EUS-guided Shear Wave Elastography (SWE) and Liver Biopsy

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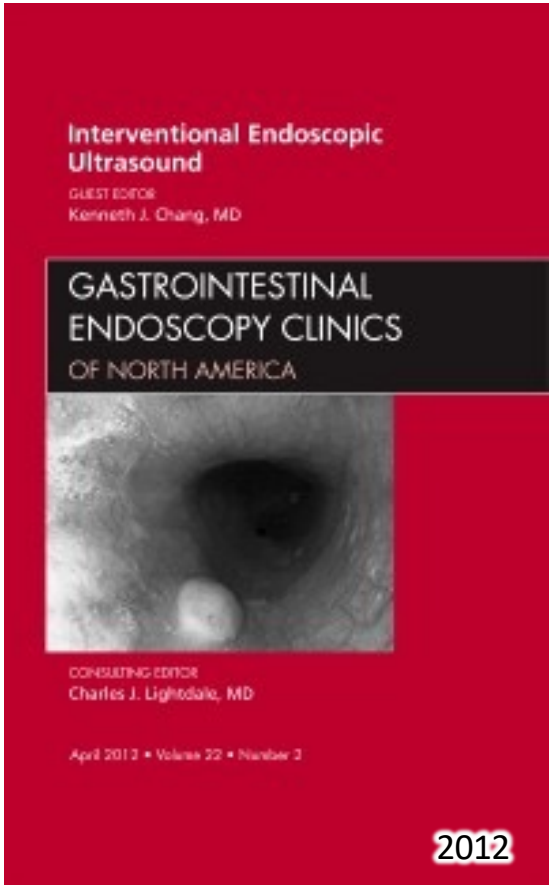
Disclosures

- Apollo
- Cook
- Creo
- Endogastric Solutions
- Erbe
- Medtronics
- Olympus

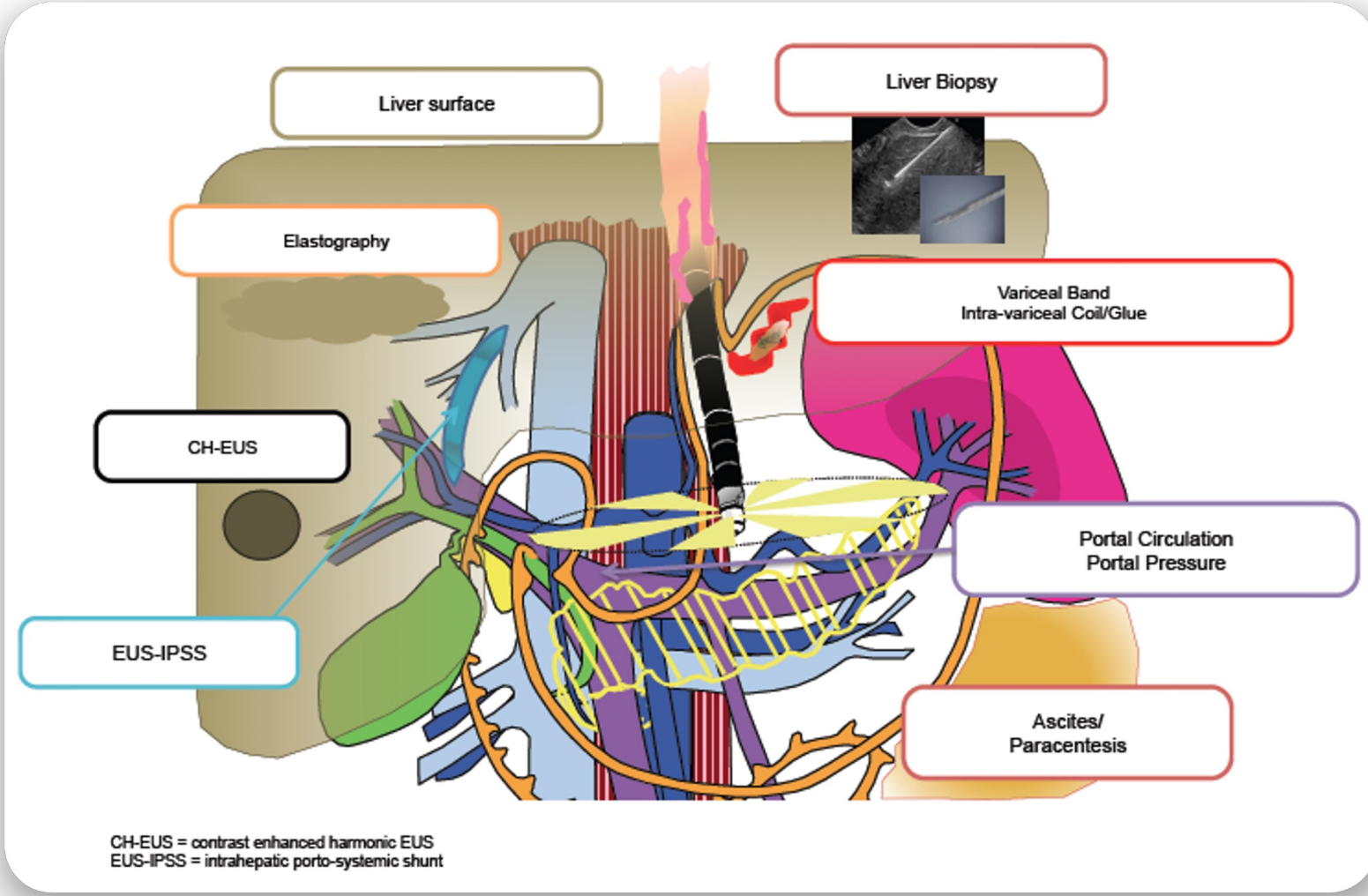


Endo-Hepatology: A New Paradigm

Kenneth J. Chang, MD[a,*], Jason B. Samarasena, MD[a], Takuji Iwashita, MD, PhD[b,c], Yosuke Nakai, MD, PhD[a,d], John G. Lee, MD[a]

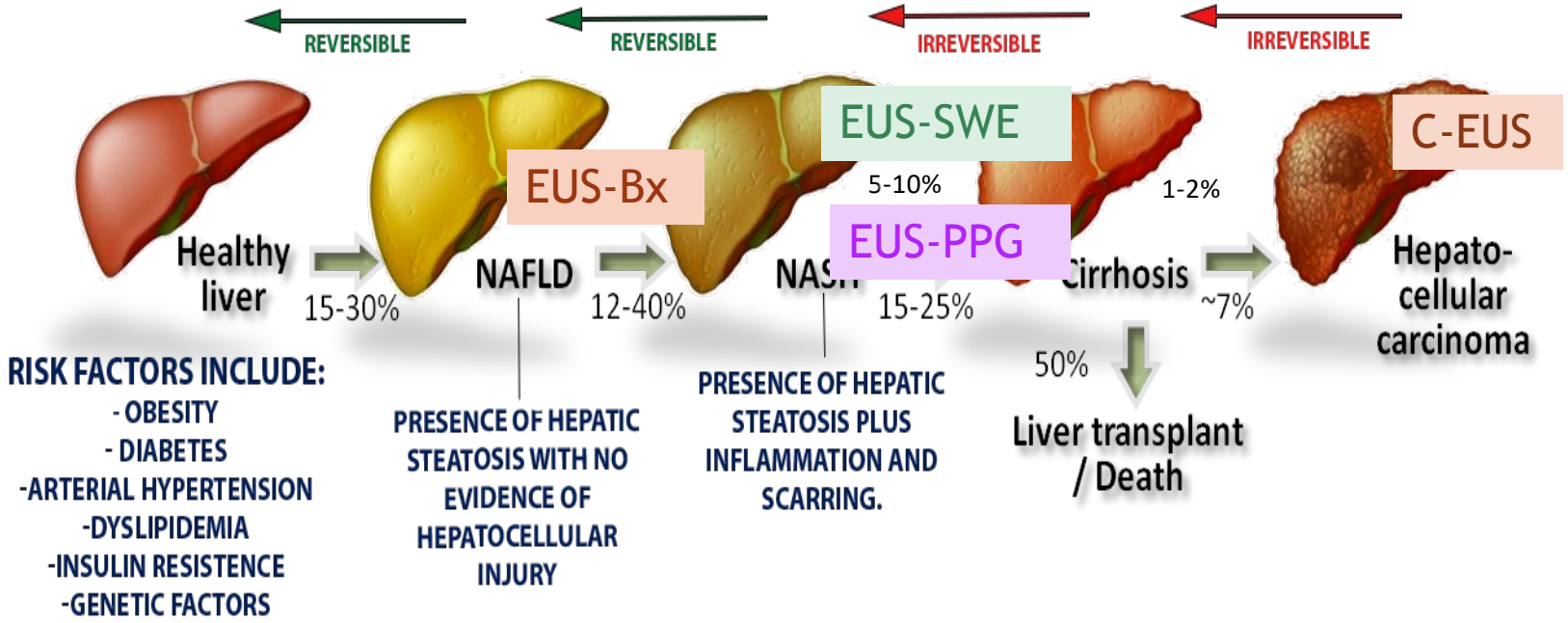
Definition: *the integration of endoscopy within the practice of hepatology*

Gastrointest Endoscopy Clin N Am 22 (2012) 379–385



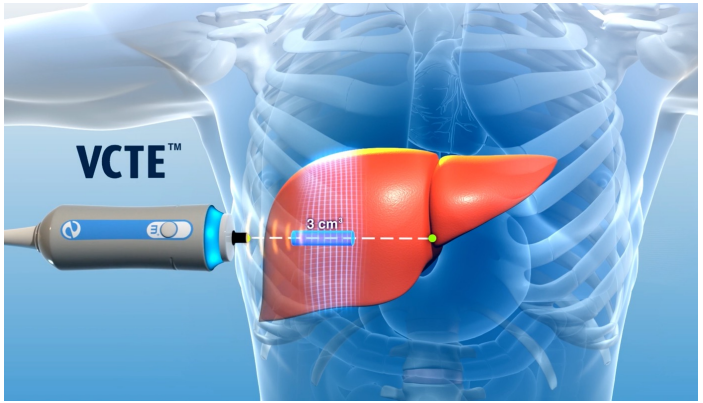
CH-EUS = contrast enhanced harmonic EUS
EUS-IPSS = intrahepatic porto-systemic shunt

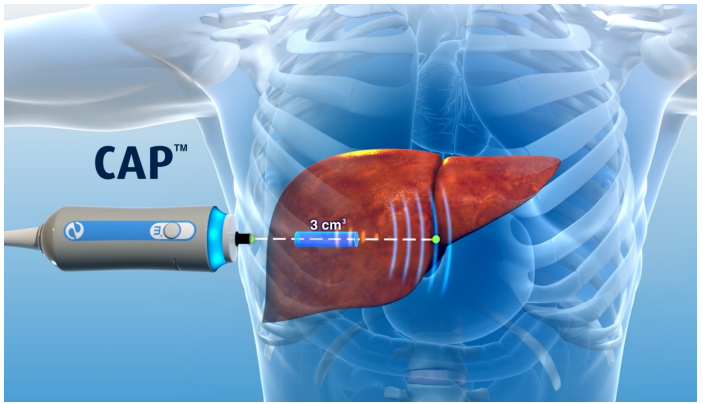
THE NON-ALCOHOLIC FATTY LIVER DISEASE (NAFLD) SPECTRUM



Transient Elastography (TE)

- Vibration Controlled TE - similarly produces a shear wave, and calculates propagation velocity over a 3cm ROI (no ultrasound imaging)
- Controlled Attenuation Parameter (CAP) - assesses fat content





Transient Elastography - Limitations

- Obese patients
- Ascites
- Lacks 2-D image guidance of measurement
- Cannot assess left liver lobe

TE discordance with liver biopsy

Transient elastography versus liver biopsy: discordance in evaluations for fibrosis and steatosis from a pathology standpoint

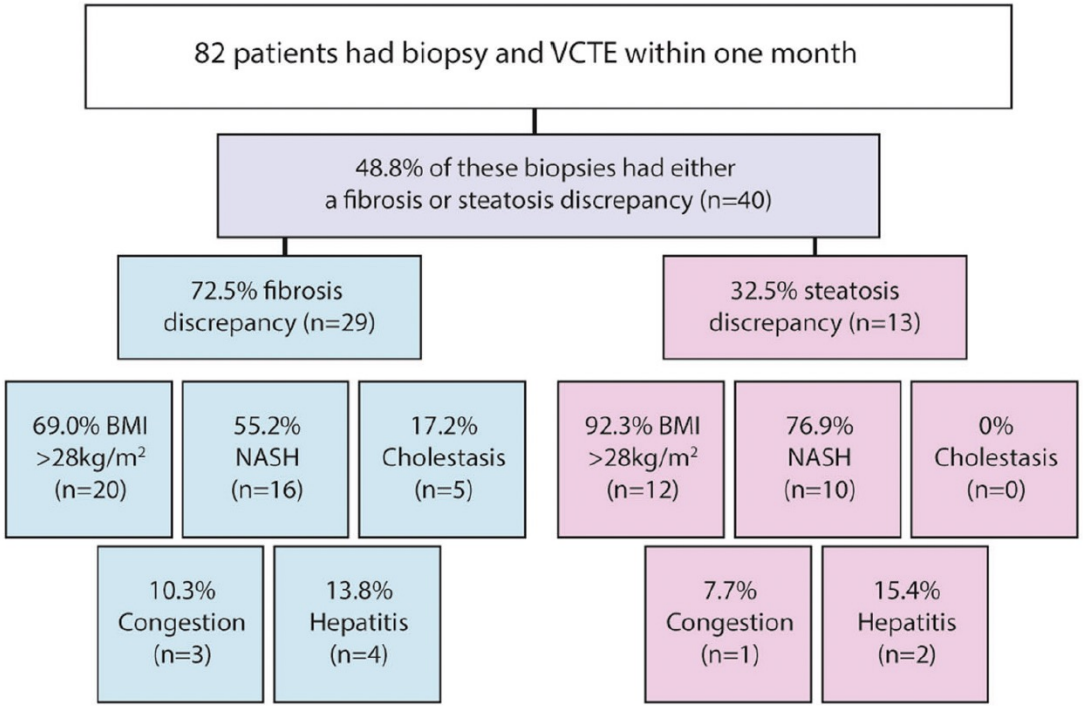
82 patients had biopsy and VCTE within one month

- Discordance in fibrosis defined: F3-F4 on TE, but stage F0–1 on biopsy.
- Discordance in steatosis defined: moderate to severe steatosis on TE but no or mild steatosis (<33%) on biopsy, or no steatosis on VCTE but severe steatosis (>66%) on biopsy.

Fang JM. Modern Pathology 2021; 34:1955–1962

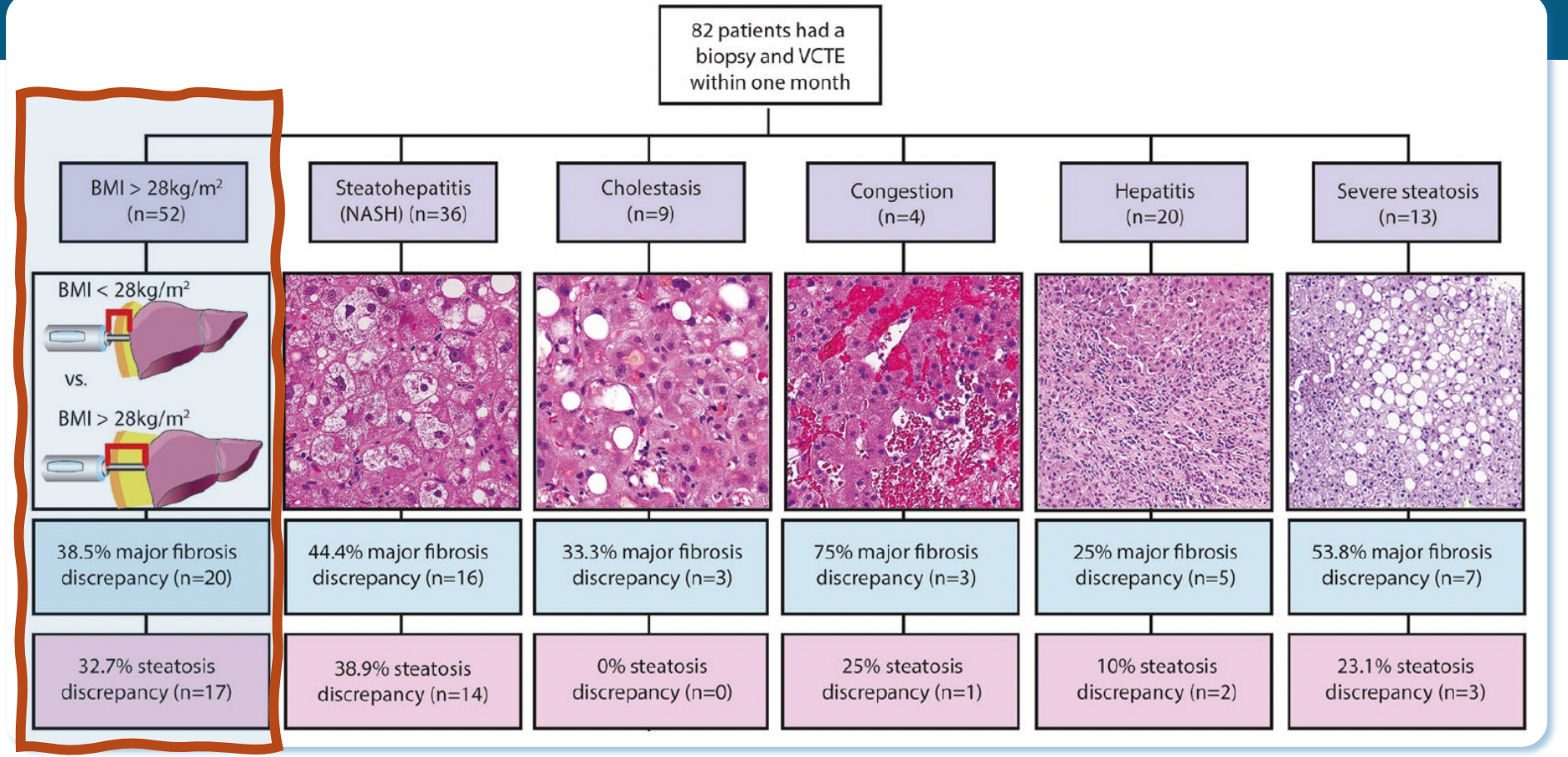
TE discordance with liver biopsy

Transient elastography versus liver biopsy: discordance in evaluations for fibrosis and steatosis from a pathology standpoint

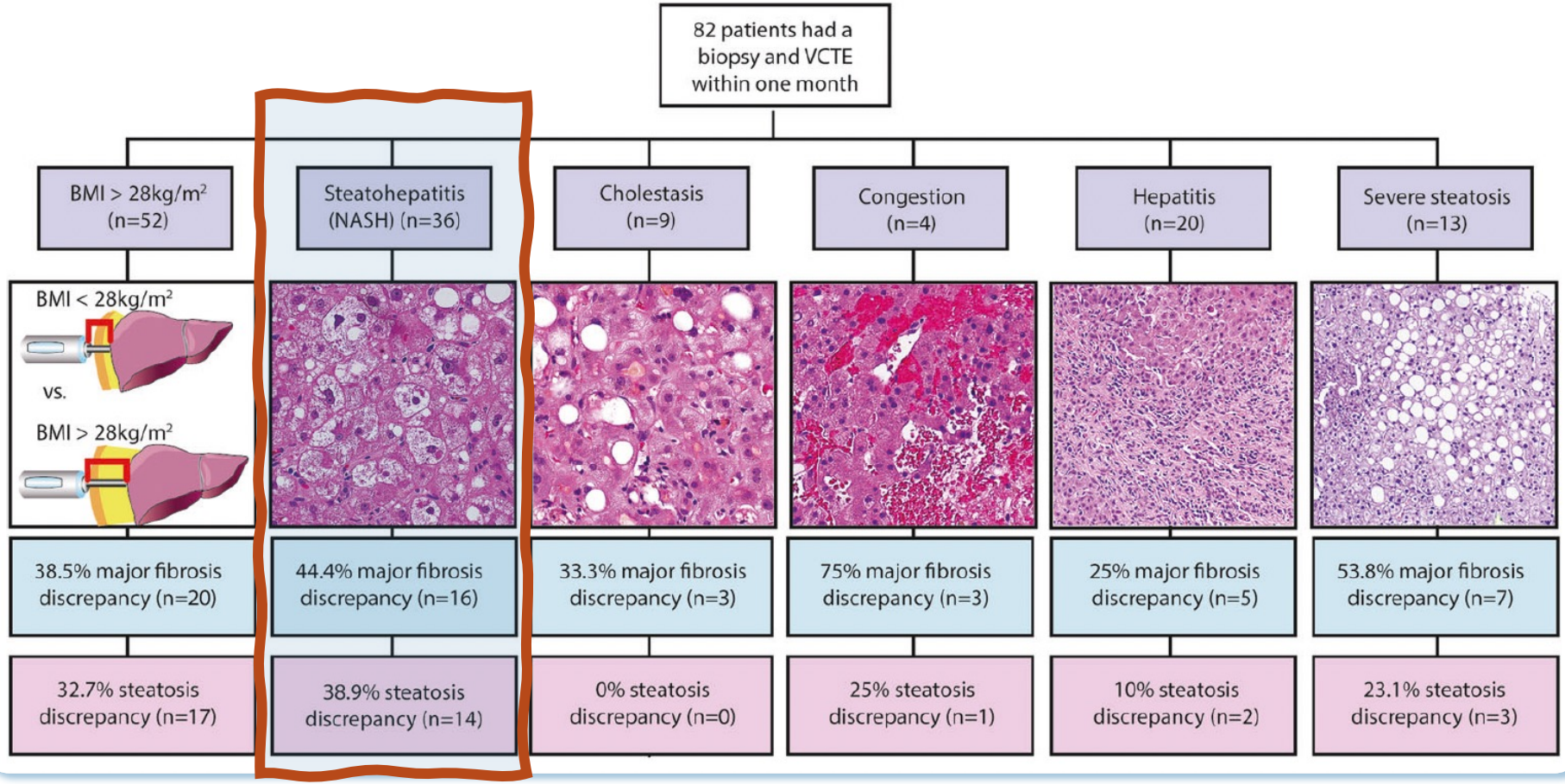


Fang JM. Modern Pathology 2021; 34:1955–1962

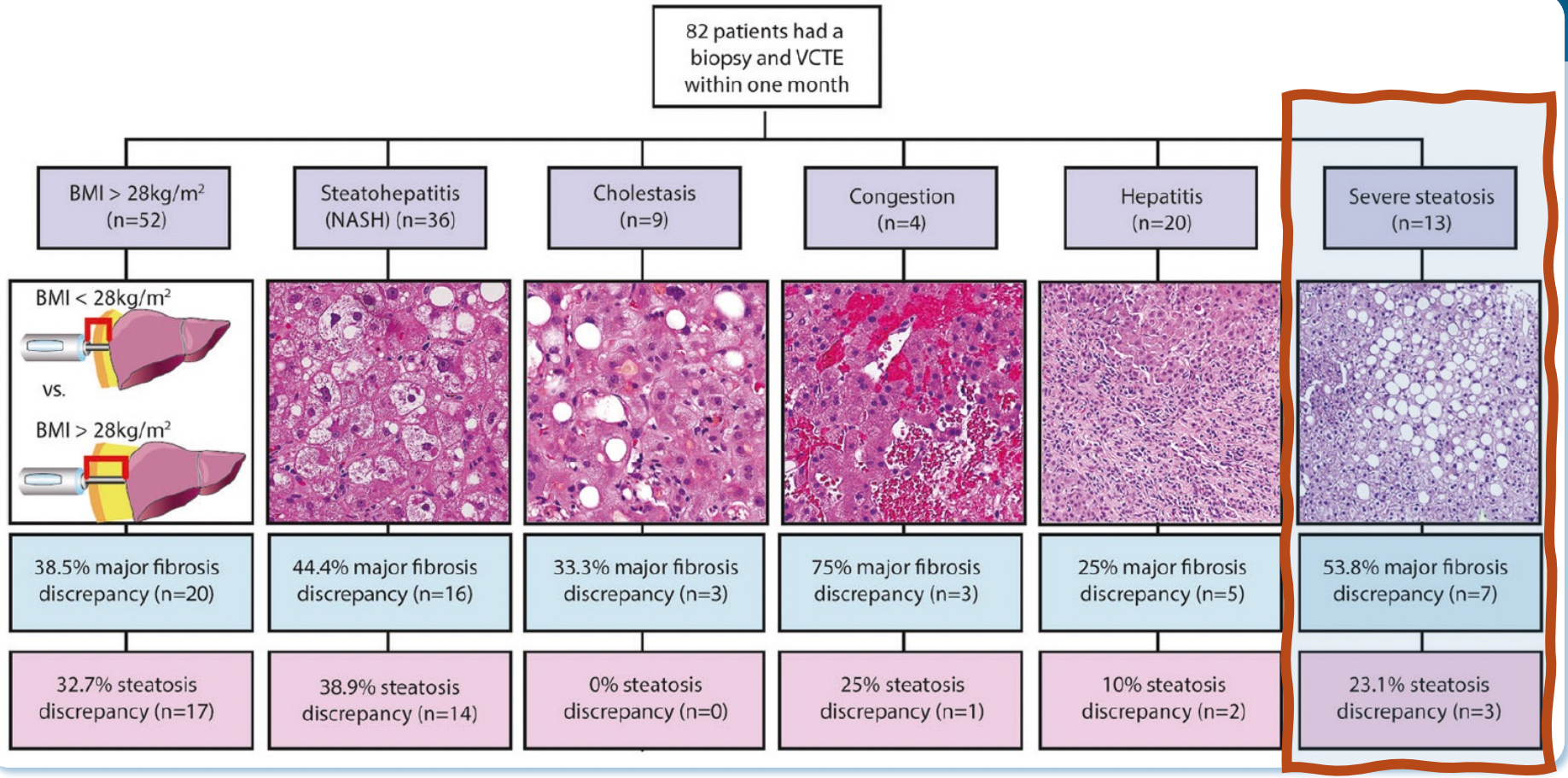
TE discordance with liver biopsy



TE discordance with liver biopsy



TE discordance with liver biopsy



TE discordance with liver biopsy

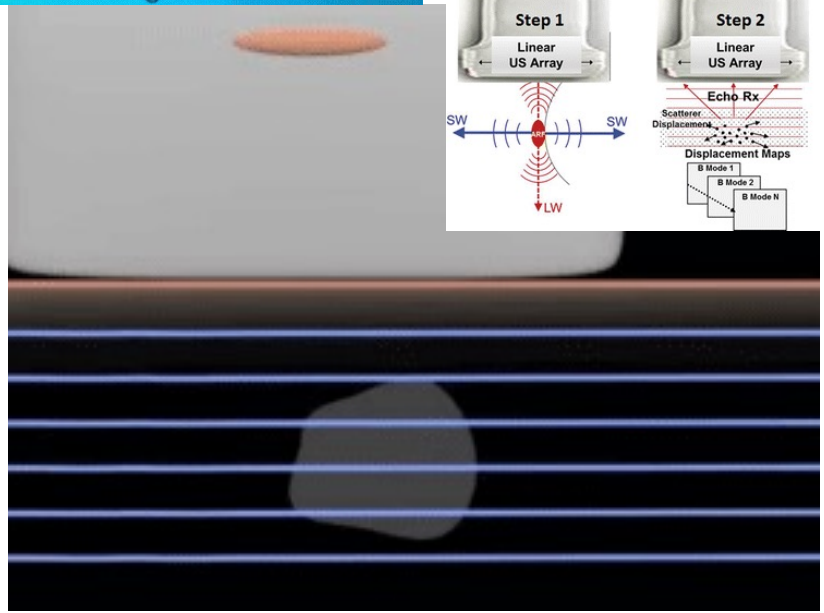
Transient elastography versus liver biopsy: discordance in evaluations for fibrosis and steatosis from a pathology standpoint

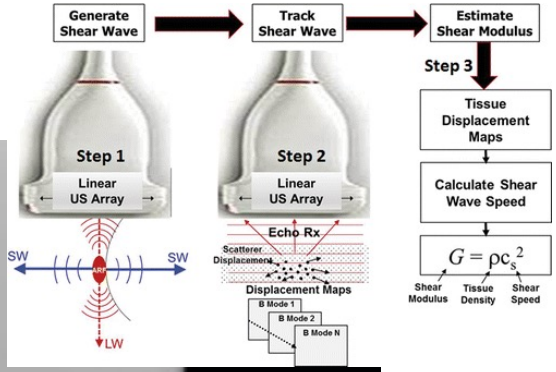
- All patients with advanced fibrosis or cirrhosis on liver biopsy were appropriately detected by TE (n = 28).
- Detection of steatosis was less sensitive as 19% (n = 4 of 21) of patients with moderate to severe steatosis on biopsy were missed by TE
- Conclusion: Although TE is a highly sensitive tool for liver fibrosis, it is not as specific, and therefore, the liver biopsy remains the gold standard for accurate fibrosis assessment

Fang JM. Modern Pathology 2021; 34:1955–1962

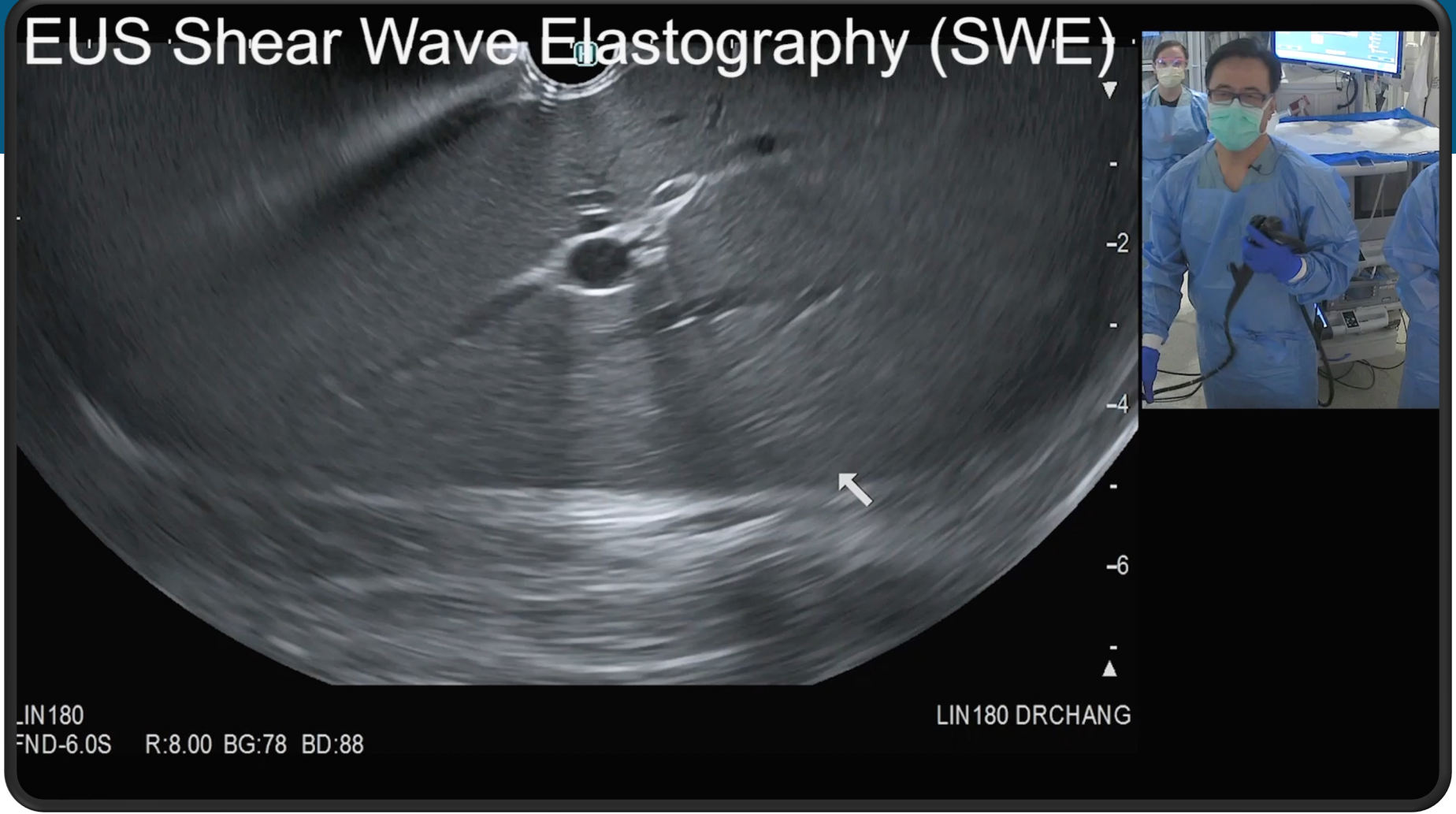
EUS-SWE

- SWE- used to assess tissue stiffness, ie liver fibrosis. Overcomes many limitations of TE.
- A “push-pulse” generates shear waves, which propagate through the liver, perpendicular to the ultrasound beam.
- SWE - provides an assessment of tissue stiffness by calculating the propagation velocity of the shear waves (Vs) in the ROI.
  - Waves will move faster in stiffer tissues
  - Waves will move slower in softer tissues





EUS Shear Wave Elastography (SWE)



EUS-SWE

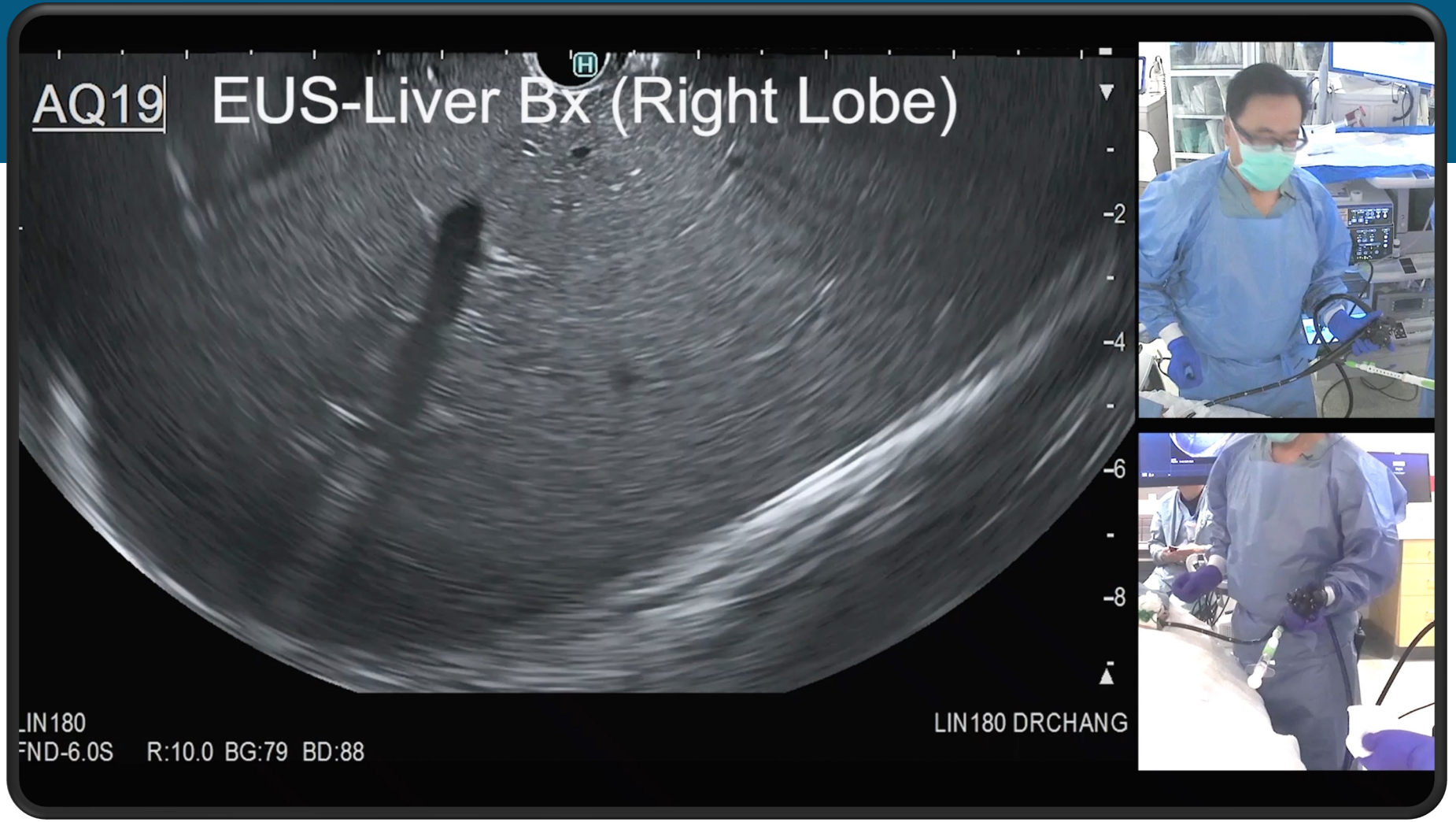
Endoscopic Ultrasound-Guided Bi-lobar Liver and Spleen Shear Wave Elastography and its Association with Hepatic Fibrosis Stage

- 44 pts: Same session EUS-SWE and Liver Biopsy

Univariate Analysis of the Variables Associated with Stage 3-4 fibrosis			
	F3-4	F1-2	p value
EUS-SWE LL ≥ 12.5 kPa	16/18 (88.9)	6/27 (22.2)	<0.0001
EUS-SWE RL ≥ 12.5 kPa	13/16 (81.3)	8/27 (29.6)	0.001

- EUS-SWE Left Liver ≥ 15 kPa + Spleen ≥ 26.3 kPa had the highest operating characteristic for predicting fibrosis ≥ 3 on liver biopsy with PPV 80%, NPV 93.8%

Choi, A. DDW 2022 ASGE Oral #1003


AQ19
EUS-Liver Bx (Right Lobe)
-2
-4
-6
-8
LIN180
FND-6.0S R:10.0 BG:79 BD:88
LIN180 DRCHANG

EUS-guided liver biopsy provides diagnostic samples comparable with those via the percutaneous or transjugular route

Jonh J. Pineda, MD,[1] David L. Diehl, MD, FACP, FASGE,[1] Chuan L. Miao, MD,[1] Amitpal S. Johal, MD,[1] Harshit S. Khara, MD,[1] Ashok Bhanushali, MD,[2] Eric Z. Chen, MD[3]

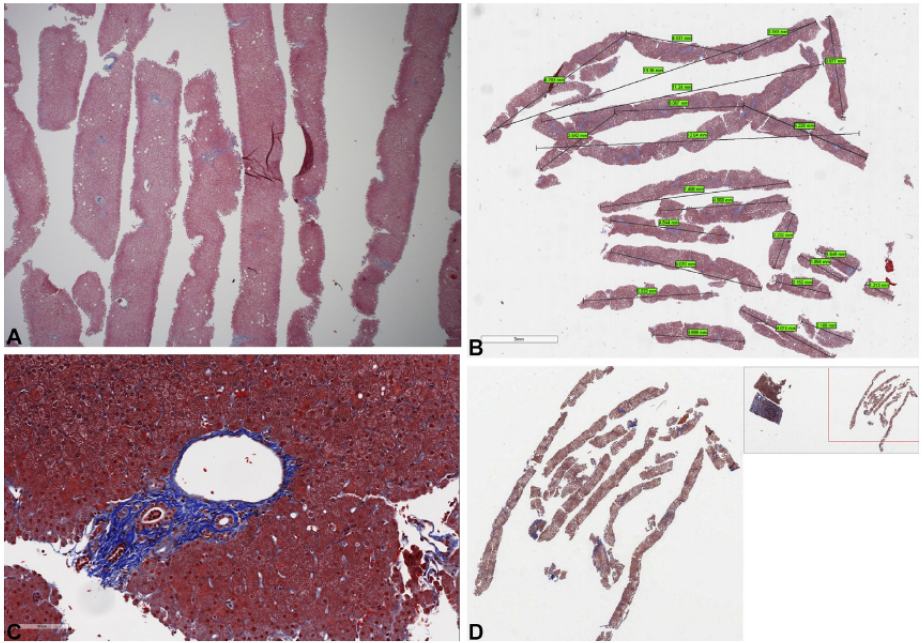


Figure 1. Representative EUS liver biopsy samples. **A**, Multiple long pieces. **B**, Determination of specimen length. **C**, Portal triad (trichrome stain). **D**, Virtual microscope image of liver biopsy specimen (a high-resolution version of this image is available as eSlide: VM00661).

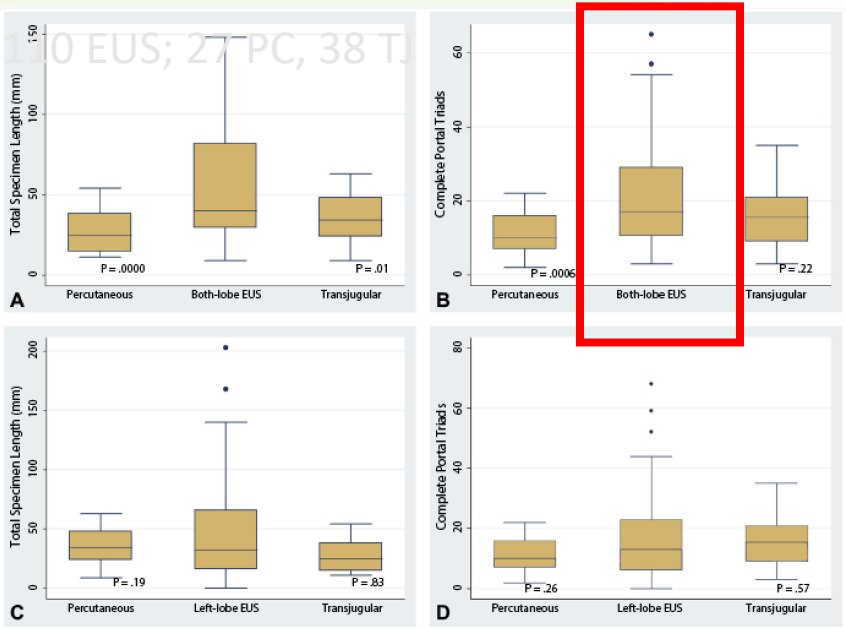


Figure 2. Comparison of total specimen length and complete portal tract, from EUS-LB, percutaneous, and transjugular routes. (Note: *P* value denotes comparison between EUS and transjugular and EUS and percutaneous.)

GIE 2016: 2016;83:360-5

EUS GUIDED LIVER BIOPSY IS MORE COST-EFFECTIVE THAN PERCUTANEOUS LIVER BIOPSY IN PATIENTS WITH NON-ALCOHOLIC FATTY LIVER DISEASE(NAFLD)

Presentation Number: Su1372

Shruti Mony[1], Ishani Shah[2], Neil Vyas[1], Aijaz Sofi[3], Ananya Das[3]
[1]Gastroenterology, St.Josephs Hospital and Medical Center, Phoenix , Arizona, United States; [2]Internal Medicine, St.Josephs Hospital and Medical Center, Phoenix, Arizona, United States; [3]Gastroenterology, Arizona Center for Digestive Health, Gilbert, Arizona, United States;

Introduction:
Recent studies have showed that EUS- guided liver biopsy(EUS-LB) using FNB needle is feasible, safe and has several advantages over percutaneous liver biopsy(PC-LB) including improved tissue acquisition (more specimen length and complete portal tracts). It is not only safer and but also targets areas and focal lesions in both lobes, may substitute ultrasound based screening for HCC and simultaneously provide a superior method for initial screening of portal hypertension and esophageal varices. However, to be clinically viable in Hepatology practice, such an approach needs to be cost-effective. The aim of our study was to evaluate cost-effectiveness of EUS guided liver biopsy compared to percutaneous liver biopsy using a systemic review of published information.
Methods:
Incremental cost-effectiveness ratio (ICER) of two primary strategies of EUS-LB vs. PC-LB were examined in a Markov model simulating the natural history of NAFLD in a hypothetical cohort 50 year old patients with NAFLD in whom a liver biopsy was indicated for clinical management over a time horizon of 5 years, and with a societal perspective. PC-LB procedures were performed under conscious sedation with ultrasound guidance and EUS procedures were performed with MAC in a hospital based outpatient setting. Under both strategies, repeat PC-LB was performed in case of initial biopsy being inadequate for pathological assessment; under the EUS guided strategy no additional cost of initial HCC screening by ultrasound and endoscopic screening for portal hypertension was considered in patients with advanced fibrosis and cirrhosis of liver. Clinical probabilities in terms of natural history of NAFLD, safety and diagnostic yield, adverse events with liver biopsy by both techniques and also health state utilities under both strategies were obtained from a systemic review of published information (Table). Only direct costs were considered and were obtained from Center for Medicare Services data and also from the National Inpatient Sample database.
Results:
In the baseline analysis, EUS based strategy dominated PC-LB with cost per patient of $2,610 vs. $ 2,660 and yielded 3.8741 QALY vs. 3.8738 quality adjusted life years (QALYs), respectively. Sensitivity analyses showed that the model is sensitive to parameters such as, cost of EUS-LB and PC-LB, probability of inadequate specimen by EUS –LB and probability of cirrhosis in the NAFLD cohort but still cost-effective within the range reported in published information (Figure1).
Conclusion:
EUS-LB is more cost-effective than PC-LB in patients with NAFLD and prospective randomized trials are needed to establish its superiority in clinical practice over percutaneous approach, considering that it obviates the need for initial endoscopic screening for esophageal varices in patients with cirrhosis.

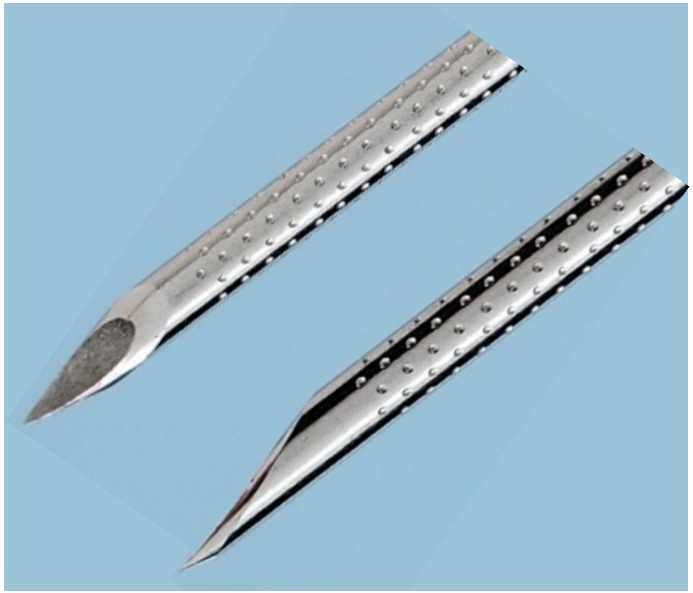
GIE, 2018;87,6, AB326–AB327

- EUS-guided Liver Biopsy may be more cost effective than percutaneous liver biopsy in patients with NAFLD

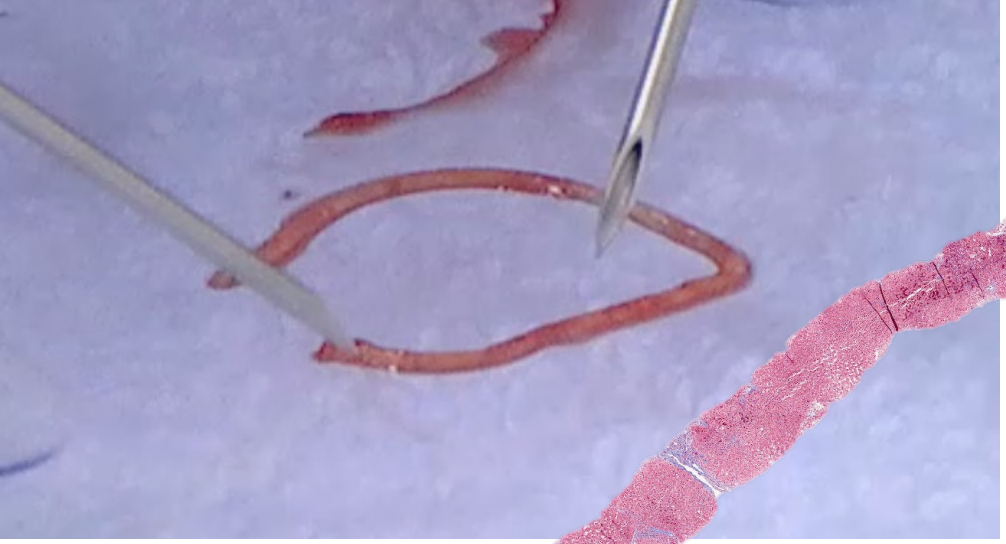
Specialized Tip Core needles

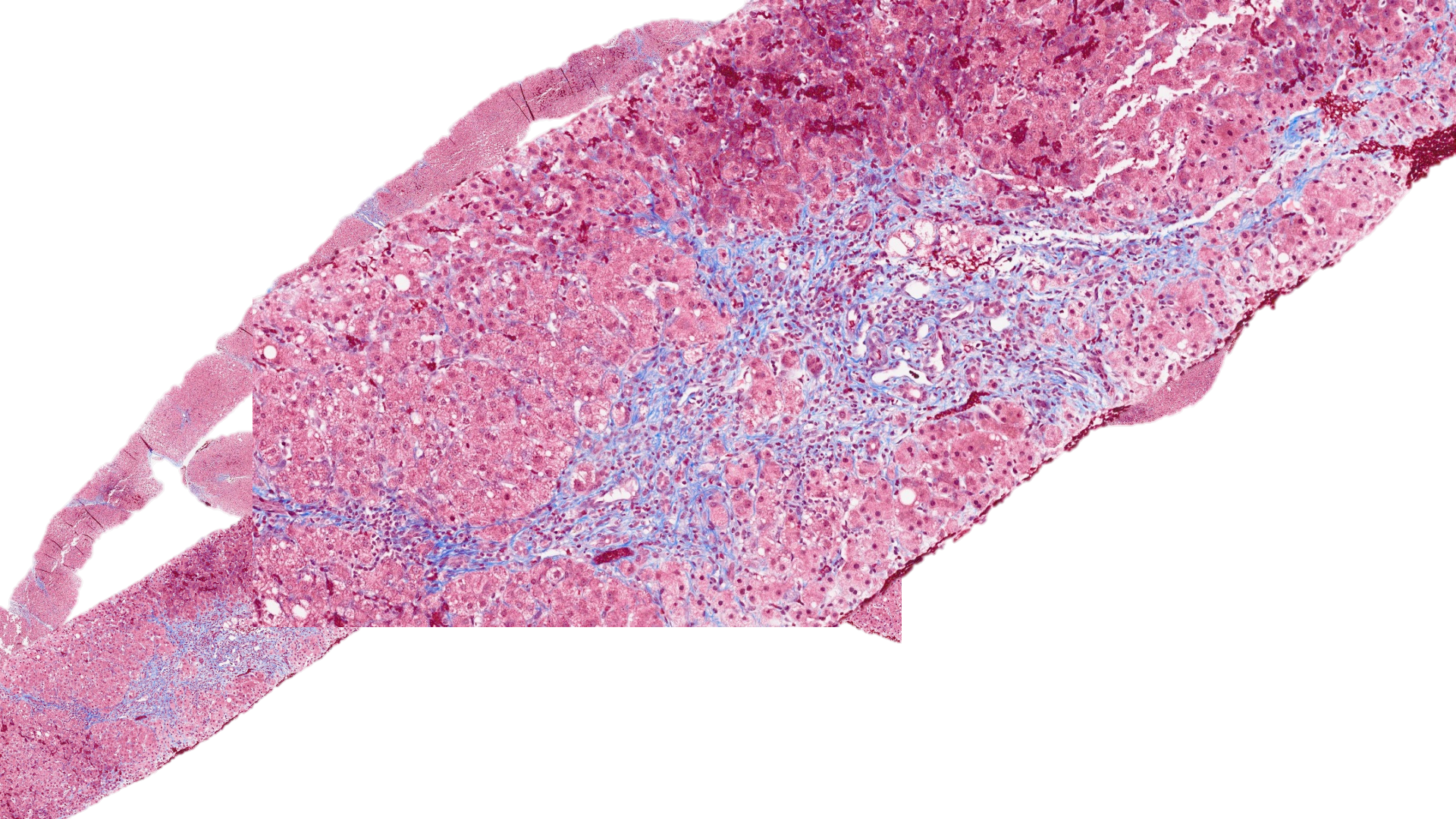
Fork-tip

Franseen



Menghini





19 G aspiration needle versus 19 G core biopsy needle for endoscopic ultrasound-guided liver biopsy: a prospective randomized trial

Take Home:

- **19G Franseen tip better than 19G standard needle**
- Both Left and Right lobe
- (7-10 to/fro); heparinized, suction
- EUS-LB using the FNB needle delivered longer liver biopsy specimens with more CPTs than the regular (non-core) needle.

Ching-Companioni RA et al.
Endoscopy 2019; 51: 1059–1065

▶ **Table 1** Quantitative outcomes comparing fine-needle aspiration versus core biopsy needles.

	FNA (n = 20)	FNB (n = 20)	*P* value
Aggregate specimen length, mean (SD), cm			
▪ Pre-processing	10.89 (4.38)	15.78 (5.19)	0.003*
▪ Post-processing	11.4 (5.55)	15.32 (5.24)	0.028*
Length of longest piece, mean (SD), cm			
▪ Pre-processing	1.47 (0.46)	2.09 (0.41)	<0.001*
▪ Post-processing	1.05 (0.42)	1.78 (0.66)	<0.001*
Length of the longest piece			
▪ <2 cm	17 (85)	10 (50)	0.04*
▪ ≥2 cm	3 (15)	10 (50)	0.04*
Total specimen complete portal triads			
▪ Mean (SD)	18.1 (9.3)	42.6 (25.0)	<0.001*
▪ Median (range)	16.5 (6–38)	38.0 (0–81)	0.004*
Portal triads groups, n (%)			
▪ <11	6 (30)	2 (10)	0.24
▪ ≥11	14 (70)	18 (90)	0.24
No. of fragments ≥ 9 mm, mean (SD)			
▪ Pre-processing	3.5 (2.4)	7.7 (3.7)	<0.001*
▪ Post-processing	1.1 (1)	4.8 (3.6)	<0.001*

EUS-guided fine-needle core liver biopsy with a modified one-pass, one-actuation wet suction technique comparing two types of EUS core needles

- 420 pts: 210 each needle (2 passes)
- 19G Franseen needle (25.3 CPT) and 19G fork tip needle (19.8 CPT)

► **Table 1** Comparison of outcomes between two needles.

	Fork-tip needle	Franseen needle	*P* value
Overall			
Mean TSL (SD) (cm)	6.0 (2.07)	6.5 (2.56)	0.02
Mean ISL (SD) (cm)	2.7 (1.14)	3.1 (1.39)	0.01
Mean CPT (SD)	19.5 (8.55)	24.0 (8.81)	<0.01
F0–2			
Mean TSL (SD) (cm)	6.17 (2.03)	6.23 (2.51)	0.23
Mean ISL (SD) (cm)	2.64 (1.21)	2.92 (1.31)	0.87
Mean CPT (SD)	18.20 (6.64)	24.18 (8.95)	<0.01
F3–4			
Mean TSL (SD) (cm)	6.97 (1.78)	6.94 (2.79)	0.94
Mean ISL (SD) (cm)	3.00 (0.92)	3.33 (1.44)	0.23
Mean CPT (SD)	19.81 (7.09)	25.27 (8.96)	<0.01

SD, standard deviation; TSL, total specimen length; ISL intact specimen length; CPT, complete portal tracts

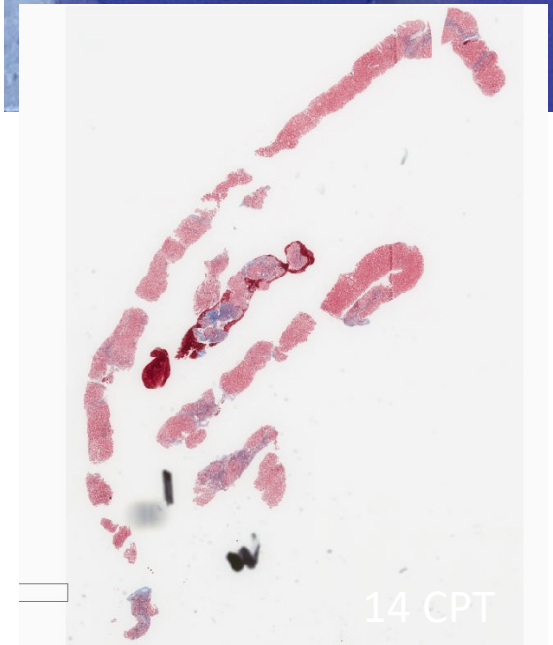
Nieto J. et al EIO 2020;08:E938-E943

Comparison of Two Specialized Histology Needles for Endoscopic Ultrasound (EUS)-Guided Liver Biopsy: A Pilot Study

	19G Franseen (n=22)	19G Fork-tip (n=22)	p-value
Randomized to first pass, n (%)	11 (50%)	11 (50%)	1
Left lobe vs Right Lobe, n:n	11:11	11:11	1
Pre-fix aggregate specimen length, mm	51.7	45	0.215
Post-fix aggregate length specimen, mm	44.9	34.6	0.097
Post-fix longest length specimen, mm	19.9	13.7	0.175
Complete portal tracts (CPTs), mm	**14.4**	**9.5**	0.043
Adequate specimen, n			
Pathologist Qualitative Assessment	22	21	0.312
NEJM 2001, n(%)[CPT≥5; lengh≥15mm]	21 (96)	17 (77)	0.079
AASLD 2009, n(%) [CPT≥1; length≥20mm]	15 (68)	6 (27)	0.015

Hashimoto, Chang, et al
Dig Dis Sci 2020
https://doi.org/10.1007/s10620-020-06391-3

SC19



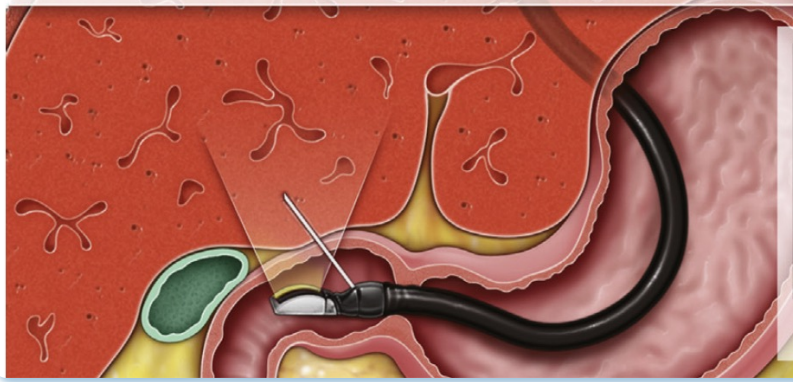
AQ19

Single-pass 1-needle actuation versus single-pass 3-needle actuation technique for EUS-guided liver biopsy sampling: a randomized prospective trial (with video)

CME

EUS-guided liver biopsy

Single pass 1 actuation versus single pass 3 actuations



Tissue Yields	1:1	1:3	*p* value
Mean aggregate specimen length (SD)	6.89 cm (1.86)	12.85 cm (4.02)	<0.001
Number of complete portal triads	17.25 (6.20)	24.5 (9.88)	0.008
Length of longest piece (SD)	2.48 cm (0.52)	2.35 cm (0.57)	0.445

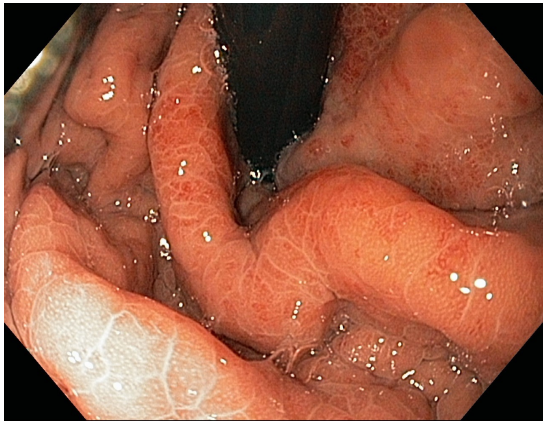
SD = Standard deviation

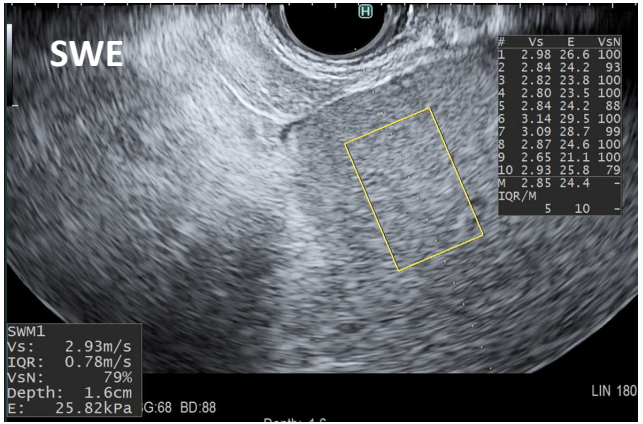
- Prospective randomized trial of EUS-LB in 40 patients
- Compared 1 pass, 1 actuation (1:1) versus 1 pass 3 actuations (1:3) using 19G Francine Tip Needle

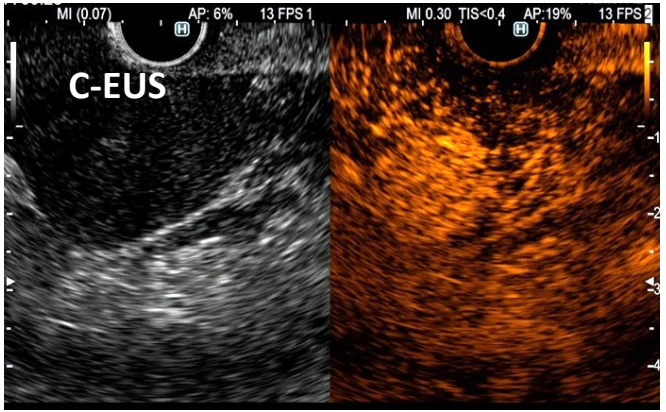
Ching-Companioni, RA et al Gastrointest Endosc 2021;94:551-8

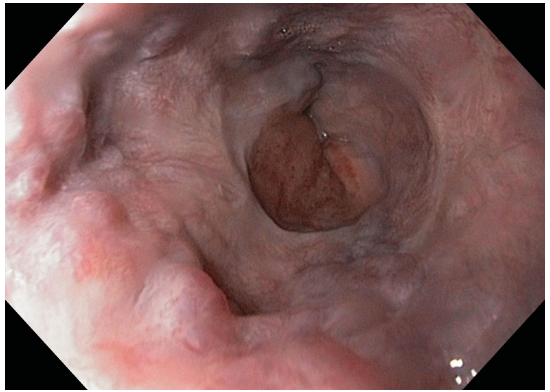
One-stop shop

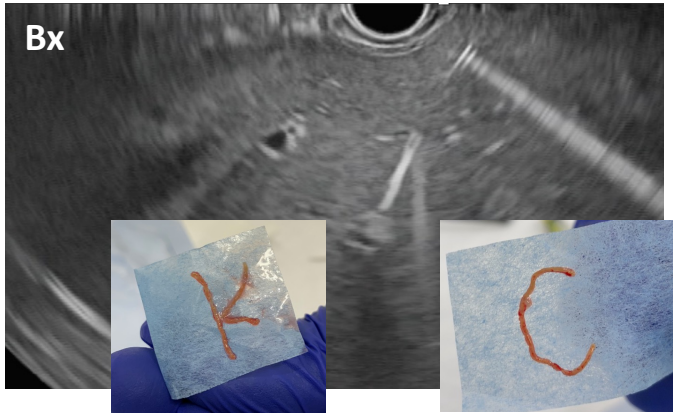
Endoscopic liver evaluation

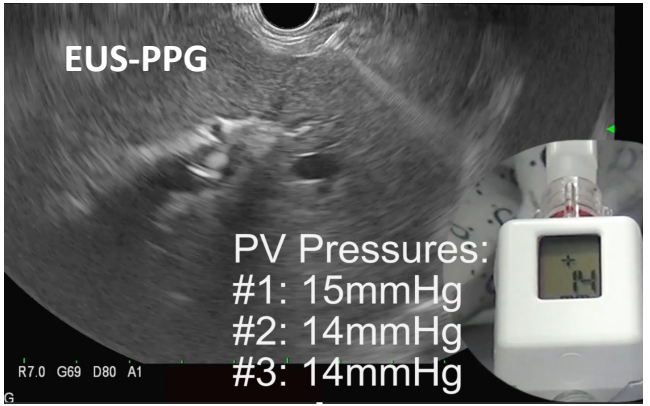












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