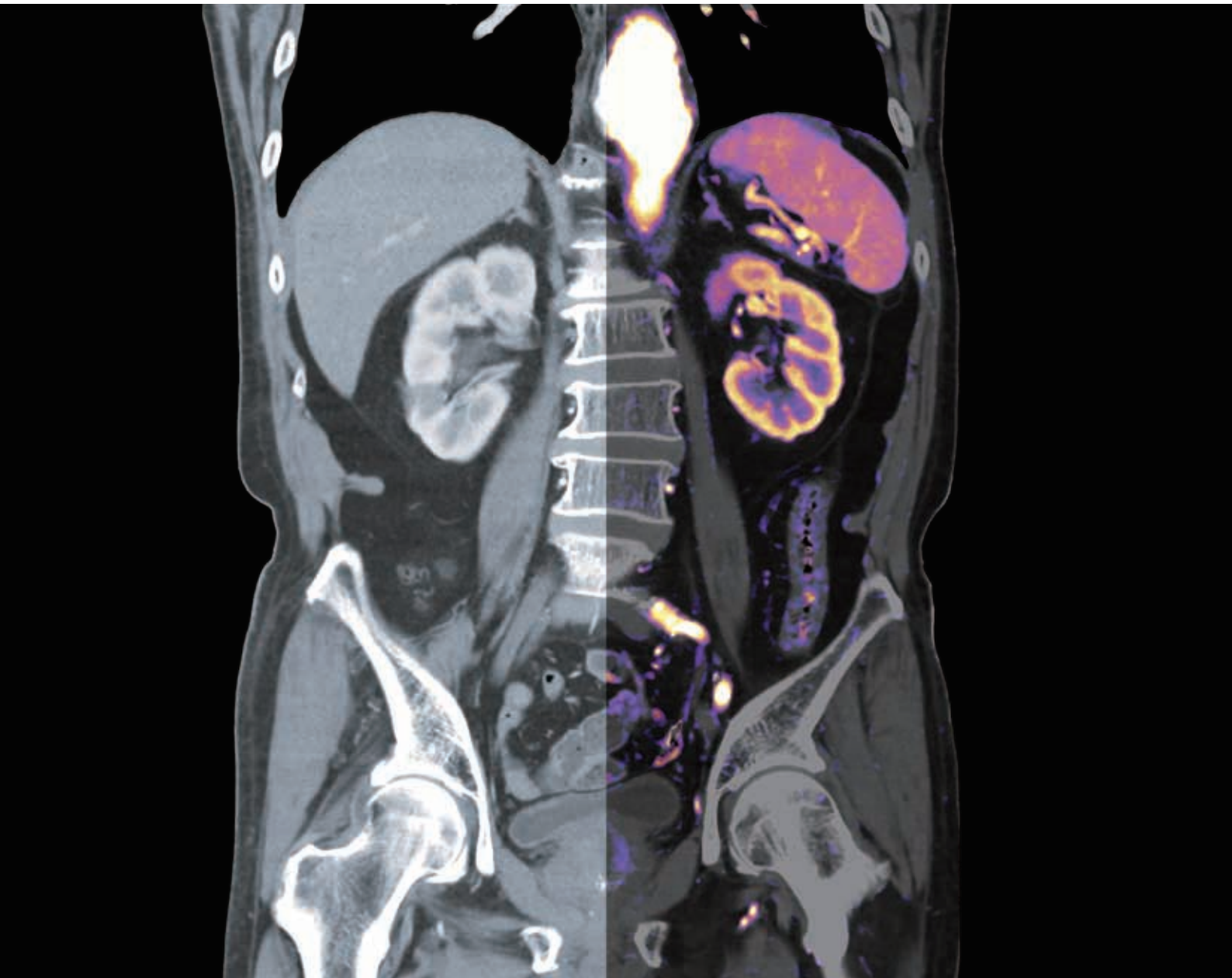
Canon

CT Clinical Brochure

Iodine Mapping SCT

Enhancing diagnostic confidence



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We gratefully acknowledge the following institutions that contributed to this brochure:

CHU Strasbourg, France
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Radboud University Medical Center, Nijmegen, the Netherlands
TMG Asaka Medical Center, Japan

Introduction

Multi-phase contrast-enhanced CT examinations of various anatomical regions have become an accepted technique in the diagnosis and monitoring of patients with suspected carcinoma and a range of other clinical pathologies.

However, with reporting physicians facing several challenges, including an ever-increasing workload, associated eye strain, and mental fatigue, their ability to spot lesions with subtle contrast enhancement in gray-scale images can be impeded.

Introducing Canon Medical's Iodine Mapping Subtraction CT (SCT)*.

Years of research and development have gone into creating a bold solution that helps improve the visualization of subtle, low-enhancing lesions in routine multiphase examinations.

With our smart, custom iodine extraction technique, you can now achieve a full-color blood flow map for any contrast-enhanced phase. These maps drastically improve conspicuity of lesions and can be added to any routine single source multiphase protocol that includes a pre-contrast scan.

What's more, Canon Medical has optimized the Iodine Mapping SCT workflow from scan to diagnostic review, enabling fully automated results that can be delivered directly to your reading station.

A word from the experts

"Iodine Mapping SCT increases the diagnostic information available for any routine multiphase body protocol by extracting the iodine enhancement on each phase. The iodine signal is displayed in color blood flow maps to help assess local vascularization.

These maps can be widely applied and aid, for example, in differentiating solid from cystic lesions, evaluating treatment effects, distinguishing hypo-from hypervascular lesions, and establishing organ ischemia."

Professor Mathias Prokop MD, PhD
Chairman of the Department of Radiology & Nuclear Medicine
Radboud University Medical Center
Nijmegen, the Netherlands

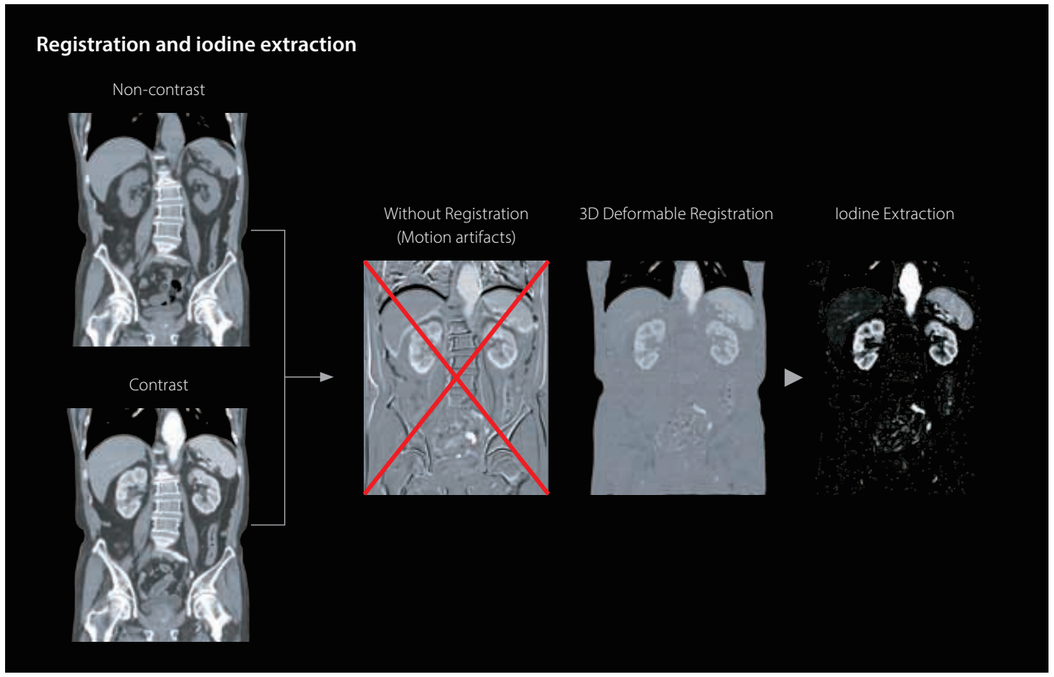
* SURESubtraction Iodine Mapping is available as an optional application.

How Iodine Mapping can help you

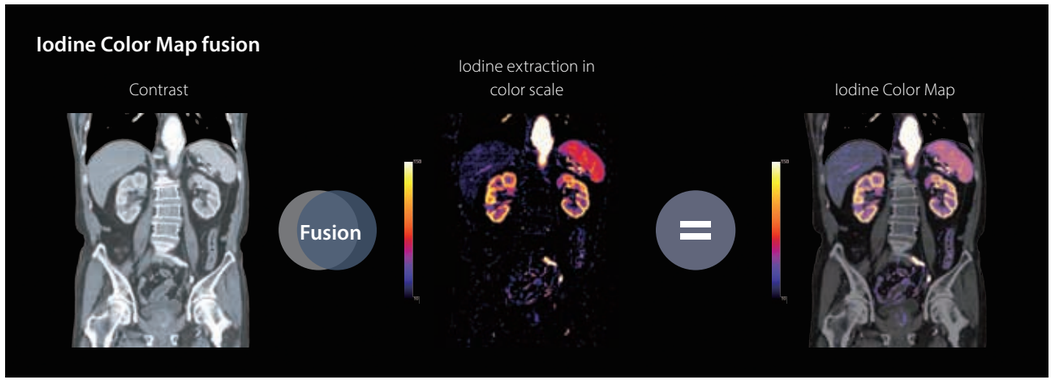
Better outcomes led by intelligent technology

Accurate results
Enjoy the confidence that comes with a 3D deformable registration algorithm that compensates for patient motion, ensuring highly accurate iodine signal extraction.

How it works:



The output of this registration algorithm is the precise extraction of iodine contrast media from the datasets provided. This iodine extraction is generated by subtracting the non-CE image from the contrast-enhanced image. Registration is automatically applied before the subtraction to ensure accurate alignment and precise iodine extraction.

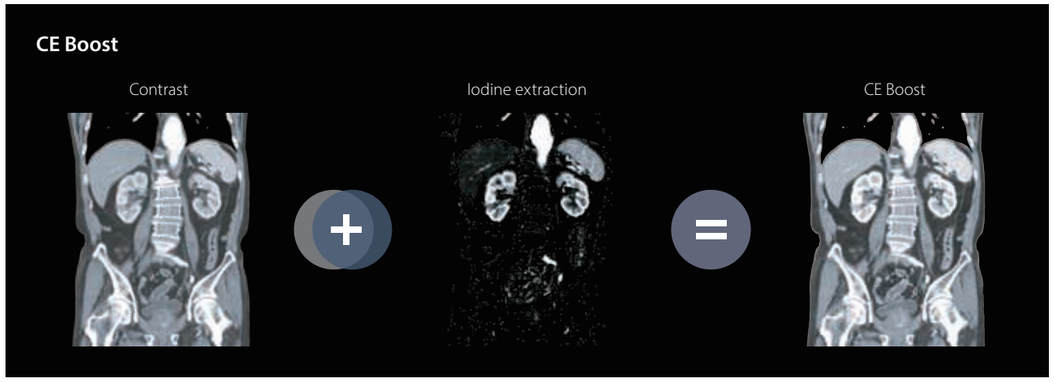


The extracted iodine image depicted in color can then be fused with the contrast-enhanced image, producing a full iodine color map.

Brighter images

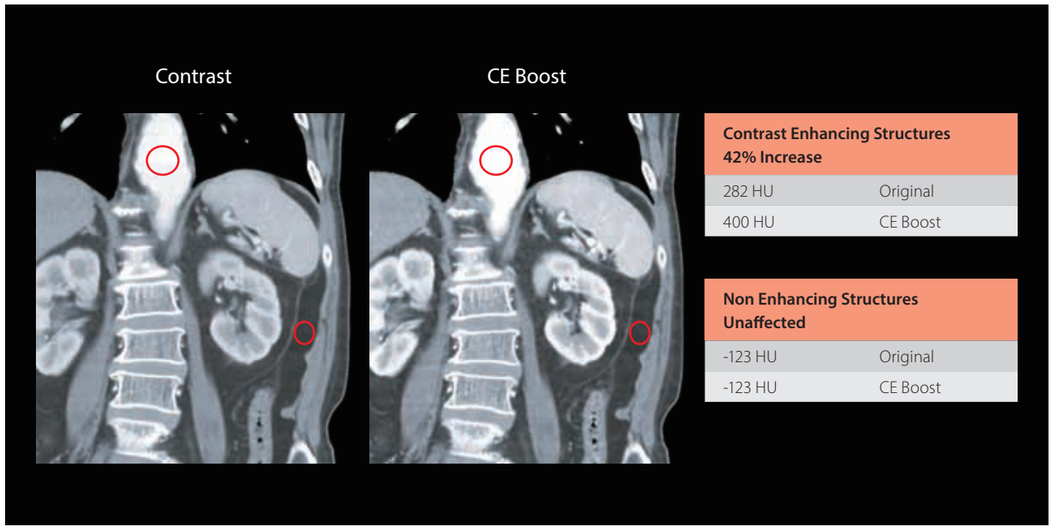
Contrast Enhanced Boost (CE Boost) is an image processing technique that virtually enhances the iodine signal to improve image quality and give you a better understanding of your patient.

How it works:



The extracted iodine signal is added to the original contrast-enhanced gray scale image. The CE Boost image is then displayed in gray scale and 'boosts' visualization of the contrast media. This may be excellent for evaluating the vascular tree, especially the small vascular branches.

CE Boost in action



Where iodine is shown, HU values are increased and appear brighter. In this example, the HU value increases by up to 42%. Conversely, in the absence of iodine, the HU value remains relatively constant.

By increasing the iodine density, these CE Boost images may appear similar to low kV images where contrast appears to be brighter. The higher kV used in SCT reduces the noise and streak artifacts sometimes associated with low kV imaging performed in larger patients.

This virtual boost of iodine visualization may allow a reduction in the total iodine load needed for contrast-enhanced scans, a benefit that's particularly useful for patients with renal insufficiency.

A word from the experts

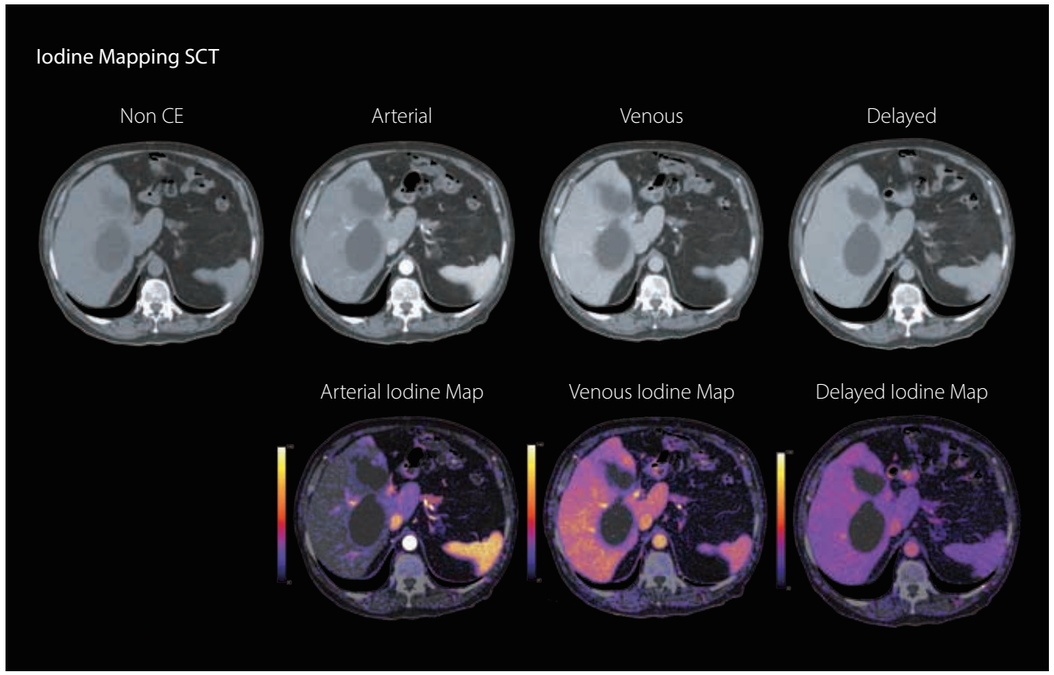
"Iodine Mapping SCT maximizes the data obtained from a routine dose-neutral multi-phase scan protocol. By applying well-established image analysis algorithms, the system automatically generates robust iodine color maps that highlight the uptake of iodine, enhancing our diagnostic capabilities and confidence."

Professor Catherine Roy, MD
Radiologist
Strasbourg University Hospital, France

Revolutionize your workflow

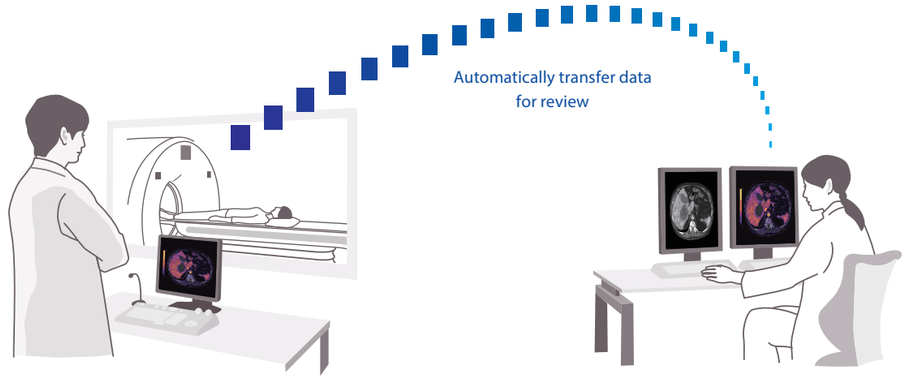
Tailored to each patient
The CT scanner has a dedicated, easy-to-use SCT mode, which helps streamline your workflow and maintain consistency. In addition, it synchronizes the scan and reconstruction parameters necessary for iodine mapping processing across all multiphase scans.

Deeper insight where you need it
Iodine maps can be implemented quickly and easily to your current multiphase protocols to enhance your diagnostic confidence without the need for additional scans and an increase in radiation dose.



Example of routine 4 phase liver protocol with Iodine Mapping SCT

Access results anywhere
For extra efficiency, the iodine maps are reconstructed in the background and can be sent from the scanner to any destination, for example, PACS, for immediate review. This process is completely automated to ensure a fast workflow that does not require manual post-processing.



Canon CT Scanner
Easily acquire routine images with a synchronized scan protocol for consistent results.

PACS
Diagnose with more confidence.
Distribute and share results with the patient's care team.

A word from the experts

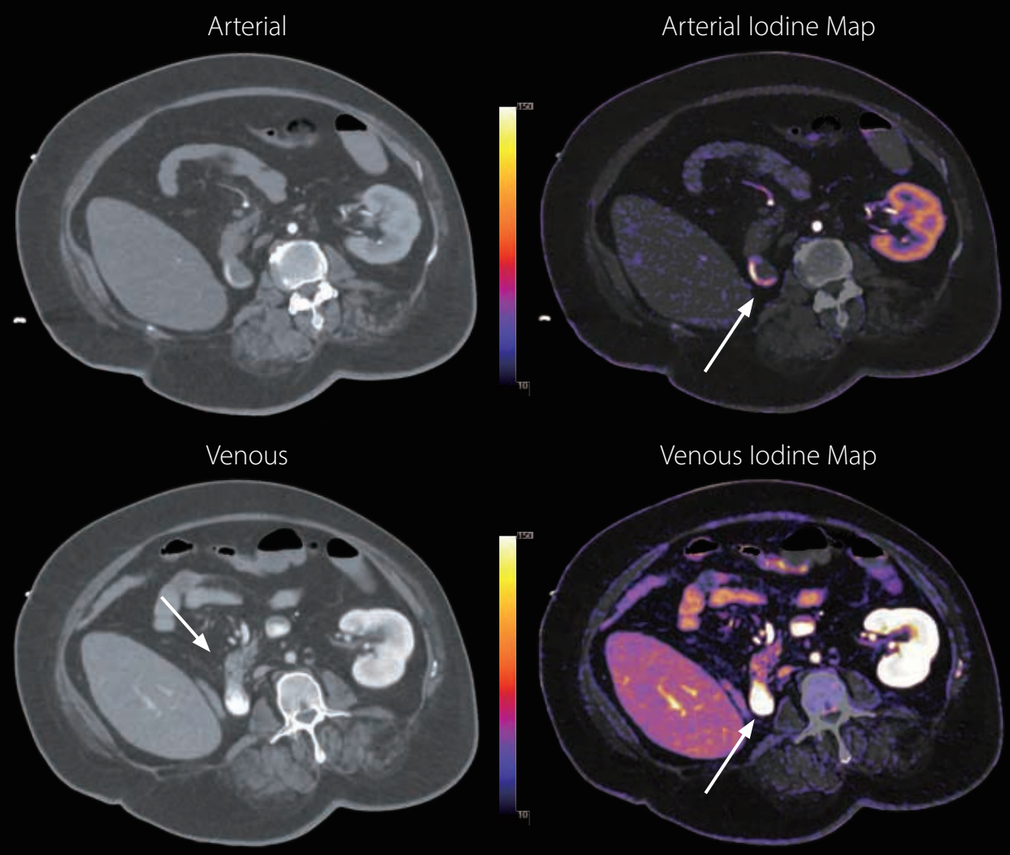
A word from the experts

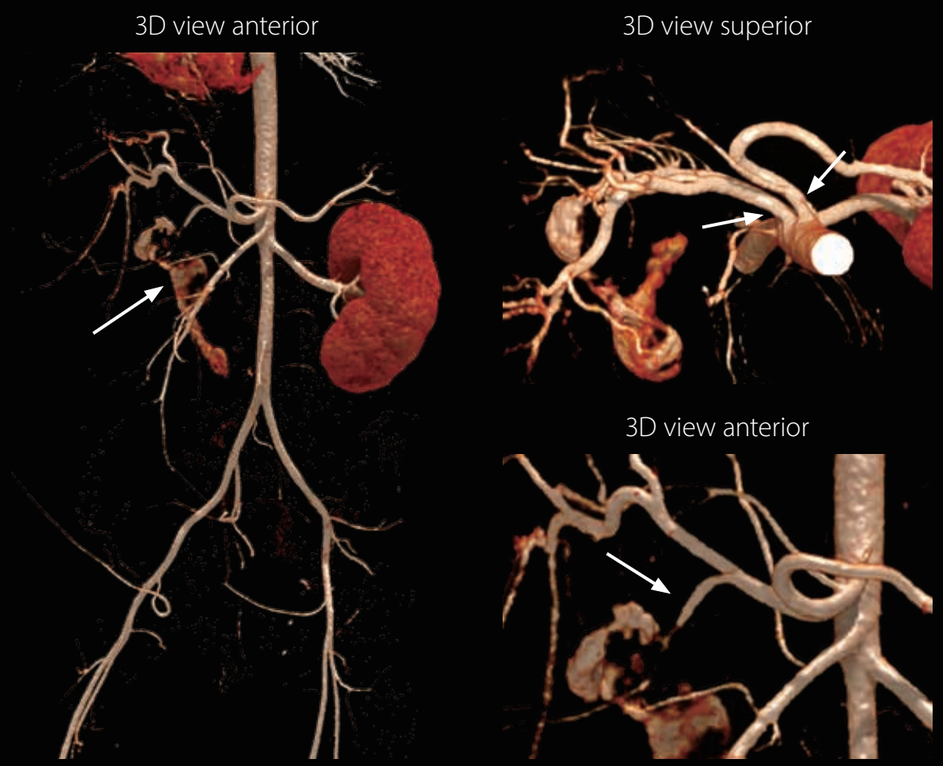
"Iodine Mapping SCT has a dedicated easy-to-use scan mode to synchronize multi-phasic protocols. Using this as our default protocol for all our multi-phase examinations, the iodine maps are generated automatically and sent to PACS without the need for time-consuming manual processing."

Stephanie Sandel
CT Team Lead Radiographer
Strasbourg University Hospital, France

Case Study 1

Duodenum bleed





Patient history

A 60-year-old obese man presented to the emergency department with upper abdominal pain and rectal bleeding. A routine 3 phase abdominal scan was performed to evaluate for active bleeding.

The images were reconstructed with Advance intelligent Clear-IQ Engine (AiCE) (Deep Learning Reconstruction).

Findings

The arterial phase shows a large active bleed arising from the gastroduodenal artery. The ability to interactively review color iodine maps provides an excellent means to quickly focus on the area of greatest concern.

There is an absence of the celiac trunk in this patient with the common hepatic and splenic arteries arising separately from the abdominal aorta. This is an important finding to note when considering treatment options and is clearly demonstrated in the Global Illumination 3D images.

Acquisition

3 phase abdomen pelvis
1 Non CE, Scan Range 486 mm, CTDI 12.30 mGy, DLP 650.5 mGy·cm
2 Arterial, Scan Range 486 mm, CTDI 12.30 mGy, DLP 650.5 mGy·cm
3 Venous, Scan Range 486 mm, CTDI 12.30 mGy, DLP 650.5 mGy·cm

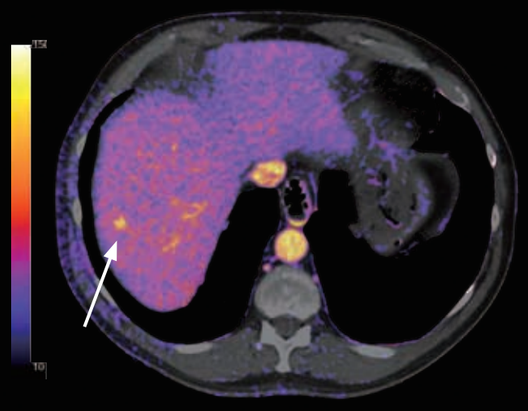
Case Study 2

Liver lesion

Venous

CE Boost

Venous Iodine Map



Patient history

A 68-year-old man presented for investigation of metastasis following treatment for cancer. A routine CT scan of the chest, abdomen and pelvis was performed.

Findings

A small lesion can be seen in the liver. The lesion is poorly visualized in the venous phase; however, the CE Boost images and iodine color maps highlight the lesion making it more conspicuous. The patient was referred for further investigation of this lesion.

Acquisition

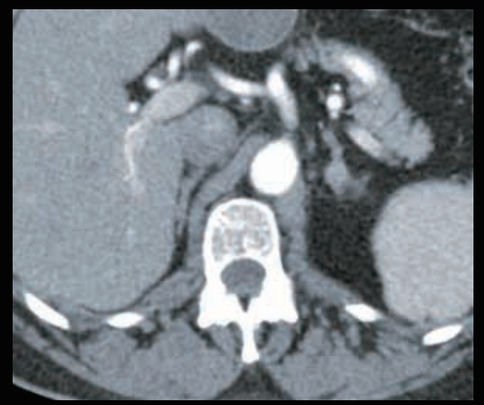
2 phase chest abdomen pelvis
1 Non CE, CAP, Scan Range, 924.8 mm, CTDI 1.6 mGy, DLP 155.8 mGy·cm
2 Venous, CAP, Scan Range 924.8 mm, CTDI 7.3 mGy, DLP 707.9 mGy·cm

Case Study 3

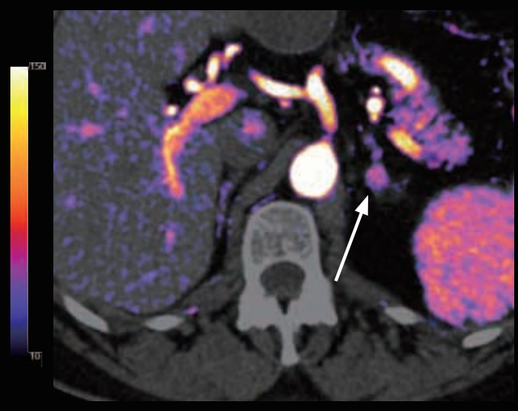
Adrenal gland lesion

Non CE

Arterial



Arterial Iodine Map



Patient history

A 62-year-old man with a known history of renal neoplasm and secondary pulmonary lesions presented for a follow up examination. A routine multiphase CT was requested to investigate evidence of further secondary lesions.

Findings

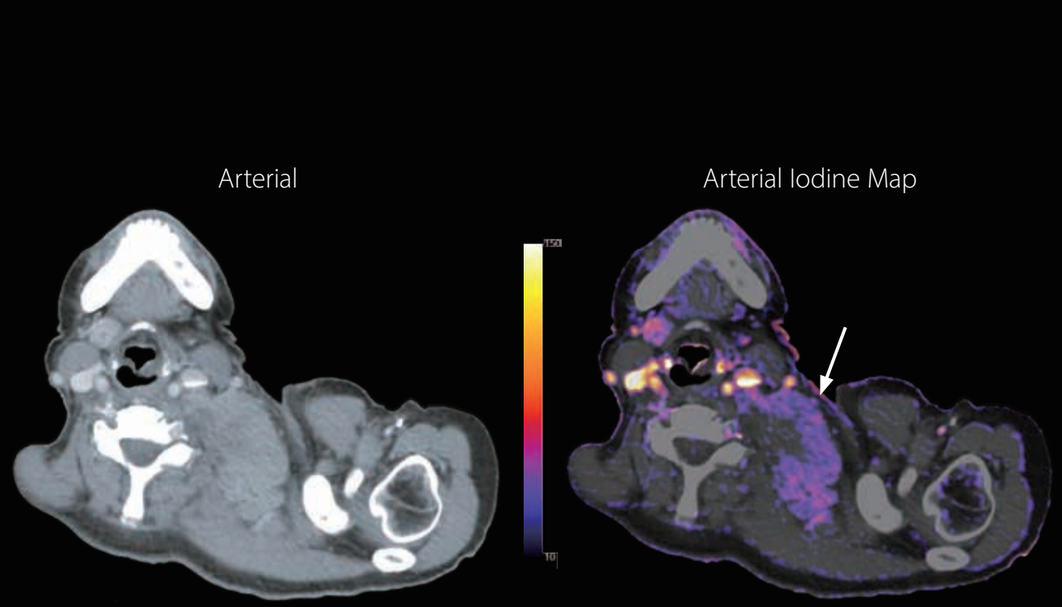
A small left adrenal nodule is seen in the axial images, which is consistent with a Conn adenoma and highlighted with greater certainty in the iodine map.

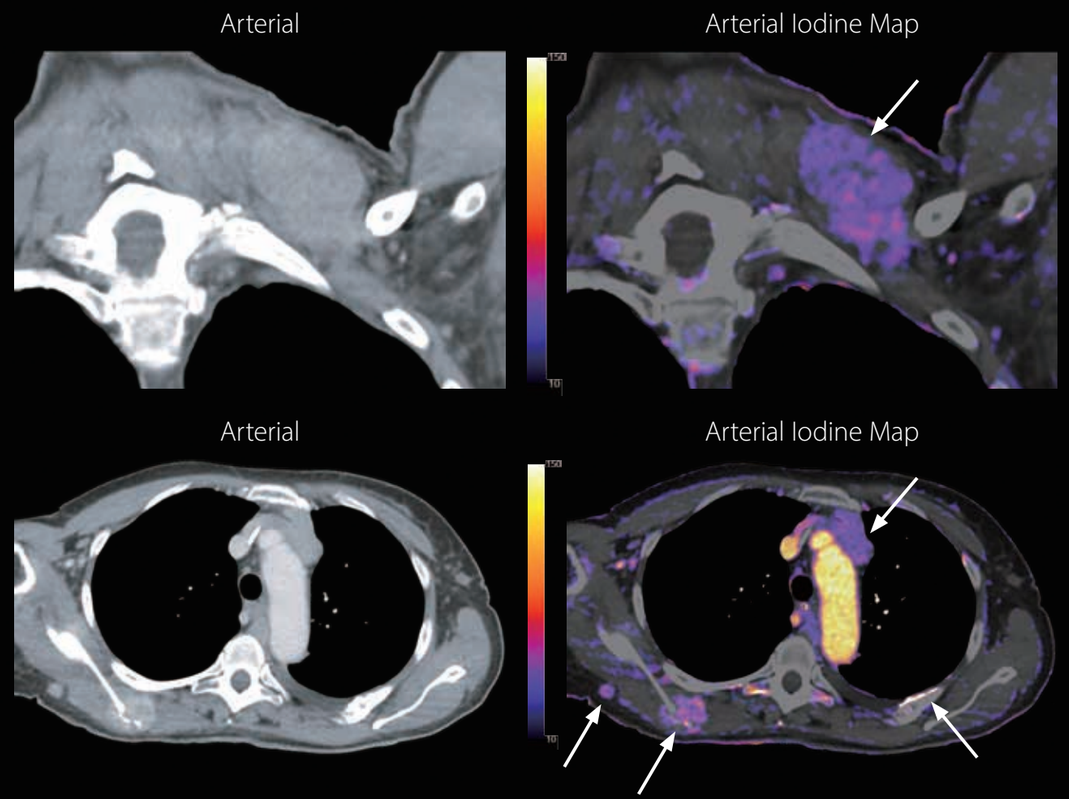
Acquisition

2 phase kidney
1 Non CE, CAP, Scan Range 644 mm CTDI 5.2 mGy, DLP 360.1 mGy·cm
2 Arterial, CAP, Scan Range 644 mm, CTDI 7.9 mGy, DLP 539.7 mGy·cm

Case Study 4

Neck and chest metastases





Patient history

A 73-year-old woman with known excreto-urinary carcinoma presented with a palpable mass in the left supraclavicular region causing pain. A routine multiphase CT scan was performed for investigation of metastatic disease.

Findings

Metastases are demonstrated in the supraclavicular, para-aortic, scapula, ribs and soft tissue regions. The supraclavicular mass causing pain is confirmed as a metastasis.

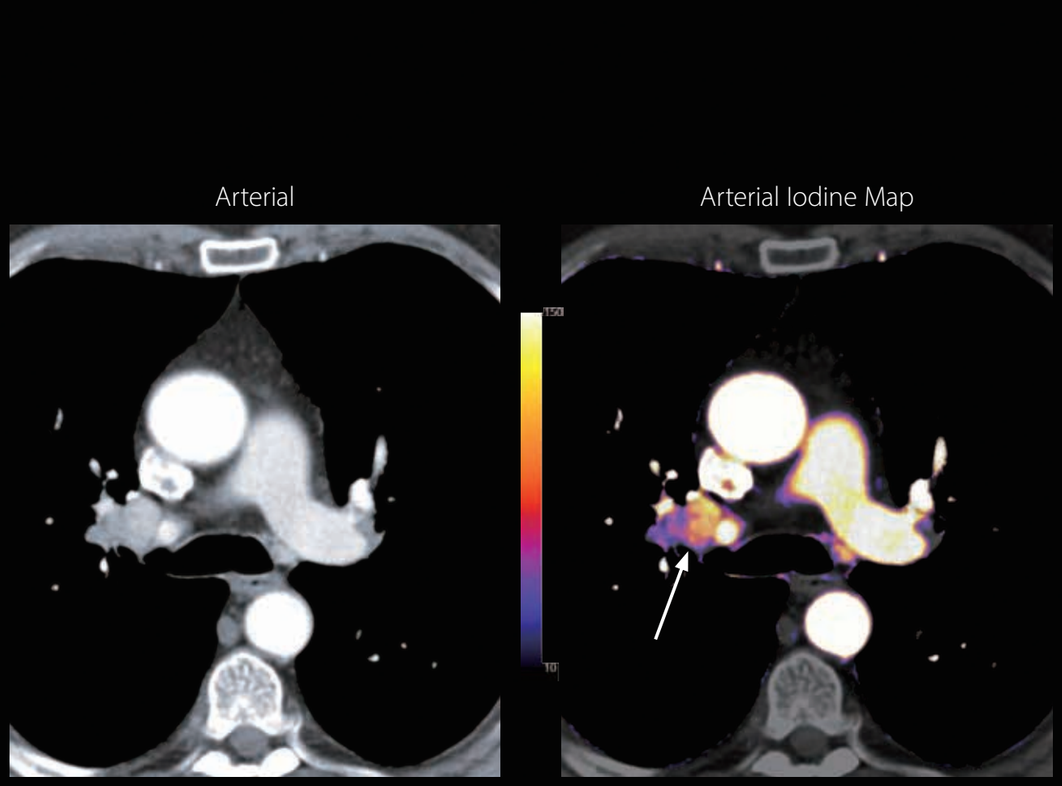
The iodine maps increase the conspicuity of the lesions when compared with the arterial images.

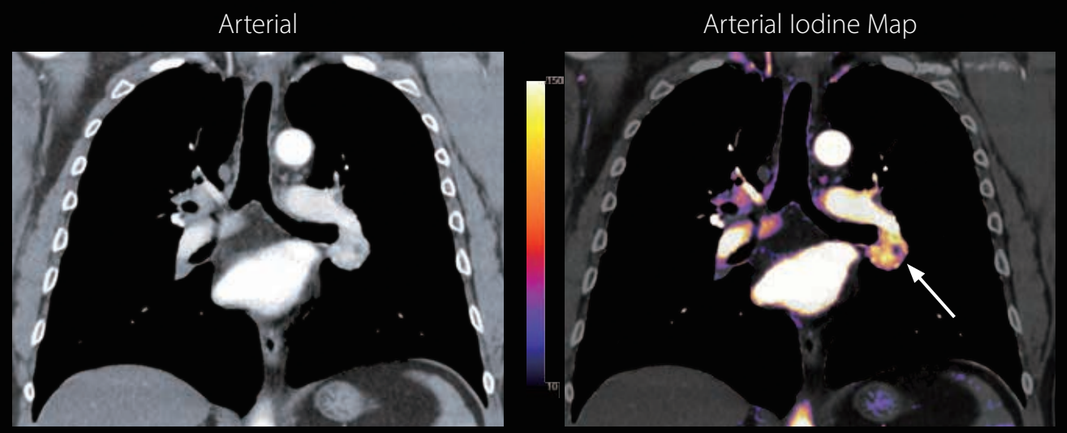
Acquisition

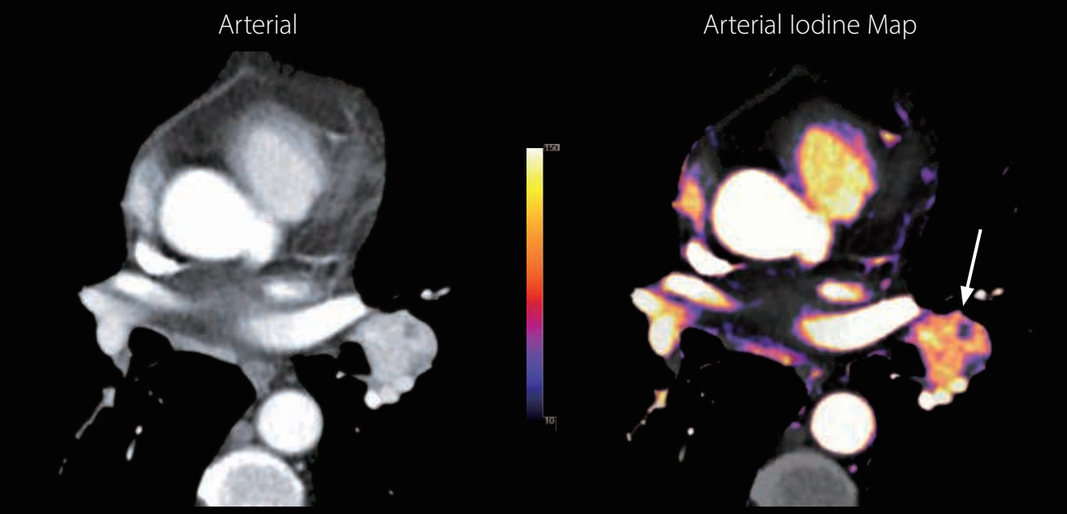
2 phase chest abdomen pelvis
1 Non CE, CAP, Scan Range 749 mm, CTDI 1.00 mGy, DLP 80.60 mGy·cm
2 Arterial, CAP, Scan Range 749 mm, CTDI 5.2 mGy, DLP 414.8 mGy·cm

Case Study 5

Mediastinal metastases







Patient history

A 59-year-old man, who was treated previously for clear cell renal cell carcinoma, presented for further investigation of metastatic disease. A routine multiphase CT scan of the chest and abdomen was performed.

Findings

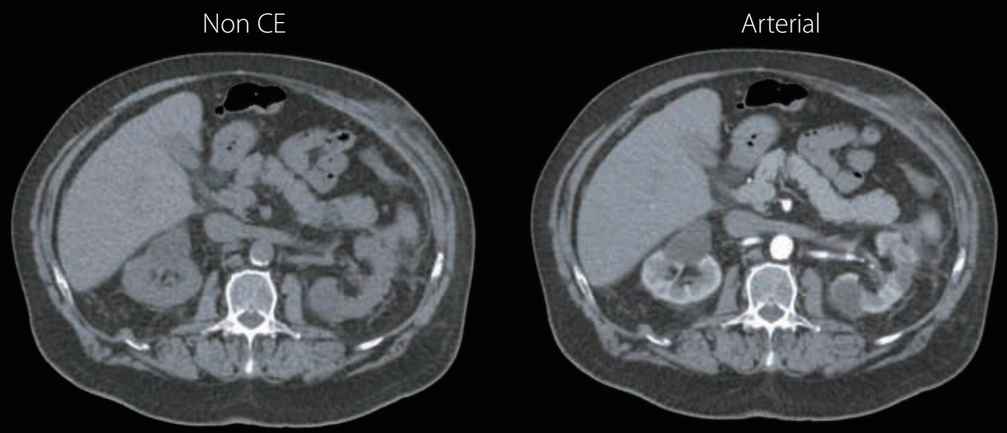
Metastases are seen in the hilar regions of both lungs. Tumor heterogeneity is more easily appreciated in the iodine maps. You'll also notice that it's easier to distinguish the relationship of the tumor to the surrounding vessels.

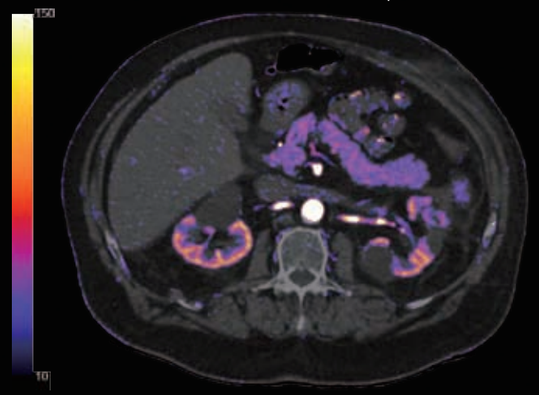
Acquisition

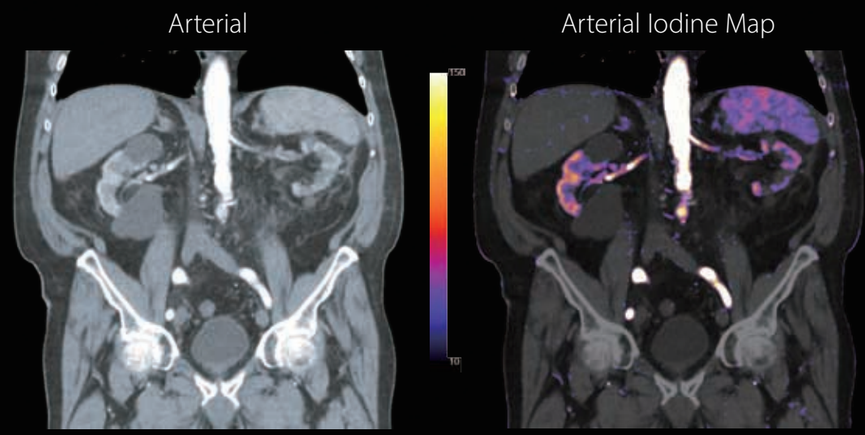
2 phase chest abdomen pelvis
1 Non CE, CAP, Scan Range 648 mm, CTDI 3.9 mGy, DLP 266.6
2 Arterial, CAP, Scan Range 648 mm, CTDI 8.6 mGy, DLP 597

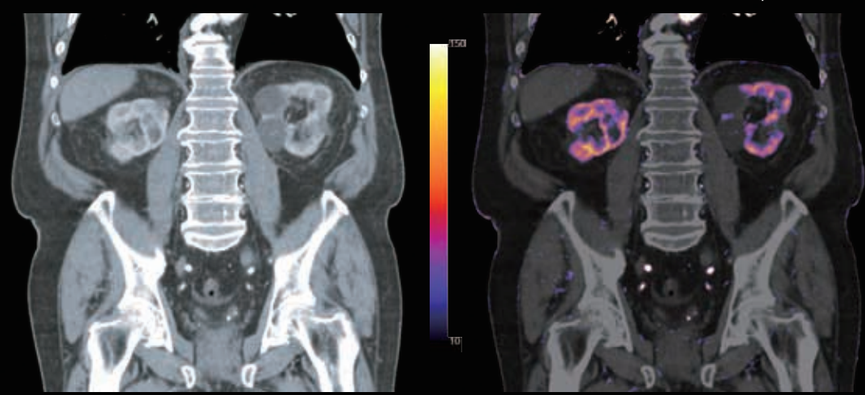
Case Study 6

Multiple renal cysts after partial nephrectomy









Patient history

This 85-year-old man with a known left partial nephrectomy presented for a follow up CT scan. A routine multiphase CT scan was performed.

Findings

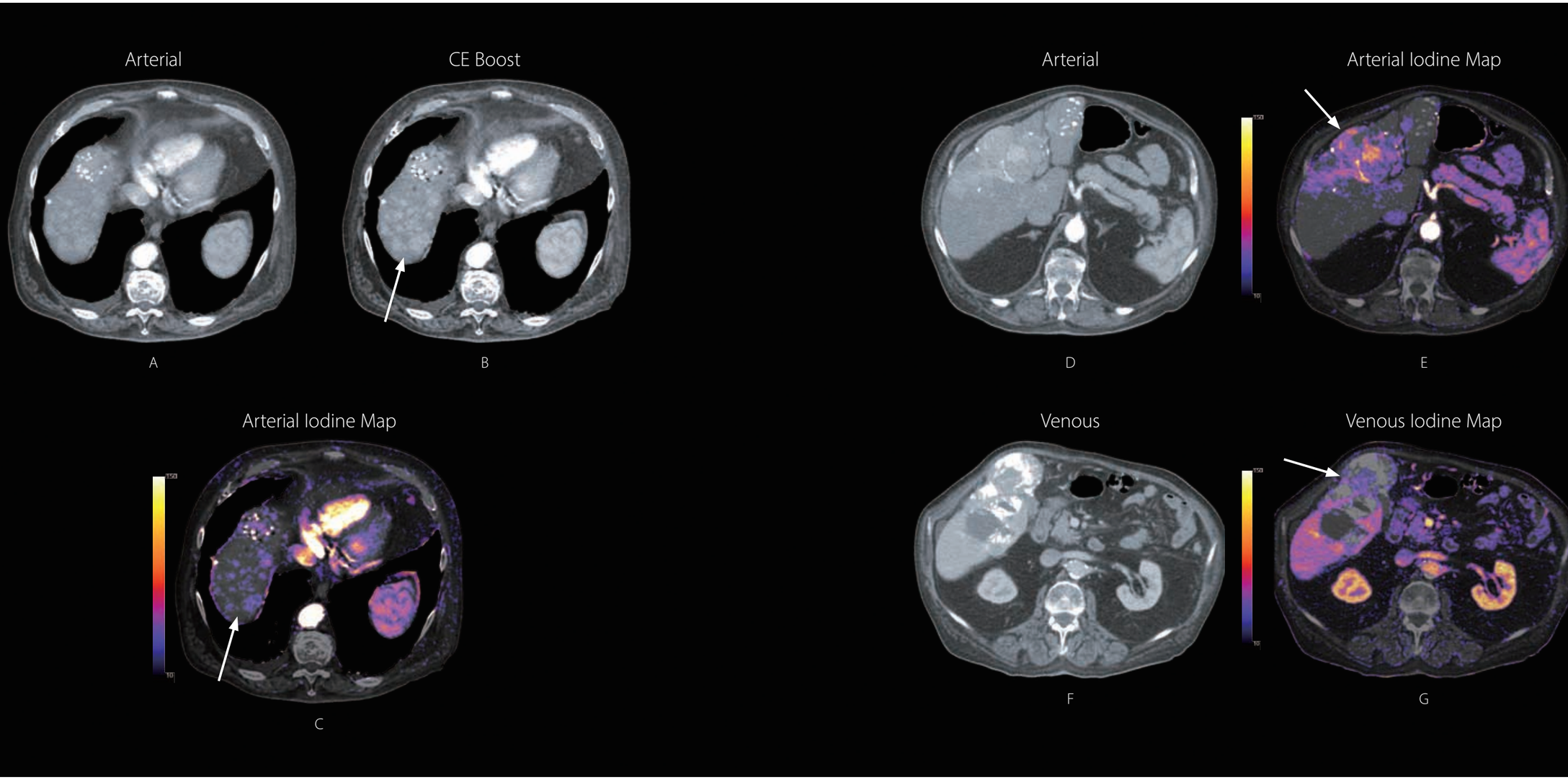
Multiple renal cysts are shown in both kidneys. The iodine maps confirm with greater certainty there is no contrast uptake in the cysts excluding malignancy. No tumor recurrence is seen and no other pathology is detected.

Acquisition

2 phase kidney
1 Non CE, Abdomen Pelvis, Scan Range 416 mm, CTDI 6.9 mGy, DLP 315.3 mGy·cm
2 Arterial, CAP, Scan Range 620 mm, CTDI 10.10 mGy, DLP 673.9 mGy·cm

Case Study 7

Liver lesion post chemo embolization



Patient history

This 79-year-old man presented for a follow up multiphase CT scan of the liver one month after chemo-embolization treatment for multifocal hepatocellular carcinoma.

Findings

Multiple small enhancing lesions are seen in the arterial phase image and highlighted with greater certainty in the CE Boost and iodine color map images (A, B, C).

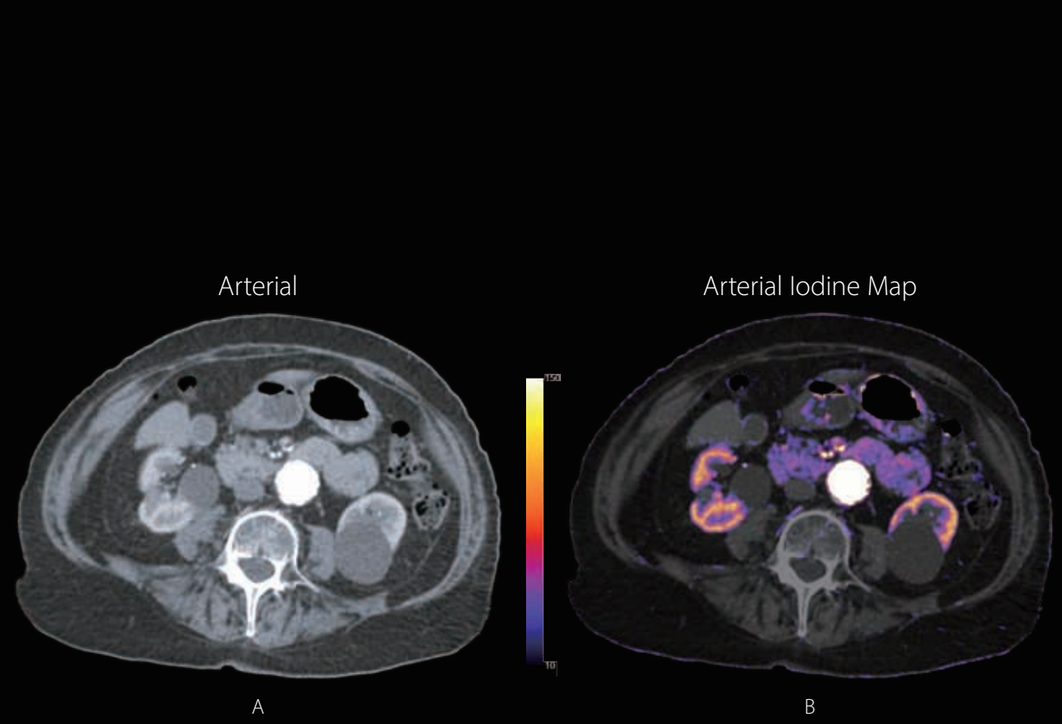
The post embolization material, lipiodol, is present from the previous treatment (A-G). Using the SCT technique the lipiodol is suppressed in the iodine maps and allows the reader to clearly visualize the surrounding tissue. The HCC lesions appear more prominent in the iodine maps, facilitating a more confident diagnosis.

Acquisition

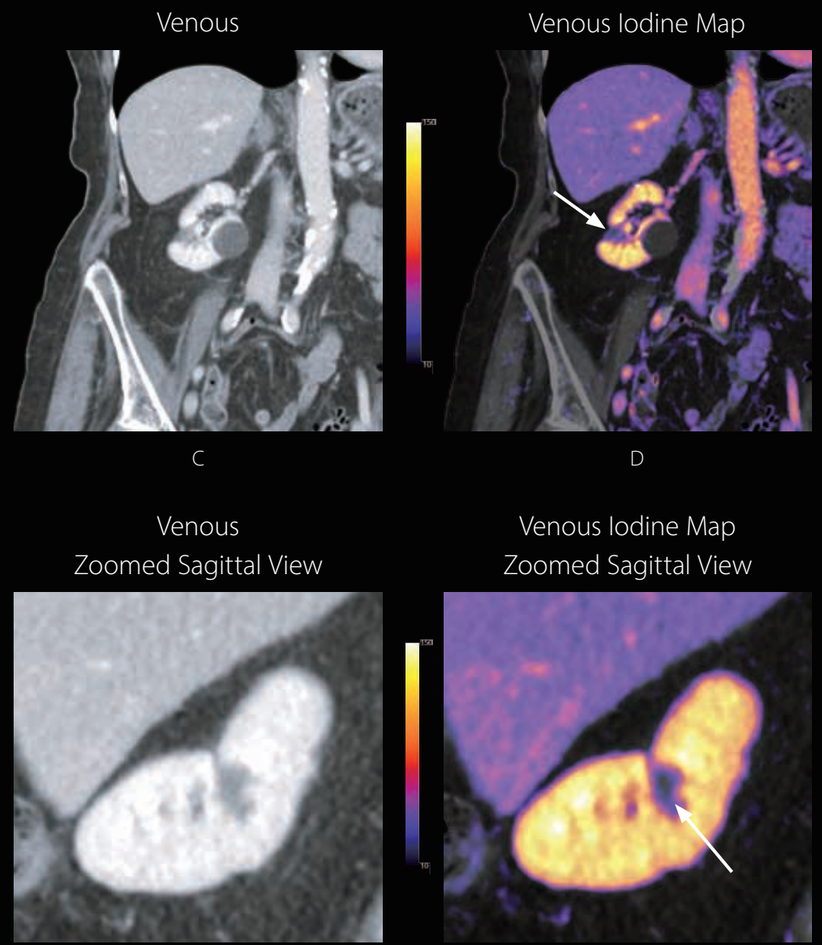
3 phase liver protocol including chest
1 Non CE, Upper Abdomen, Scan Range 281 mm, CTDI 7.4 mGy, DLP 239.6 mGy·cm
2 Arterial, Upper Abdomen, Scan Range 281 mm, CTDI 11.6 mGy, DLP 374.20 mGy·cm
3 Venous, CAP, Scan Range 596 mm, CTDI 9.6 mGy, DLP 614.4 mGy·cm

Case Study 8

Partial nephrectomy follow up



A B



C D E F

Patient history

This 77-year-old woman presented for a follow-up exam after a right partial nephrectomy for renal epithelioma.

Findings

Cystic structures are seen in both kidneys. The iodine maps clearly show there is no contrast uptake in the cysts excluding evidence of malignancy (A & B).

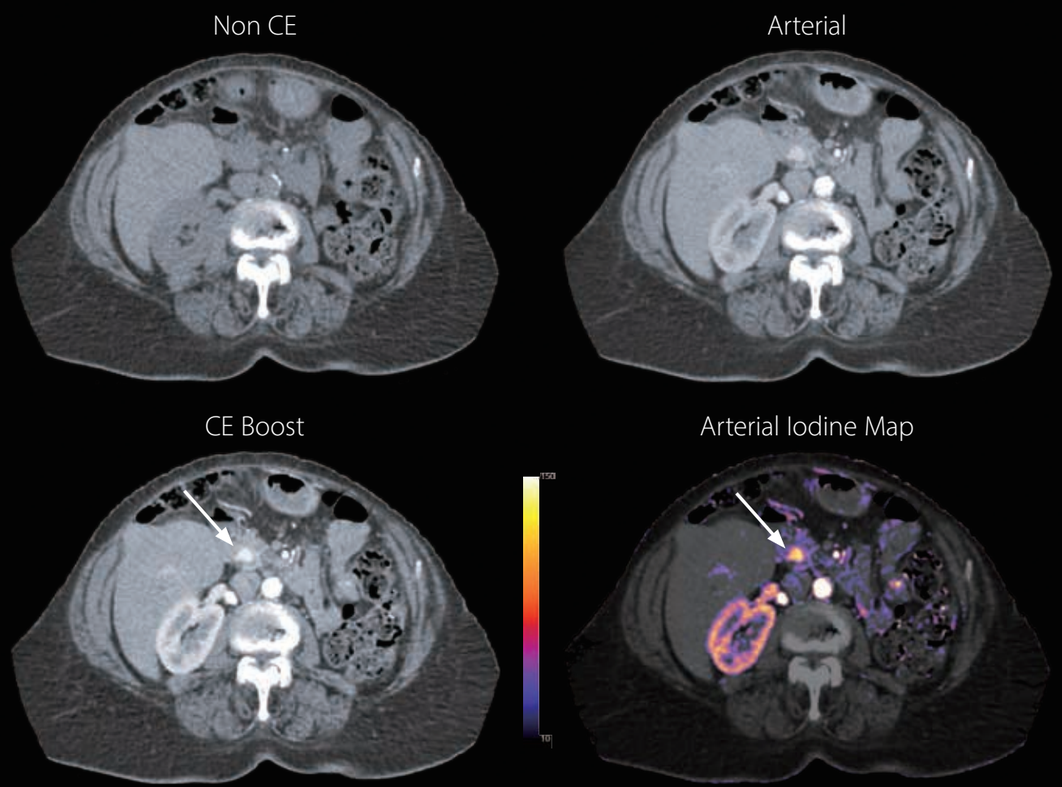
The area of partial nephrectomy in the right kidney shows no evidence of carcinoma recurrence (images C & D) and this is confirmed in the iodine maps (D & F) highlighting no contrast uptake in these areas.

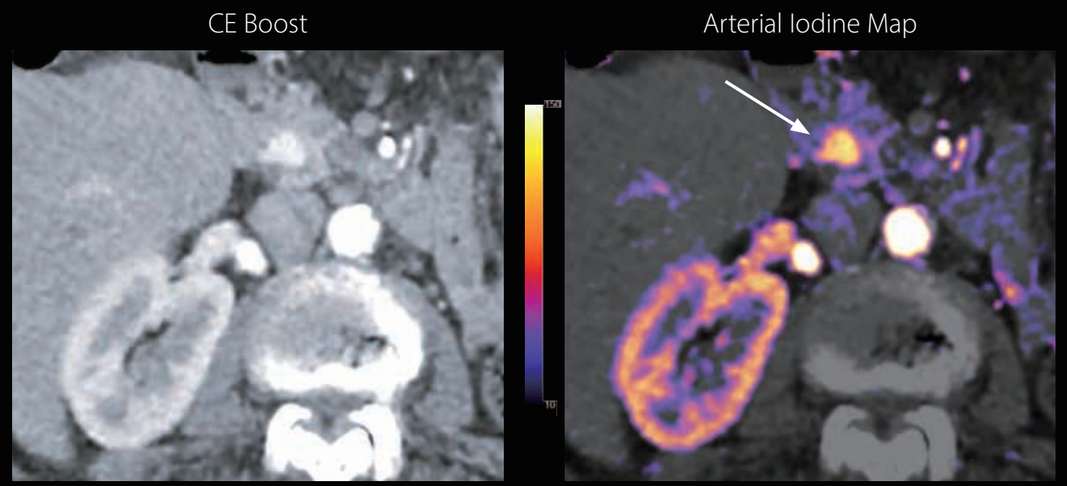
Acquisition

3 phase kidney
1 Non CE, Abdomen Pelvis, Scan Range 410 mm, CTDI 3.9 mGy, DLP 175.4 mGy·cm
2 Arterial, Abdomen Pelvis, Scan Range 410 mm, CTDI 5.4 mGy, DLP 242.9 mGy·cm
3 Venous, Abdomen Pelvis, Scan Range 410 mm, CTDI 5.4 mGy, DLP 242.9 mGy·cm

Case Study 9

Pancreas head lesion





Patient history

A routine multiphase CT scan of the pancreas is requested for an obese 76-year-old woman following treatment for metastatic cancer.

Findings

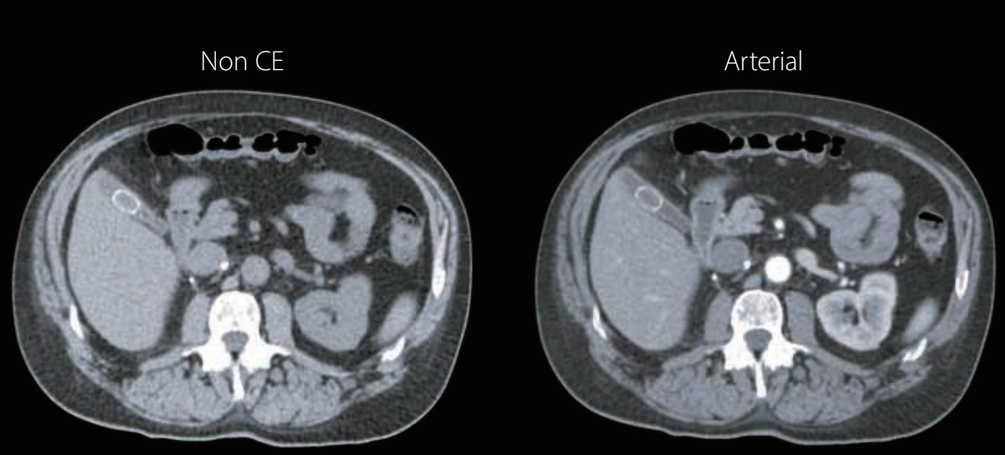
A small hypervascular lesion is seen in the pancreatic head. The lesion shows a low amount of contrast uptake in the arterial image. The CE Boost and iodine maps show with greater confidence the uptake of contrast in the lesion indicating the presence of carcinoma.

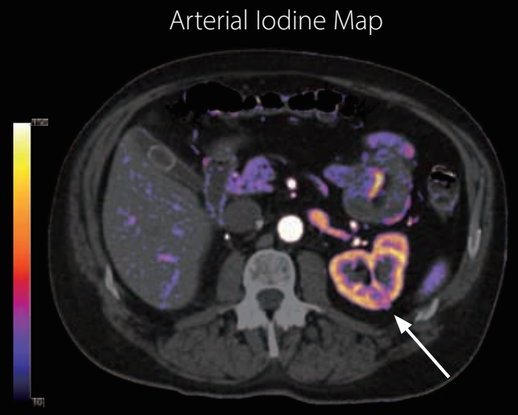
Acquisition

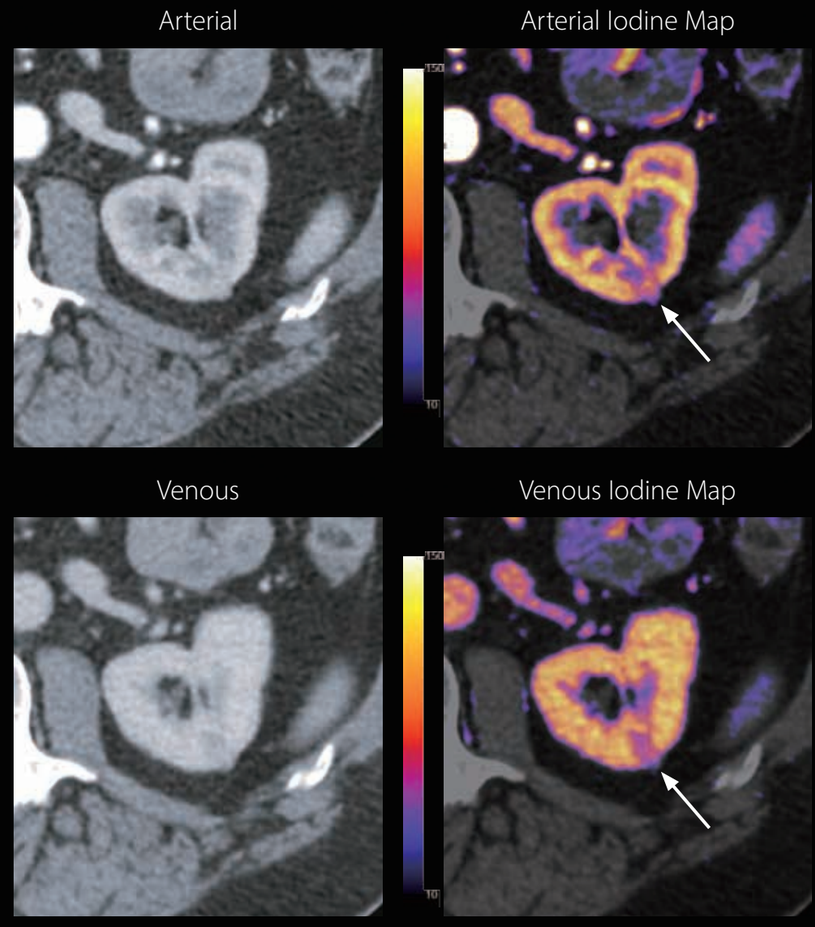
2 phase pancreas
1 Non CE, CAP, Scan Range 560 mm, CTDI 5.7 mGy, DLP 340.8 mGy·cm
2 Arterial, CAP, Scan Range 560 mm, CTDI 10.5 mGy, DLP 629.7 mGy·cm

Case Study 10

Total nephrectomy







Patient history

A 62-year-old man has a history of total nephrectomy of the right kidney for a Fuhrman grade II renal cell carcinoma. A multiphase CT scan was requested for one year routine follow up.

Findings

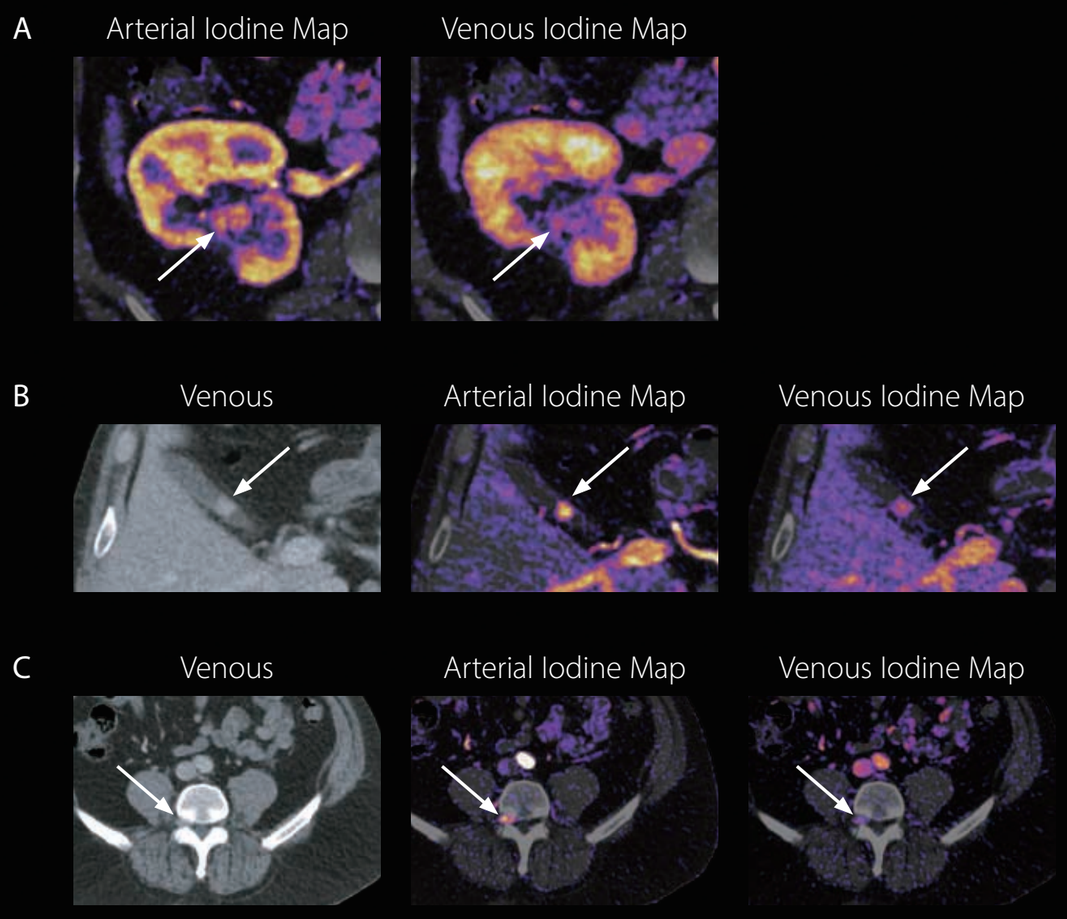
A small enhancing lesion is seen in the periphery of the left kidney. Due to the patient's history, this is likely a recurrence of renal cell carcinoma. The carcinoma recurrence is best visualized on the iodine color map.

Acquisition

3 phase kidney
1 Non CE, CAP, Scan Range 644 mm CTDI 5.2 mGy, DLP 360.1 mGy·cm
2 Arterial, CAP, Scan Range 644 mm, CTDI 7.9 mGy, DLP 539.7 mGy·cm
3 Venous, Abdomen Pelvis, Scan Range 463 mm, CTDI 8.6 mGy, DLP 435.5 mGy·cm

Case Study 11

Follow-up of renal cell carcinoma



Patient history

A 54-year-old male presented with a history of renal cell carcinoma of the left kidney for which a radical nephrectomy was previously performed. A multiphase CT scan of the kidneys was requested to assess local recurrence and potential metastasis.

Findings

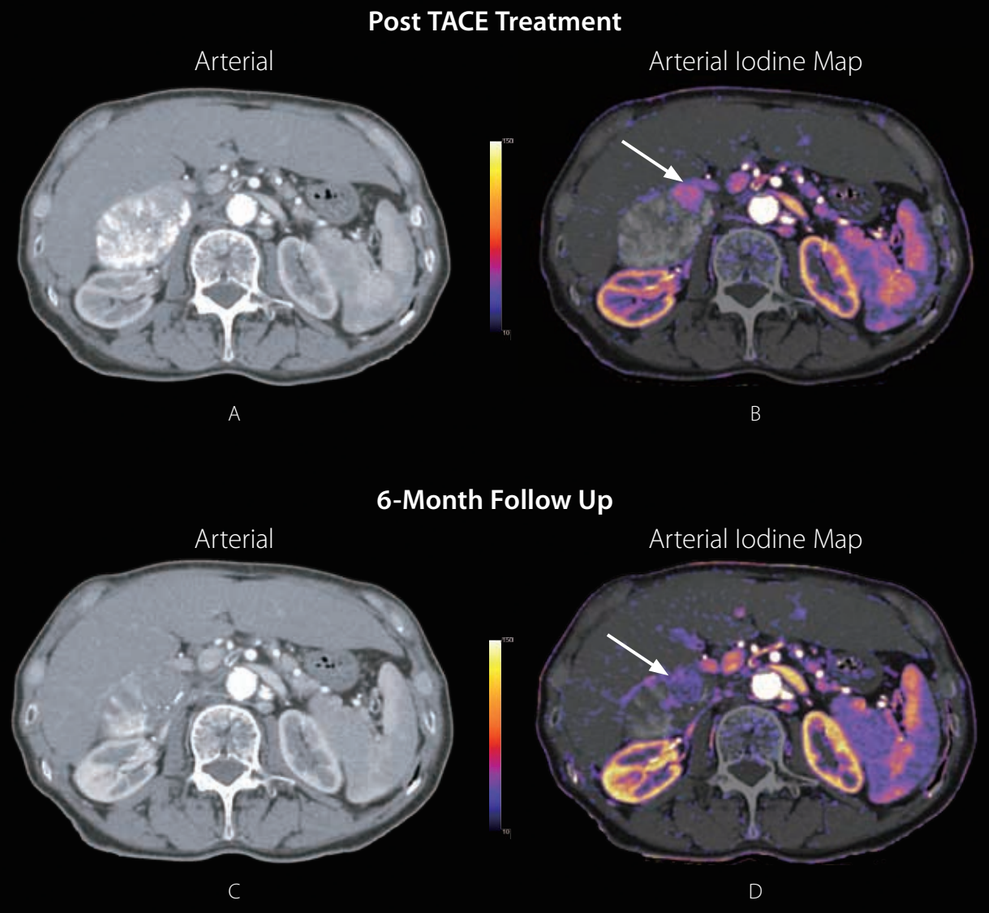
The arterial iodine maps show an enhancing lesion within the surgical defect of the right kidney (A). In the gallbladder, an enhancing lesion is visible. The gallbladder lesion may easily be mistaken for a gallbladder stone on the venous phase CT images alone (B). Furthermore, a lesion is visible in the right intervertebral foramen (C). All identified lesions show arterial enhancement and venous washout, consistent with recurrent RCC.

Acquisition

3 phase abdomen pelvis (Non CE, Arterial, Venous) Scan Range, 290.4, CTDI 9.0 mGy, DLP 300.8 mGy·cm

Case Study 12

Hepatocellular carcinoma



Patient history

A 70-year-old man presented for a follow-up multiphase scan following TACE treatment for HCC with a 6-month follow-up.

Findings

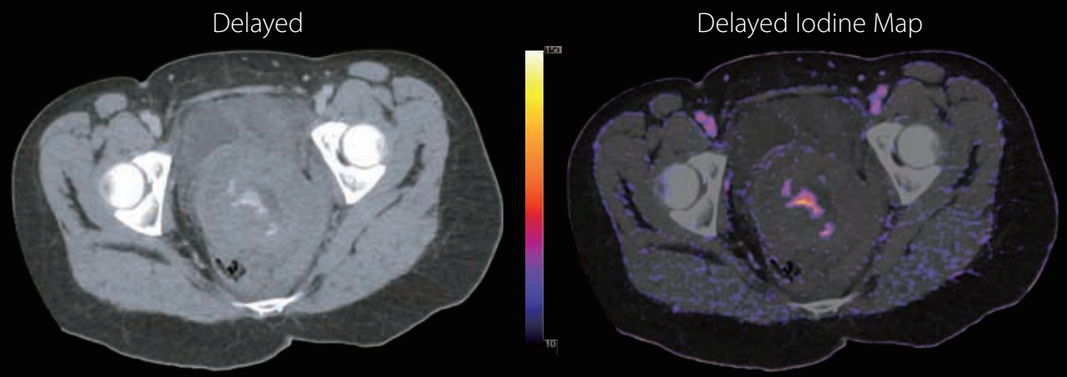
The lipiodol used in the TACE procedure obscures contrast enhancement making residual tumor difficult to identify in arterial phase image (A) but easily identified on the extracted iodine map (B). In the 6-month follow-up scan after chemotherapy, the residual tumor has reduced in size as seen clearly in the iodine map image (D).

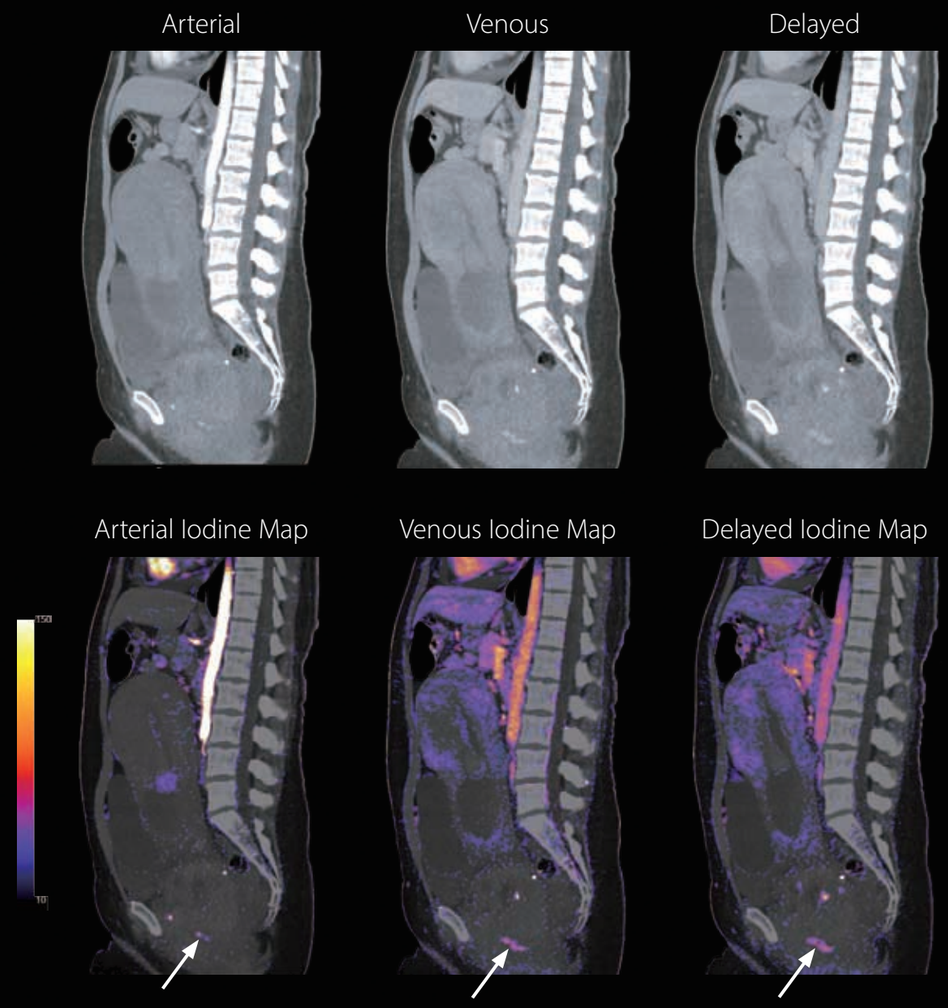
Acquisition

2 phase liver
Post-TACE treatment: (Non CE, Arterial), Scan Range 214 mm CTDI 7.2 mGy, DLP 180.1 mGy·cm
6-month follow-up: (Non-CE, Arterial), Scan Range 185 mm CTDI 4.4 mGy, DLP 102.9 mGy·cm

Case Study 13

Postpartum hemorrhage





Patient history

A 36-year-old woman presented for clinical examination after giving birth with symptoms of postpartum hemorrhage. A routine 4 phase abdominal/pelvis scan was requested to investigate the cause of her symptoms.

The images were reconstructed with AiCE (Deep Learning Reconstruction).

Findings

The automatically generated iodine maps were initially reviewed and the arterial phase image shows a small collection of intravaginal iodine. The small collection of iodine increases in size over time indicating an active intravaginal bleed.

Acquisition

4 phase abdomen/pelvis
1 Non CE, Abdomen Pelvis Scan Range 475 mm, CTDI 6.00 mGy, DLP 306.00 mGy·cm
2 Arterial, Abdomen Pelvis Scan Range 475 mm, CTDI 5.9 mGy, DLP 308.10 mGy·cm
3 Venous, Abdomen Pelvis Scan Range 475 mm, CTDI 5.9 mGy, DLP 308.10 mGy·cm
4 Delayed, Abdomen Pelvis Scan Range 475 mm, CTDI 5.9 mGy, DLP 308.10 mGy·cm

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Canon Medical Systems Corporation meets internationally recognized standards for Quality Management System ISO 9001, ISO 13485.
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