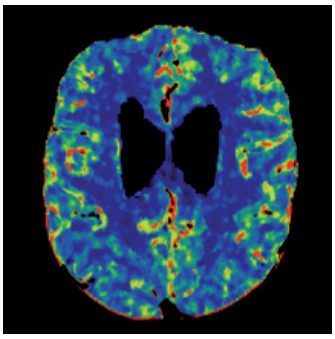
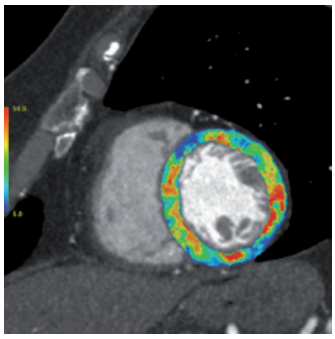
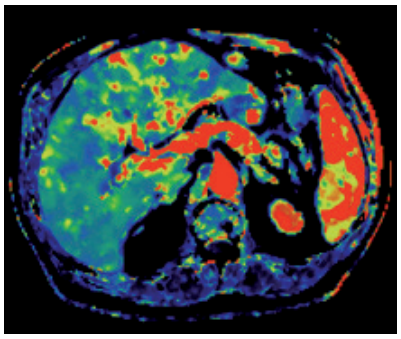
GE Healthcare

Case studies

Combined Anatomical and Functional Imaging with Revolution* CT

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Case 1

Whole Brain Perfusion and CT Angiography in a Single Exam

Patient History

A man in his 70s was referred to CT for suspicion of carotid lesion.

Head and neck angiography and whole brain perfusion were acquired to assess anatomy and function in a single exam.

Acquisition

Head & Neck CT Angiography

- Helical pitch 0.992:1, 80 mm collimation
- 120 kV, Noise Index 12
- 0.5 sec rotation
- BMI: 25
- ASiR*-V[1] 50%
- **DLP 303 mGy-cm**
- **1.48 mSv[2]**
- Coverage: 300 mm
- **Acquisition time: 1.9 sec**

Brain Perfusion & 4D CT Angiography

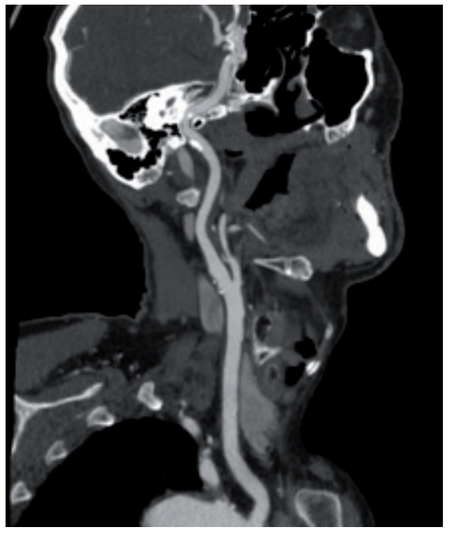
- Dynamic acquisition
- **Axial 140 mm for whole organ coverage**
- 50 cc of contrast media (350 mg I/mL)
- BMI: 25
- ASiR-V 80%
- **DLP 760 mGy-cm**
- **1.74 mSv[3]**
- *Group 1: wash-in (15 passes)*
  - 80 kV & 240 mA
  - 0.5 sec rotation speed
  - 2.5 sec between passes
- *Group 2: wash-out (5 passes)*
  - 80 kV & 180 mA
  - 0.5 sec rotation speed
  - 4 sec between passes

Results

Head & Neck CT Angiography

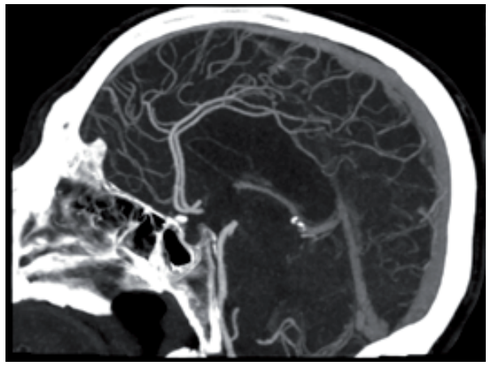
3D Volume rendering

Curved view

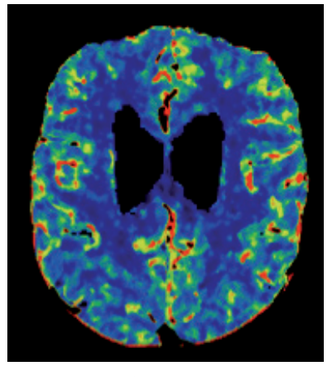


Curved view

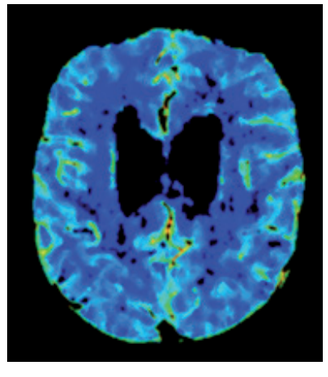
Brain Perfusion & 4D CTA



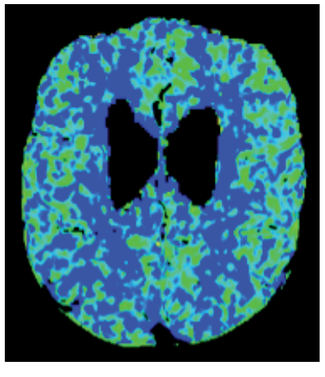
Coronal view showing 140 mm coverage



Cerebral blood flow



Cerebral blood volume



Cerebral mean transit time Time

This study shows that the intermediate stenosis at the base of the right carotid bulb and the severe stenosis at the origin of the right external carotid have no impact on the perfusion of the right hemisphere.

The whole brain perfusion maps show no perfusion abnormality. The total examination dose is 3.2 mSv for both head and neck angiography (1.7 mSv) and brain dynamic perfusion (1.5 mSv).

Conclusion

This case study demonstrates the feasibility of combining anatomical assessment of supra aortic trunks and accurate functional assessment of brain perfusion in one single study thanks to the whole organ coverage. Brain perfusion is performed without table motion, helping ensure homogeneous image quality. Furthermore, ASiR-V dose reduction capabilities and flexible sampling rate and tube current make it possible to perform the study at the dose of a conventional head examination.

Case 2

Comprehensive Cardiac Assessment: Coronaries and Myocardial Perfusion

Patient History

A woman in her 70s with multiple risk factors and complaining of atypical chest pain was referred to CT for coronary assessment.

Gated dynamic acquisition was performed to assess coronary arteries and myocardial perfusion in a single exam, with a single injection.

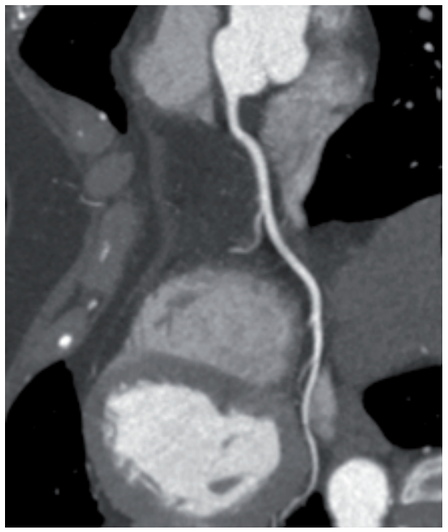
Acquisition

- Prospectively gated dynamic acquisition
- **160 mm axial for whole organ coverage**
- **60 cc of contrast media (350 mg I/mL)**
- BMI: 27
- ASiR-V 50%
- **DLP 699 mGy-cm**
- 9.7 mSv[4]
- *Group 1: wash-in (10 passes)*
  - 100 kV & 450 mA
  - 0.28 sec rotation speed
  - 2.2 sec between passes
- *Group 2: wash-out (5 passes)*
  - 100 kV & 240 mA
  - 0.28 sec rotation speed
  - 4 sec between passes

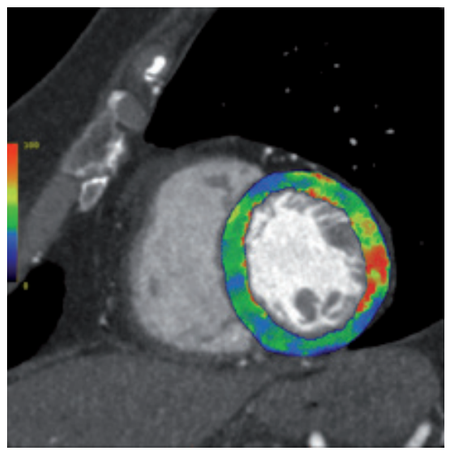
Results

3D – Coronary tree

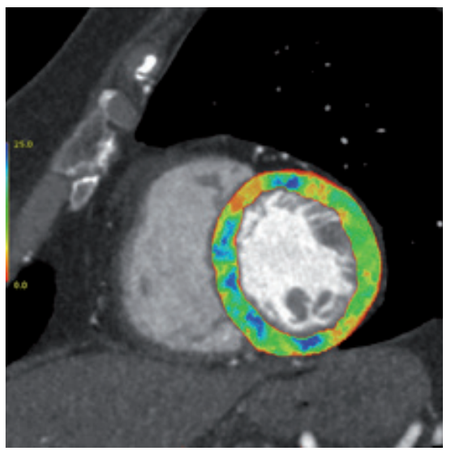
First diagonal curved view



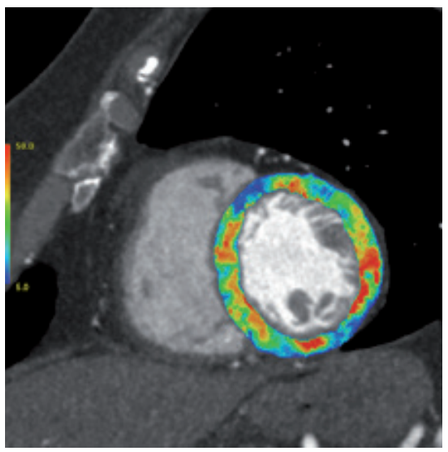
RCA curved view



Short axis - myocardial blood flow



Short axis – myocardial blood volume



Short axis - myocardial mean transit time

Coronary arteries are normal, and no significant ischemia was detected on the myocardial perfusion maps.

Conclusion

Dynamic cardiac perfusion was performed with no table motion, taking advantage of the 160 mm-coverage detector that provides uniform image quality and accurate perfusion quantification. With Revolution CT it is now possible to combine anatomical assessment of the coronary tree with an accurate functional assessment of the myocardial perfusion in a single acquisition, using a single injection, at low radiation dose.

This acquisition technique could potentially enable an increase in specificity and positive predictive value of Coronary CT angiography.

Case 3

Quantitative CT liver perfusion imaging

Patient History

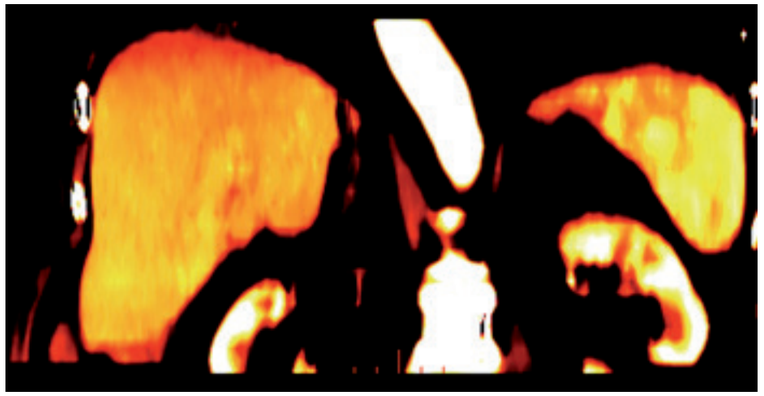
A man in his 70s was referred to CT for cholangiocarcinoma follow-up.

Whole-organ dynamic acquisition was performed to assess morphological and functional changes of the hepatic lesion.

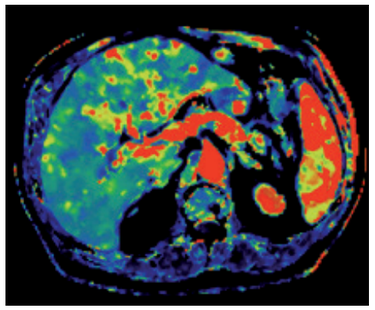
Acquisition

- Dynamic acquisition
- **160 mm axial for whole organ coverage**
- 60 cc of contrast media (350 mg I/mL)
- BMI: 24
- ASiR-V 80%
- **DLP 880 mGy-cm**
- 13 mSv[5]
- *Group 1: wash-in (7 passes)*
  - 100 kV & 90 mA
  - 0.5 sec rotation speed
  - 2 sec between passes
- *Group 2: wash-out (8 passes)*
  - 100 kV & 90 mA
  - 0.5 sec rotation speed
  - 8.5 sec between passes

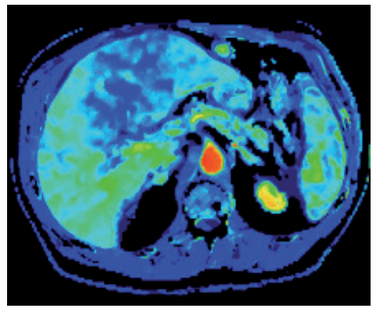
Results



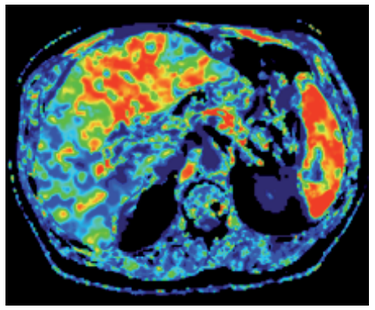
Coronal view showing 160 mm coverage



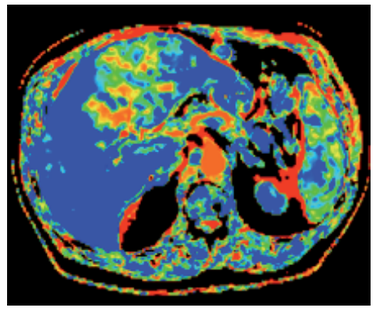
Blood flow



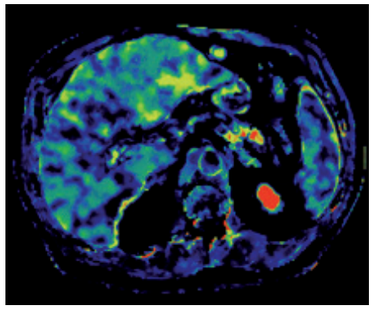
Blood volume



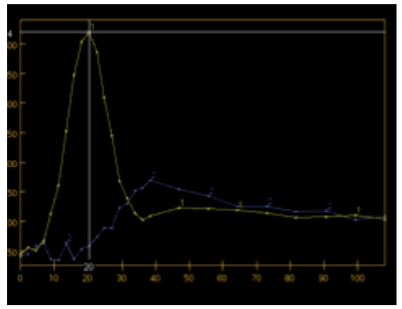
Hepatic arterial fraction



Mean transit time



Surface permeability



Arterial and venous input functions

Analysis of the perfusion maps demonstrates a reduction of blood volume, an increase of MTT and blood flow compared to normal liver parenchyma. The high HAF shows that blood in the lesion is mainly supplied by the hepatic artery.

Conclusion

Revolution CT enables accurate liver dynamic perfusion thanks to whole organ coverage, HU uniformity, and adequate temporal resolution thanks to no table motion.

The use of a variable sampling rate in combination with ASiR-V and flexible tube current allows performing this comprehensive study at low dose, making it suitable for routine applications.

Enabling Technologies

- The Revolution CT allows for whole organ dynamic acquisition with **up to 160 mm of coverage, with no table motion.** This enables perfusion study of the heart, brain, liver, kidneys and other organ and tissues. It also provides you with 4D imaging capabilities for all anatomies to visualize vascular flow, organ motion or kinetic properties.
- Revolution CT introduces the groundbreaking **Gemstone* Clarity Detector**, with focally-aligned, miniaturized modules and 3D collimator that is designed to ensure contrast uniformity and excellent image quality across the whole detector and overcome challenges such as cone beam or beam hardening artifacts associated with wide coverage.
- The next generation of iterative reconstruction, **ASiR-V, the flexible collimation** (between 5 mm to 160 mm), the **variable sampling rate and tube current** during dynamic perfusion acquisition help you to optimize radiation dose of such studies.

> “Revolution CT allows acquiring anatomical and functional information in one examination, at low dose. This capability has the potential to reduce the need for additional investigations.
>
> In cardiac, this will help us evaluate the impact of a stenosis on the myocardial perfusion and therefore improve the specificity of Cardiac CT.
>
> In oncology, perfusion imaging has the potential to help characterize lesion, and to better evaluate the response under specific treatments, such as anti-angiogenics.
>
> In early stroke management, identifying penumbra and necrosis can be critical for treatment decision and patient management.”
>
> Jean-Louis Sablayrolles

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GE (NYSE: GE) works on things that matter - great people and technologies taking on tough challenges. From medical imaging, software & IT, patient monitoring and diagnostics to drug discovery, biopharmaceutical manufacturing technologies and performance improvement solutions, GE Healthcare helps medical professionals deliver great healthcare to their patients.

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GE imagination at work

The clinical cases are displayed for educational purposes only and for the benefit of healthcare students and professionals

[1] In clinical practice, the use of ASiR-V 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.
[2] Obtained by EUR-16262 EN, using a head and neck CTA conversion factor of 0.0049*DLP
[3] Obtained by EUR-16262 EN, using a head conversion factor of 0.0023*DLP
[4] Obtained using a chest conversion factor of 0.014*DLP
[5] Obtained using a abdomen conversion factor of 0.015*DLP.

Legal Mentions : The system is intended to produce cross-sectional images of the body by computer reconstruction of x-ray transmission projection data from the same axial plane taken at different angles. The system has the capability to image whole organs in a single rotation. Whole organs include but are not limited to brain, heart, liver, kidney, pancreas, etc..
The system may acquire data using Axial, Cine, Helical, Cardiac, and Gated CT scan techniques from patients of all ages. These images may be obtained either with or without contrast. This device may include signal analysis and display equipment, patient and equipment supports, components and accessories.
Class: IIb – Manufacturer: GE Medical Systems LLC, USA – LNE/G-MED – NB 0459 – GMDN 37618.

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