

Elastography in evaluation of Metabolic Syndrome population

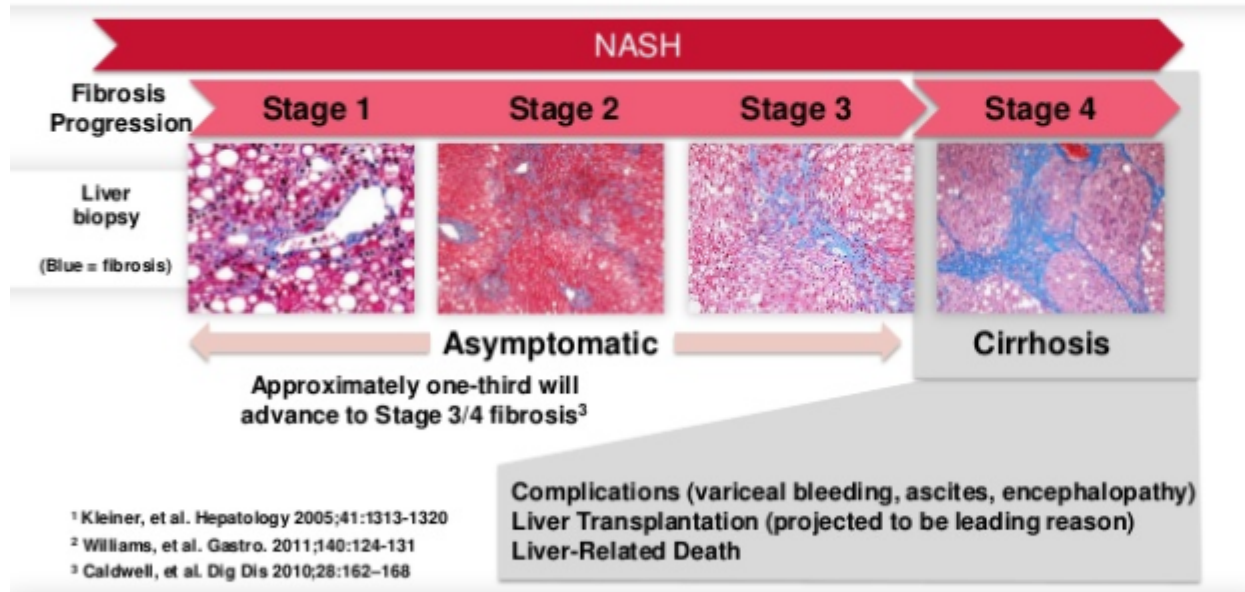
11/01/2018

Kazimierz Kukulski

End-Stage Fibrosis (Cirrhosis) Is When Patients With NASH Experience Symptoms And Complications



Estimated prevalence of advanced fibrosis^{1,2}: ~ 6 million
Estimated prevalence of cirrhosis¹: ~ 1-2 million



NASH/NAFLD

1. Steatosis

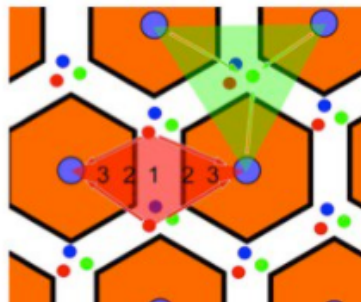
- $\geq 5\%$ (beyond physiologic level)

2. Steatohepatitis

- Ballooned hepatocytes
- Mallory-Denk bodies
 - Damaged IF within hepatocytes; CAM5.2+
- Neutrophilic infiltrate

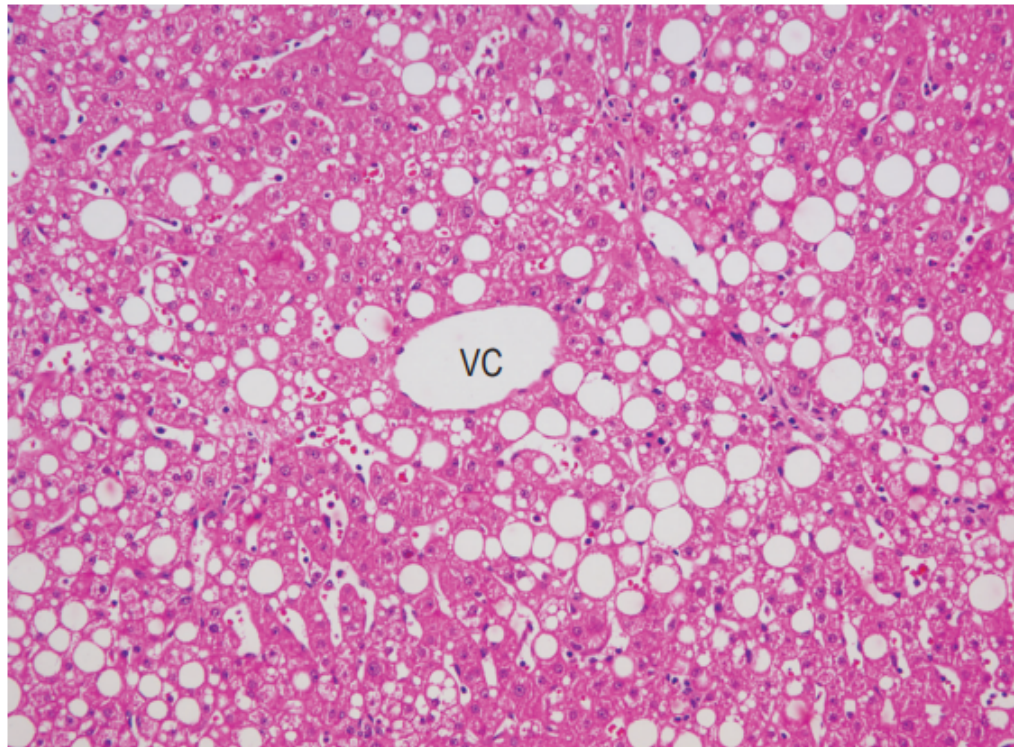
3. Steatofibrosis

- Acinar zone 3 (perivenular/pericellular) fibrosis may progress to **central-portal** bridging cirrhosis

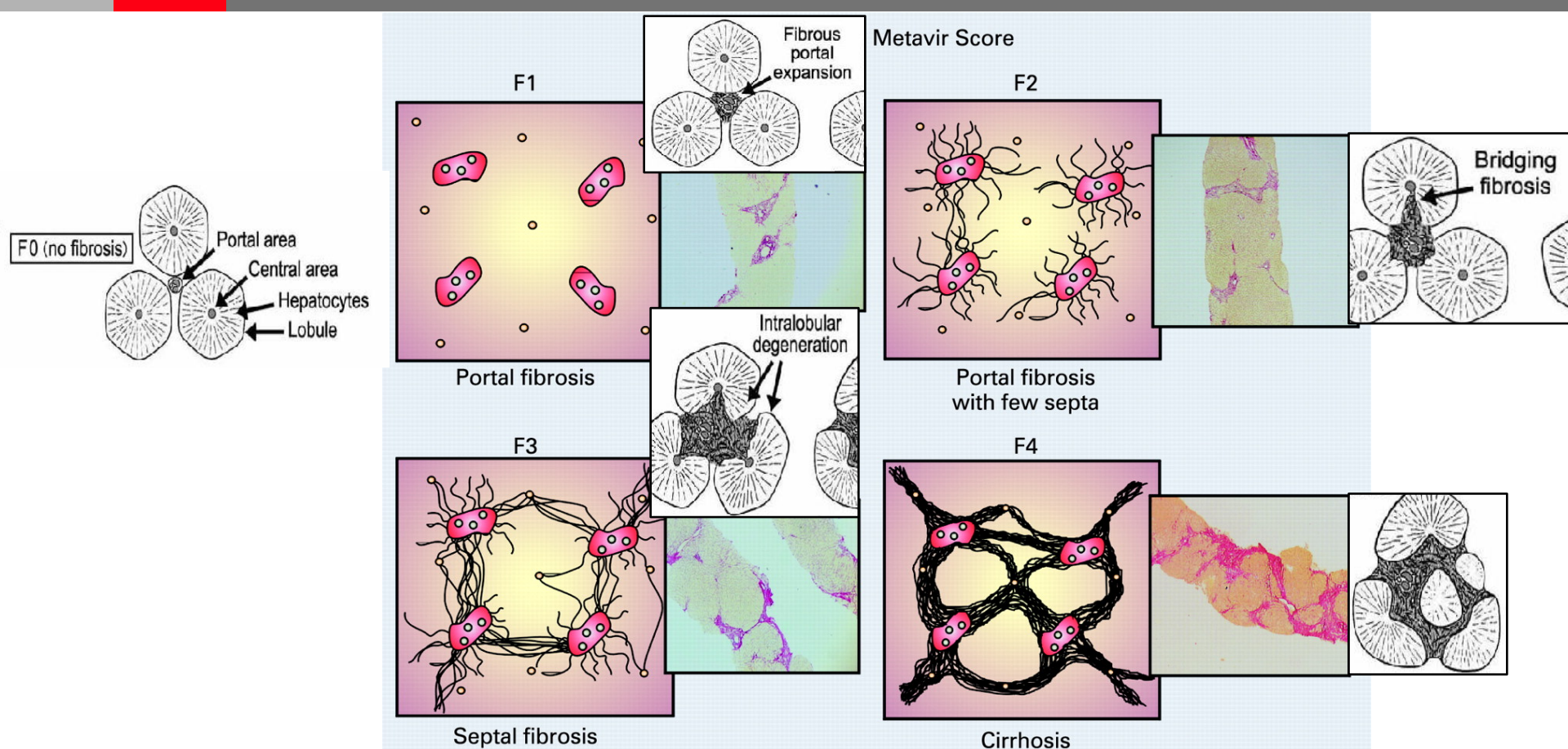


Three or more of these traits:

- **Large waist circumference** — a waistline that measures at least 89 centimeters for women and 102 centimeters for men
- **High triglyceride level** — 150 milligrams per deciliter,(mg/dL), or 1.7 millimoles per liter (mmol/L), or higher of this type of fat found in blood
- **Reduced high-density lipoprotein (HDL) cholesterol** — less than 40 mg/dL (1.04 mmol/L) in men or less than 50 mg/dL (1.3 mmol/L) in women of this "good" cholesterol
- **Increased blood pressure** — 130/85 millimeters of mercury (mm Hg) or higher
- **Elevated fasting blood sugar** — 100 mg/dL (5.6 mmol/L) or higher

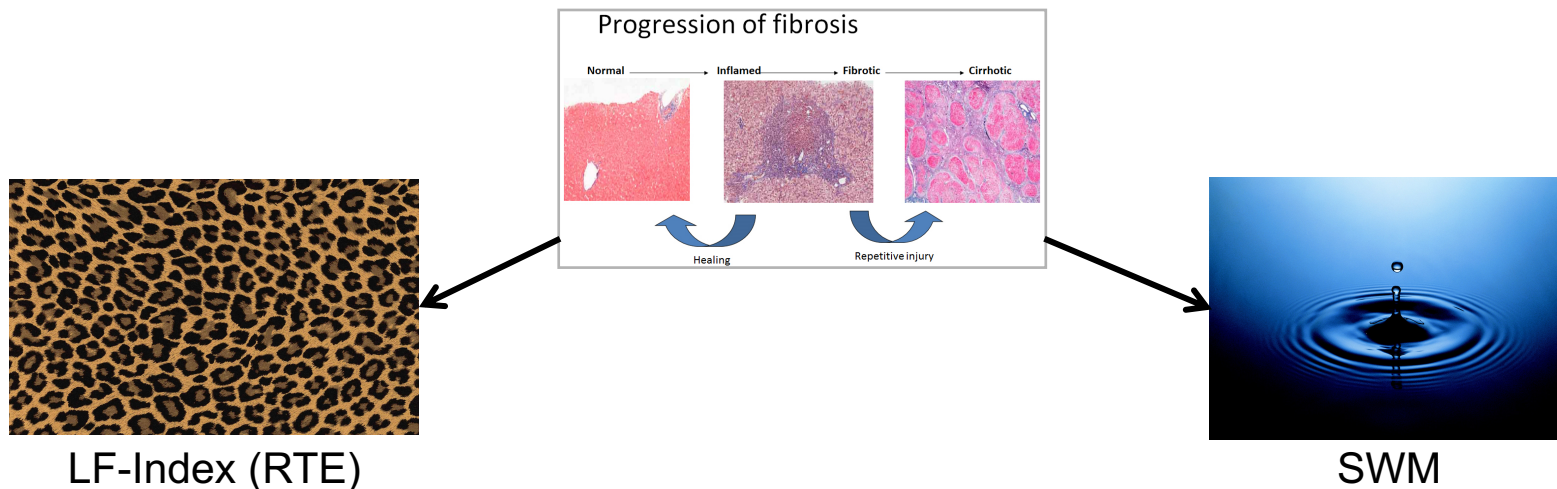


Fibrosis the way we see liver function deterioration



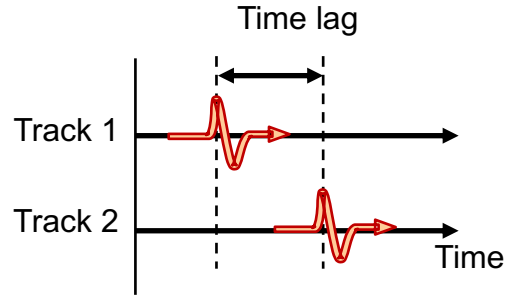
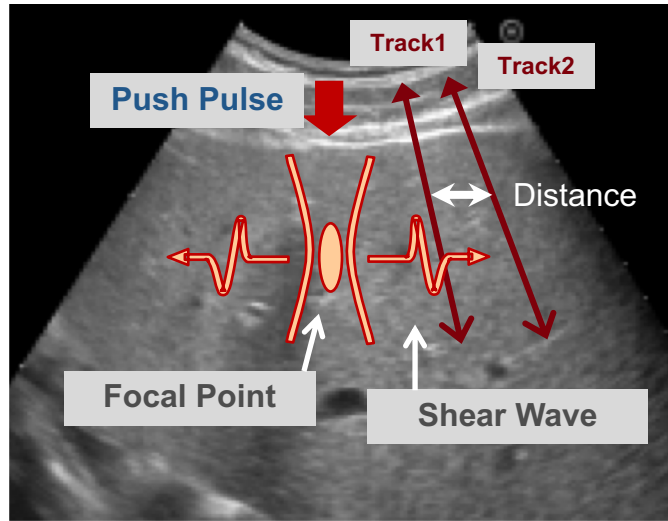
Different methods of evaluation of liver diffuse disease

- LF Index – shows correlation with the degree of fibrosis
 - measurement not affected by degree of inflammation*
- Shear Wave Measurement (SWM), measures the propagation speed of the Shear Wave
 - Less dependent on examiner technique



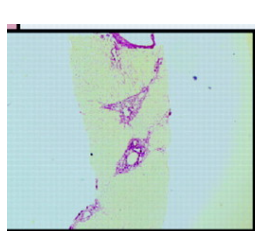
*Fujimoto K. et al, Oncology 2013;84(suppl 1):3–12

SWM (point sheare wave measurement)

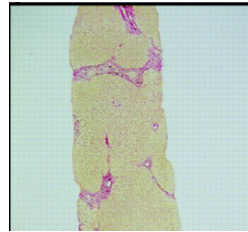


$$V_s = \text{Distance} / \text{Arrival time lag}$$

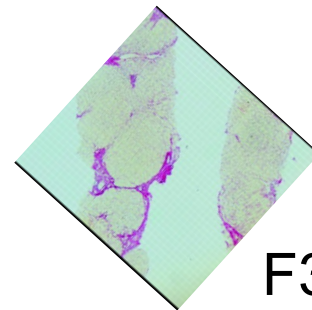
- Calculate Propagation Speed:
 - Tx. Rx. "**Track Pulse (T1,T2)**" continuously
 - Detect arrival time at each position



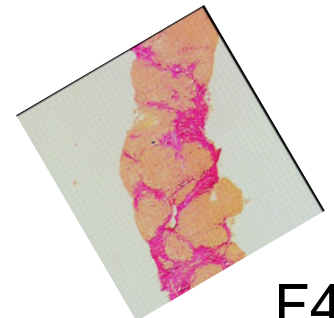
F1



F2

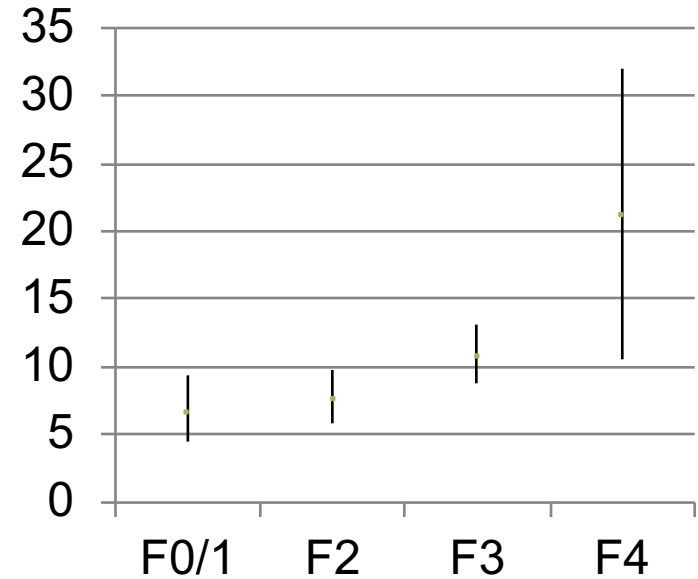
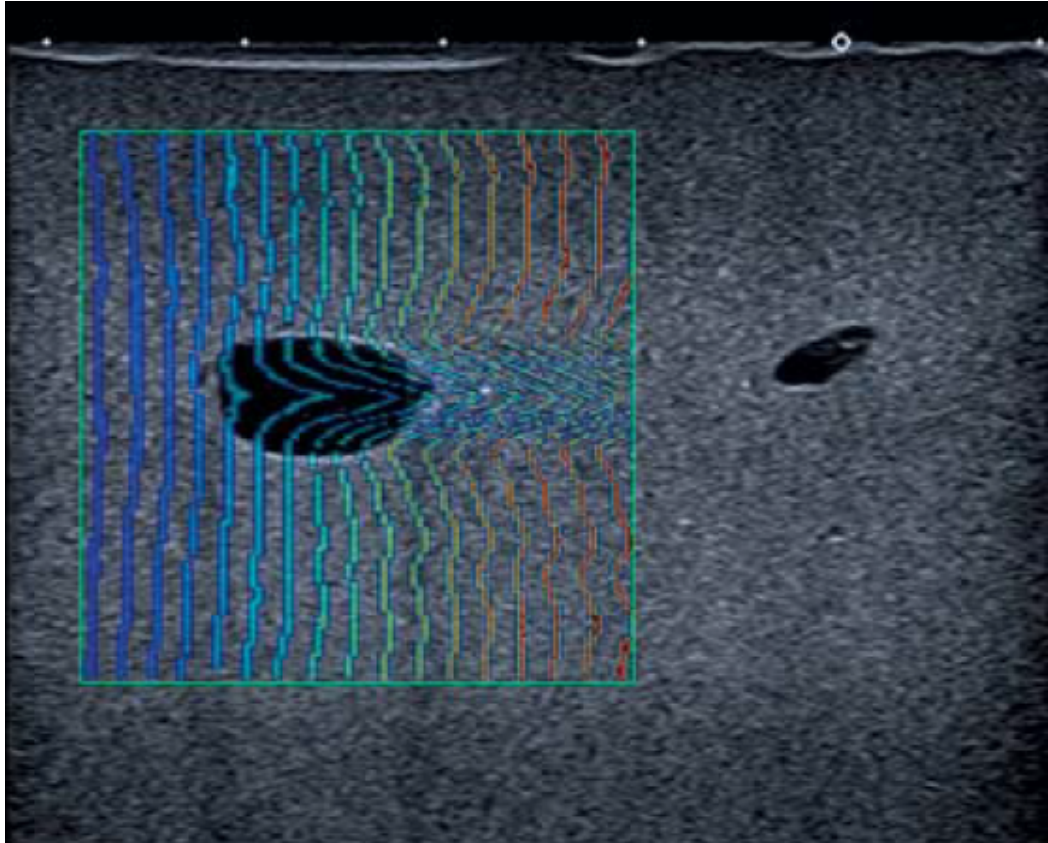


F3



F4

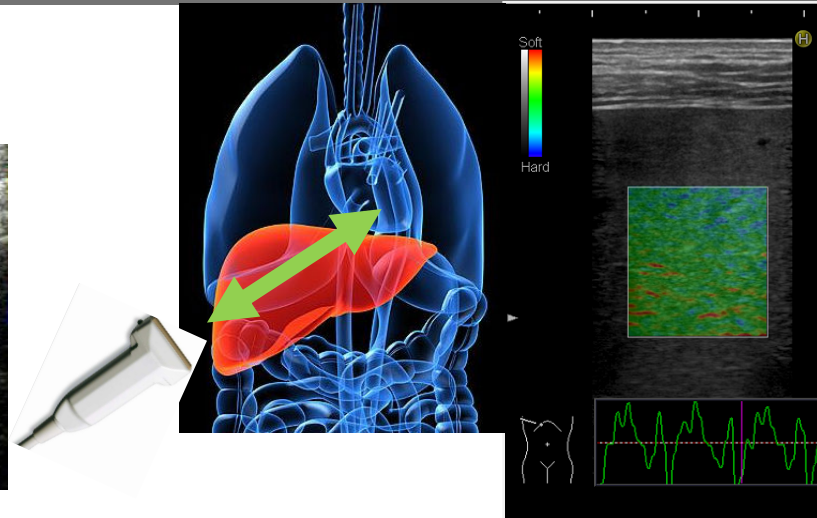
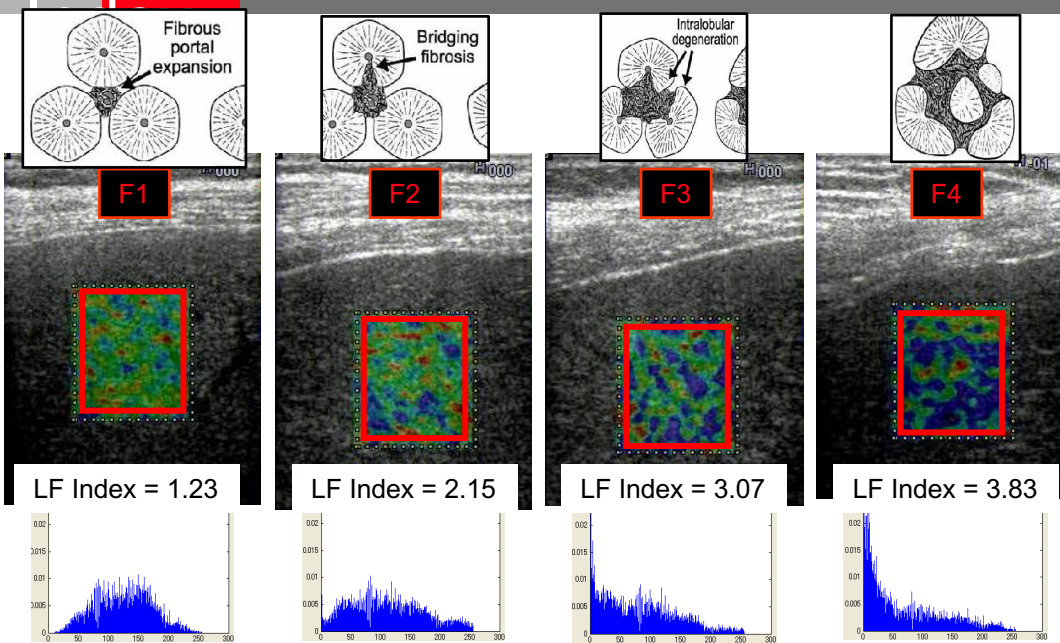
Shear Wave Elastography (2D SWE)



the shear modulus increases with vascular and interstitial pressure

- Deep inspiration
- Food
 - Investigation minimum 3 hours after eating
 - Coffee, smoking drinking – stop as above
- Alcoholic hepatitis
 - Stiffness decreases after 1-4weeks abstinence
- Exercises
 - Minimum rest 10min
- **Hepatic inflammation**
- **Obstructive cholestasis**
- **Hepatic congestion**
- **Acute toxic hepatitis (drug induced)**
- **Amyloidosis**
- **Lymphomas**
- **Extramedullary hamopoiesis**
- **Steatosis???**

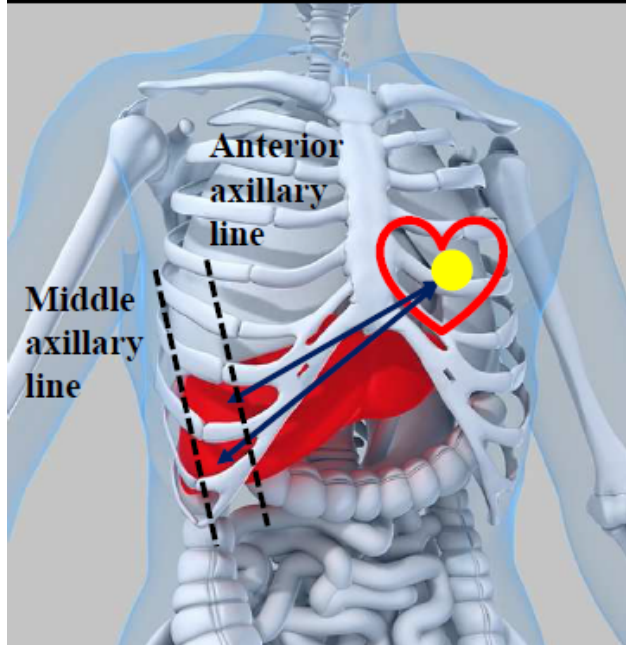
Strain Elastography



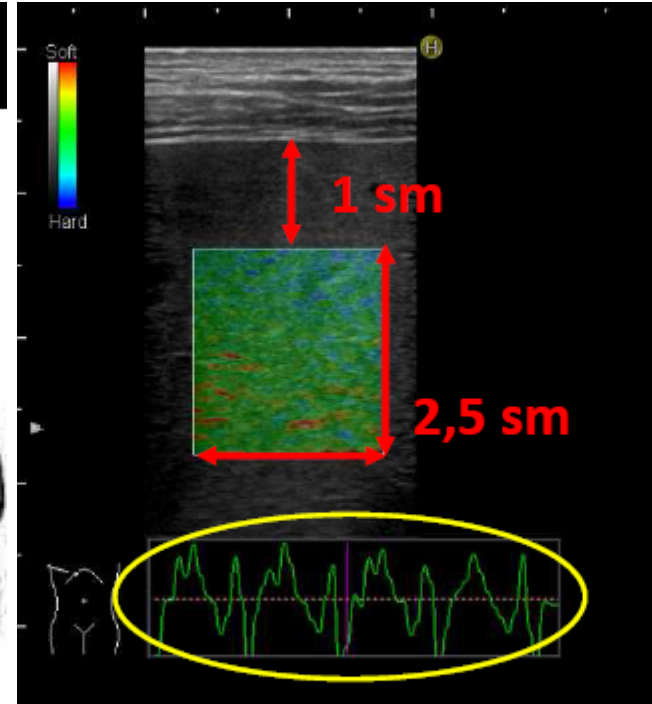
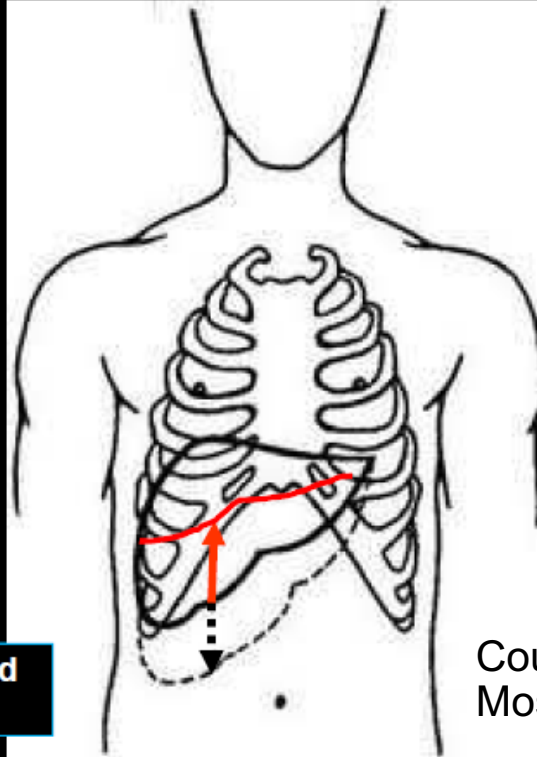
$$\begin{aligned} \text{LF Index} = & - 0.00897 \times \text{MEAN} - 0.00502 \times \text{SD} + 0.0232 \times \% \text{AREA} \\ & + 0.0253 \times \text{COMP} + 0.775 \times \text{SKEW} - 0.281 \times \text{KURT} + 2.08 \times \text{ENT} \\ & + 3.04 \times \text{IDM} + 40.0 \times \text{ASM} - 5.54 \end{aligned}$$

Fujimoto K. et al ; Kanzo 51(9) ; 539-541 (2010)

SCAN TECHNIQUE (in non-atrophic Liver)

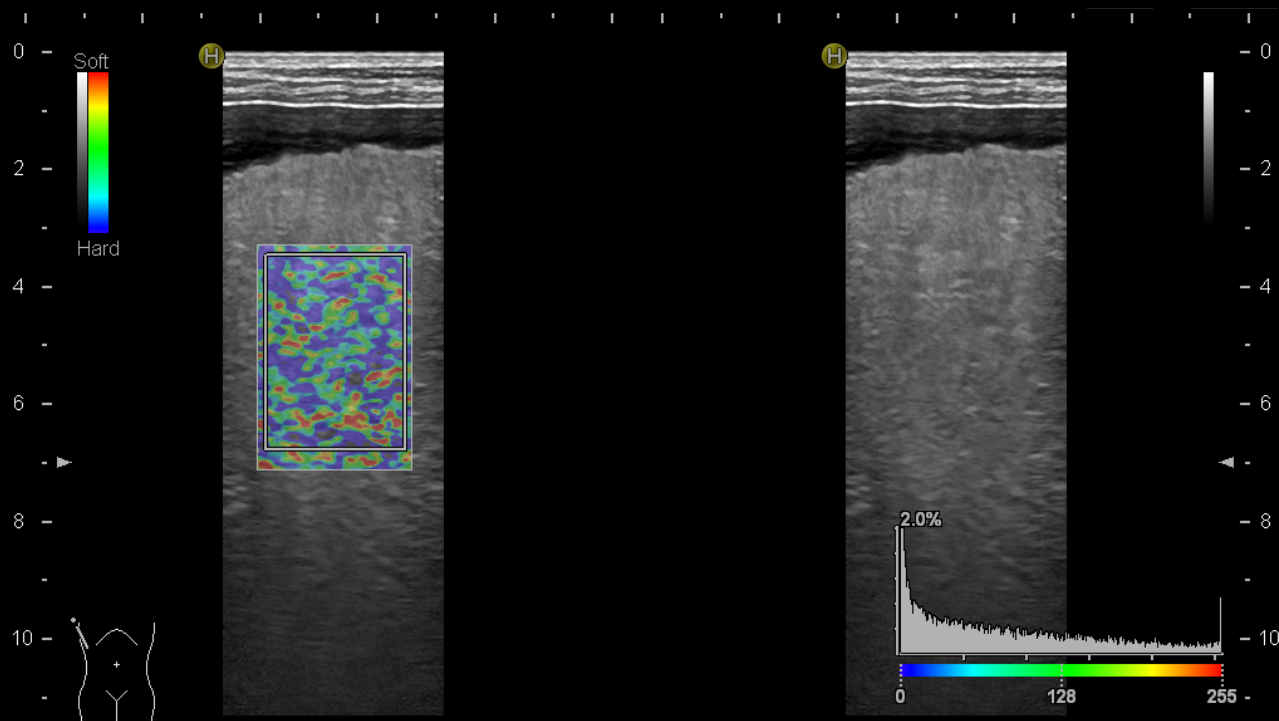


Intercostal space between anterior and middle axillary line (around S5/8)

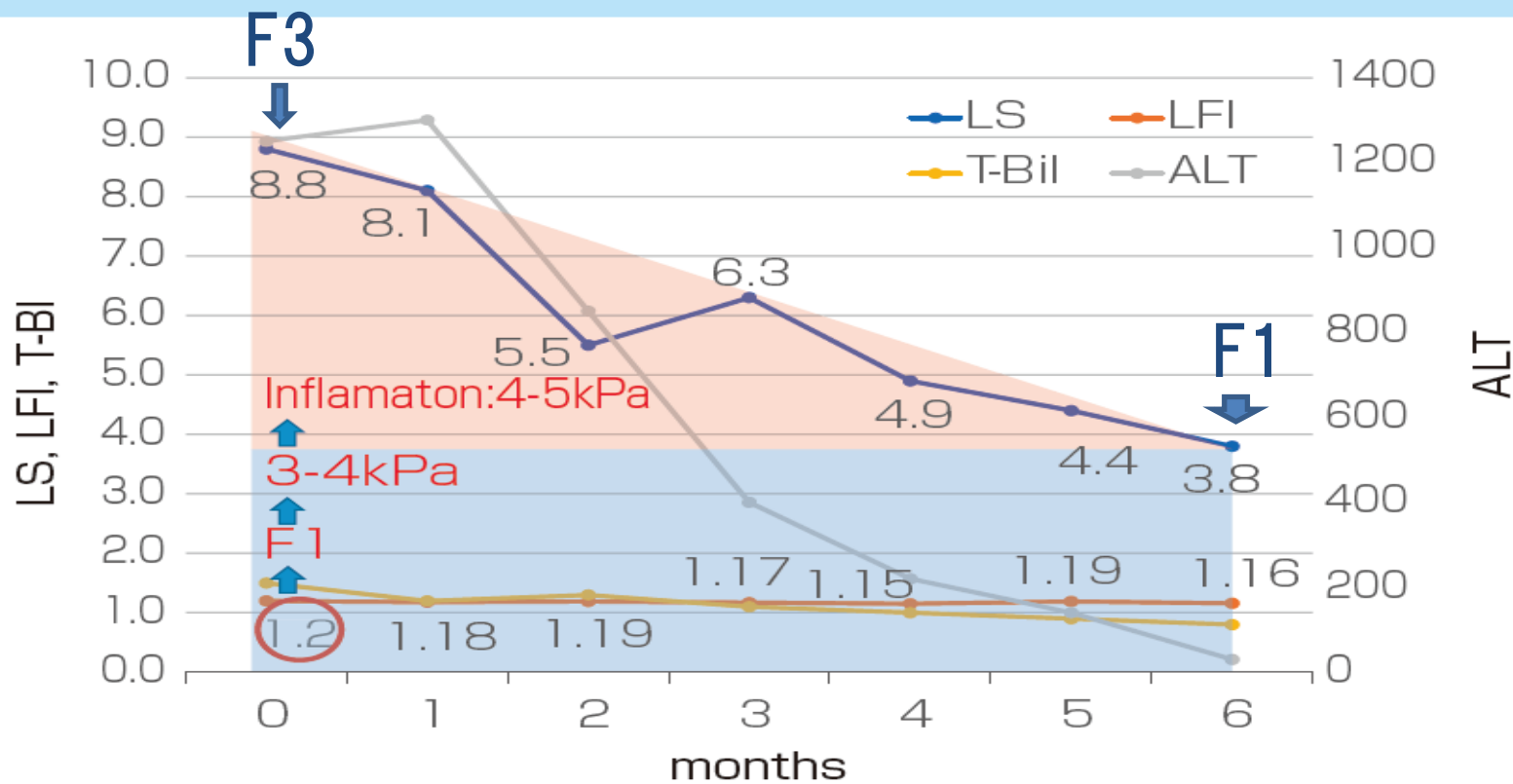


Courtesy: Dr.N.Postnova NVD Hospital Moscow

RTE



Str. Histo					
C	113.9 mm				
A	7.89 cm2	MEAN	74.1	SD	73.2
COMP	64.23	LF INDEX	4.93	%AREA	52.53 %
L52		HdTHI-P Low	BL.:28%	L52	HdTHI-P



“Data in patients undergoing IFN-free antiviral therapies suggest that liver stiffness

rapidly declines during treatment, even in patients with advanced fibrosis and cirrhosis.

This decline appears to reflect the reduction in liver inflammation, restoration of liver function and the decrease in portal pressure, like an effect of HCV eradication”

■ SWM

- Results in **absolute values** of speed or elasticity modulus
- Results **not influenced** by:
 - steatosis

■ RTE

- Works in **ascites**
- Results are **not influenced** by:
 - acute inflammation
 - jaundice
 - congestion (portal hypertension)

EFSUMB Guidelines and Recommendations on the Clinical Use of Liver Ultrasound Elastography, Update 2017 (Long Version)

EFSUMB-Leitlinien und Empfehlungen zur klinischen Anwendung der Leberelastographie, Update 2017 (Langversion)

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