

Angiography ^{SURE}Subtraction CT: Optimizing workflow and improving diagnostic confidence in CT Angiography



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Introduction

CT angiography represents one of the most important examinations for the diagnosis and monitoring of vascular pathologies. Automated post processing allows for an increase in productivity and quality of reconstructions, encouraging their adoption into routine workflows.

The Angiography ^{SURE}Subtraction CT (SCT) applications (Figure 1) uses a low dose pre-contrast acquisition and a post-contrast acquisition to create the images for registration and subtraction. In order to obtain accurate results, the technique uses a deformable 3D anatomical registration that compensates for any difference in anatomical position between the two acquisitions.

Angiography SCT automatically removes bone, calcium and stents from the post contrast scan with a high degree of accuracy. This provides an unobstructed view of the true vessel lumen for better evaluation of the arterial vasculature and quantification of luminal stenosis. This application is integrated into the scan protocol (Figure 2) automatically generating 3D Volume rendered (VR) and 3D MIP images providing automated workflow for both the technologist and the physician.

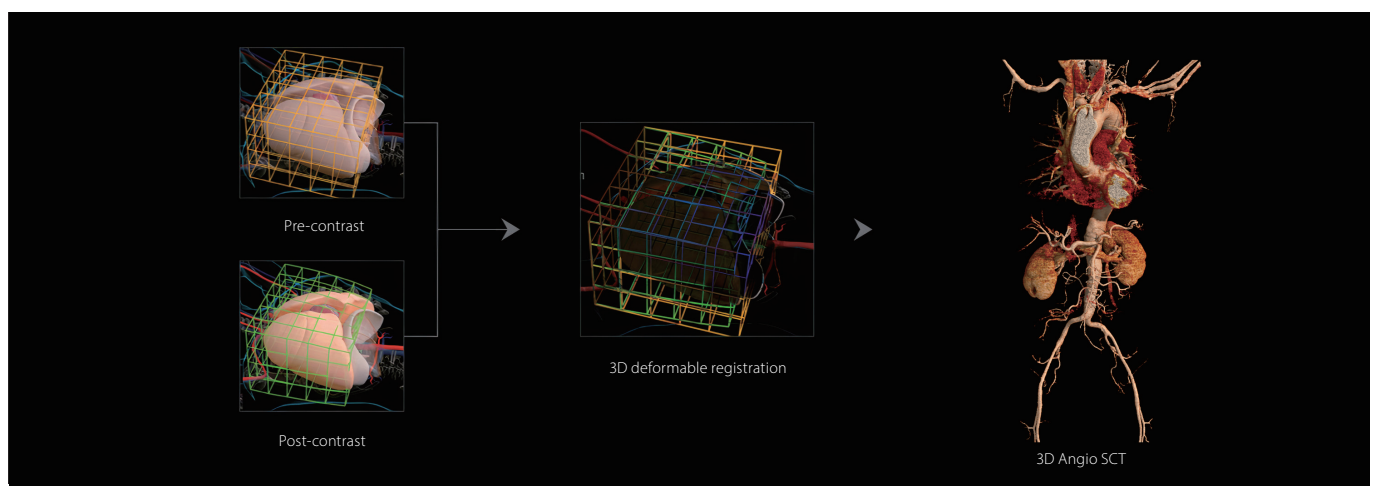


Figure 1: Angiography SCT Registration.

"The level of automation provided by the Angiography SCT technology has been welcomed in our busy CT Suite. Thanks to this automatic workflow, we save a lot of time for our technologist and physician when performing CT angiographic studies, by removing the need for manual and time-consuming post processing on a workstation."

Juliana de Brito Braga, MSc

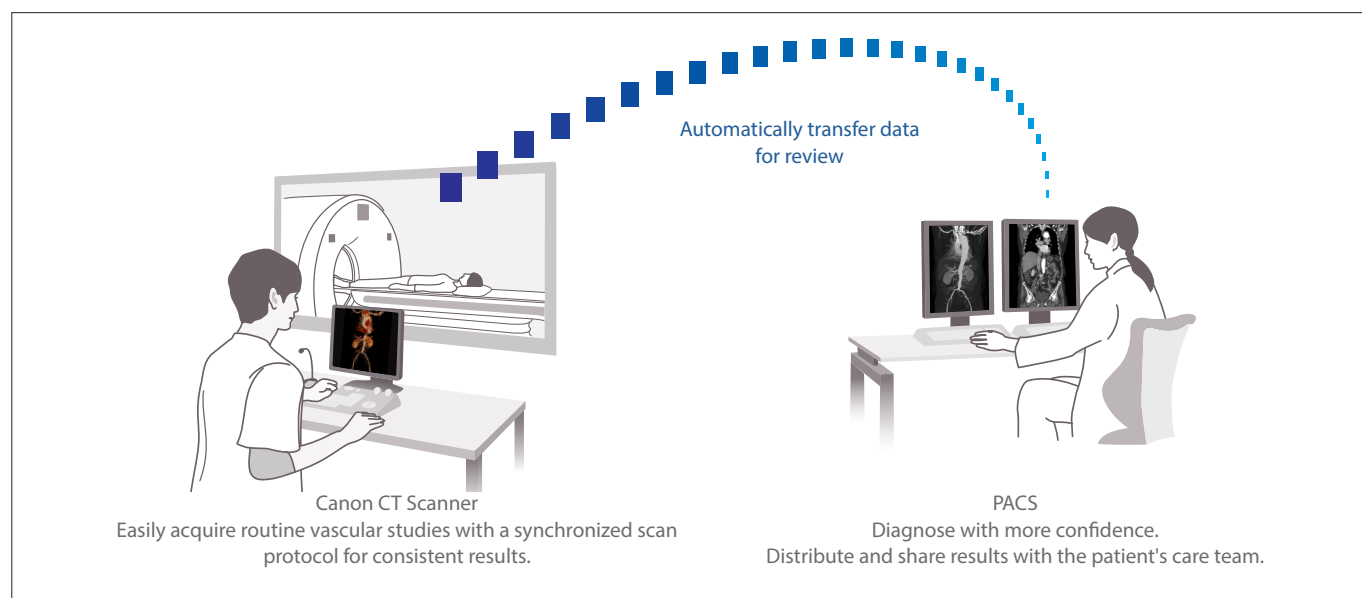


Figure 2: Zero Click Workflow. The Angiography SCT scan mode automatically synchronizes the acquisition and reconstruction parameters for CTA scans. Automated results are sent directly to the reporting station.

Technology

Over the years some excellent algorithms have been developed on dedicated workstations to isolate and remove bones from CT Angiographic examinations. However, these algorithms often require manual corrections especially when the vasculature is in contact with bones as with the anterior tibial artery in the lower leg (Figure 3).

In addition, there have been no reliable methods to accurately segment and remove calcified plaque or stents particularly when the HU value is closer to that of iodinated contrast media.

Subtraction without highly accurate registration is also insufficient due to the inevitable movement of patient anatomy that occurs between any two scans.

The key to the success of the Angiography SCT application lies with the incredible accuracy of the deformable registration that corrects for most anatomical misregistration between the pre and post contrast scans, thus ensuring the subtracted images are free from mis-registration artifacts providing an unobstructed view of the true vessel lumen (Figure 4).

"Everyone benefits from the workflow improvements: Physicians, nurses, technologists and ultimately the patients. Every CTA examination should have this technology."

Cesar H. Nomura, PhD

Aorta & Runoff CTA



Figure 3: Bone segmentation performed on a workstation. Several bones are remaining requiring manual correction.

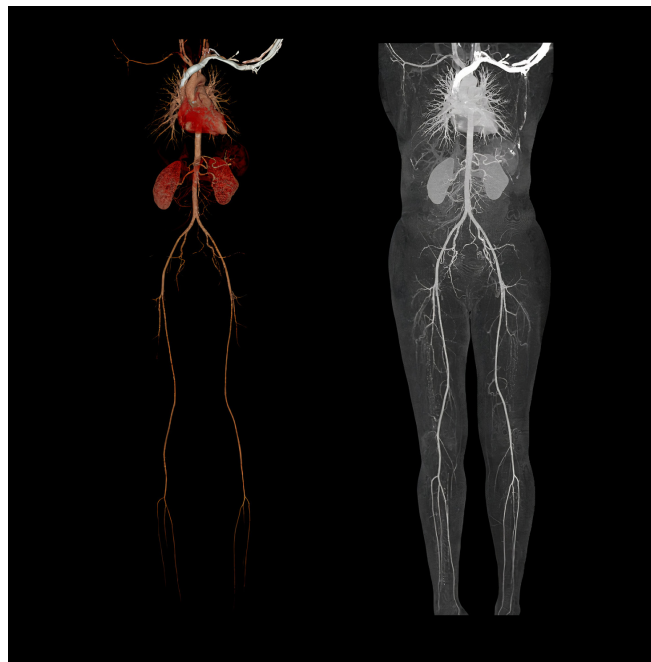


Figure 4: Accurate bone removal requiring no manual correction using Angiography SCT.

Workflow

In combination with a dedicated Angiography SCT scan protocol, the results are automatically generated making advanced visualization easy to adopt into clinical practice as part of any routine vascular studies. This saves technologists the time required to perform often complex post processing and ensures consistent results are achieved for interpretation by the reporting physicians.

The accuracy of the deformable registration performed as part of the Angiography SCT processing provides highly accurate subtracted images on a wide variety of angiographic examinations. 3D VR and MIP images readily compliment the source images that enable CTA examinations to be interpreted much faster and with a higher degree of confidence.

Carotid CTA

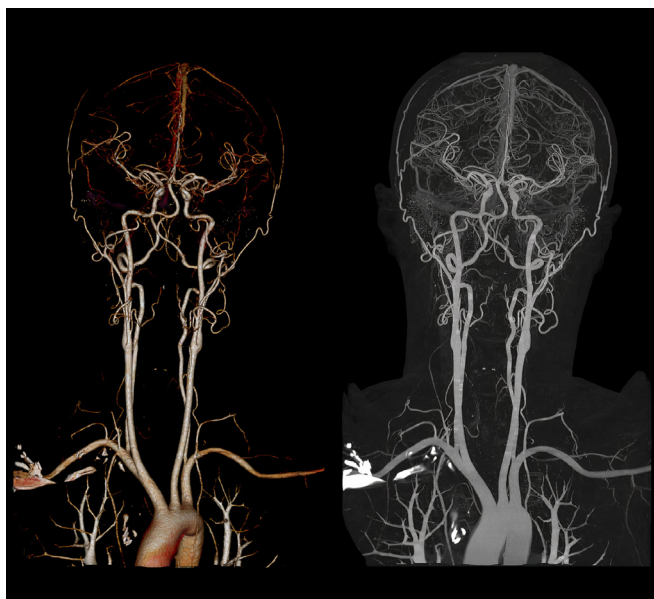


Figure 5: Automatically generated 3D VR and 3D MIP Angiography SCT images of a Carotid CTA.



Figure 6: 3D VR and 3D MIP Angiography SCT images of the abdominal aorta.

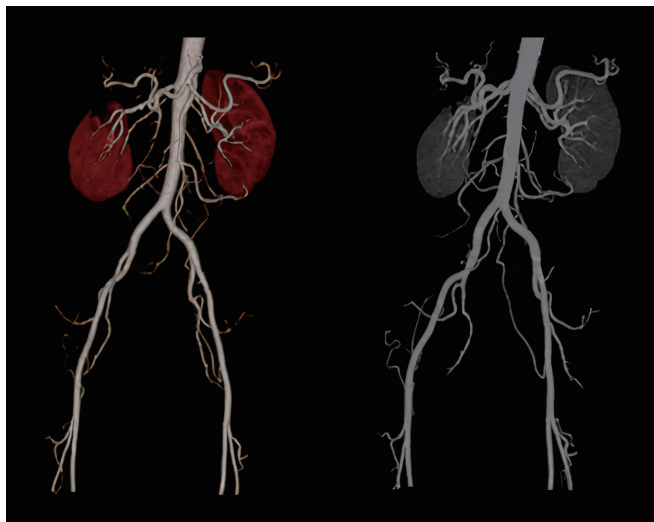


Figure 7: Angiography SCT images provide high quality visualization of the true vessel lumen allowing rapid and confident reporting.

Scanner Model: Aquilion ONE / PRISM Edition

Scan Mode: Ultra Helical

Collimation: 0.5 mm x 80

Exposure: 120 kV, ^{SURE}Exposure

Rotation Time: 0.5 s

Dose Reduction: Adaptive Iterative Dose Reduction (AIDR) 3D

Effective Dose:

Carotid CTA – DLP = 259 mGy·cm – 1.5 mSv (k=0.0059*)

Abdominal Aorta CTA – DLP = 208 mGy·cm – 3.1 mSv (k=0.015*)

Runoff CTA – 309 mGy·cm

* American Association of Physicists in Medicine (AAPM) Report 96, 2008.

Conclusion

The Angiography SCT application provides fully automatic 3D CT angiography images that are integrated into the scan protocol for easy adoption in your daily workflow. These images are free from bone, calcium and stents with highly accurate results allowing rapid assessment of the true vessel lumen and better quantitative assessment of vessel stenosis.

This application saves time, improves productivity and ultimately allows reporting physicians to provide patients with a more confident diagnosis. Moreover, it has the potential to assist in better communication across different specialties for diagnosis, preoperative treatment planning and also patient communication.

Acknowledgment

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Model number: TSX-306A MWPC0009EA 2023-04 CMSC/Produced in Japan

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