Pediatric MRI Elastography

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Pediatric MRI Elastography

- Introduction: What is MRI Elastography?
- Tools Needed for MRI Elastography
- MRI Elastography Protocol
- How to perform successful Pediatric Elastography
- MRI Elastography Post Processing
- Take Home Points
What is Elastography?

“Elastography is a medical imaging modality that maps the elastic properties of soft tissue”

Source, Wikipedia
A mechanical stress is applied to an area of the body by an external mechanical source. The mechanical stress is called shear waves.

These shear waves are then imaged inside of the body using a special MRI technique which results in data that generates quantitative images displaying the stiffness of tissue.

An electrical signal is created and synchronized to the MRI pulse sequence and amplified before being fed into a mechanical driver.
Why?

- Excellent non-invasive way to assess liver health
- Very cost effective versus biopsy
- Procedure that's received well by most patients
Tools Needed for MRI Elastography

- Active Driver
- Passive Driver
- Elastic Band
Active Driver

- Sometimes called the acoustic driver

- This creates the mechanical shear wave and sends it through a tube to the patient

- The box is approximately 11.5in tall, 15.5in. wide, 19.5in. Long

- Weighing approximately 35lbs.
Passive Driver

- Adult or larger patient passive driver
Passive Driver

- Pediatric or small patient passive driver
Elastic Band

- Elastic band keeps the passive driver tight to the body for optimal shear wave propagation.
MRI Elastography Resoundant System
The actual Elastography sequence is a breath hold 2D GRE.

A typical Elastography scan should have a table time of 30 minutes.

The GRE Elastography sequence generates 6 types of images.
Phase Image
Color Stiffness Image
Color Stiffness 95% Confidence Map
Black and White Confidence Map
Wave Image
No Activation
Guide Lines For Successful Pediatric Elastography

- Patient should have fasted for at least 4 hours upon arrival
- Consult child life to prep patient for breath holding instructions and patient set up.
- Always make sure the active driver is on and tube connection is sound.
- Make sure the passive driver is securely held in place by the elastic band.
Passive Driver Positioning

- Position the passive driver over the right chest wall centered at the level of the xiphoid process.

- Fasten the passive driver against the body wall firmly with the elastic band.

- Have patient hold their breath on inspiration.
Slice Selection for 2D GRE MRE

- Position slices in the widest cross section of the liver, about 5-10cm away from the superior margin of the liver.
An Example of Good Slice Placement
Bad Slice Placement
Troubleshooting

- Make sure tube is connected securely after table moves into scanner
Troubleshooting

- Make sure the active drive is on
Make sure USB from the Active Driver is connected to the MRI computer
Post Processing

- Kilopascal is a measure of pressure (kPa)
- The color scale generated on the color images gives representation of liver stiffness represented by the color bar (0-8 kPa)
Post Processing
Save Color images as a RGB

- Stiffness image
- Stiffness 95%
- Wave
Magnetic resonance elastography predicts advanced fibrosis in patients with nonalcoholic fatty liver disease: A prospective study
Disease Processes that Warrant MRI Elastography

- Biliary Atresia- a condition in which the normal extrahepatic biliary system is disrupted. Characterized by luminal obstruction of the extrahepatic bile duct.
Fontan Procedure—surgical procedure in children with congenital heart defects involving diverting venous blood from the right atrium to the pulmonary arteries without passing through the morphologic right ventricle.
Technical Failures

- Patients with hepatic iron overload or Hemachromatosis. With conventional gradient echo MRE sequences, very high liver iron content may cause the signal intensity of the liver to be too low to visualize the mechanical waves.

- There may also be some issue with patients with a large amount of ascites.
Take Home Points

- Excellent preparation means excellent imaging and reliable data.
- All patients should have fasted for at least 4 hours
- Perform breath holding on inspiration.
- Meticulous ROI placement is necessary for good data
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