


MEDIAN ARCUATE LIGAMENT SYNDROME ULTRASOUND PROTOCOLS

BY : NATIONAL MALS FOUNDATION

 www.malsfoundation.org

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PURPOSE:

A mesenteric ultrasound is the most straightforward way to determine if there is compression to the arteries in the abdomen. Capturing images of the arteries to look for compression is essential. Measuring the specific velocity of blood flow in each artery is the most precise means of understanding the severity of possible compression. The higher the velocities, the more significant the compression or stenosis. In many cases, velocities will be higher on deep expiration (breathing out) than inspiration (breathing in) because the median arcuate ligament shifts and compresses the artery more deeply as the diaphragm moves when the lungs deflate. So, it is vital to ensure that measurements and images are taken both when the patient breathes in and breathes fully out.

INDICATIONS:

- Abdominal pain associated with eating
- Significant weight loss
- Bruit
- Nausea
- Vomiting
- Chest Pain or Pressure
- Exercise-induced pain or exercise intolerance
- Suspected Median Arcuate Ligament Syndrome (MALS)
 - Also known as Celiac Artery Compression Syndrome (CACs) , Dunbar Syndrome and Harjola-Marable Syndrome.

CONTRAINDICATIONS:

- Open Wounds
- Abdominal Drains
- Overlying Sutures
- Bowel Gas that Completely Limits Visualization
- Rapid Breathing
- Inability to Hold Breath

PREFERRED EQUIPMENT:

- Color Doppler ultrasound to capture optimal blood flow

INSTRUCTIONS FOR PATIENTS:

- Fast for 8 hours before Ultrasound
- Wear Comfortable Clothing
 - No Bra
- Ultrasound may be done in different positions
 - Supine
 - Standing
- Patients will need to take deep breaths in and out during the exam.
 - Many patients find this uncomfortable or painful.
- Take Oral Simethicone the night before to help minimize Gas Bubbles over the Celiac.

GENERAL EXAMINATION GUIDELINES FOR CLINICIAN:

- A complete examination includes an evaluation of the entire course of the accessible portions of the abdominal aorta and major visceral arteries, including the celiac artery, superior mesenteric artery (SMA), and inferior mesenteric artery (IMA).
- If exploring possible compression syndrome, obtain velocities on inspiration and expiration in both a supine (horizontal) and erect (upright) position.

For MALS (Median Arcuate Ligament Syndrome) in particular, it is essential to capture Spectral Doppler with PSV at deep inspiration and complete expiration and document celiac artery excursion between deep inspiration and complete expiration. Calculating the deflection angle (DA), which is the angle between the celiac and aorta at inspiration, is vital.

As asserted in the MALS Foundation video made in partnership with Osmosis and NORD, a mesenteric duplex ultrasound of the abdomen indicative of MALS will show the increased peak-systolic velocity of blood flow in the celiac artery, typically more than 200 cm/sec, and end-diastolic velocity of more than 55 cm/sec. An increase in velocity on deep expiration indicates celiac artery compression.

A deflection angle >50 degrees between inspiration and expiration is also indicative of MALS.

TECHNICAL GUIDELINES FOR OPTIMAL USE OF EQUIPMENT:

- Optimize gain and display setting with respect to depth, dynamic range, and focal zones on grayscale imaging first
- Optimize the Color Doppler Setting to show Optimal Flow
- Adjust Scale and Gain to Maximally Fill the Vessel of Interest without Artifact
- Light Color in the middle of the Vessel Lumen
- Areas of Aliasing due to Turbulent Flow should be Documented
- Use Power Doppler if suspect Absent Flow with Color Doppler
- Optimize Spectral Doppler
- Place Time-Gate Centrally within the Vessel of Interest
- Adjust Scale to Extend Spectral Waveform (Amplitude Adequate for Interpretation)
- Reduce Aliasing for High Flow Evaluation
- As much as possible, Utilize Angle Correction of ≤ 60 degrees to Measure Velocities
 - Angle Correction should always be Parallel to the Vessel Wall
 - For certain Anatomy, may need to try different approaches to optimize the angle
- Areas of suspected Stenosis or Obstruction will include Spectral Doppler Waveforms and Velocity Measurements Recorded at and Distal to the Stenosis or Obstruction
- If a stent has been placed, these sites will include Spectral Doppler Waveforms and Velocity measurements within the Proximal, Mid, and Distal Stent as well as Interrogation of the Native Vessel Proximal and Distal to the stent.
- The Gastroduodenal Vessel should be evaluated if it is suspected the Celiac is Occluded.
- If MALS is suspected, calculate the Deflection Angle (DA)

REPORTING AFTER ULTRASOUND CONDUCTED:

- This report should include the velocities for the celiac artery documented both on inspiration and expiration, as well as the velocities of the common hepatic, left gastric and splenic artery, and the superior and inferior mesenteric arteries.
- Patients should request a copy of the Written Report and CD for their own records.

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SOURCES:

Pediatric Indications for MALS - 200 cm/sec:

Title: Median Arcuate Ligament Syndrome in the Pediatric Population

By: Grace Z. Mak, Christopher Speaker, Kristen Anderson, Colleen Stiles-Shields, Jonathan Lorenz, Tina Drossos Donald C. Liu, and Christopher L. Skelly

Published: November 1, 2014

The diagnostic criteria for celiac artery stenosis of 70% or greater include a peak systolic velocity (PSV) >200 cm/s and end-diastolic velocity (EDV) >55 cm/s.5:

Title: Celiac Artery Compression Syndrome - NIH

By: Taimur Saleem; Shravan Katta; Donald T. Baril.

Published: April 26, 2023

Technical Guidelines for Ultrasound:

UT Southwestern Department of Radiology: Ultrasound - Mesenteric Artery Protocol

ACR-AIUM-SPR-SRU Practice Guideline (Revised 2017)

- IAC Guidelines (Updated 8/2018)
- Mesenteric/Splanchnic Artery Duplex Imaging. (2010, January 25). Society for Vascular Ultrasound. Retrieved from: McPharlin, M., Rumwell, C., (n.d.). Vascular Technology. Education for the Sonographic Professional.
- Rumwell, C., McPharlin, M., (2000) Vascular Technology. (p 47). Pasadena, California: Davies Publishing.
- Zierler, R. (2010). Strandness's Duplex Scanning in Vascular Disorders 4th edition. Philadelphia, Pennsylvania: Lippincott Williams & Wilkins.
- Daigle, R. (2009). Techniques in Noninvasive Vascular Diagnosis An Encyclopedia of Vascular Testing 3rd edition. Littleton, Colorado: Summer Publishing, LLC.

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