CT Clinical Brochure

Aquilion ONE

Series

Pediatric Imaging with Area Detector CT

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Toshiba Medical gratefully acknowledges the following institution that contributed to this brochure: Bristol Royal Hospital for Children, United Kingdom

Reference for Radiation Dose Calculation

Calculation of the effective doses in this brochure is based on the conversion coefficients for patients given in the following publication:

American Association of Physicists in Medicine (AAPM) Report 96. "The Measurement, Reporting, and Management of Radiation Dose in CT." Report of AAPM Task Group 23 of the Diagnostic Imaging Council CT Committee. January 2008.

Introduction

The imaging of pediatric patients presents unique challenges as compared to adult patients. Children face greater risks from the effects of ionizing radiation because their developing cells are more sensitive to radiation damage. In addition, when imaging children, motion and respiration can be a challenge as infants and small children may not be able to stay still or follow verbal instructions and older children may be uncooperative.

Toshiba Medical's commitment to patient centered imaging, and imaging of children in particular, has led to the continuous development of technologies that both enhance patient safety through radiation dose reduction and put the patient at ease, helping to minimize sedation.

The Aquilion ONE™ dynamic volume CT scanners, with 16 cm of cranio-caudal coverage, allow for infants' and toddlers' chests or abdomens to be scanned in just one rotation without the need for table movement. Scanning in one rotation eliminates the need for helical-overlap and over scanning, which reduces the use of radiation dose and minimizes the need for sedation.

Toshiba Medical's Handy Snap provides an easy way to prepare and start the scan from inside the scan room while putting the patient at ease and keeping them under observation.

The dedicated 'child-mode' display on the Aquilion ONE ⓘStation located on the CT gantry is a special feature Toshiba Medical has developed to create a child friendly CT environment. For children who can comply with breathing instructions, a movie with animals is used to practice these instructions before the scan.

This brochure contains 13 pediatric clinical cases scanned with Toshiba Medical's Aquilion ONE CT.

Miglioretti DL, Johnson E, Williams A, et al. The Use of Computed Tomography in Pediatrics and the Associated Radiation Exposure and Estimated Cancer Risk. JAMA Pediatr. 2013;167(8):700-707. doi:10.1001/jamapediatrics.2013.311.
The Alliance for Radiation Safety in Pediatric imaging, http://www.imagegently.org/
Mather R. PhD, Aquilion ONE: Pediatric Imaging. Clinical white paper 2009

From a radiographer's perspective:

" The wide detector of the Aquilion ONE / vISION Edition means we can complete many of our scans in one rotation, significantly lowering our scan acquisition times and therefore often reducing the requirement for anaesthesia when imaging infants or patients with behavioural or learning difficulties."

" The combination of ONE rotation protocols with the Handy Snap has been of great benefit when scanning very young patients or patients with behavioural or learning difficulties. It enables us to get closer to the patient and assess the right moment to initiate a rapid scan."

" AIDR 3D Enhanced iterative reconstruction algorithms have allowed us to optimize our paediatric scan protocols to significantly lower radiation doses whilst maintaining a high standard of image quality."

Jonathan Green

(Lead Paediatric CT Radiographer, Paediatric Radiology, Bristol Royal Hospital for Children)

" With the wide detector of the Aquilion ONE / vISION Edition, we can scan an infant chest in one rotation only. This is especially useful for dynamic volume scanning, which allows us to examine airway collapsibility in infants during free breathing and at low dose and precludes the need for anaesthesia with ventilation to achieve the same objectives."

Professor Savvas Andronikou

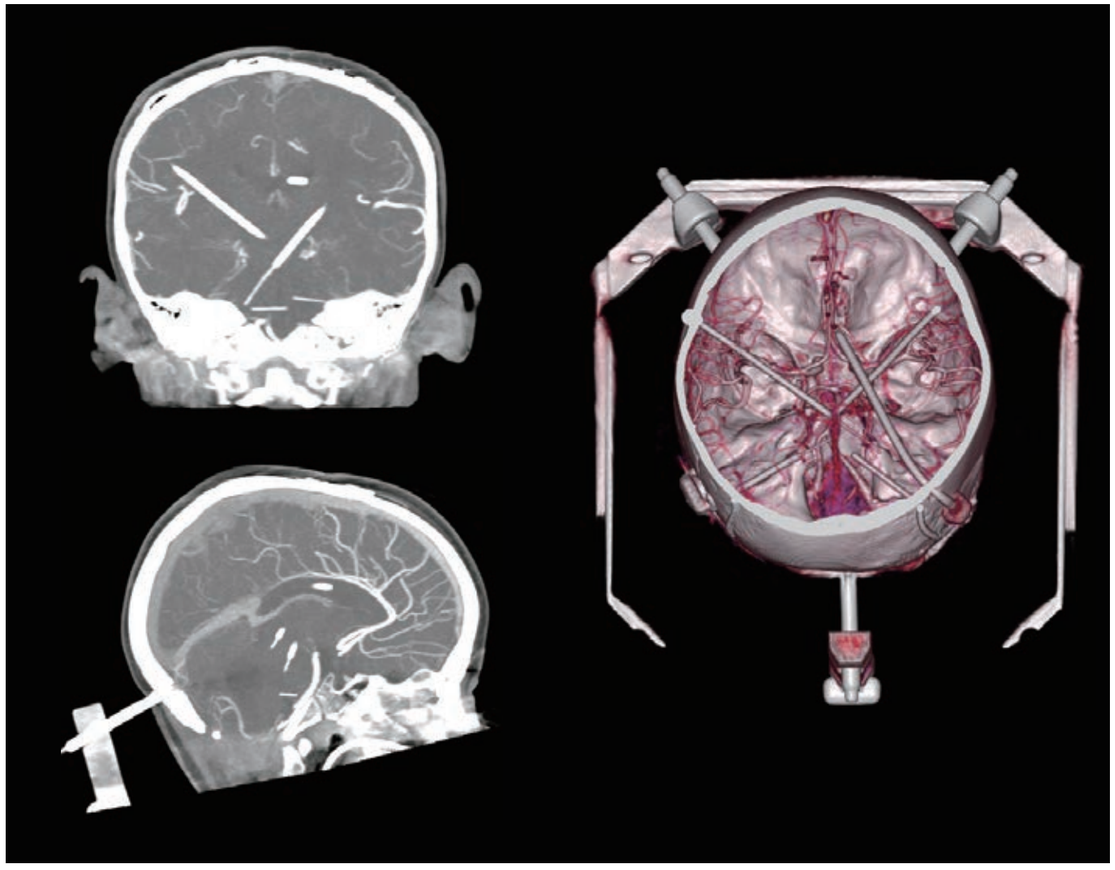
(Professor, Paediatric Radiology, Bristol Royal Hospital for Children)

Progressive Brain Stem Glioma Treatment

Patient History

This 4-year-old boy with a progressive brain stem glioma was scheduled to undergo treatment by convection-enhanced delivery of carboplatin. This essentially means that catheters are placed within the brain to deliver the carboplatin more accurately. A frame is attached to the head for navigation. Then, after placement of the catheters, a one-volume CTA of the brain is performed to confirm their locations.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Volume	Arterial	0.5 mm × 320	-	100	75	0.5	160	AIDR* 3D	9.0	143.6	0.96	0.0067



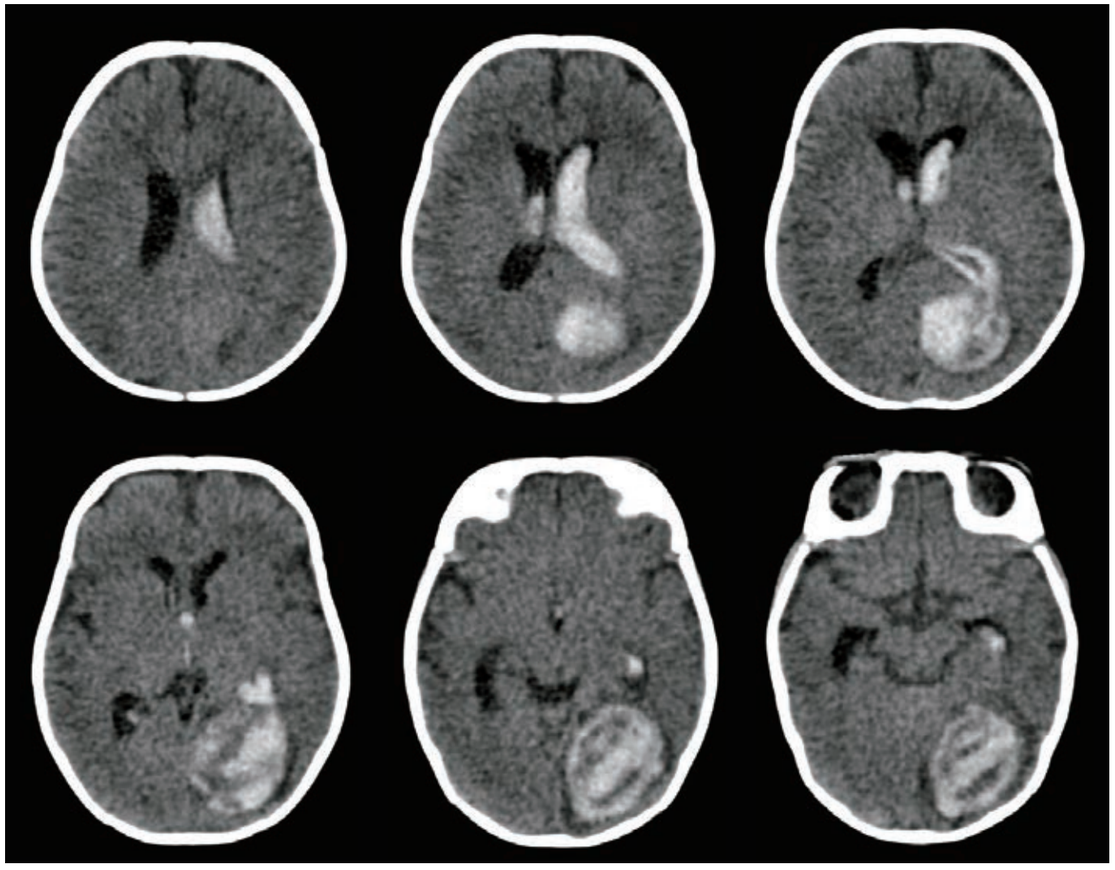
* Adaptive Iterative Dose Reduction

ONE Rotation Brain Hematoma

Patient History

This 2-month-old girl presented to the emergency department with multiple seizures. A CT scan of the brain was performed to investigate the cause. A large intraparenchymal hematoma with extension into the ventricles and associated hydrocephalus is seen.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Volume	-	0.5 mm × 240	-	100	85	0.5	120	AIDR 3D	10.7	128.7	1.42	0.011

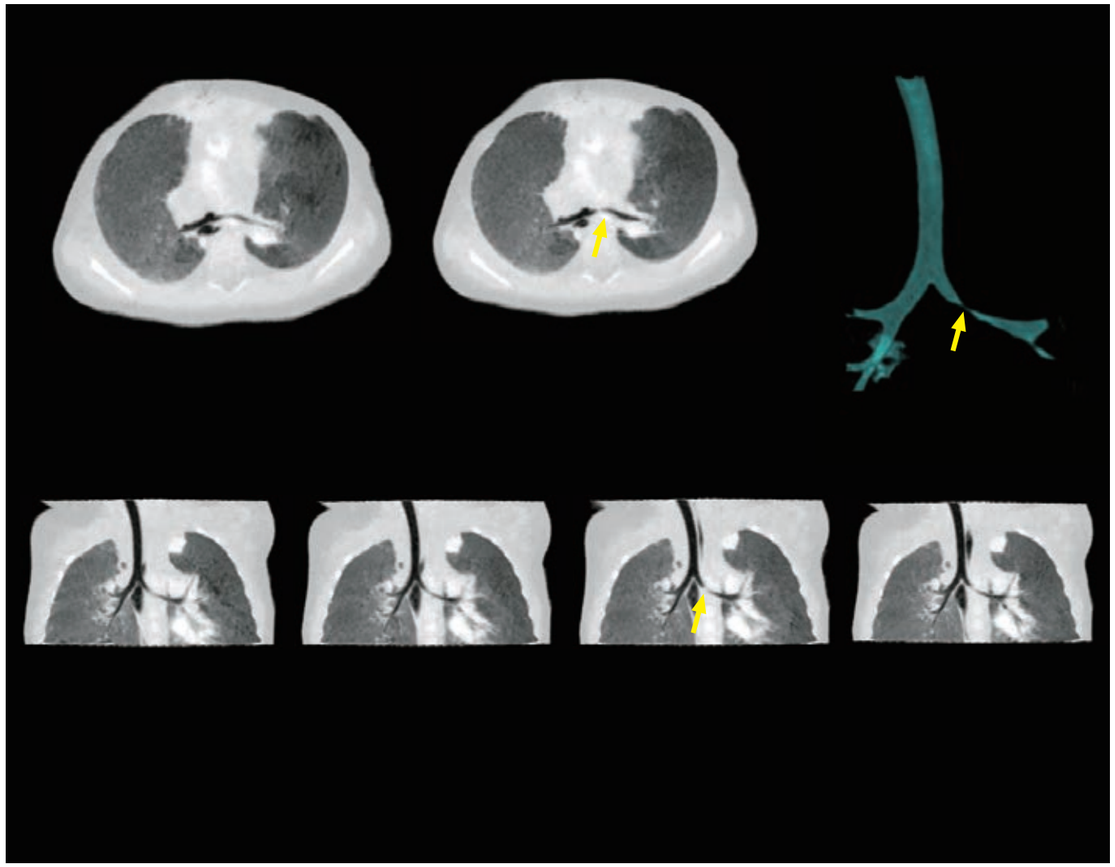


4D Dynamic Airways Analysis

Patient History

A CT scan of this 5-month-old boy was requested to investigate persistent breathing problems. A dynamic scan of four volumes was performed during breathing to capture both inspiration and expiration. A stenosis is seen in the left main bronchus (arrows).

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Dynamic Volume	Arterial	0.5 mm × 320	-	80	12	0.35	160	AIDR 3D Enhanced	1.7	13.9	0.54	0.039

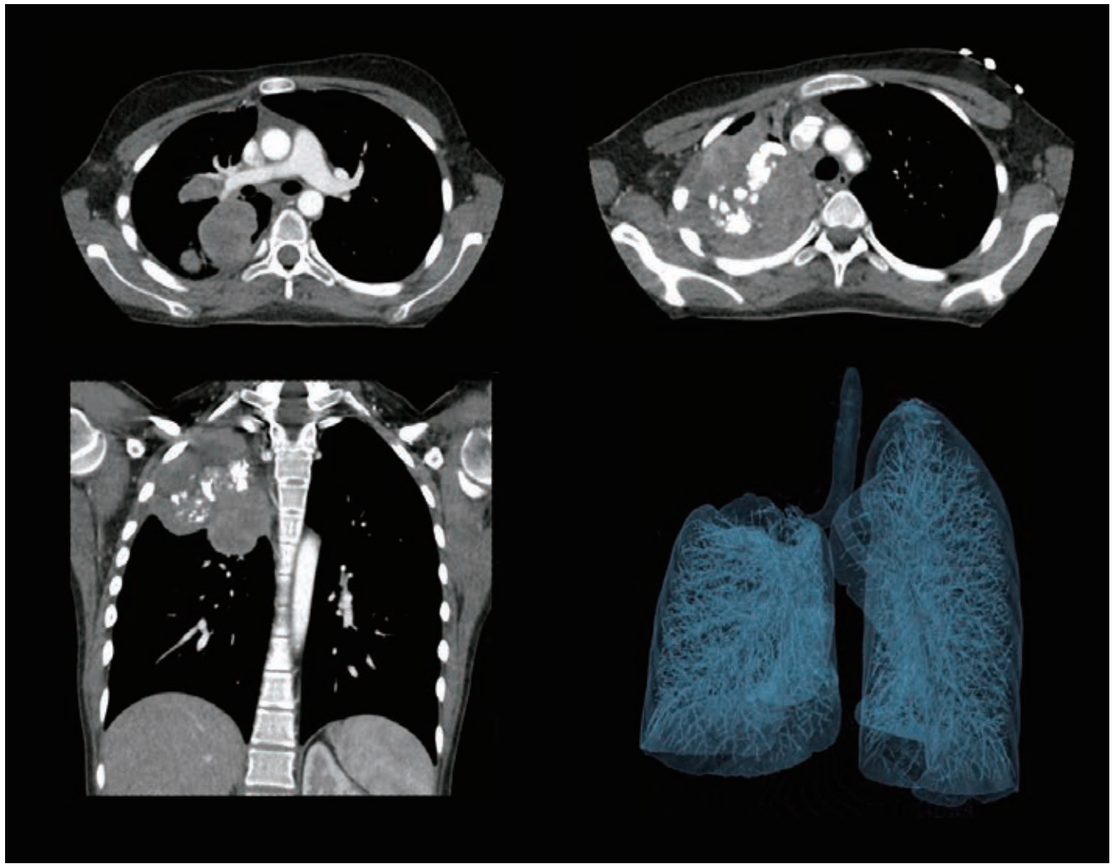


Lung Mass

Patient History

A CT scan was performed to evaluate a mass in the right lung of this 14-year-old girl. The mass is lobular and partly calcified. A mediastinal extension with encasement of the bronchus and pulmonary artery is seen. The fastest rotation time was used to eliminate motion artifacts.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Ultra Helical	Arterial	0.5 mm × 80	Standard	80	SURE Exposure™ 3D	0.275	147.8	AIDR 3D Enhanced	1.5	49.2	0.69	0.014

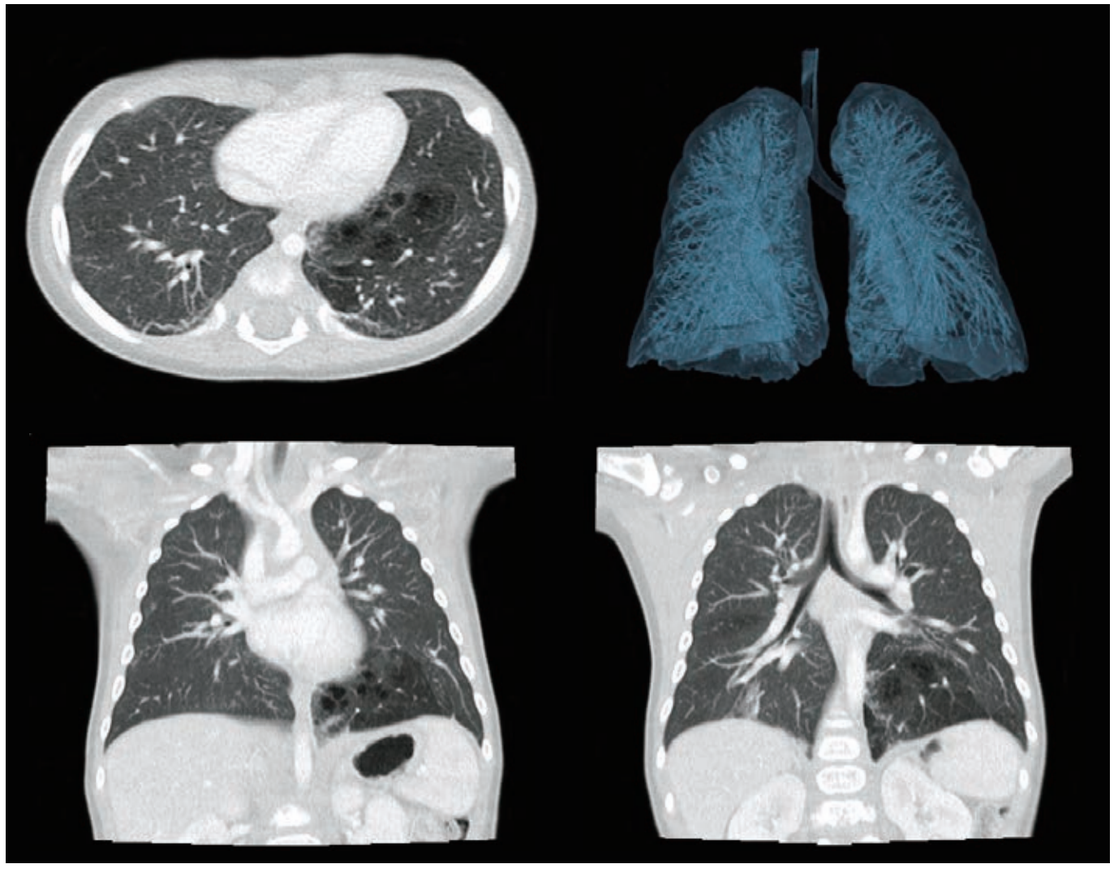


Congenital Pulmonary Airway Malformation

Patient History

A volume scan of the chest was performed on this 6-month-old boy. The abnormality seen in the left lung could be associated with a congenital pulmonary airway malformation.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Volume	Arterial	0.5 mm × 320	-	80	24	0.275	160	AIDR 3D Enhanced	0.8	12.5	0.3	0.026

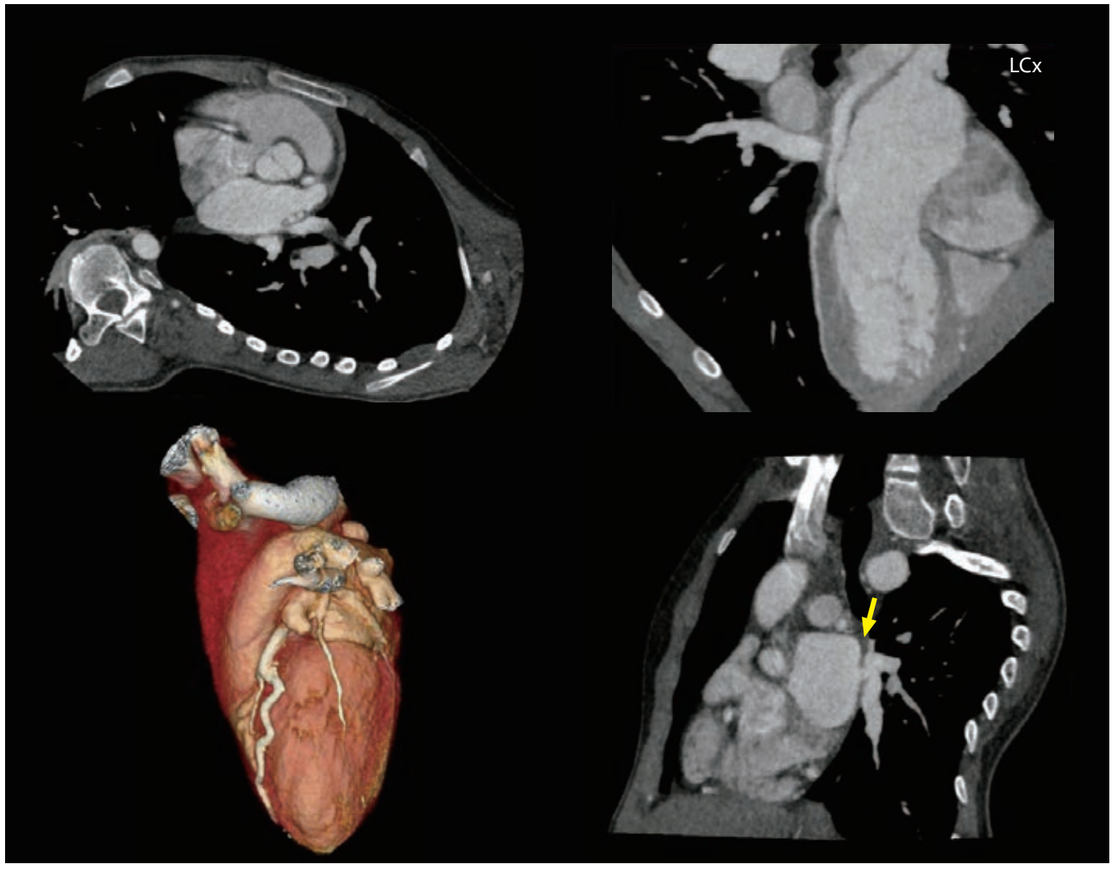


ONE Rotation Cardiac CTA with Anomalies

Patient History

This 14-year-old girl with severe scoliosis was scanned with ECG gating in one volume to delineate the great vessel anatomy as well as her known cardiac anomalies. A bicuspid aortic valve is visualized, as well as anomalous coronary arteries. The left circumflex artery originates from the left pulmonary artery. The inferior pulmonary vein shows a mild ostial stenosis (arrow).

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Volume	Arterial	0.5 mm × 320	-	80	63	0.275	160	AIDR 3D Enhanced	3.7	59.1	0.83	0.014

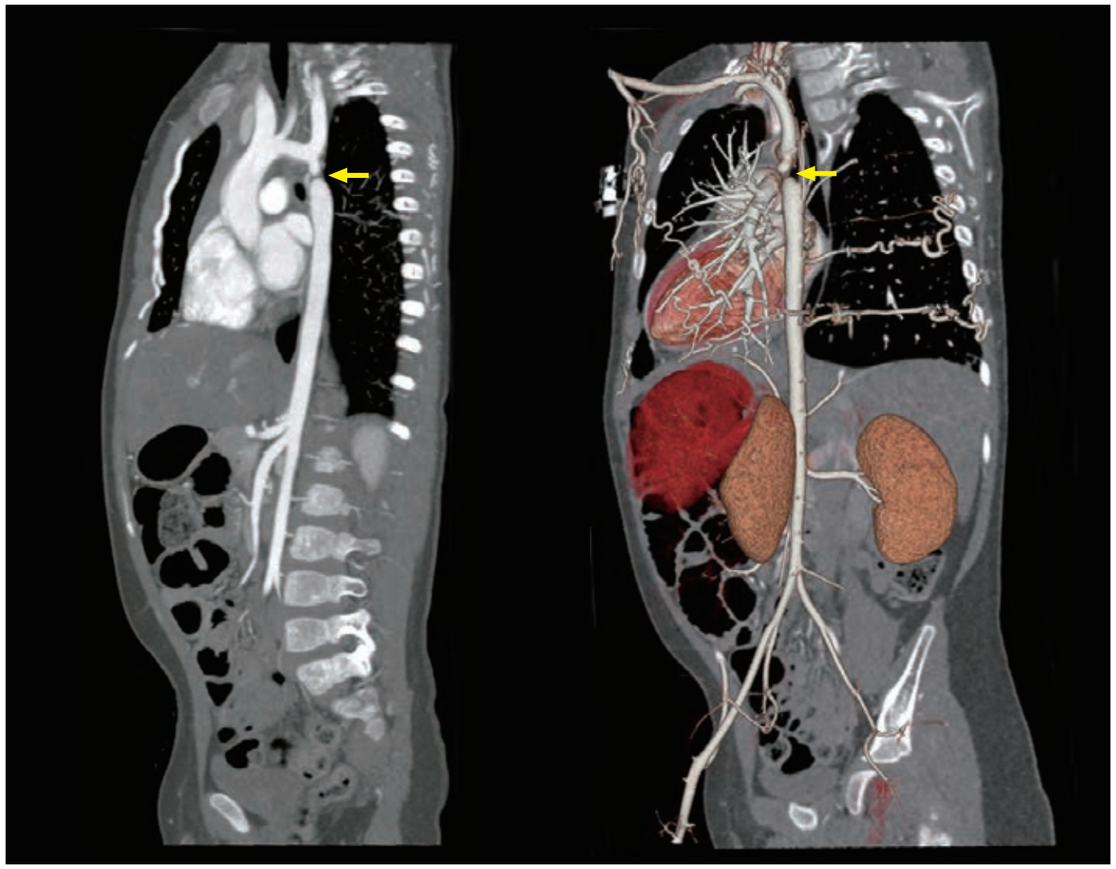


Ultra-Helical Aortic Interruption

Patient History

This 2-year-old boy presented late with congenital anomaly of the aorta. CT was performed to plan surgery and to evaluate the possibility of catheter-based intervention. An interruption of the aorta is clearly seen, with associated collateral vessels (arrows).

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Ultra Helical	Arterial	0.5 mm × 80	Standard	80	SURE Exposure 3D	0.275	396	AIDR 3D Enhanced	1.4	58.4	1.04	0.019

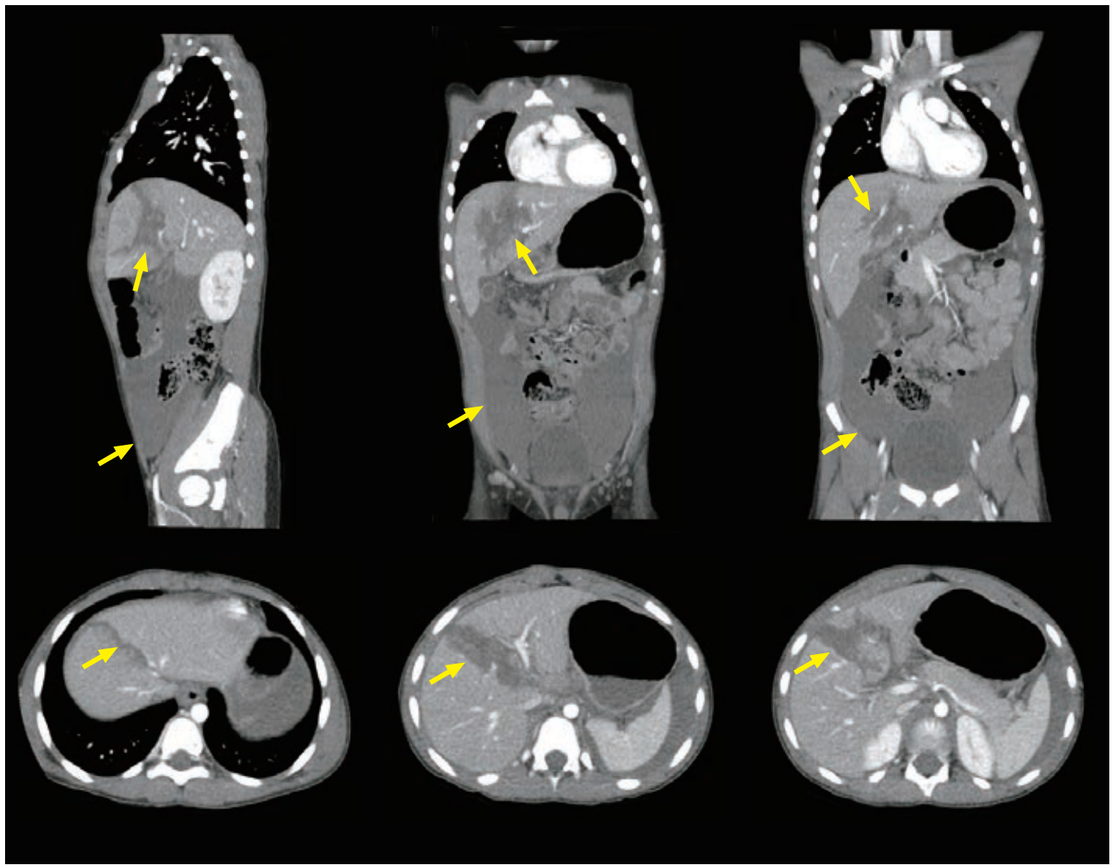


Split-Bolus Contrast CT – Liver Laceration

Patient History

This 6-year-old boy was brought to the emergency department after a high-speed mountain bike accident. The abdomen showed severe bruises, so a CT scan with split-bolus contrast injection was performed. A Grade IV liver laceration is seen with large associated hemoperitoneum (arrows).

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Ultra Helical	Split bolus	0.5 mm × 80	Standard	80	SURE Exposure 3D	0.275	708.6	AIDR 3D Enhanced	1.3	63.6	1.21	0.019

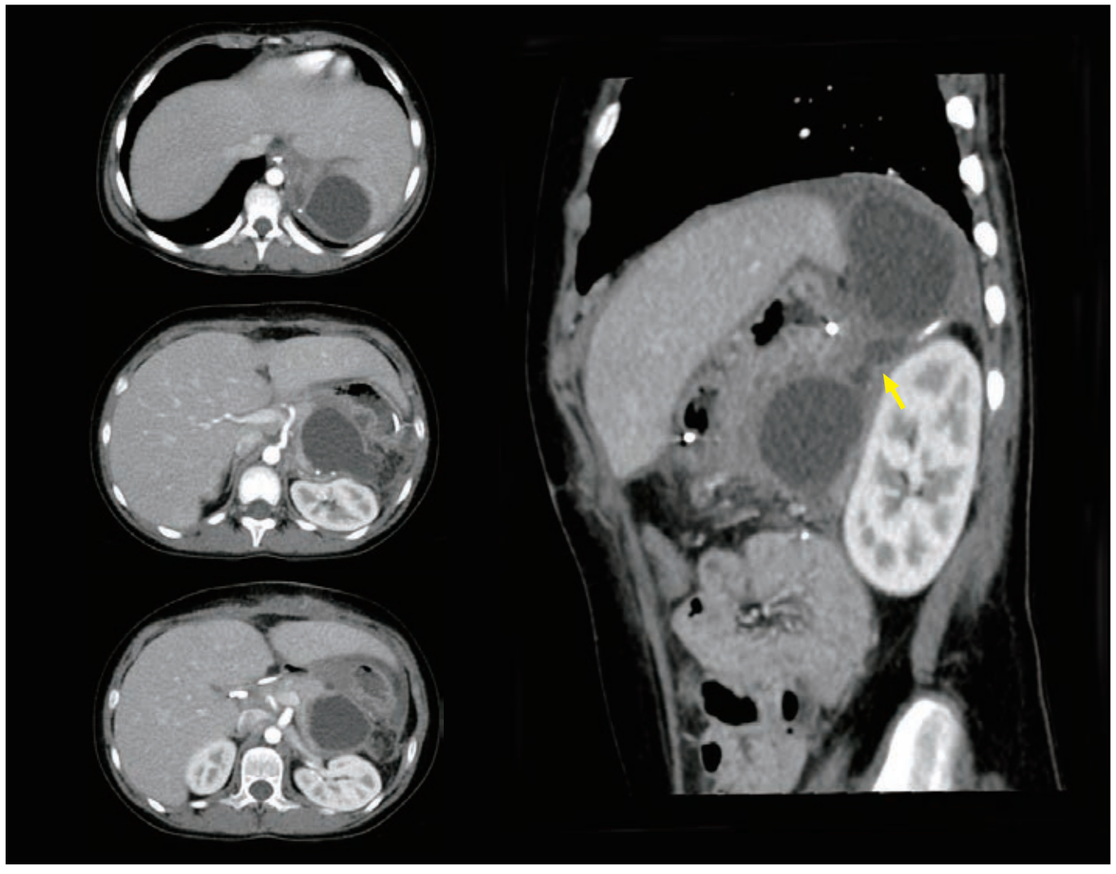


Split-Bolus Contrast CT – Abdominal Fluid Collection

Patient History

A follow up abdomen CT was performed on this 8-year old girl with necrosectomy and spenectomy after pancreatitis. Fluid collections are visualized in the splenic bed and in the peripancreatic area subjacent to the distal pancreas. A slender communication between the two collections is seen (arrow).

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Ultra Helical	Split bolus	0.5 mm × 80	Standard	100	SURE Exposure 3D	0.35	254.4	AIDR 3D Enhanced	2.6	78	1.17	0.015

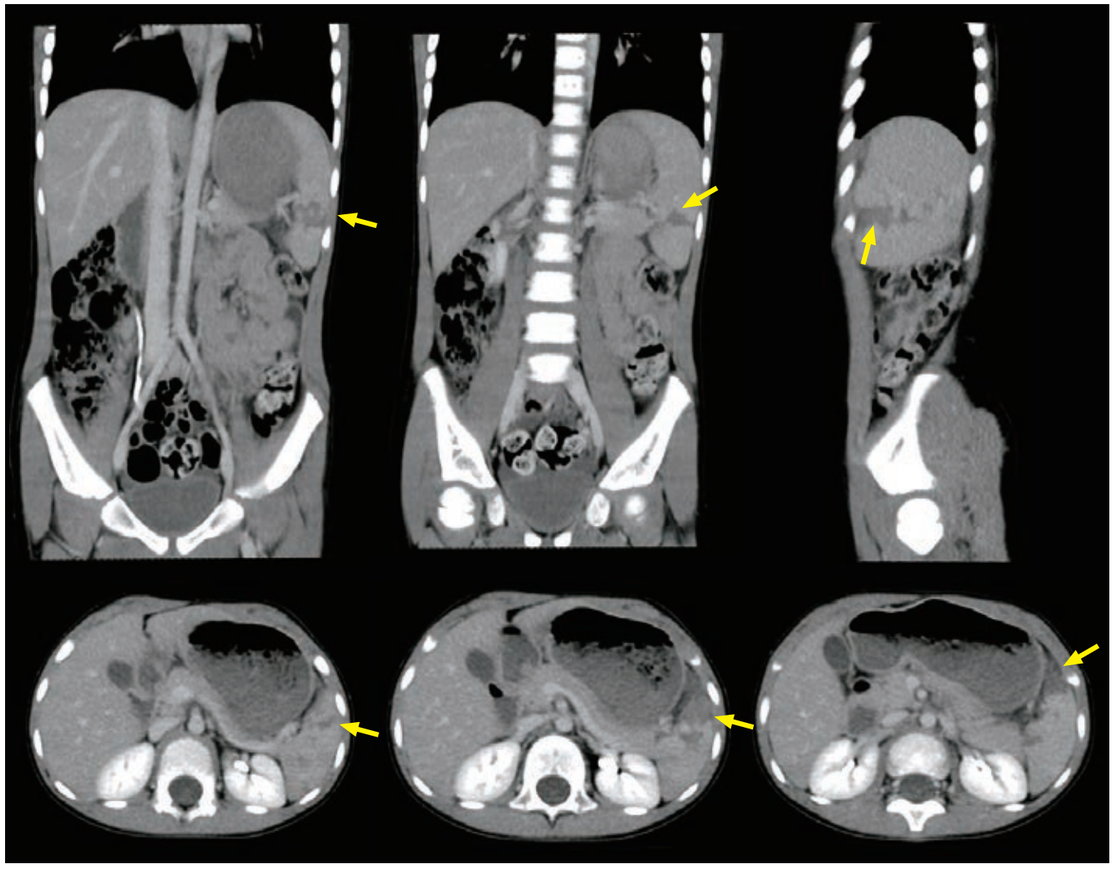


Spleen Laceration

Patient History

This 5-year-old boy presented with abdominal pain after a seatbelt injury sustained in a car accident. A Grade III laceration of the spleen is seen (arrows) with associated hemoperitoneum.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Ultra Helical	Venous	0.5 mm × 80	Standard	100	SURE Exposure 3D	0.35	324	AIDR 3D Enhanced	1.7	63.2	1.26	0.02

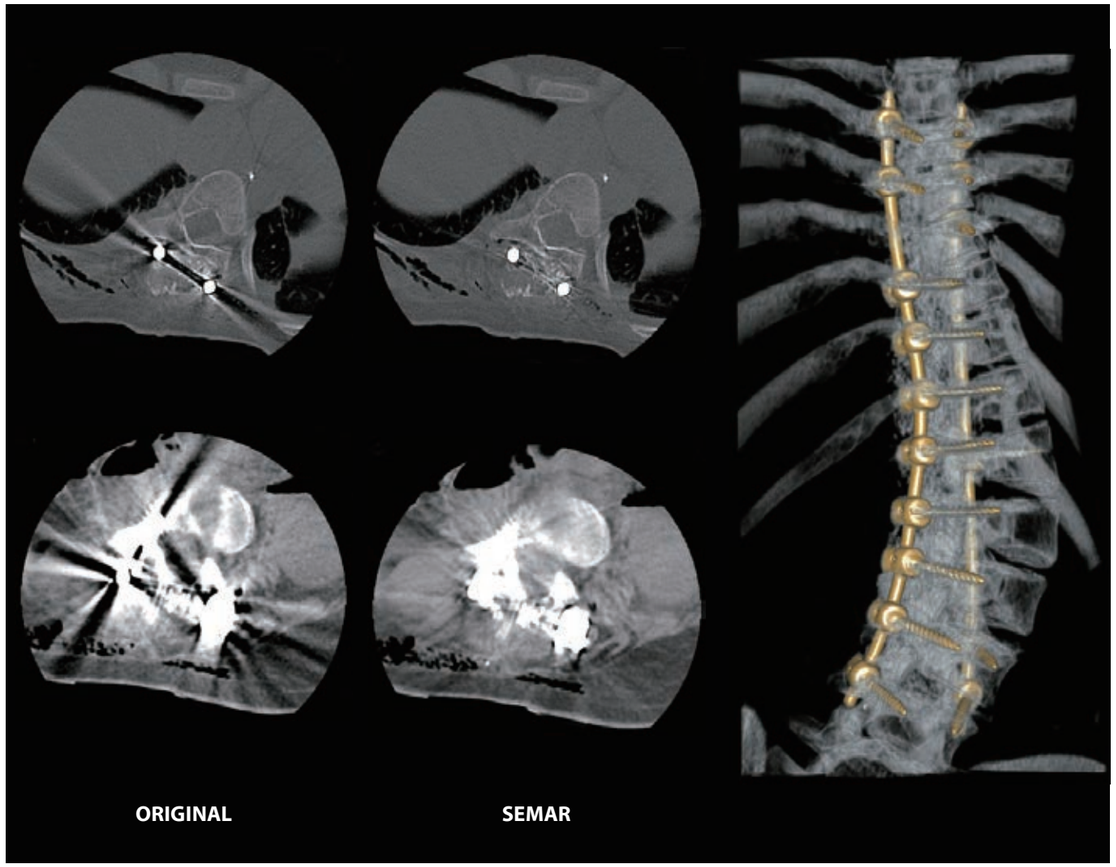


Post Scoliosis Surgery with SEMAR

Patient History

Following scoliosis surgery, a CT scan was performed to confirm the positions of the implants in this 12-year-old girl. Single Energy Metal Artifact Reduction provides clear views of the central canal and the positions of the implants.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Ultra Helical	-	0.5 mm × 80	Standard	100	SURE Exposure 3D	0.5	312	AIDR 3D Enhanced	2.5	87.7	1.14	0.013

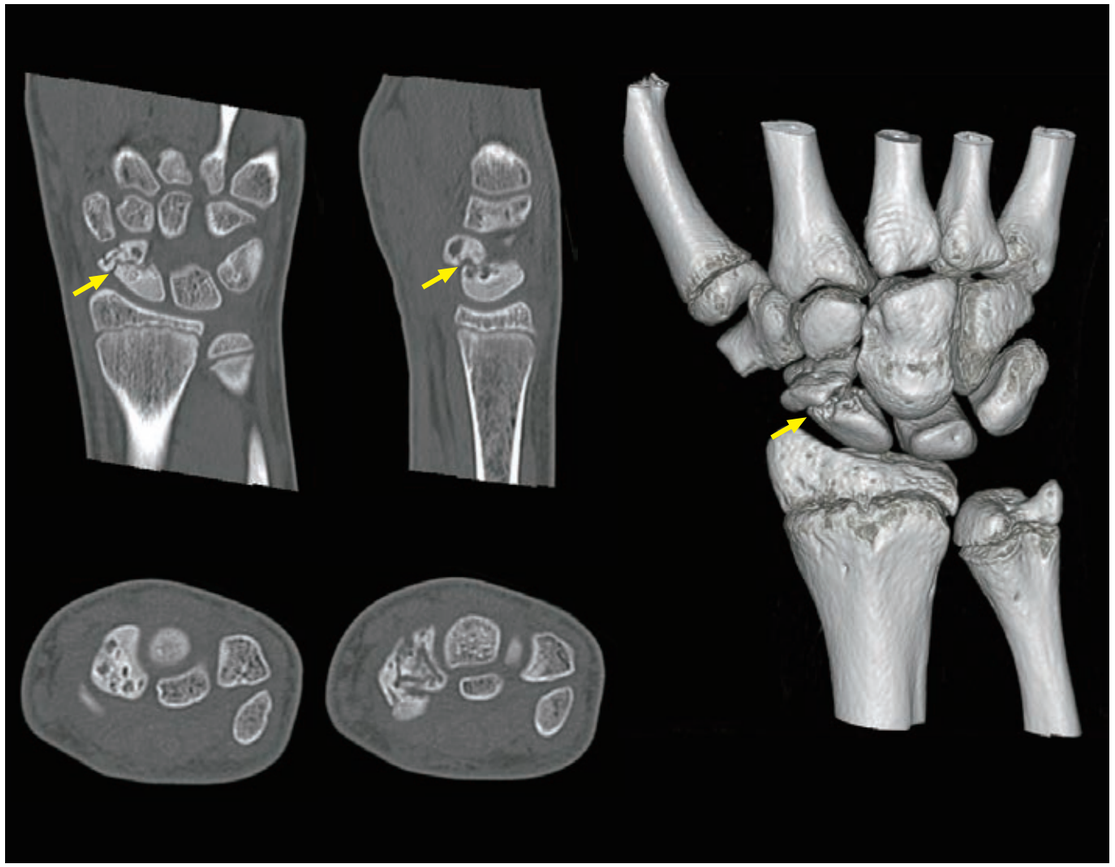


ONE Shot Scaphoid Fracture

Patient History

A scaphoid fracture in this 14-year-old boy was imaged with an ONE Shot volume CT scan for surgical planning. The scaphoid shows a nonunion fracture with cystic changes (arrows). The proximal pole shows dense areas suggestive of avascular necrosis.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Volume	-	0.5 mm × 200	-	100	50	0.5	100	AIDR 3D	2.5	24.8	0.02	0.0008

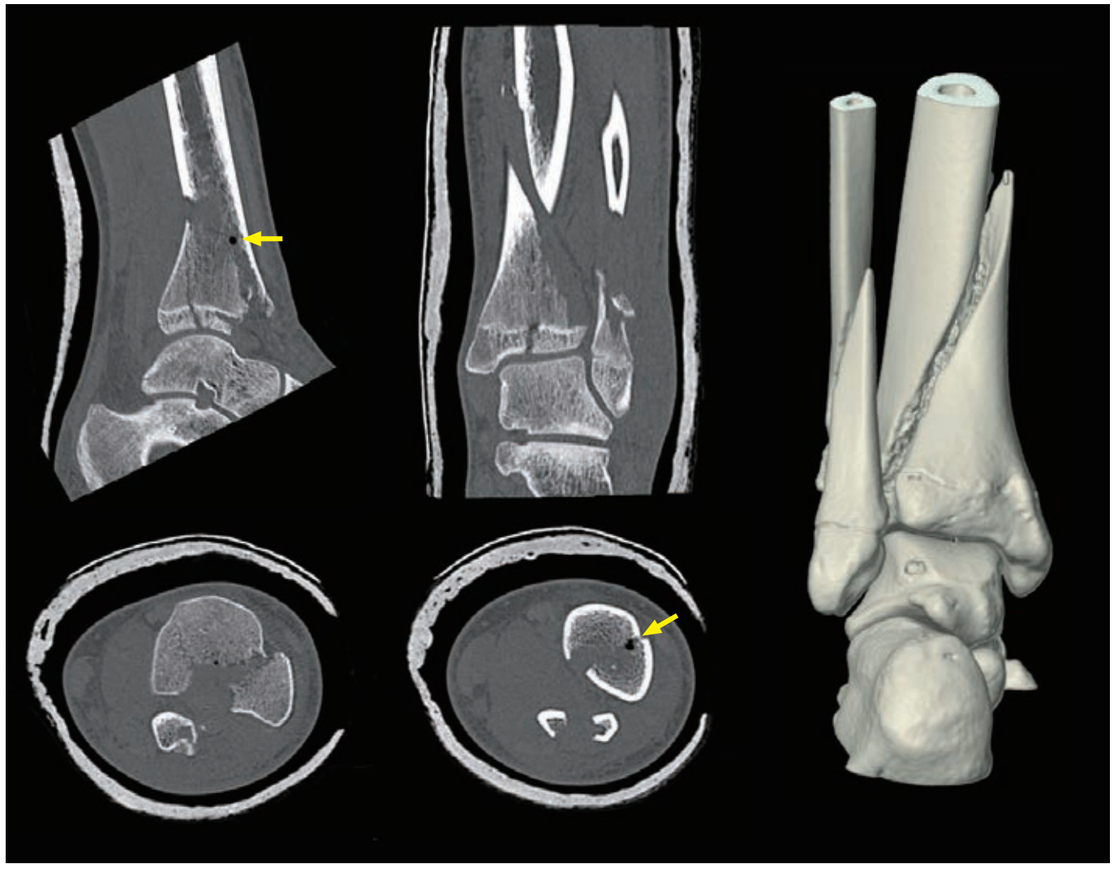


ONE Shot Tibia-Fibula Fracture

Patient History

This 14-year-old boy underwent a preoperative ONE Shot volume scan for a comminuted tibia-fibula fracture. Locules of gas are seen (arrows), consistent with an open fracture.

Scan Mode	Contrast	Collimation	Pitch	kVp	mAs	Rotation Time (s)	Scan Range (mm)	Dose Reduction	CTDIvol (mGy)	DLP (mGy·cm)	Effective Dose (mSv)	k
Volume	-	0.5 mm × 320	-	100	75	0.5	160	AIDR 3D	4.9	79.1	0.06	0.0008



WARNING: Any reference to X-ray exposure, intravenous contrast dosage, and other medication 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. Use the As Low As Reasonably Achievable (ALARA) radiation dose principle to balance factors such as the patient's condition, size and age; region to be imaged; and diagnostic task.

Disclaimer: In clinical practice, the use of the AIDR 3D feature 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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