Current Status of Ultrasound Shear Wave Elastography to determine Liver fibrosis in MASLD: A Clinical Practice Scenario

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BACKGROUND

Metabolic dysfunction-associated steatotic liver disease (MASLD) has emerged as a leading cause of chronic liver disease globally. Non-invasive assessment of liver fibrosis is crucial for patient management. This study aimed to compare the diagnostic performance of shear wave elastography using Siemens ACUSON Sequoia (pSWE) and Canon Aplio i800 (2DSWE) systems in MASLD patients for estimation of liver fibrosis with varying degrees of hepatic steatosis.

METHODS

- Prospective study of 100 consecutive MASLD patients with ultrasonographically confirmed hepatic steatosis (S1-S3)
- All patients underwent liver stiffness measurements using point SWE on Siemens ACUSON Sequoia and 2D SWE on Canon Aplio i800
- The SRU “Rule of Four” was used for fibrosis staging for all platforms
- Wherever the staging had a discordance or 2 or above, MRI PDFF was used as the gold standard
- Multivariate analysis for age, sex, BMI, skin-to-capsule distance (SCD), and shear wave dispersion (SWD) was also performed.

RESULTS

- The final cohort included 88 patients (63 males, 25 females; mean age: 52 years; mean BMI: 29.5 kg/m²), rest were excluded due to poor propagation maps on
- The most common clinical diagnoses in this cohort were MASLD (n=31/88, 35.2%) and advanced chronic liver disease (ACLD) (n=29/88, 33.0%).
- Ten valid measurements were achieved in 96% of patients with Sequoia, 94% with Aplio i800.
- Categorisation with both systems in shown in Figure 1 and 2.
- The mean inter-system difference in stiffness values was -1.44 kPa (±SD), with greater variability observed in F4 patients (-5.79 kPa ±SD) than non-F4 (0.60 kPa ±SD).

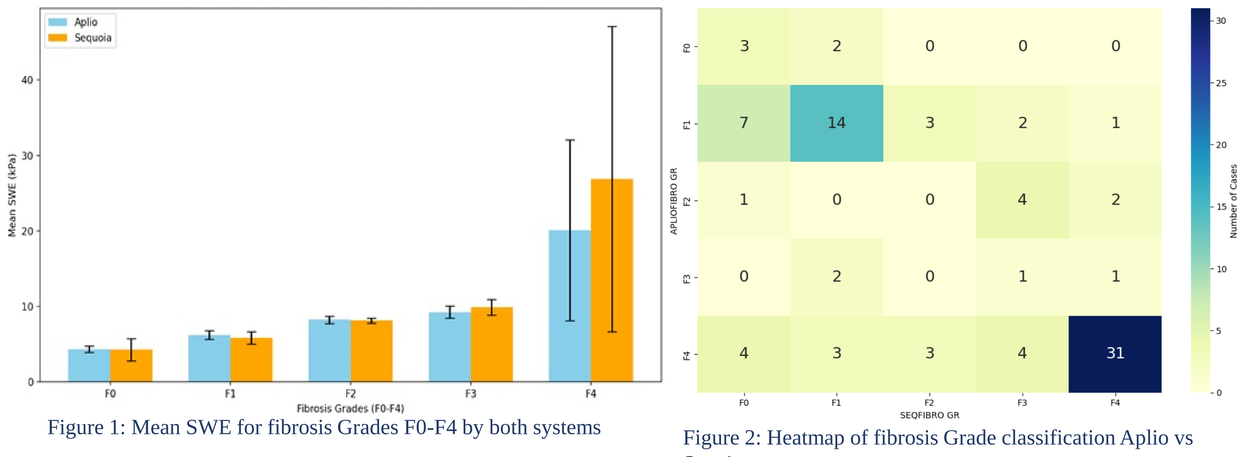


Figure 1: Mean SWE for fibrosis Grades F0-F4 by both systems

Figure 2: Heatmap of fibrosis Grade classification Aplio vs Sequioa

Examples images for concordant and discordant cases are shown in figures 3 and 4.

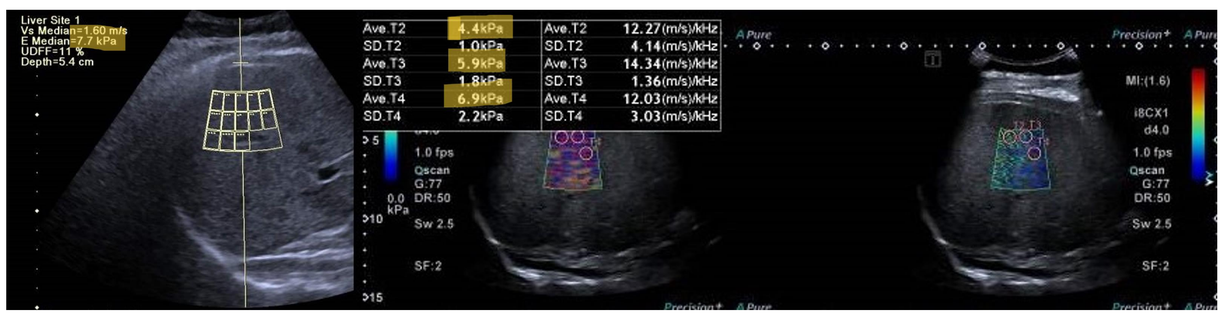


Figure 3: Example of 2D Images from both systems showing concordance between SWE values. F1 for both systems

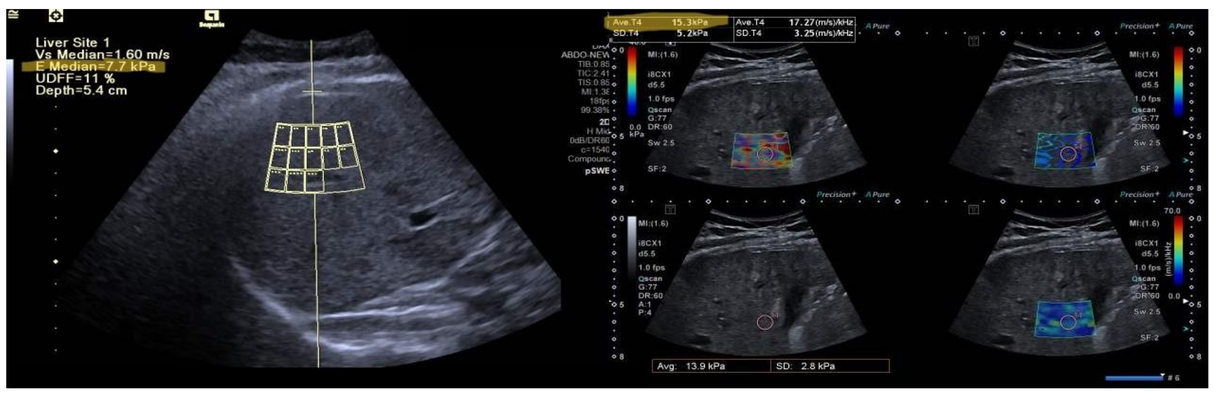
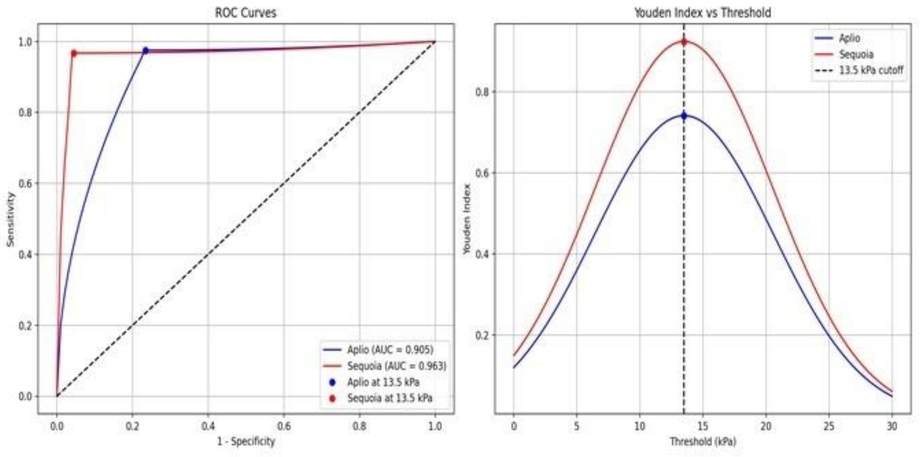


Figure 4: Example of 2D Images from both systems showing discordance between SWE values. F1 on ACUSON Sequioa and F4 on Canon Aplio i800

F4 category of patients:

- Cohen's Kappa analysis for F4 classification showed a Kappa score of 0.643, confirming substantial agreement between Aplio and Sequoia for F4 classification with an overall agreement of 82.0%.
- The sensitivity for F4 was identical at 97.8% for both systems, while the specificity was significantly higher for Sequoia (100%) compared to Aplio (79.6%).

The diagnostic performance metrics for F4 classification are shown in figure 5.



Parameter	Aplio	Sequoa
Sensitivity	0.978	0.971
Specificity	0.796	1.000
PPV	0.800	1.000
NPV	0.977	0.981
Accuracy	0.879	0.989

Figure 5: ROC curves and table showing performance for both systems

Non-F4 Fibrosis Staging

- The agreement in non-F4 categories was poor, with a Cohen's kappa of only 0.09. The heat map matrix (Figure 2) revealed that most of the disagreements (15 cases) were within 1 stage difference, while there were 6 cases with a 2-stage difference and 2 cases with a 3-stage difference.
- F1 showed the highest agreement at 58.3%,
- F0 showed moderate agreement at 40.0%,
- F3 showed poor agreement at 16.7%,
- F2 showed no agreement at 0.0%. The Aplio system tended to classify patients at higher fibrosis stages compared to Sequoia.

Multivariate Analysis

Multivariate analysis identified skin-to-capsule distance (mean: 2.24 cm ±0.52) and shear wave dispersion (mean: 14.5 m/s/kHz ±4.91) as significant contributors to measurement variability, particularly for the Aplio system.

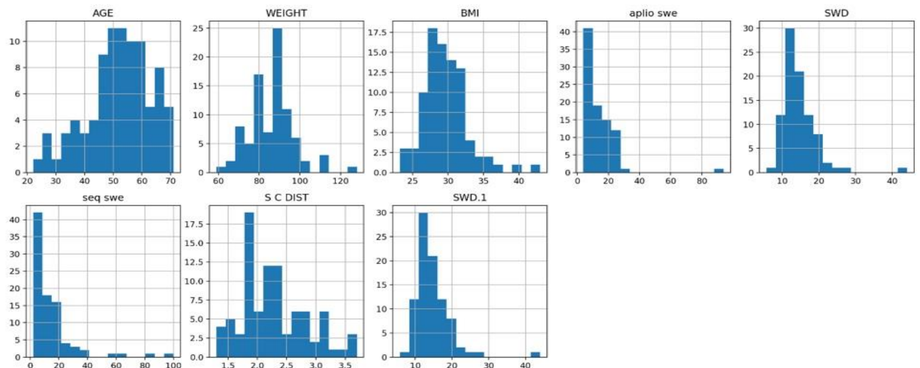


Figure 6: Histogram for various parameters included in multivariate analysis

Sno.	Predictor	Aplio_Coef.	Sequoia_Coef.
0	AGE	0.0	0.0
1	SEX	0.0	0.0
2	S C DIST	0.3755532049	0.0
3	SWD	0.3593854444	0.4097025111
4	BMI	0.0	0.0

Figure 7: Lasso regression coefficient values for both systems

CONCLUSION

Moderate correlation was observed between ACUSON Sequoia and Aplio i800 for SWE measurements. Measurements between systems are not directly interchangeable, especially in patients with advanced fibrosis, greater subcutaneous fat, or inflammation. While the SRU "rule of four" remains a useful framework for liver stiffness interpretation, system-specific performance and patient-related factors must be considered for accurate and clinically meaningful assessment.