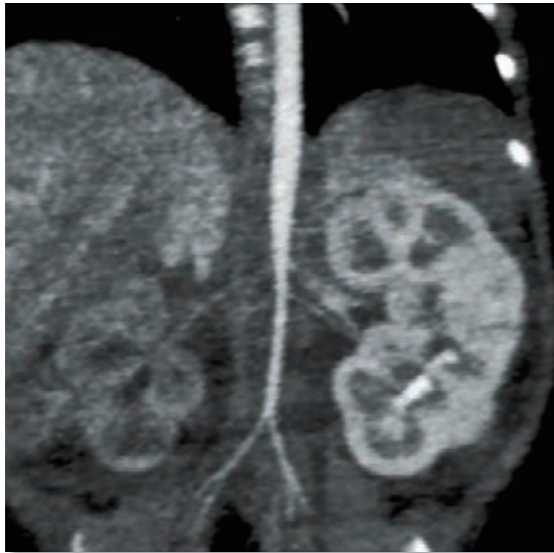
Image Reconstruction:

Volume	Pediatric Body
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Reformatting:

Multiview	Axial	Coronal
Start	Superior	Anterior
End	Inferior	Posterior
Slice Thickness	3 mm (2 mm <15 kg)	3 mm (2 mm <15 kg)
Spacing	3 mm (2 mm <15 kg)	3 mm (2 mm <15 kg)

CT Vascular



CT Vascular - Brain CTA

Patient Positioning:

Supine, Head First  
Wrap infant in blanket, use head straps on child

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	kV	mA	Rotation Time
Brain Infant 0-2 yrs	Volume	0.5 mm	100	150	0.5 s
Brain Child 3-5 yrs	Volume	0.5 mm	100	250	0.5 s
Brain Child 6-12 yrs	Volume	0.5 mm	120	250	0.5 s

Scan Range:

Start	1 cm below base of skull
End	Above vertex
Plane	Parallel to OM baseline or to avoid the eyes

Contrast:

Volume	2 mL/kg
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Based on a concentration of 300 mgI/mL  
<sup>SURE</sup>Start can be used to accurately time the contrast bolus.

Image Reconstruction:

Volume	Pediatric Brain
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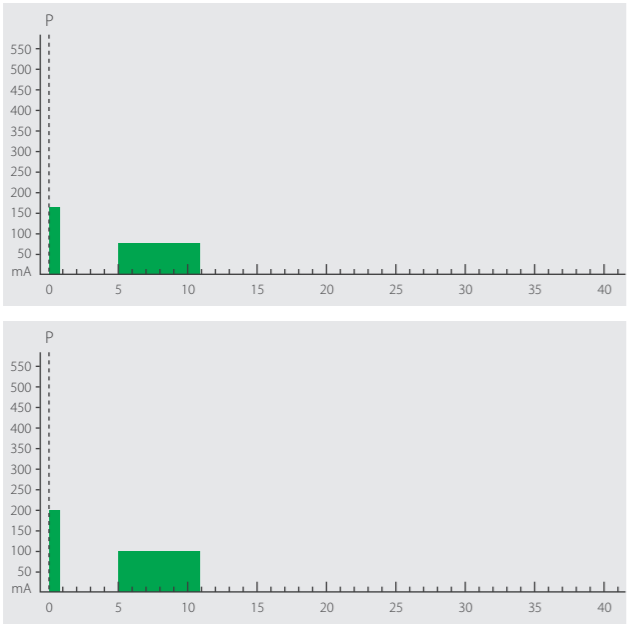
Reformatting:

Multiview	Axial
Start	Inferior
End	Superior
Slice Thickness	2 mm
Spacing	2 mm

CT Vascular - 4D Brain DSA

**Patient Positioning:**  
Supine, Head First  
Wrap infant in blanket, use head straps on child

**Scan Protocol:**



**Scan Range:**

Start	1 cm below base of skull
End	Above vertex
Plane	Parallel to OM baseline or to avoid the eyes

Note: We recommend referring to our Aquilion ONE 4D Neurological Imaging Guide for detailed instructions for performing these studies.

**Contrast:**  
Single-phase contrast injection protocol

Phase 1	30 mL @ 3 mL/s
Phase 2 (Saline)	30 mL @ 3 mL/s

Based on a concentration of 300 mgI/mL

**Image Reconstruction:**

Volume	4D CBP
--------	--------

CT Vascular - Carotid CTA

**Patient Positioning:**  
Supine, Head First

**Scan Protocol:**

Protocol	Scan Mode	Scan Slice Thickness	Pitch	kV	mA	Rotation Time
Neck Child <15 kg	Volume	0.5 mm	n/a	80	<sup>SURE</sup> Exposure <15 kg (Neck)	0.35 s
Neck Child 15-30 kg	Volume	0.5 mm	n/a	100	<sup>SURE</sup> Exposure 15-30 kg (Neck)	0.35 s
Neck Child 31-45 kg	Helical	0.5 mm	Detail	100	<sup>SURE</sup> Exposure 31-45 kg (Neck)	0.5 s
Neck Child 46-60 kg	Helical	0.5 mm	Detail	120	<sup>SURE</sup> Exposure 46-60 kg (Neck)	0.5 s
Neck Child >60 kg	Helical	0.5 mm	Detail	120	<sup>SURE</sup> Exposure >60 kg (Neck)	0.5 s

**Scan Range:**

Start	Above pituitary fossa
End	Aortic arch
Plane	Straight gantry

**Contrast:**

Volume	2 mL/kg
--------	---------

Based on a concentration of 300 mgI/mL  
<sup>SURE</sup>Start can be used to accurately time the contrast bolus.

**Image Reconstruction:**

Volume	Pediatric Neck
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**Reformatting:**

Multiview	Axial
Start	Superior
End	Inferior
Slice Thickness	2 mm
Spacing	2 mm

CT Vascular - Aorta CTA

Patient Positioning:

Supine, Feet First  
Arms above head

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	Pitch	kV	mA	Rotation Time
Abdomen Infant <15 kg	Volume	0.5 mm	n/a	80	<sup>SURE</sup> Exposure <15 kg	0.35 s
Abdomen Child 15-30 kg	Volume	0.5 mm	n/a	100	<sup>SURE</sup> Exposure 15-30 kg	0.35 s
Abdomen Child 31-45 kg	Helical	0.5 mm	Standard	100	<sup>SURE</sup> Exposure 31-45 kg	0.5 s
Abdomen Child 46-60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure 46-60 kg	0.5 s
Abdomen Child >60 kg	Helical	0.5 mm	Standard	120	<sup>SURE</sup> Exposure >60 kg	0.5 s

Scan Range:

Start	Top of higher hemidiaphragm
End	Below ischium
Plane	Straight gantry

Contrast:

Volume	2 mL/kg
--------	---------

Based on a concentration of 300 mgI/mL  
<sup>SURE</sup>Start can be used to accurately time the contrast bolus.

Image Reconstruction:

Volume	Pediatric Body
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Reformatting:

Multiview	Axial
Start	Superior
End	Inferior
Slice Thickness	3 mm (2 mm <15 kg)
Spacing	3 mm (2 mm <15 kg)

CT Vascular - Cardiac

Patient Positioning:

Supine, Feet First  
Arms above head  
Place ECG electrodes on chest outside scan range

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	kV	mA	Rotation Time
Pediatric Cardiac Target CTA	Target CTA	0.5 mm	100	250	0.35 s
Pediatric Cardiac CTA/CFA	CTA/CFA no modulation	0.5 mm	100	250	0.35 s

Scan Range:

Start	Carina
End	Below apex of heart
Plane	Straight gantry

Note: We recommend referring to our Aquilion ONE Cardiac Imaging Guide for detailed instructions for performing these studies.

Contrast:

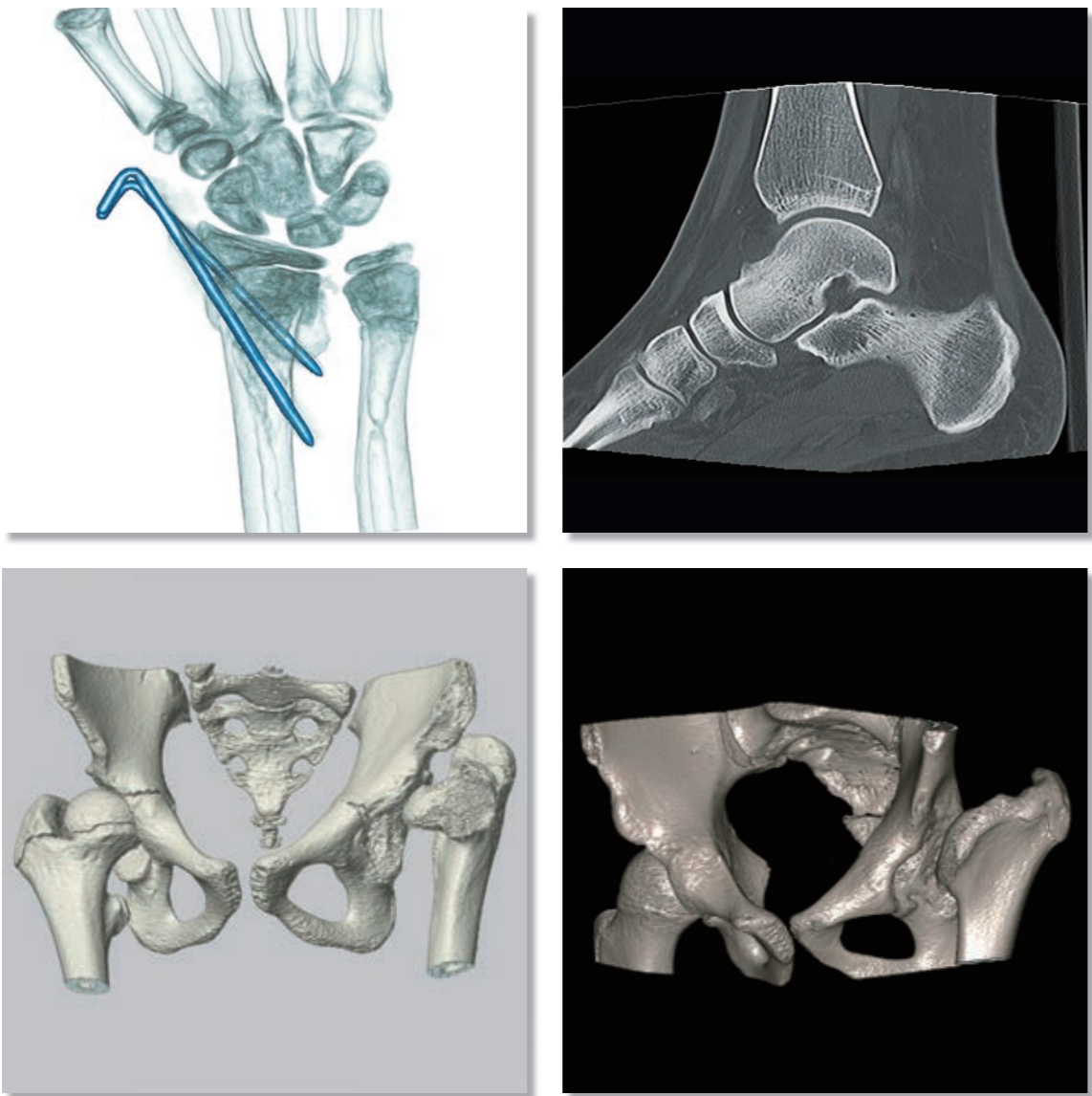
Volume	2 mL/kg
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<sup>SURE</sup>Start in descending aorta at 150 HU  
Based on a concentration of 300 mgI/mL

Image Reconstruction:

Volume	Pediatric Cardiac 75%
Volume	Pediatric Cardiac phaseXact
Volume	Pediatric Cardiac CFA (if available)

CT Musculoskeletal



CT Musculoskeletal - Extremities

Patient Positioning:

Position extremity at center of FOV  
Immobilize extremity if necessary

Scan Protocol:

Protocol	Scan Mode	Scan Slice Thickness	kV	mA	Rotation Time
Extremity <15 kg	Volume	0.5 mm	80	80	0.5 s
Extremity 15-34 kg	Volume	0.5 mm	100	80	0.5 s
Extremity 35-45 kg	Volume	0.5 mm	100	100	0.5 s
Extremity 46-60 kg	Volume	0.5 mm	120	100	0.5 s
Extremity >60 kg	Volume	0.5 mm	120	160	0.5 s

Scan Range:

Start	Above area of interest
End	Below area of interest
Plane	Straight gantry

Image Reconstruction:

Volume	Bone Sharp
Volume	Soft Tissue Sharp

Reformatting:

Multiview	Axial	Coronal	Sagittal
Start	Superior	Anterior	Lateral
End	Inferior	Posterior	Medial
Slice Thickness	2 mm	2 mm	2 mm
Spacing	2 mm	2 mm	2 mm

**Disclaimer:** Any reference to X-ray exposure is intended as a reference guideline only. The guidelines in this document do not substitute for the judgment of a healthcare provider. Each scan requires medical judgment by the healthcare provider about exposing the patient to ionizing radiation. In clinical practice, the use of the AIDR (Adaptive Iterative Dose Reduction) 3D features may reduce CT patient dose depending on the clinical task, patient size, anatomical location and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.  
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