VISUALSONICS
FUJIFILM

Imaging Guide

Guide to Small Animal **Reproductive Organs Imaging** using the Vevo® Imaging Systems

System Compatibility: This guide contains instructions and suggestions for work on the Vevo2100, VevoLAZR, Vevo 3100 systems and transducers from the MS, MZ and MX series.

Objective

This guide is designed to assist the user to:
- Select the appropriate transducer and position for imaging of the reproductive systems
- Recognize organs of the reproductive systems and associated structures in typical views of various imaging modes available on the Vevo systems
- List available measurements and calculations in the respective imaging modes

Ovaries – Female Reproductive System

Female mouse ovaries are located lateral to the kidneys on both sides of the animal and reside in fat pads found at the end of the uterine horn and are connected to the horn by the fallopian tube (Figure 1).

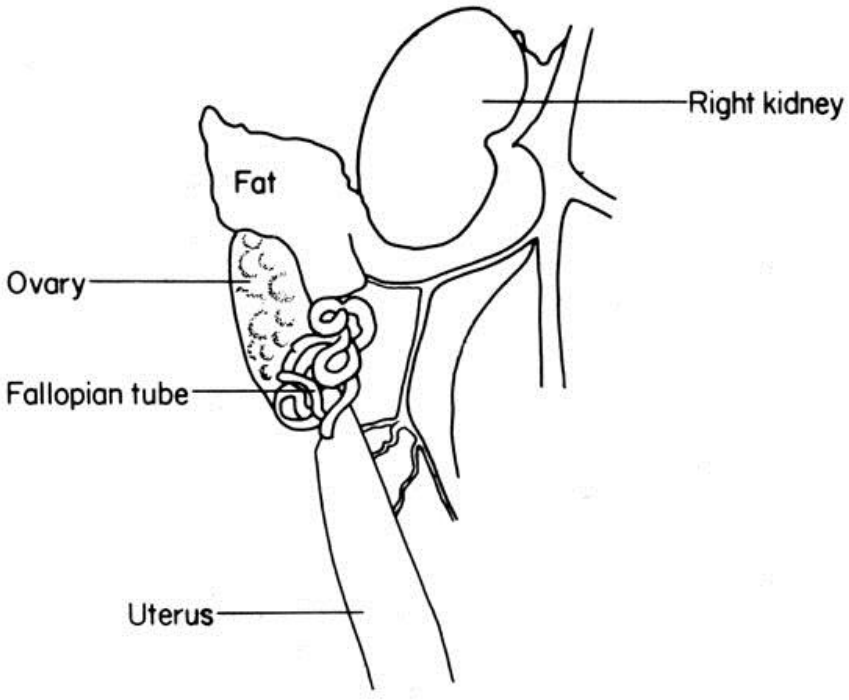

Figure 1 - Position of the right side ovary with respect to surrounding anatomy.

http://www.informatics.jax.org/cookbook/figures/figure69.shtml

Selecting the Appropriate Transducer

The main criteria in selecting the correct transducer are:

- age of the animal
- target tissue
- pathology

For normal adult mice the 550D and 550S models are all well suited for most types of tissue.

For young and very young mice the 550S and 700 series with frequencies of 40 and 50MHz are the best option.

Animal Preparation

The animal preparation shall adhere with the Institution's Animal Care Committee approved SOP.

Transducer Positioning

Figure 2 – Transducer positioned for imaging the left ovary in the transverse plane. The most important landmark is the kidney as the ovary is positioned laterally towards the side of the abdomen.

Ovaries B-Mode Imaging

To image the ovary, start with the probe in a transverse plane position and place it to the side of the animal slightly below the ribs. Using the Y-axis manipulator move the animal up to image lower along the abdomen. The fat pad has a whiter appearance than the ovary (Figure 3). If the mouse has ovulated recently, a fluid build-up (black) will be seen around the ovary.

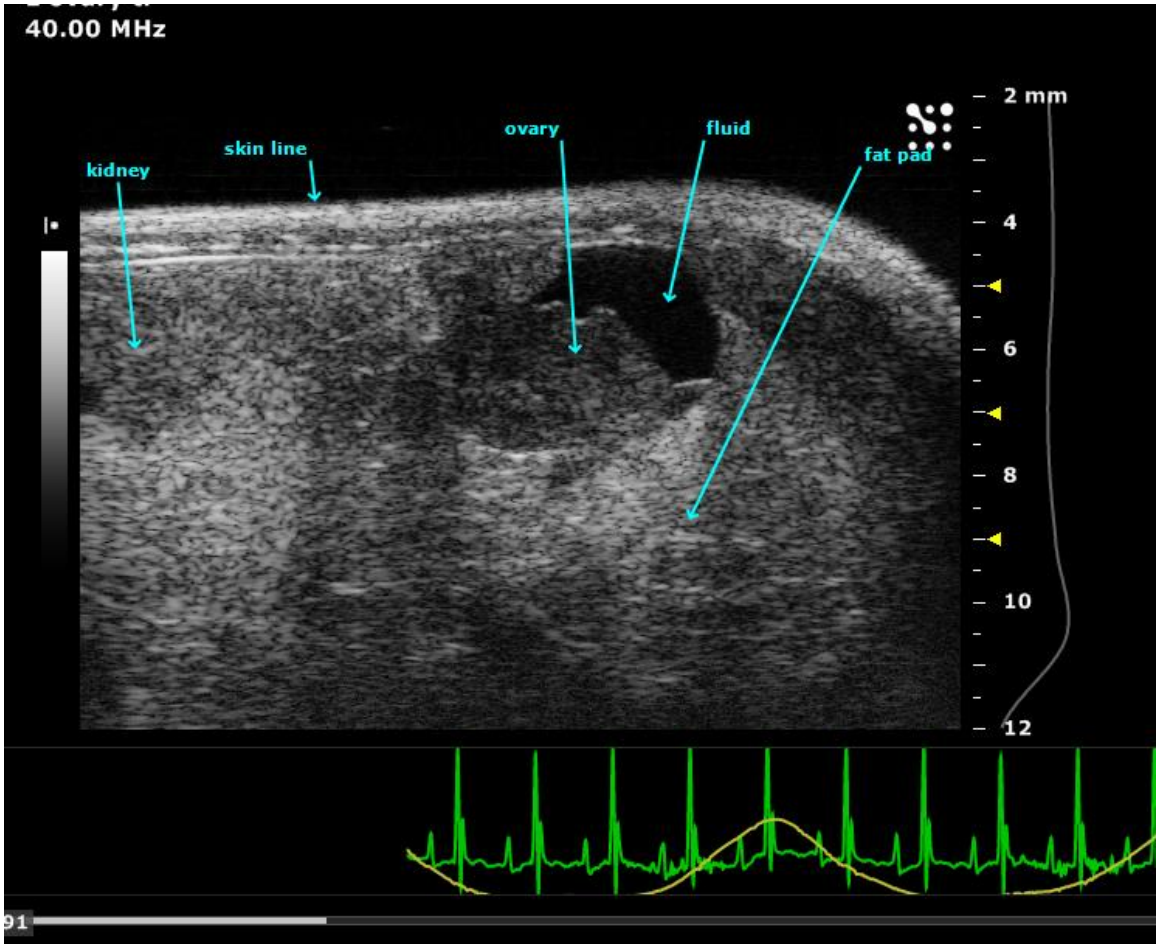

Figure 3 – B-Mode image of the mouse left ovary in the transverse view displaying its relative position to the left kidney, fat pad and skin line.

Measurements and Calculations for Ovaries in B-Mode

Measurements	Calculations
LOv Sag	N/A
LOv Trans	N/A
LOv Art Diam	N/A
LOv Vein Diam	N/A
ROv Sag	N/A
ROv Trans	N/A
ROv Art Diam	N/A
ROv Vein Diam	N/A

Ovaries Color Doppler and Power Doppler Imaging

Color Doppler Mode and Power Doppler Mode imaging helps with identification of ovarian intensity and directional flow and also helps identify the best points of interrogation in PW Doppler Mode for the blood flow of significant velocity. Also, Color Doppler Mode imaging could be very helpful in identification of flow pattern change for various pathologies.

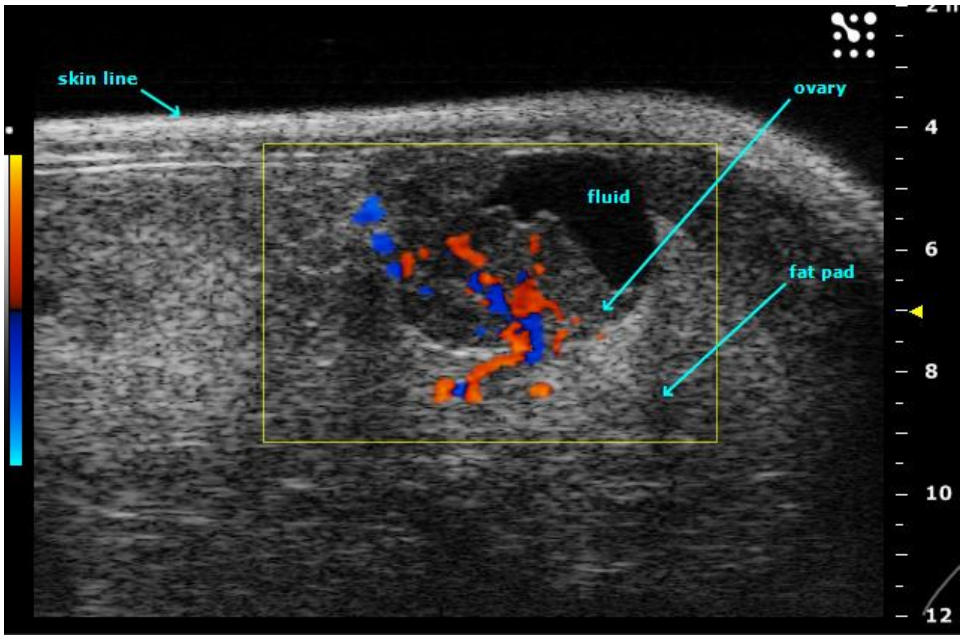

Figure 4 - Color Doppler Mode image of mouse left ovary in the transverse view displaying directional flow.

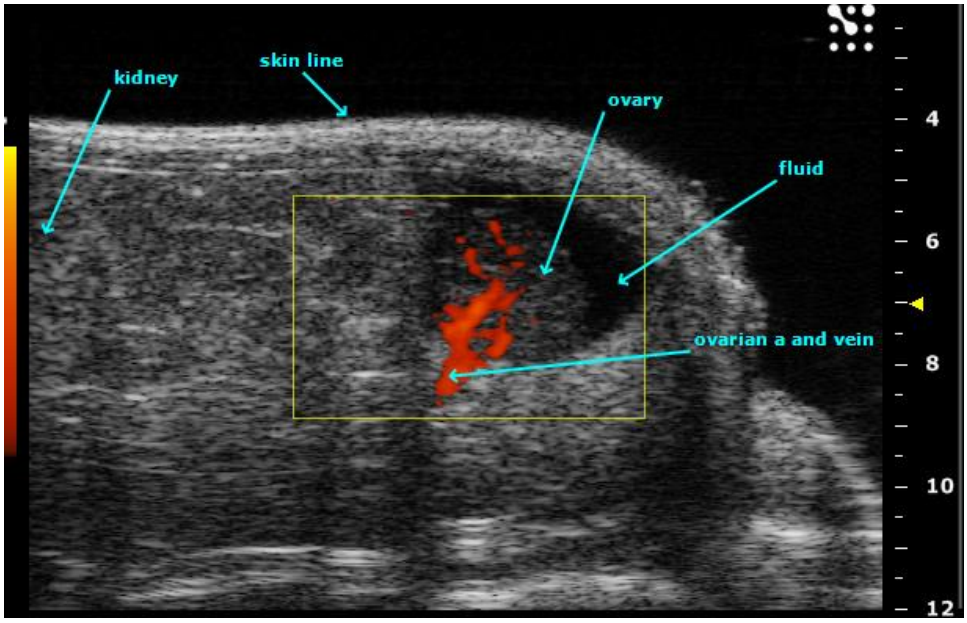

Figure 5 - Power Doppler Mode image of mouse left ovary in the transverse view display flow intensity patterns.

Ovaries PW Doppler Imaging

PW Doppler Mode imaging of ovarian artery and vein are of significant importance for various pathologies where velocity measurements and Resistive and Pulsatility Indexes offer insights into tissue changes.

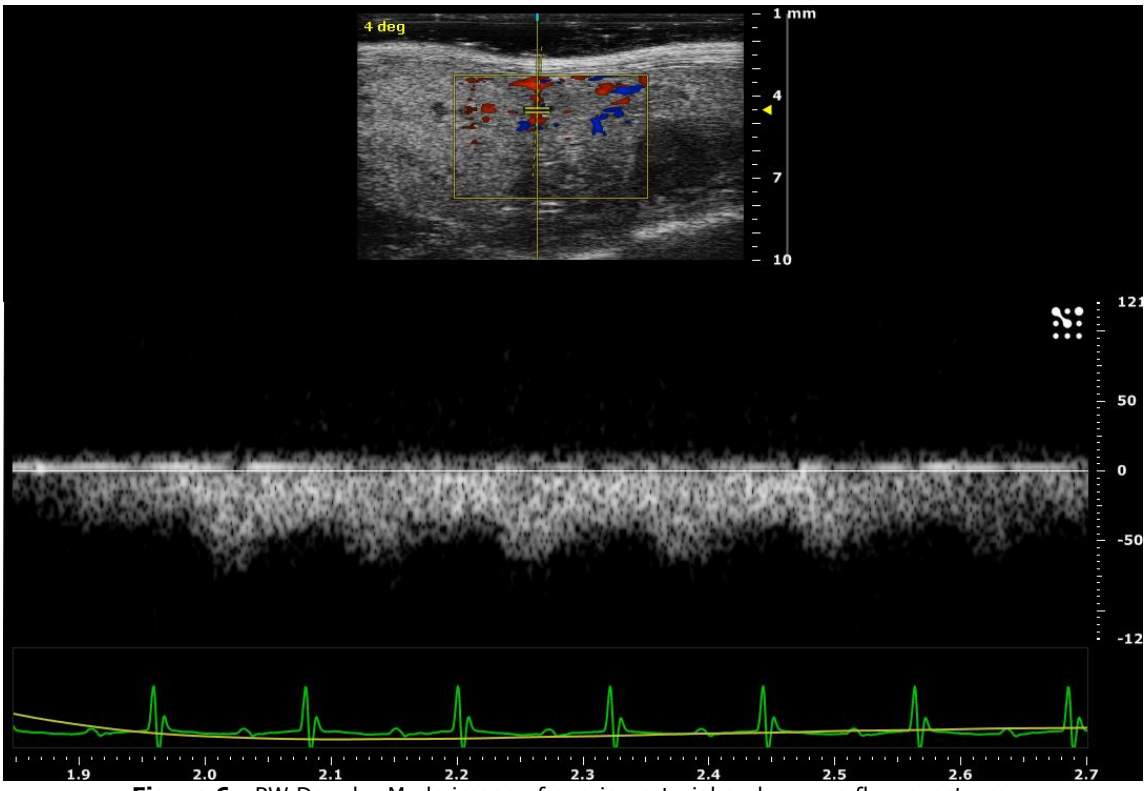

Figure 6 - PW Doppler Mode image of ovarian arterial and venous flow spectrum.

Measurements and Calculations for Ovaries in PW Doppler Mode

Measurements	Calculations
LOv Art Vel	LOv PI
LOv PS Vel	LOv RI
LOv LD Vel	ROv PI
LOv VTI	ROv RI
ROv Art Vel	
ROv PS Vel	
ROv LD Vel	
ROv VTI	

Male Reproductive System – Testicle and Epididymus

Overview of the anatomy

The testicles are located in the lower pelvic region and they can be imaged either be descended or ascended. If they are descended, they will be located in the scrotal sac. If they are ascended, they will likely be located on the sides of the bladder. The epididymus is a long structure shaped like a tadpole. The head of the epididymus is typically located directly above the testicle and the tail extends to the medial lower side of the testicle.

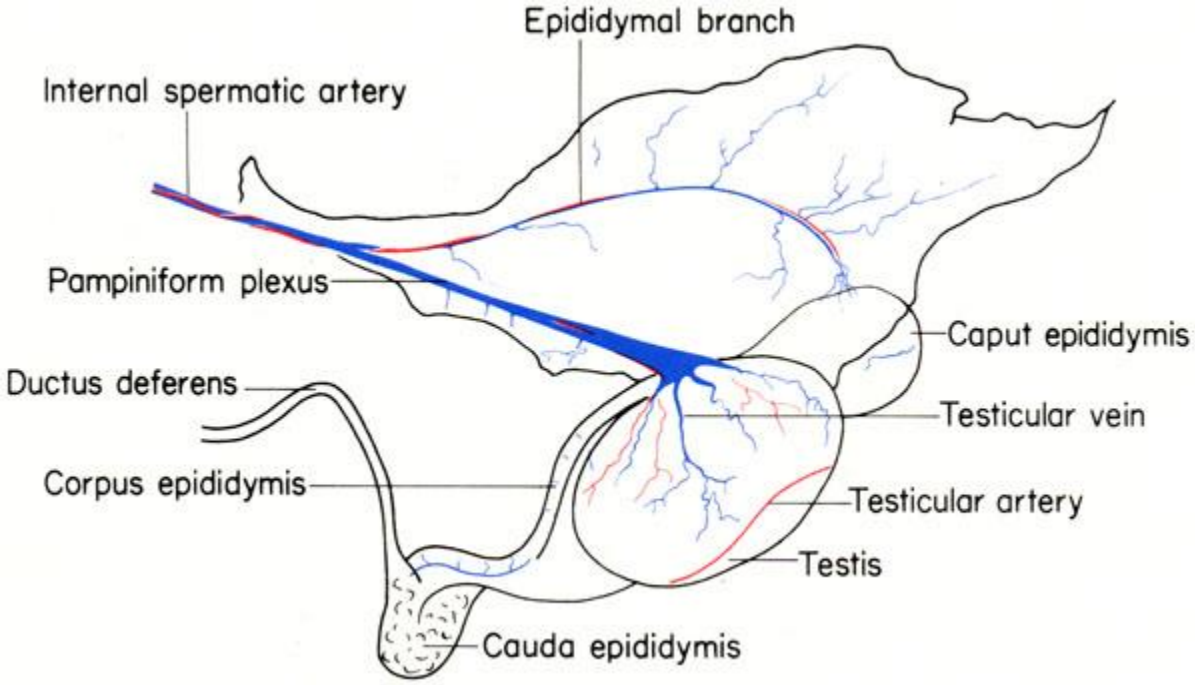

Figure 7 - Schematic of the testicle and epididymus.

http://www.informatics.jax.org/cookbook/figures/figure114.shtml

Transducer Positioning

Figure 8 – Transducer positioned for imaging the testicle and epididymus. The most important landmark is the kidney as the ovary is positioned laterally towards the side of the abdomen.

Testicle and Epididymus B-Mode Imaging

When the testicles are retracted, very common under anaesthesia with the decrease in body temperature, place the transducer near the bladder in sagittal orientation. The testes will appear be oval shaped in structure, approximately 6 x 2 mm in size (for adult mice). In the sagittal view, the head of the epididymus will also appear beside the testicle.

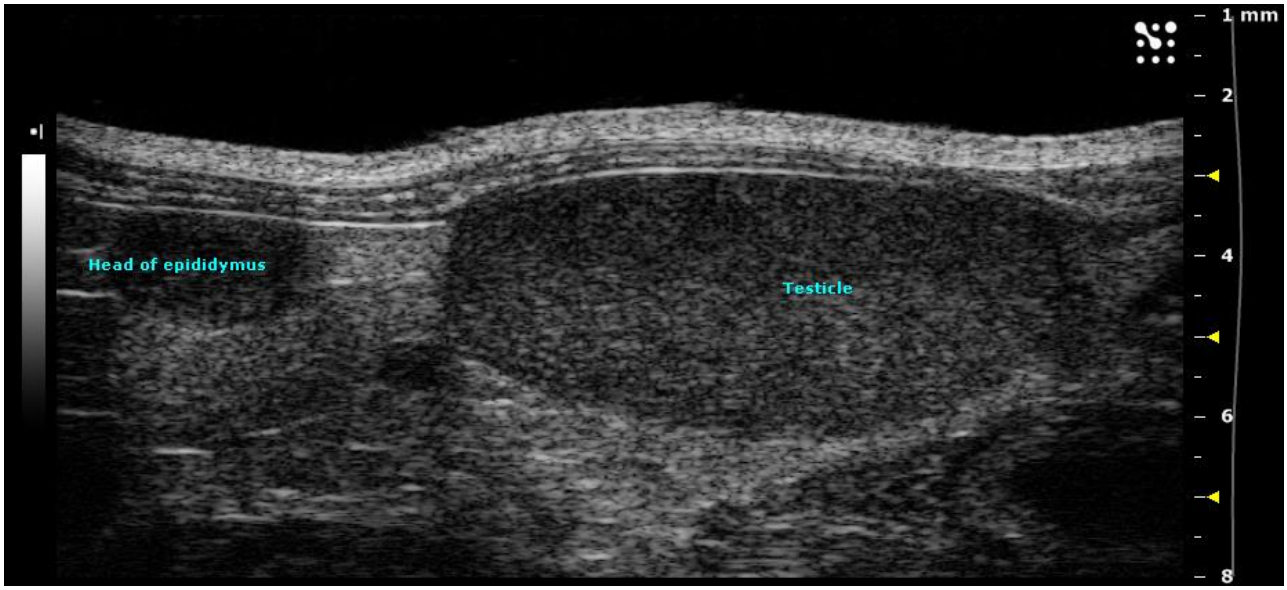

Figure 9 - B-Mode image of the testicle and head of epididymus.

Measurements and Calculations for Testicle and Epididymus in B-Mode

Measurements	Calculations
L Test Sag	N/A
L Test Trans	N/A
LTA Diam	N/A
LTV Diam	N/A
R Test Sag	N/A
R Test Trans	N/A
RTA Diam	N/A
RTV Diam	N/A
Epid Head	N/A
Epid Tail	N/A

Testicle and Episidymus Color and Power Doppler Mode Imaging

Color and Power Doppler Mode imaging will help identify flow patterns and direction in the testicle and epididymus.

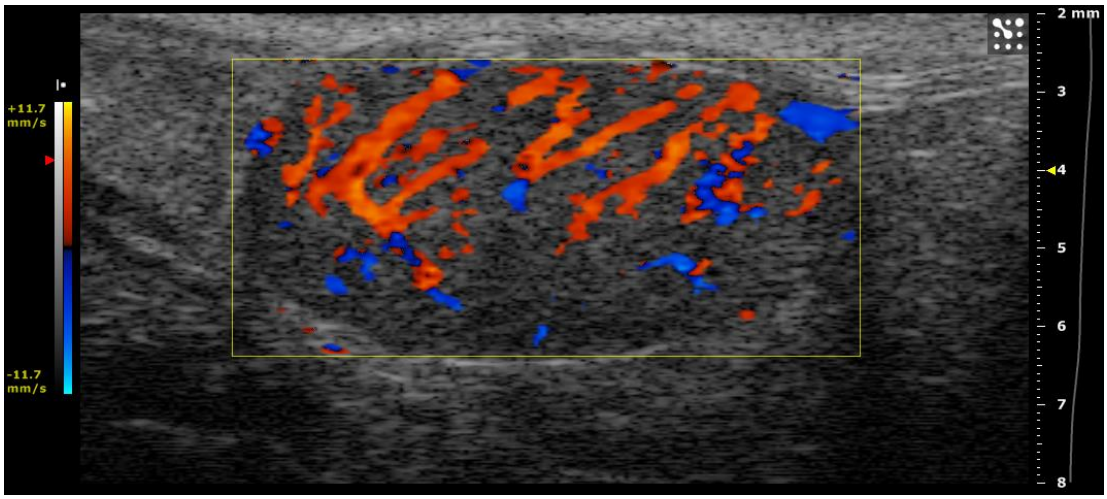

Figure 10 - Color Doppler Mode image of the testicle.

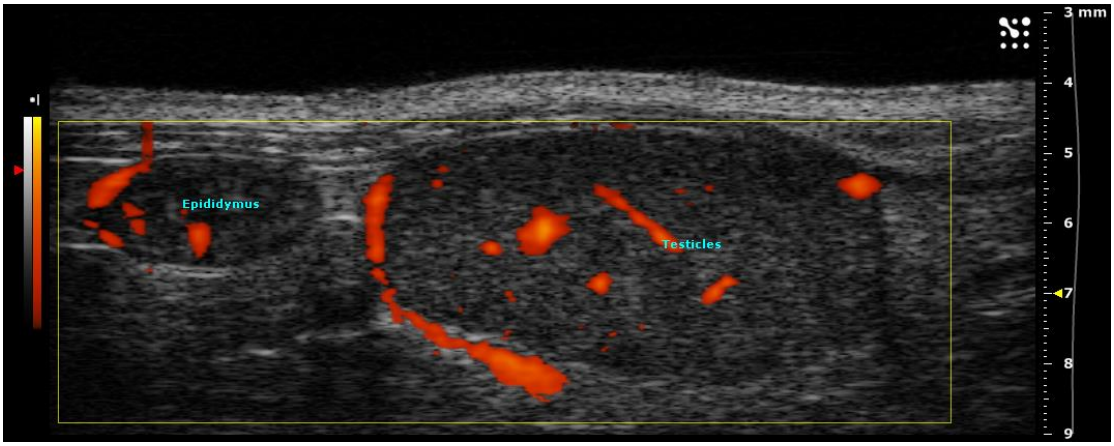

Figure 11 - Power Doppler Mode image of testicle and head of epididymus

Testicles PW Doppler Imaging

PW Doppler Mode imaging of testicle artery and vein are of significant importance for various pathologies where velocity measurements and Resistive and Pulsatility Indexes offer insights into tissue changes.

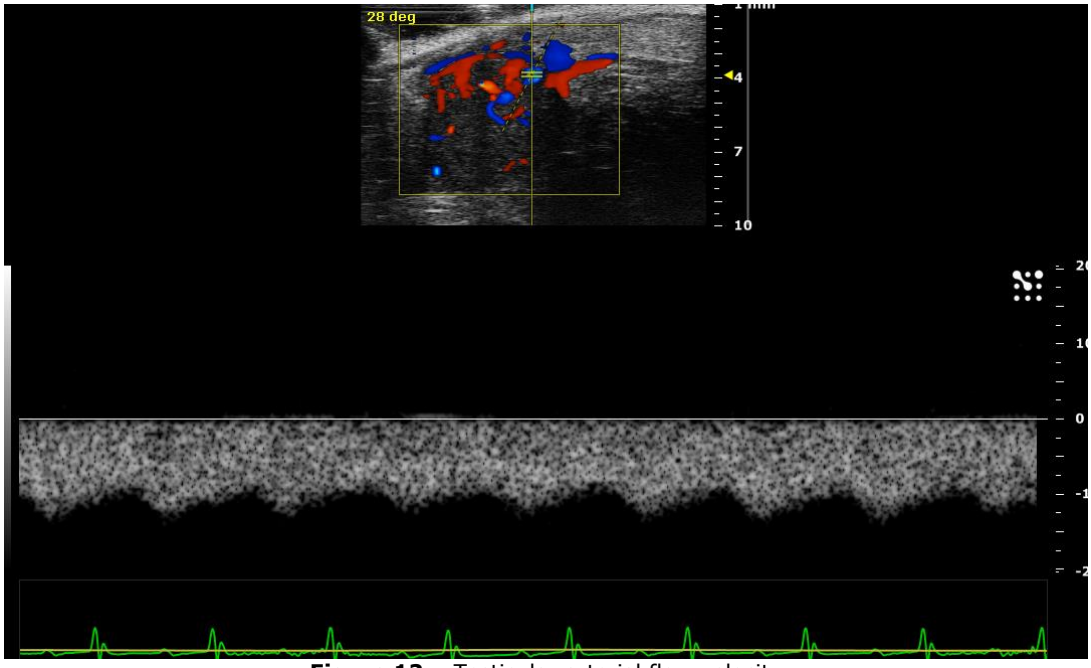

Figure 12 – Testicular arterial flow velocity

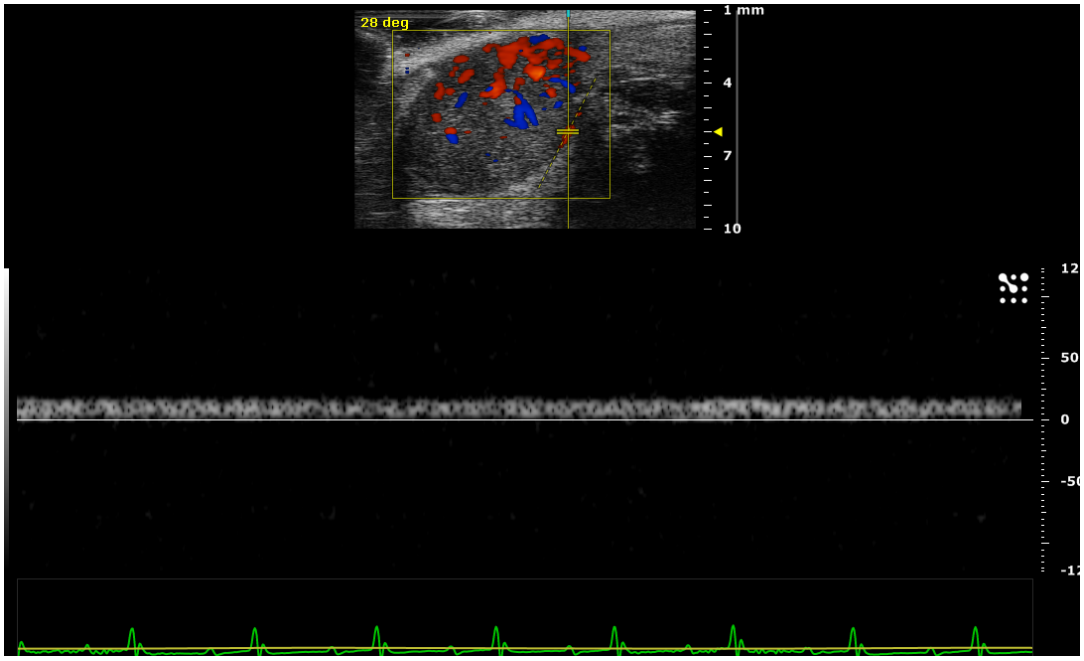

Figure 13 – Testicular arterial flow velocity

Measurements and Calculations for Ovaries in PW Doppler Mode

Measurements	Calculations
LTA Vel	LTA PI
LTV Vel	LTA RI
LTA PS Vel	RTA PI
LTA LD Vel	RTA RI
LTA VTI	
RTA Vel	
RTV Vel	
RTA PS Vel	
RTA LD Vel	
RTA VTI	

Testicle and Epididymus 3D-Mode Imaging

3D-Mode imaging can be done to quantify the volumes of the testicle and epididymis or vascular patterns and relative volumetric vasculature in Power Doppler 3D. To perform 3D-Mode imaging, using the micromanipulator, scan across the testicle or epididymus while noting their sizes by reading the ruler located on the micromanipulator. Return the transducer to the center of the region of interest; enter the range and step size for the volumetric course and record the volumetric rendering of the selected region of interest.

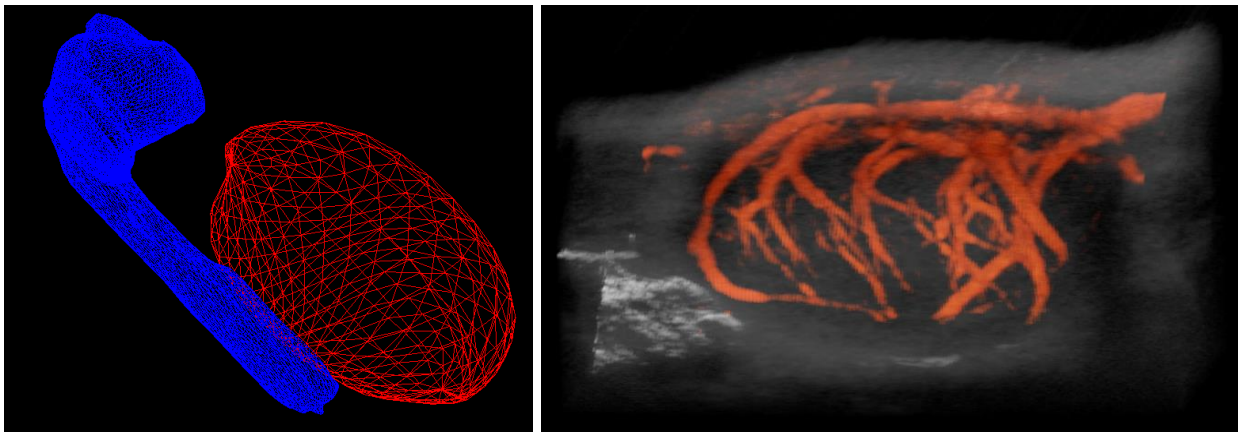

Figure 14 - 3D mesh trace of the testicle (red) and epididymus (blue) (L). 3D Power Doppler Mode of vasculature in the testicle (R).

Male reproductive system – Prostate

Overview of the Research Areas

The prostate gland is of interest in numerous areas of research, including reproductive biology and oncology. The Vevo imaging systems are well suited for imaging this gland by visualizing the structural changes, as well as measuring changes in blood flow through the area. The prostate is a gland which surrounds the urethra as it exits the bladder. In this guide there will also be indicated other anatomical structures which may be visualized when imaging the prostate.

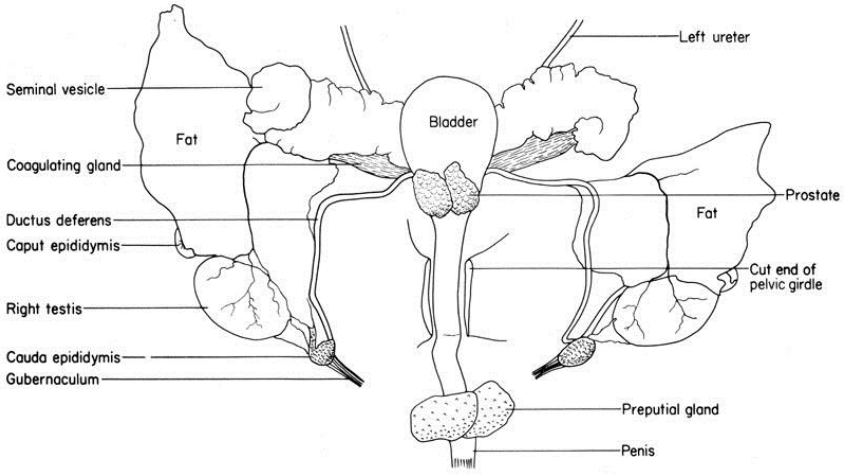

Figure 15 - Male reproductive anatomy featuring the prostate.
http://www.informatics.jax.org/cookbook/figures/figure65.shtml

Prostate imaging in B-Mode

The prostate gland can be imaged either in long axis (sagittal) or short axis (transverse) views in B-Mode, a simple rotation of the transducer with 90° allows for imaging in either orientations. The bladder is a helpful landmark when imaging the prostate, generally the prostate can be found on either side of the bladder, and has a distinctive appearance compared to surrounding structures such as the vesicular glands (seminal vesicles) and the scent gland.

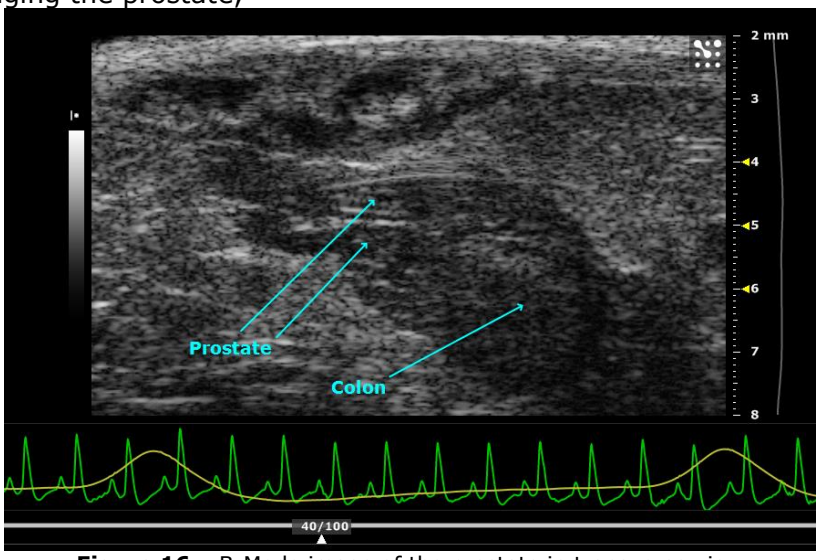

Figure 16 – B-Mode image of the prostate in transverse view

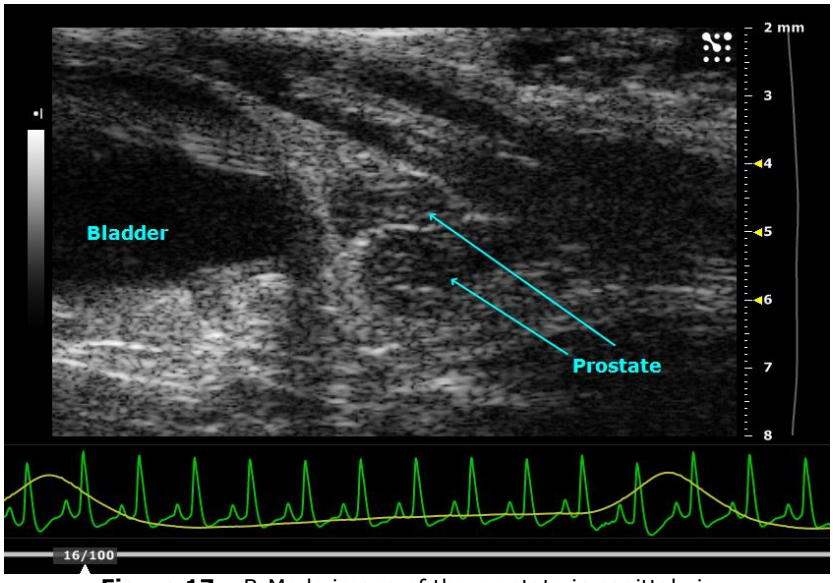

Figure 17 – B-Mode image of the prostate in sagittal view

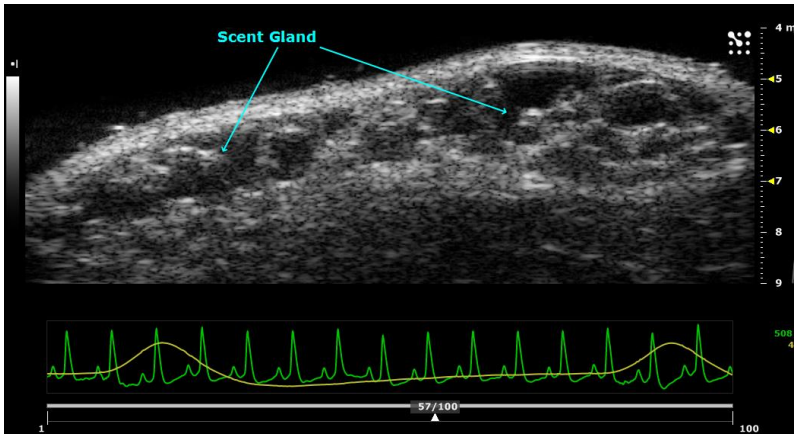

Figure 18 – B-Mode image of the scent glands in transverse view

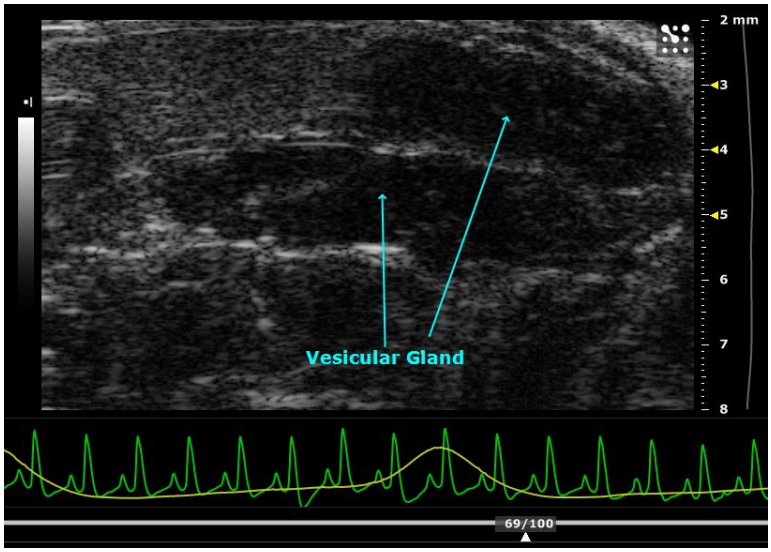

Figure 19 – B-Mode image of the vesicular gland in transverse view

Prostate Color and Power Doppler Mode Imaging

Color Doppler Mode can be used to assess relative vascularization of the prostate gland however overall assessment is limited due to very low values of flow velocity. Detection of blood flow using Color Doppler and Power Modes it is not possible in small vessels such as the capillaries; this size of blood vessels is best assessed through perfusion calculations sing contrast agents.

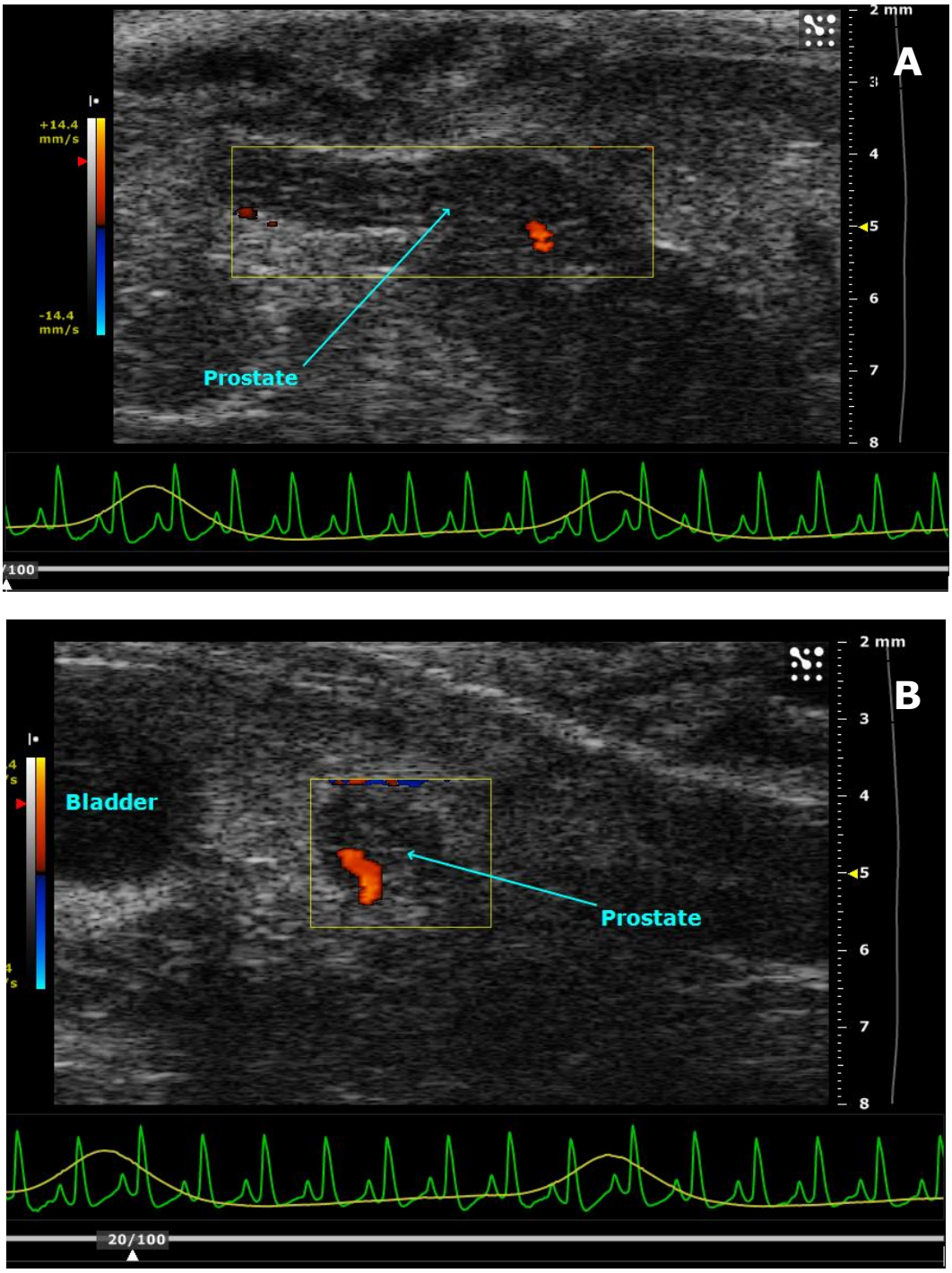

Figure 20 - Color Doppler Mode image of the prostate gland can be done in transverse (A) or sagittal (B) views.

Prostate perfusion using Contrast Mode Imaging

To assess flow in the prostate gland the Non-Targeted MicroMarker contrast agent imaging and analysis offer the best option. Data relative to blood and blood volume could be evaluated by injecting the contrast agent and assessing the wash-in curve of the contrast agent. The Vevo imaging systems offer comprehensive visualization and analysis tools for Contrast imaging and in depth details could be found in dedicated materials offered by Visualsonics.

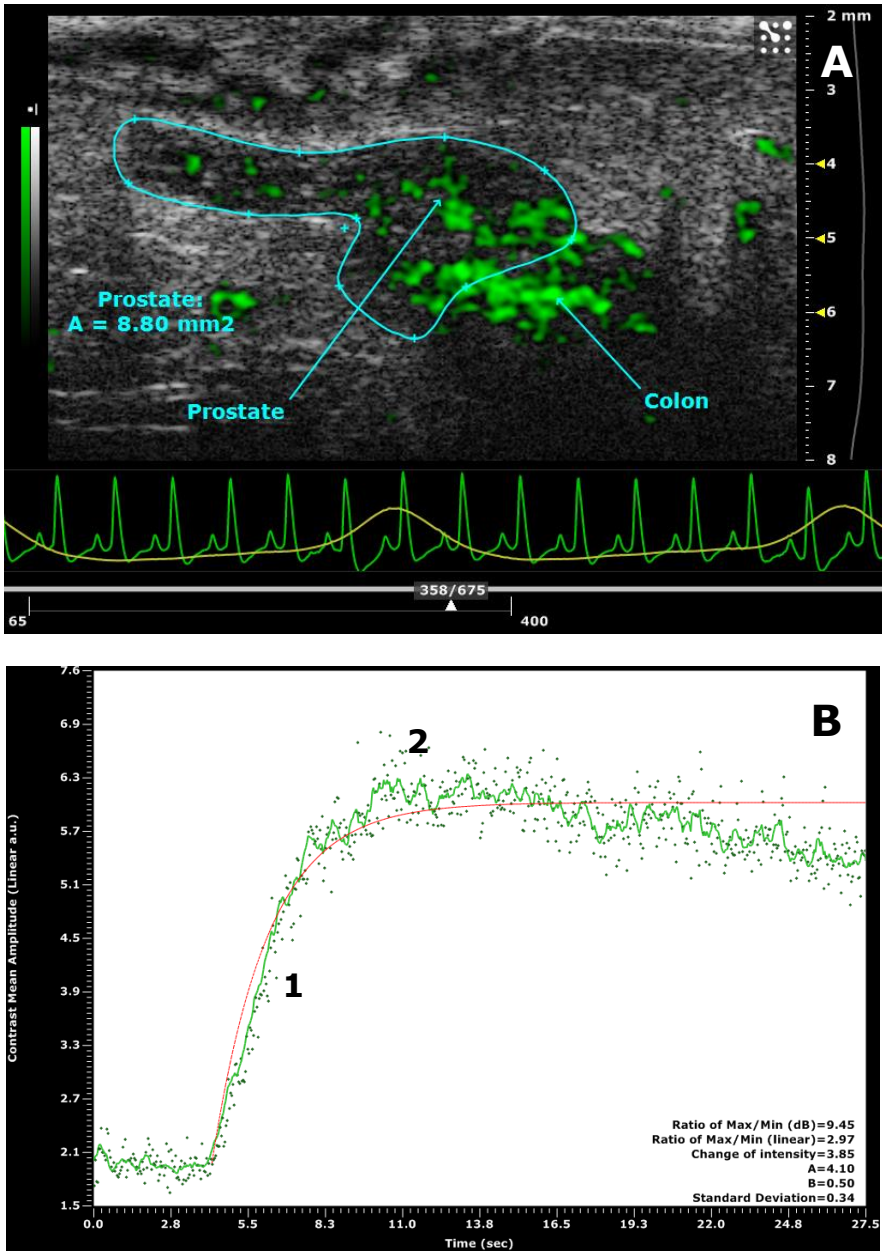

Figure 21 – Example of Contrast Mode imaging with contrast visualization in the prostate – green overlay and drawn region of interest (A). Contrast agent wash-in analysis (B) with the relative blood velocity represented by the slope of the curve (1) and relative blood volume represented by the plateau value (2).

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