Imaging Vascular Anatomy in Nude Mice Harboring Lung Carcinoma in Flank

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 the 133 uA setting was only available on some older SCANCO vivaCTs which had lower powered x-ray tubes. On newer vivaCT models the 177 uA setting should be used instead as it gives more signal and results in a better signal to noise. If you want to have the same signal level and same dose, you may reduce the integration time to 750 ms. Other examples of the capabilities of Fenestra and a selection of additional case studies are available on MediLumine's website at **medilumine.com/resources**

Fenestra® VC provides flexible, long-lasting contrast enhancement for a wide range of computed tomography imaging applications, including vascular and hepatobiliary anatomy and function.

Animal Model

Strain

Nude mice

Model

Nude mice with lung carcinomas implanted in the flank.

APPLICATION NOTE

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Animal Preparation

Fasting/GI preparation

MicroCT imaging is best performed in mice that have been maintained on a non-chow, soft (vegetable or liquid) diet for 24-48 hours prior to study. Though not absolutely required, the soft diet preparation protocol serves to minimize imaging artifacts due to minerals that are found in rodent chow. While fasting is an alternative to the soft diet, clearance of digested chow and fecal pellets from the GI tract may be incomplete using fasting alone.

Anesthesia

For the imaging component of this study, mice were anesthetized via inhalation of 1-2% isoflurane. Maintenance of anesthesia was achieved over the duration of the study by fitting the animal 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 in increase blood flow to the tail and dilate the vessels.

NOTE: Refer to the MediLumine's Publication 'Optimal Usage of Fenestra Nanoemulsions' for recommendations and detailed instructions related to dosage, animal preparation, and administration at **medilumine.com/resources/user-guides**.

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Image Acquisition

Equipment

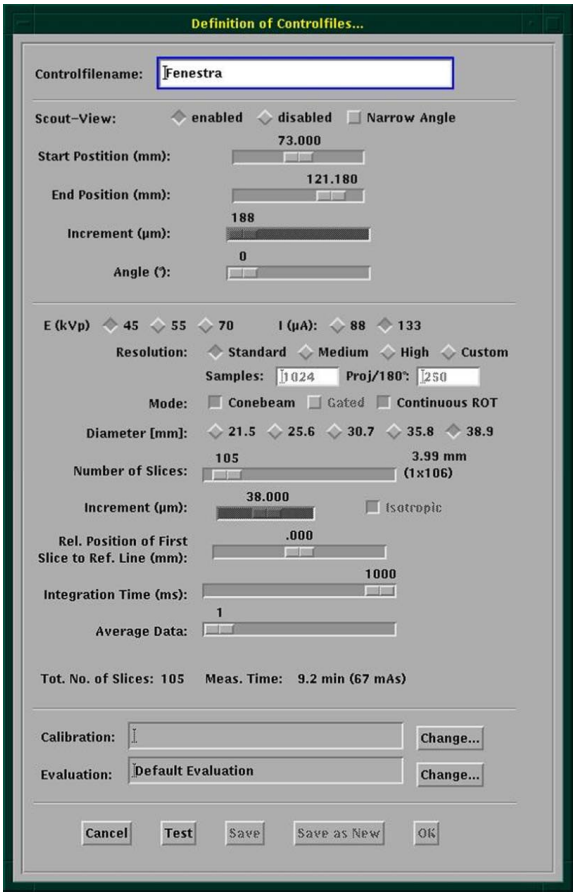
SCANCO Medical vivaCT 40 microCT scanner.

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 mm) 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



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The custom parameters selected for this study were as follows:

Parameter	Setting
Number of Samples	512
Number of Projections	3072
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

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

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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.

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

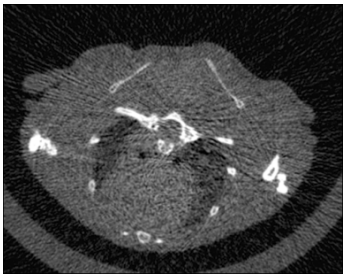

Figure 1. Non-contrast axial scan of a mouse. Poor soft tissue contrast is evident in the thoracic cavity and heart chambers.

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Fenestra VC Exam

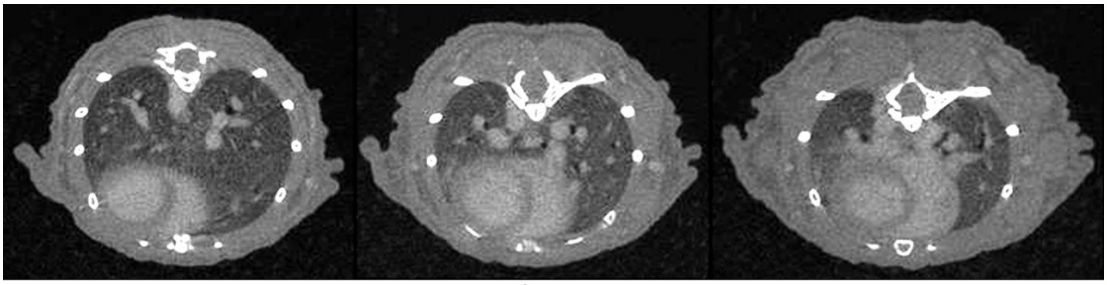

Figure 2. Axial views of a mouse 2 hours after IV injection of Fenestra VC. Images a and b depict both ventricles of the heart, as well as several major vessels in the thoracic cavity. Image c also shows both cardiac chambers, as well as additional thoracic vasculature near the bottom of the heart.

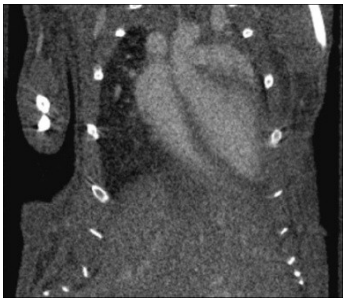

Figure 3. Coronal view of a mouse 2 hours after IV injection of Fenestra VC. The image shows both cardiac chambers, as well as small hepatic vessels

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