Aixplorer® Tips

Evaluation of Liver Fibrosis using ShearWave™ Elastography on Aixplorer®

SSID02892-01
November 2012
Evaluation of Liver Fibrosis using SWE™ on Aixplorer®

Introduction

From a clinical standpoint, staging liver fibrosis is of major importance¹,²:
- to make a prognosis
- to follow up the evolution of chronic liver diseases (cirrhosis or hepatitis)
- to monitor antifibrotic treatments

The stage of the fibrosis is correlated to the stiffness of the tissue, which is also correlated to the velocity of the shear wave.

ShearWave™ Elastography (SWE™) performed with Aixplorer® is a 2D imaging mode¹,³ that provides a view of the organ and a map of the shear wave velocity over the region of interest. With the Adjustable Numerical Scale, the map can be fine-tuned to highlight the stiffer or the softer parts of the ROI.

Apart from fibrosis, many studies demonstrated the influence of several clinical factors on liver stiffness:
1. Respiration⁴, deep breath
2. Central venous pressure⁵
3. Intrahepatic cholestasis⁶-⁷
4. Hepatic necro-inflammatory activity (steatosis⁸ for example)
5. Peliosis hepatitis (affection of the liver parenchyma vasculature)
6. Thrombosis of hepatic vein (clot)
7. Congestive hepatopathy⁹...

These should be considered when assessing liver stiffness.

The known limitations of conventional ultrasound examination also apply to the SWE™ mode: narrow intercostal spaces, thick layer of fat...

Noteworthy: the presence of ascites is not a limitation for the evaluation of liver fibrosis with SWE™.

Reference

1. The patient

- He/she lies in the supine position, with the right arm in maximum abduction to make the right hypochondrium accessible.
- Fasting is mandatory.
- Normal breathing is recommended.

2. The probe

- Choose the SC6-1 curved probe, with the preset "Liver" in the "Abdominal" application.
- Scan intercostally (probe parallel to the intercostal space within the space) with sufficient gel and minimize rib shadowing. If SWE signal is weak, unstable, and/or not visible, apply a pressure on the probe to open the rib space (improve the acoustic window) and decrease tissue thickness between the probe and the ribs. Contrary to what has been recommended as a rule for most of the organs, a pressure must be applied to the probe when scanning the liver. The ribs will absorb the pressure and the elasticity of the liver will not be impacted.
- The patient can be scanned subcostally, although it is not recommended. If scanned subcostally, apply the slightest pressure required for visualization in B-Mode.
- Slow or even no movement of the probe is recommended to avoid motion artifact and to stabilize the map.

The SWE™ acquisition of the right lobe is recommended in priority. However, if it has to be performed on the left lobe, apply the slightest pressure required for visualization in B-Mode. Be aware that the SWE™ acquisition on the left lobe is more subtle and requires no pressure.
3. SWE™ and the B-Mode image

The brightness of the B-Mode image is related to the best acoustic window for the SWE velocity map. **Ensure the optimal B-Mode image before engaging the SWE™ Mode and placing the SWE™ box:**

- Enlarge the intercostal space and decrease the thickness of the subcutaneous fatty layer, by using correct patient positioning and pressure on the probe.
- Ensure the optimal contact between the probe and the skin.
- Place the probe parallel to the intercostal window to avoid shadowing from the ribs.

4. The SWE™ Velocity map

**Maintain pressure on the probe.**

The SWE™ default settings have been optimized for the assessment of liver fibrosis. **Run the first exam with the default settings. Adjust them only if necessary.**

a. The SWE™ box

- Move it onto a vessel-free parenchyma.
- Place it within a zone of uniform parenchyma as defined by the B-Mode image.
- Avoid placing the SWE™ box close to the liver capsule.
- The most robust acquisition is performed between 3 and 7 cm in depth.

b. SWE™Optimization (Res/Std/Pen)

If a lack of SWE™ signal is observed, turn to "Penetration"

c. Freezing the image

- The patient should hold his/her breath for at least 4 seconds during the expiration phase.
- This delay allows sufficient filling of the SWE box and stabilization of the image in a no-movement context.
- Freeze
d. SWE™ Adjustable Numerical Scale

(Live or frozen)

Default value: 0-3.2 m/s

- Increasing the scale enables the velocities higher than 3.2 m/s to be spread over a wider range, hence to better discriminate the areas with different velocities higher than the default value.

- Decreasing the scale enables the velocities lower than 3.2 m/s to be spread over a wider range, hence to better discriminate the areas with different velocities lower than the default value.

**Default ANS: 3.2 m/s**

**Decreasing the ANS will show more details in softer tissue: 2.6 m/s**

c. Assessing the reliability of the SWE™ acquisition

- Repeat this procedure 3 times to acquire 3 valid, independent SWE™ images of the same scanning view.

- If the 3 acquisitions are not similar, it is recommended to consider the test a failure.
Examples of acquisitions that should be considered unsuccessful

B-mode image
Shadowing, poor image quality, rushed acquisition.

Non valid for the SWE™ Velocity map

SWE™ Velocity map
SWE box underneath the capsule, liver motion due to the patient’s respiration, lack of SWE signal, rushed acquisition.

Non valid SWE™ acquisition
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