



Getting Great Results with Fenestra Contrast Agents



The Fenestra™ line of imaging products provide flexible, long-lasting contrast enhancement for a wide range of computed tomography imaging applications, including vascular and hepatobiliary anatomy and function.

Imaging Vascular Anatomy in Nude Mice Harboring Lung Carcinoma with Fenestra VC and SCANCO Medical's vivaCT 40 Scanner

This case study provides guidance and recommendations for vascular imaging in nude mice with implanted tumors using SCANCO Medical's vivaCT 40 microCT scanner. You should note that other examples of the capabilities of Fenestra and a selection of additional case studies are available on the ART website at www.art.ca/en/imaging-agents/.

Animal Model

Strain

Nude mice (20 to 21 g males).

Model

Nude mice with lung carcinomas implanted in the flank.

Animal Preparation

Anesthesia

Mice were anesthetized via inhalation of 1 to 2% isoflurane. Anesthesia was maintained during the duration of the study by fitting the animals with a nose cone apparatus linked to a supply of isoflurane.

Administration

Fenestra VC was injected intravenously into the lateral tail vein of un-anesthetized mice at a dose of 0.4 ml per 20 g body weight over a period of 15 to 30 seconds. A 1 ml disposable syringe fitted with a 30-gauge needle was used to inject the contrast agent. Prior to injection of Fenestra, animals were placed under a heat lamp for several minutes to increase blood flow to the tail and dilate the vessels.

NOTE Refer to the ART publication *Using Fenestra Contrast Agents* (PMK-UG001-E) for recommendations and detailed instructions related to dosage, animal preparation, and administration.



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Image Acquisition

Equipment

SCANCO Medical vivaCT 40 microCT scanner.

Animal Placement

Anesthetized mice were placed on the imaging table in the prone position. Use of gas anesthesia and its associated tubing for gas supply required the animals to be positioned with their tails toward the gantry. The desired body region was selected from the scout view as the anatomic landmark for image acquisition.

Settings

Image quality, which can be defined by the signal-to-noise ratio, is directly related to the selected scan parameters. To improve the contrast and quality of an image, the integration time should be set as long as possible and the resolution as low as possible. The settings selected for this high resolution (38 μm) contrast-enhanced study are shown in the following screen capture. You should note that the parameters can be modified to achieve the desired imaging results.

Definition of Controlfiles...

Controlfilename:

Scout-View: enabled disabled Narrow Angle

Start Position (mm):

End Position (mm):

Increment (μm):

Angle ($^\circ$):

E (kVp): 45 55 70 88 133

Resolution: Standard Medium High Custom

Samples: Proj/180:

Mode: Conebeam Gated Continuous ROT

Diameter [mm]: 21.5 25.6 30.7 35.8 38.9

Number of Slices: (1x106)

Increment (μm): Isotropic

Rel. Position of First Slice to Ref. Line (mm):

Integration Time (ms):

Average Data:

Tot. No. of Slices: 105 Meas. Time: 9.2 min (67 mAs)

Calibration:

Evaluation:



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The custom parameters selected for this study were as follows:

Parameter	Setting
Number of Samples	512
Number of Projections	400
Integration Time	200

You should note that changes in these parameters can influence both total image acquisition time and image quality.

The average time for image acquisition for vascular imaging with Fenestra VC was approximately eight minutes for acquiring the scout view and the 250 step study with the vivaCT 40 scanner. To save time, you can “pre-calibrate” the scanner so that the scans begin as soon as the animal is inserted.

Images were obtained immediately after administration, T=0, with subsequent scans acquired at several time points. Beginning at T=0, vascular contrast rapidly increased to a level that was sustained for the remainder of the study. The liver showed a slight increase in CT density due to its significant vascular supply, while the highly vascular structure of the spleen resulted in a high level of contrast enhancement in that organ. Beyond the 6-hour time point, vascular contrast enhancement declined gradually as Fenestra VC began to undergo hepatobiliary elimination. You should note that the gray scale may have to be adjusted to display low contrast regions.

Data Reconstruction and Visualization

Data Reconstruction

The parameters used for image reconstruction are automatically defined by the parameters chosen in the control file. For this study, the following selections were used:

Parameter	Setting
Number of Voxels in Volume	1024 × 1024 (Standard Protocol) <i>or</i> User-defined values (Custom Protocol)
Voxel Size	FOV divided by the number of samples
Reconstruction Filter	None
Reconstruction Algorithm	Cone-beam

Data Visualization

Acquired images can be visualized in the evaluation window. You should note that low contrast images may be viewed better with a black background than the standard blue. You can toggle between backgrounds by clicking on the scalar on the right side of the window or by choosing the LUT option and then selecting the correct LUT and optimizing the contrast.

In addition to exporting AIM and ISQ files, images can also be exported as TIFF files. You should note that AIM files can be converted to the DICOM file format for export. Any data visualization program capable of reading and displaying TIFF or DICOM file formats can be used to display the data.



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Representative Images

Representative images from studies conducted in normal mice with Fenestra VC, and that were obtained with SCANCO Medical's vivaCT 40 scanner, are provided in the figures below.

Pre-Contrast Exam

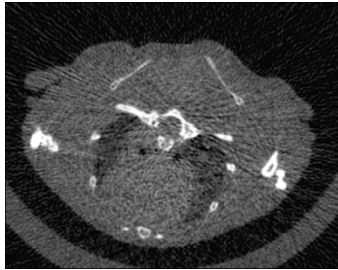


Figure 1. Non-contrast axial scan of a mouse. Poor soft tissue contrast is evident in the thoracic cavity and heart chambers.

Fenestra VC Exam

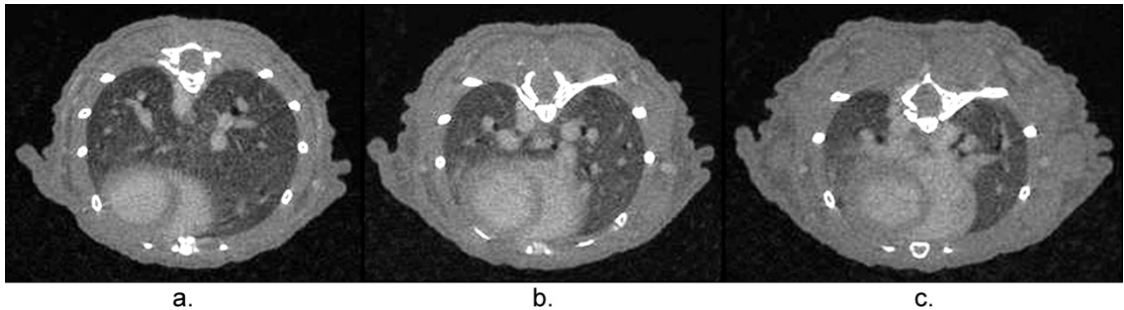


Figure 2. Axial views of a mouse 2 hours after IV injection of Fenestra VC. Images **a** and **b** depict both ventricles of the heart, as well as several major vessels in the thoracic cavity. Image **c** also shows both cardiac chambers, as well as additional thoracic vasculature near the bottom of the heart.

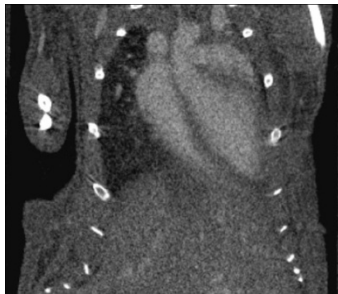


Figure 3. Coronal view of a mouse 2 hours after IV injection of Fenestra VC. The image shows both cardiac chambers, as well as small hepatic vessels.

DISCLAIMER: Your results may vary depending on the scanner model and settings, animal strain and sex, injection technique, the specific animal models employed, and other factors. Use of the tips described in this document cannot guarantee success. Some or all of these suggestions may be ineffective or even harmful depending on circumstances. ART has not verified the suggestions contained herein and assumes no liability with respect to their use. Users accept all risks and responsibility for losses, damages, costs, and all other consequences arising directly or indirectly from use of this information.

PMK-UG011-E02

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