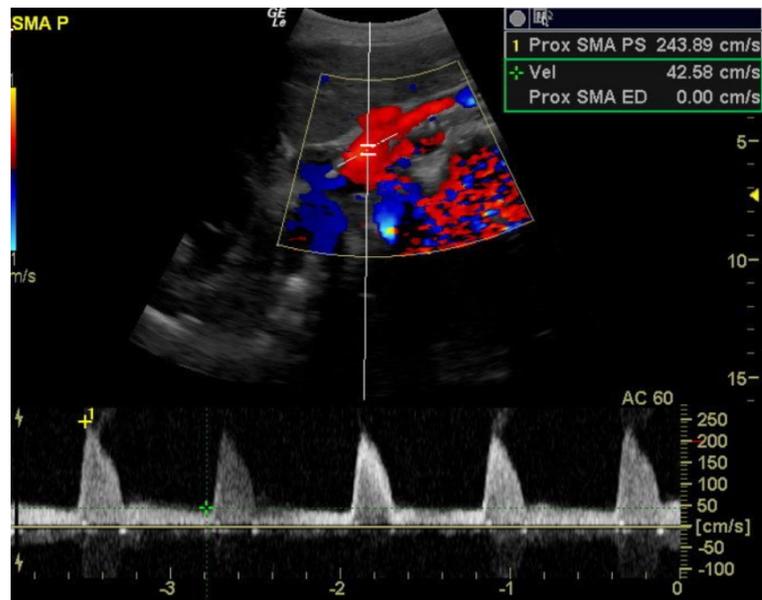


Case Study: SMA

Vascular ultrasound of the Mesenteric System is an interesting opportunity where *Visualize:Vascular's* patented algorithms can be used to extend the diagnostic capability of a standard ultrasound machine. This study concerns the Superior Mesenteric Artery (SMA). The results from the Doppler ultrasound exam show that the fasting patient has elevated velocity in both Peak Systolic Velocity (PSV) and End Diastolic Velocity (EDV). Guidance documents suggest that a PSV at 275 cm/sec correlates to 70% Stenosis. The guidance documents also suggest that an EDV >35 cm/sec is cause for concern. This patient is borderline with elevated PSV just below the criteria and EDV above the criteria. While the standard Vascular Ultrasound Exam yields results in terms of velocities from which Stenosis is estimated to compare to the Stenosis criteria, *Visualize:Vascular™* renders the residual lumen in 3D, measures the max and min diameters from the 3D visualization to calculate luminal reduction or Stenosis in the same method as an angiogram. The results are a direct measurement of Stenosis and are used directly with clinical guidance for Stenosis.

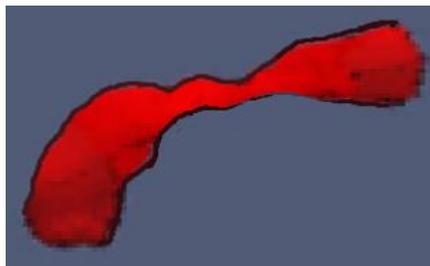
Vascular Ultrasound Exam Results:

SMA (PSV / EDV in cm/sec)	
SMA prox	244/43
SMA mid	160/35
SMA dist	167/35



Visualize:Vascular™ 3D Rendering Exam Results:

SMA (diameter in mm)	
Max	7.378
Min	2.891
Stenosis	61%



Study Review: SMA

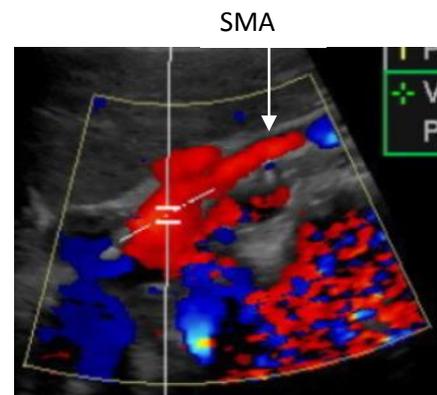
Patient History/Symptoms: 81-year-old female, gallbladder previously removed, slight atherosclerosis in Abdominal Aorta, non-smoker, non-drinker, in otherwise good health, patient currently presents with abdominal pain.

Abdominal Ultrasound, Mesenteric Vascular Ultrasound (Doppler) were performed on the patient. Slight atherosclerosis in the Abdominal Aorta was noted on the Abdominal Ultrasound Study. All organs and the IVC were noted as normal. The Mesenteric Vascular Ultrasound showed elevated velocity in both the Celiac and Superior Mesenteric Arteries, all other arteries, IVC and aorta were within normal limits. Velocity measurements at this level of gain and Stenosis typically have an error factor of plus or minus 26 cm/sec¹; accounting for error, the measured velocity of 244 cm/sec Peak Systolic Velocity (PSV) could range from 218 to 270 cm/sec. This is a wide range considering that the PSV to 70% Stenosis correlation for the SMA is set at 275 cm/sec.

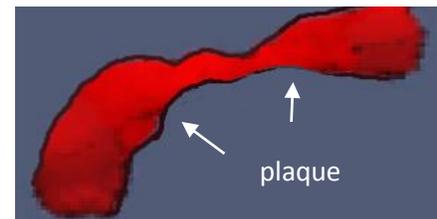
Further review of the Color Doppler study shows that the color in the image obscures the underlying pathology making it seem as if there is no concern. The Color Doppler flow measurement shows a cause for concern while the imagery does not indicate a reason for the elevated flows. Both the Abdominal Ultrasound and the Mesenteric Study result in a determination where the patient would be dismissed without further need for evaluation.

Visualize:Vascular isolates the residual lumen within an artery and renders it in 3D. The 3D visualization for this study shows that there is a definitive lump of plaque in the proximal SMA. Since the 3D rendering is of the lumen, plaque is shown as a place where the gray background pushes into the space where a natural line of the artery should extend.

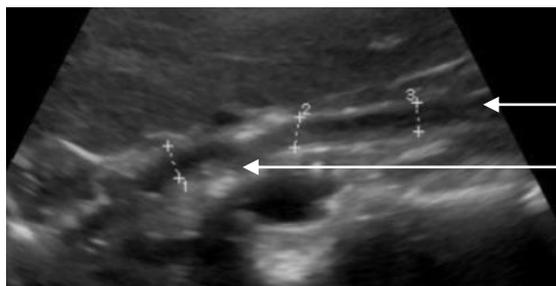
The same portion of the SMA is re-examined using grayscale ultrasound, typically used in Abdominal Ultrasound to determine if the 3D results can be confirmed. This is very delicate to image and not part of any standard exam. The image shows plaque inside the vessel which directly aligns with the 3D results



Color Doppler



3D Rendering



SMA

Plaque

Abdominal and Doppler results indicate a slight concern that would be dismissed; while *Visualize:Vascular* pinpoints that there is a definite blockage in the SMA. Abdominal and Mesenteric ultrasound did not yield results that address the patient's problem. *Visualize:Vascular* gives additional detail using a different imaging technique placing the patient on a path toward addressing the pain.

¹ Lui, et.al. "Human factors as a source of error in peak Doppler velocity measurement" Journal for vascular Surgery, November 2005