# THE VALUE OF ACOUSTIC RADIATION FORCE IMPULSE IMAGING FOR EVALUATING LIVER FIBROSIS IN PATIENTS WITH CHRONIC HEPATITIS B INFECTION

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## INTRODUCTION

Liver fibrosis assessment is recommended to perform routinely in patients with CHB infection (1). Liver biopsy – the gold standard in liver fibrosis evaluation– is impractical because of its invasiveness and potential complications (2).

Transient elastography (FibroScan®), which has been approved by the United States Food and Drug Administration since 2013, is the most validated non-invasive method in liver fibrosis assesment (**Figure 1**) (3).

Point shear wave elastography (pSWE) by acoustic radiation force impulse (ARFI) quantification is another non-invasive, effective method to detect liver fibrosis **(Figure 2)**. ARFI overcomes the limitation of FibroScan in overweight or ascites patients because it allows examiners to choose and adjust the depth of the region of interest by B-mode.

In Vietnam, data of ARFI - shear wave velocity (ARFI-SWV) in liver fibrosis assesment, especially in CHB patients, are scarce. This study aimed to determine the agreement between ARFI-SWV and FibroScan- Liver Stifness (FS-LS), establish the optimal cut-off values of ARFI in predicting significant fibrosis (F ≥ 2), cirrhosis (F4) in CHB patients.

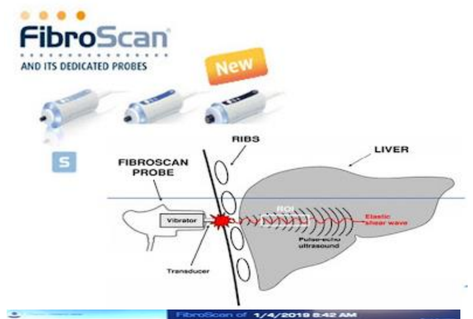
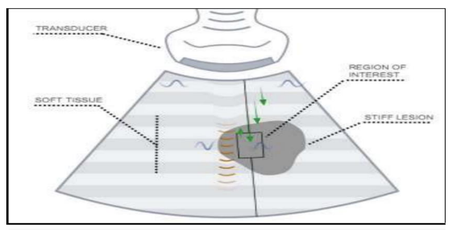




Figure 1: Transient Elastography



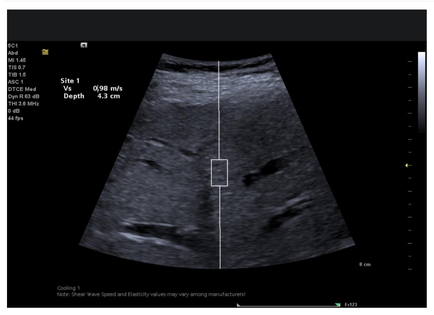




Figure 2: ARFI

## MATERIALS AND METHODS

A cross-sectional study was conducted between February 2019 to March 2021 at the Liver Clinic - University Medical Center in Ho Chi Minh City, Vietnam.

The inclusion criteria: older than 18 years old, CHB infection (hepatitis B surface antigen (HBsAg) is positive for > 6 months), regardless of undergoing antiviral therapy

The exclusion criteria: ascites, hepatocellular carcinoma; pregnancy, hepatitis B flare, chronic hepatitis C infection; heavy alcohol use (defined as consumption of >3 drinks per day for men and >2 drinks per day for women for >5 years), moderate to severe steatohepatitis (Controlled Attenuation Parameter (CAP) measured by FibroScan® S≥S2); or refusal to participate in the study **(Figure 3)**.

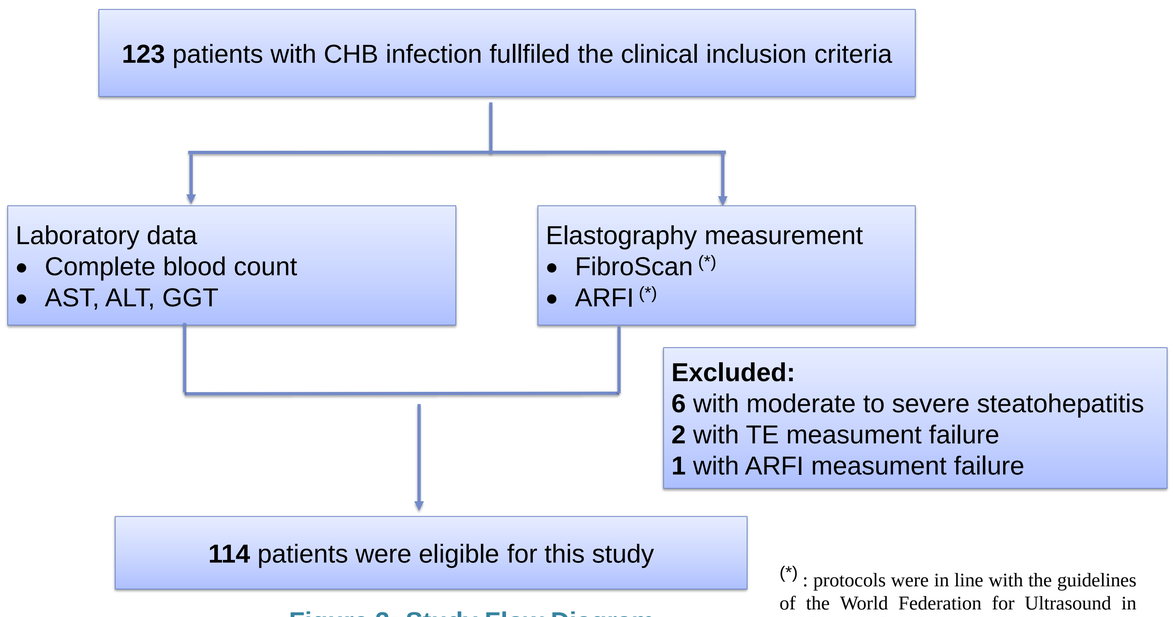



Figure 3: Study Flow Diagram

(*) : protocols were in line with the guidelines of the World Federation for Ultrasound in Medicine and Biology, 2015 (4).

### Statistical analysis

One way-ANOVA was used to exam the difference between mean ARFI values in fibrosis group stages. The correlation and agreement betwseen FS-LS and ARFI-SWV was determined using Pearson's correlation coefficient and Kappa values, respectively. ). The diagnostic performance of ARFI was assessed by generating the receiver operating characteristic (ROC) curves. The optimal cut-off values for ARFI were computed using the method that maximizes the sum of sensitivity and specificity. The significance level was set at P≤0.05

## RESULTS

**Table 1: Baseline characteristics of 114 study participants**

| Characteristics | Statistics* |
|---|---|
| Age (years) | 52 ±10 |
| Male | 69 (61%) |
| Receiving antiviral treatment | 97 (85%) |
| Treatment-naïve HBV patients | 17 (15%) |
| BMI (kg/m$^2$) | 21.6 ± 2.0 |
| HBeAg positive | 28 (25%) |
| AST (U/L) | 35.7 ± 13.1 |
| ALT (U/L) | 29.7 ± 14.5 |
| GGT (U/L) | 43.3 ± 38.6 |
| Platelet (10$^9$/L) | 169.3 ± 68.0 |
| WBC (10$^9$/L) | 6.1 ± 2.0 |
| Hb (g/L) | 140.4 ± 22.2 |
| Serum creatinine (mg/dL) | 0.9 ± 0.1 |
| Fibrosis stages | |
| F0 | 17 (15%) |
| F1 | 25 (22%) |
| F2 | 28 (25%) |
| F3 | 13 (11%) |
| F4 | 31 (27%) |

* Mean ± SD for continuous variable and count (%) for categorical variables

**Table 2: The mean values of acoustic radiation force impulse of different fibrosis stages**

| | Fibrosis stages | | | P value |
|---|---|---|---|---|
| | Group 1 (F0 + F1) (n = 42) | Group 2 (F2 + F3) (n = 41) | Group 3 (F4) (n = 31) | |
| ARFI mean ± SD (m/s) | 1.22 ± 0.17 | 1.54 ± 0.13 | 2.30 ± 0.56 | < 0.001 |

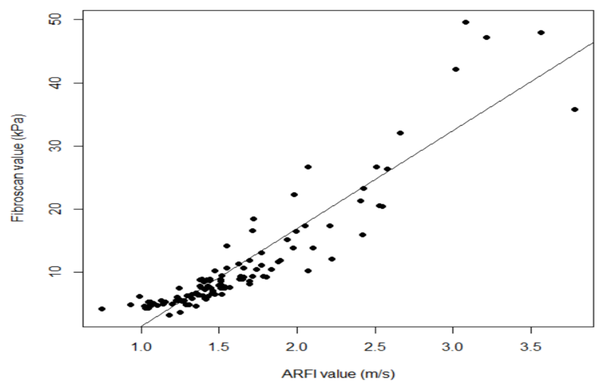



**Figure 4: Correlation between ARFI and FibroScan**
(r = 0.92, 95%CI: 0.88 - 0.94, P < 0.001)

**Table 3: Performance of ARFI in evaluating significant fibrosis, cirrhosis, and its optimal cut-off values**

| | AUROC | Cut-off value (m/s) | Sens % | Spec % | PPV % | NPV % | Kappa |
|---|---|---|---|---|---|---|---|
| Significant fibrosis (F ≥ 2) | | | | | | | |
| ARFI (m/s) | 0.975 | 1.37 | 83.3 | 100 | 100 | 81 | 0.863 |
| Cirrhosis (F4) | | | | | | | |
| ARFI (m/s) | 0.986 | 1.7 | 97 | 93 | 95 | 96 | 0.849 |

## CONCLUSION

In CHB population, ARFI-SWV have strong corrrelation, good agreement with FS-LS and high accuracy in the diagnosis of significant fibrosis and cirrhosis. ARFI-SWV can be used as an alternative method to evaluate liver fibrosis in CHB patients regardless of the undergoing antiviral treatment.

## References

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