

Vyšetření jater a žlučových cest – moderní UZ metody

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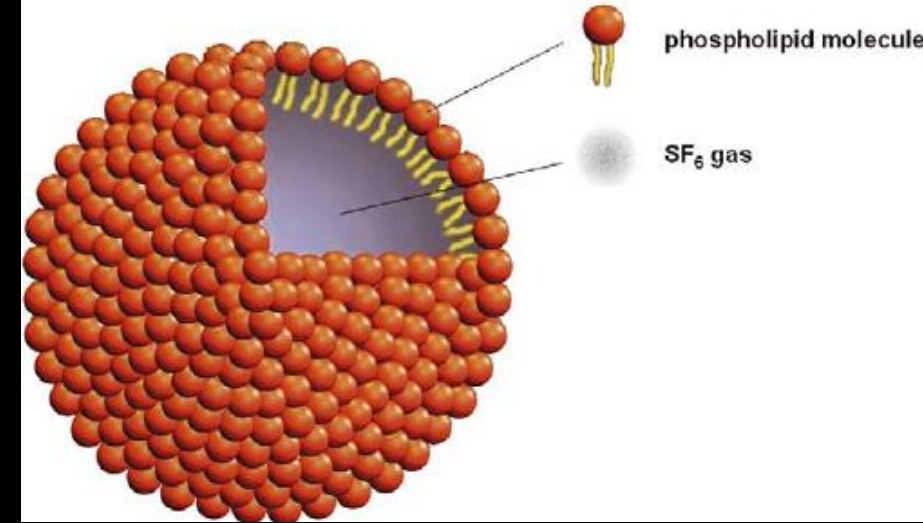
Přednosta doc. MUDr. Marek Mechl, Ph.D., MBA

CEUS (contrast enhanced ultrasound)

- metoda využívající specifickou látku, pomocí které lze zvýšit kontrast mezi zobrazovanými strukturami -> zobrazení cévního řečiště
- kontrastní látka
 - intravaskulární distribuce (nedostanou se extravaskulárně) -> zobrazení mikrocirkulace
 - životnost v cévním řečišti -> dynamické zobrazení včetně pozdní fáze (>5 minut)
 - => **SonoVue®**

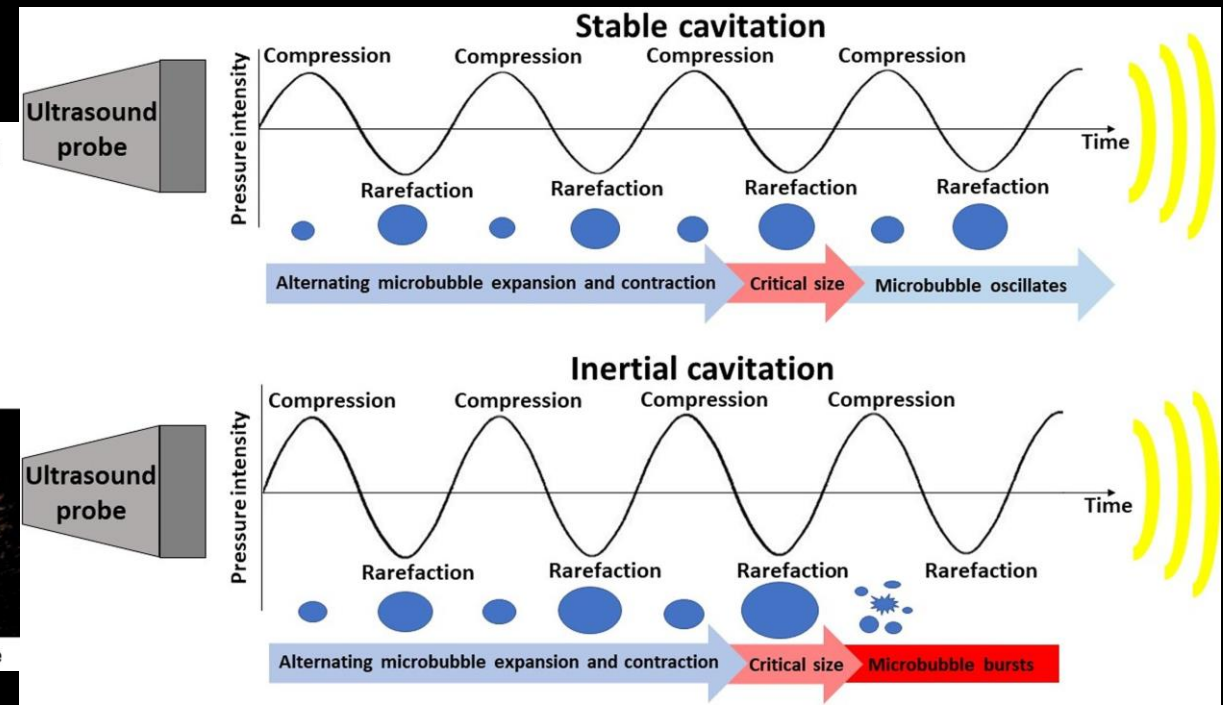
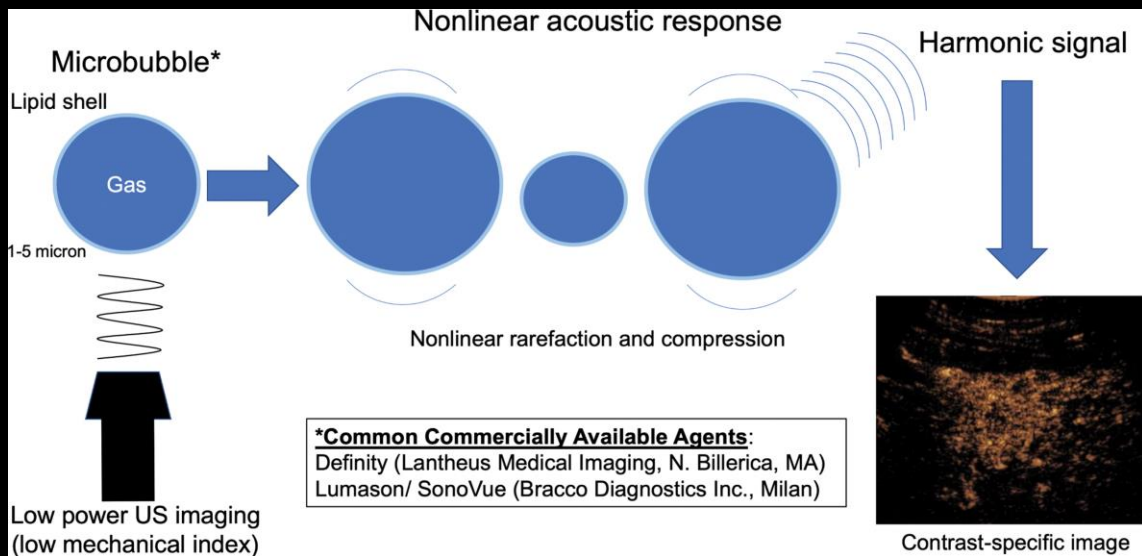
SonoVue®

- jediná schválená kontrastní látka pro CEUS v EU
- bubliny vzduchu – fluorid sírový -> eliminován plicemi
- bolus (2,5ml) + proplach (10ml fyziologického roztoku)
- nežádoucí účinky – bolest hlavy, nauzea, reakce v místě vpichu
- kontraindikace – pravo-levý zkrat, těžká plicní hypertenze, nekontrolovaná systémová hypertenze, ARDS



Harmonická frekvence

- interakcí mikrobublin (kontrastní látky) a ultrazvukové vlny dojde k jejich oscilaci
- charakter oscilace se liší podle akustického tlaku
 - $MI > 0,7$ – destrukce bublin $\rightarrow$ stimulovaná akustická emise
 - **$MI > 0,04$ – nelineární oscilace $\rightarrow$ harmonické frekvence odražených vln**
 - $MI < 0,04$ – lineární oscilace

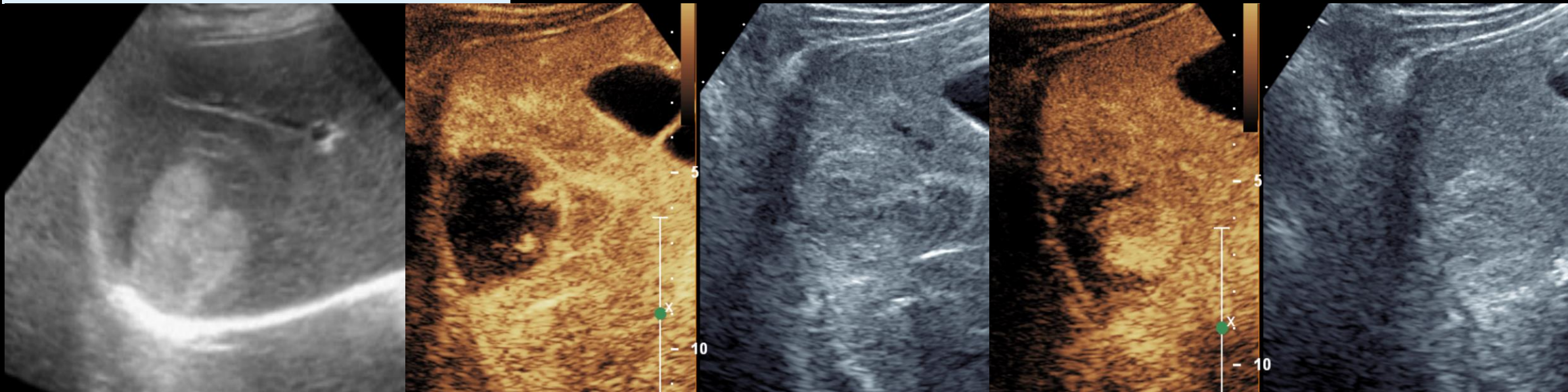


Využití – játra (EFSUMB)

RECOMMENDATION 9

Before performing CEUS to characterize FLLs, it is recommended to perform a systematic liver examination using **B-Mode** and Doppler US (LoE 5, strong recommendation) (Pro 32, Abs 0, Against 0).

- zároveň B mód
- přesná lokalizace ložiska



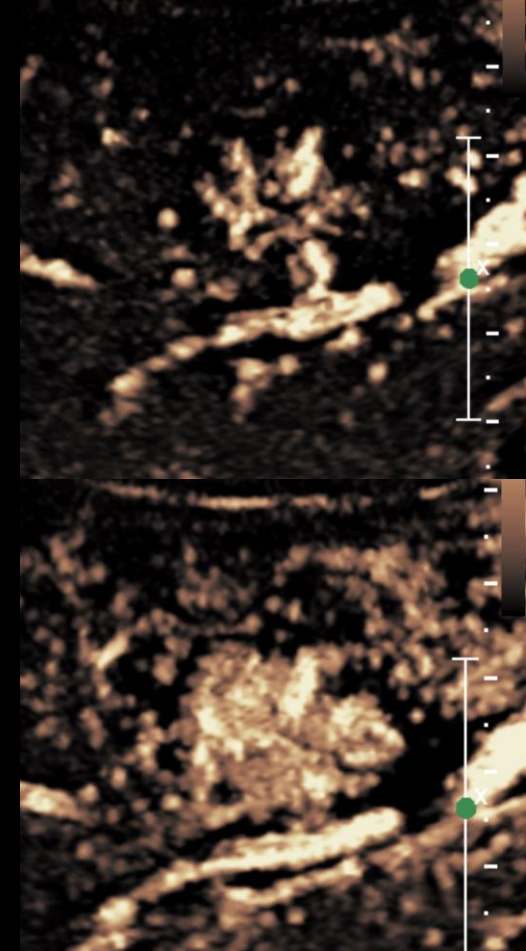
RECOMMENDATION 4

CEUS is recommended in patients with **inconclusive findings** at CT or MR imaging (LoE 2, strong recommendation) (Pro 30, Abs 0, Against 1).

RECOMMENDATION 5

CEUS should be considered as first contrast imaging modality in patients with **renal insufficiency** (LoE 5, strong recommendation) (Pro 31, Abs 0, Against 0).

Játra – incidentalomy (EFSUMB)



RECOMMENDATION 10

CEUS is recommended as the **first-line imaging** technique for the characterization of incidentally detected, indeterminate FLL at US in patients with non-cirrhotic liver and without a history or clinical suspicion of malignancy (LoE 1, strong recommendation) (Pro 30, Abs 2, Against 0).



RECOMMENDATION 14

If CEUS has definitively characterized a **benign FLL** further investigations are not recommended to confirm the diagnosis (LoE 1, strong recommendation) (Pro 26, Abs 5, Against 0).

-incidentalom jater u pacienta

-bez malignity

-bez chronického onemocnění jater

-incidentalomy – až 33 % vyšetření na radiologii

-většina benigní (hemangiom až 20 %)

hemangiom	CEUS	MR
senzitivita	88 %	92,8 %
specifická	99 %	99,4 %



RECOMMENDATION 32

CEUS assessment of FLLs in **children** is consistent with findings in the adult patients and it should be used to characterize these lesions (LoE 2b, strong recommendation) (Pro 25, Abs 0, Against 0).

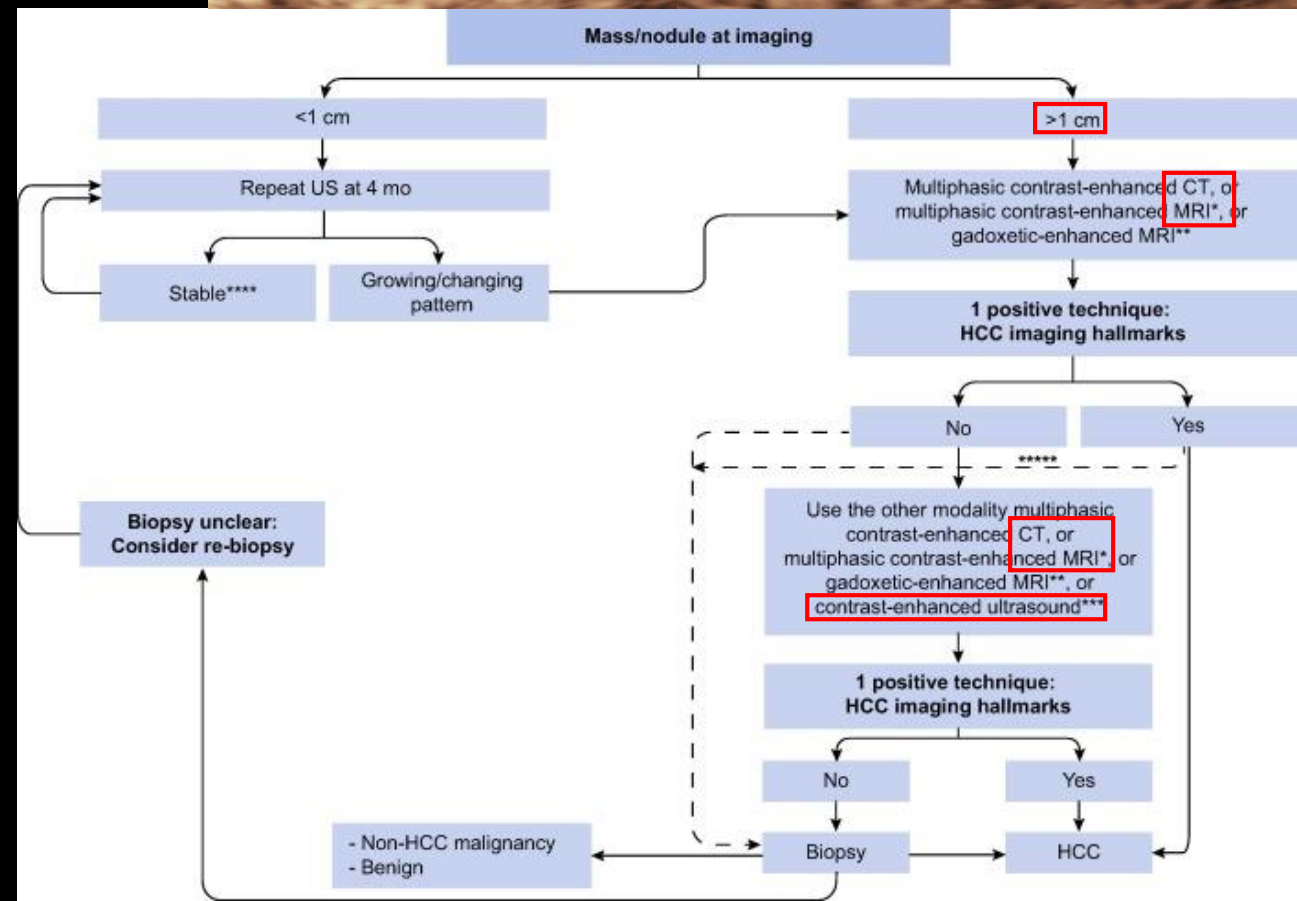
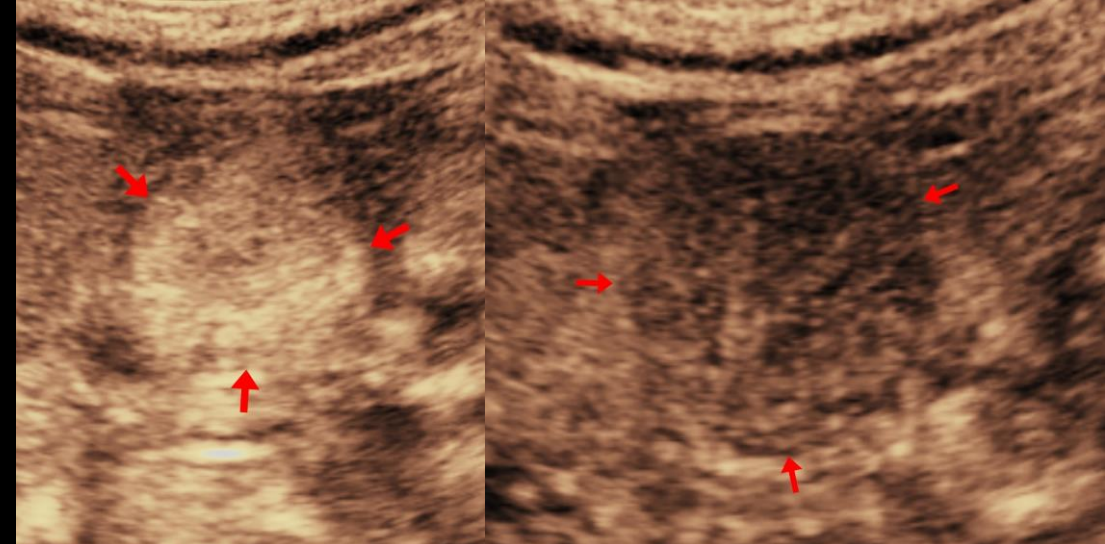
Játra – HCC (EFSUMB)

RECOMMENDATION 8

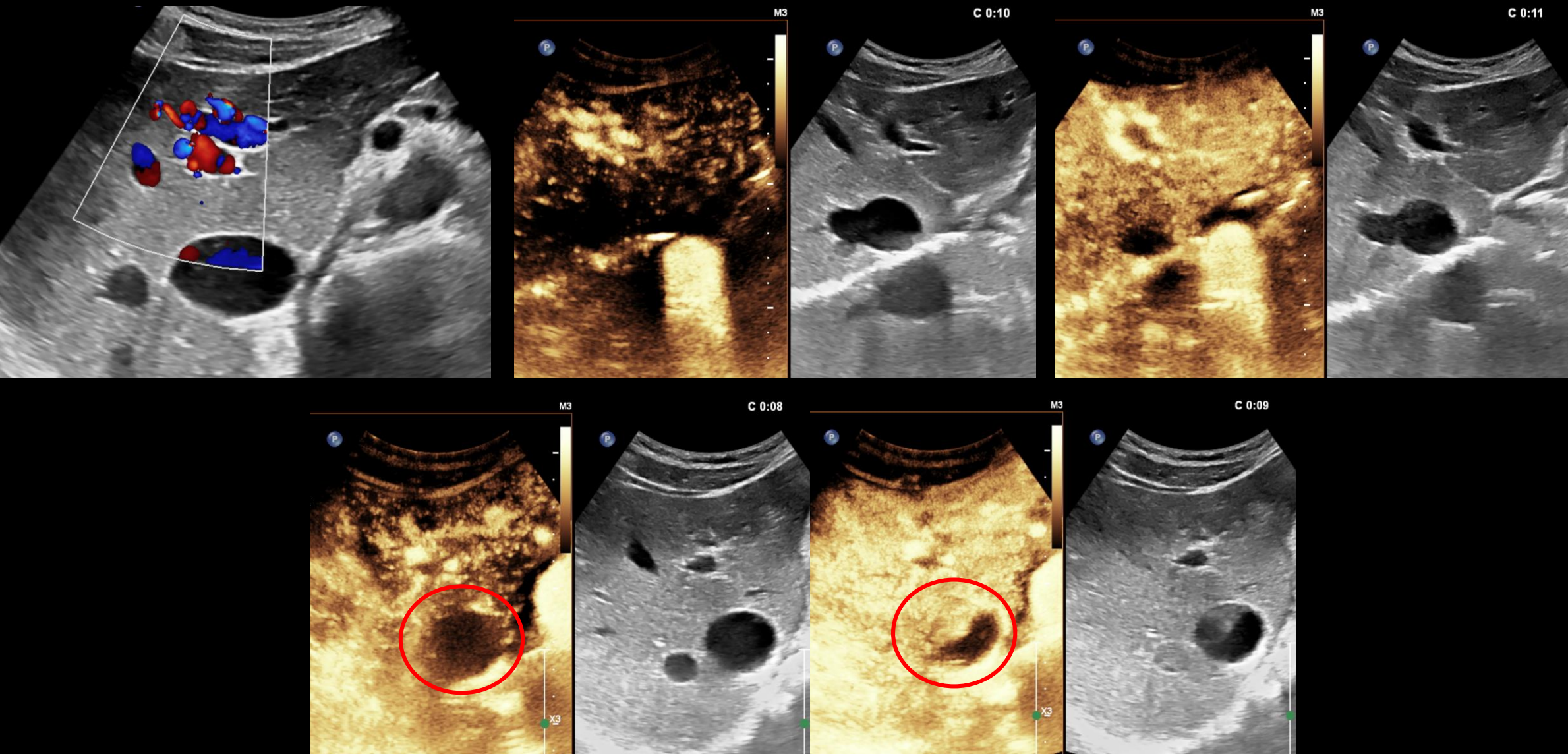
Routine use of CEUS for **staging** of HCC is not recommended (LoE 2, strong recommendation), (Pro 31, Against 0, Abs 0).

RECOMMENDATION 7

Routine use of CEUS for the **surveillance** of patients at risk for HCC is not recommended (LoE 4, strong recommendation) (Pro 29, Against 2, Abs 0).



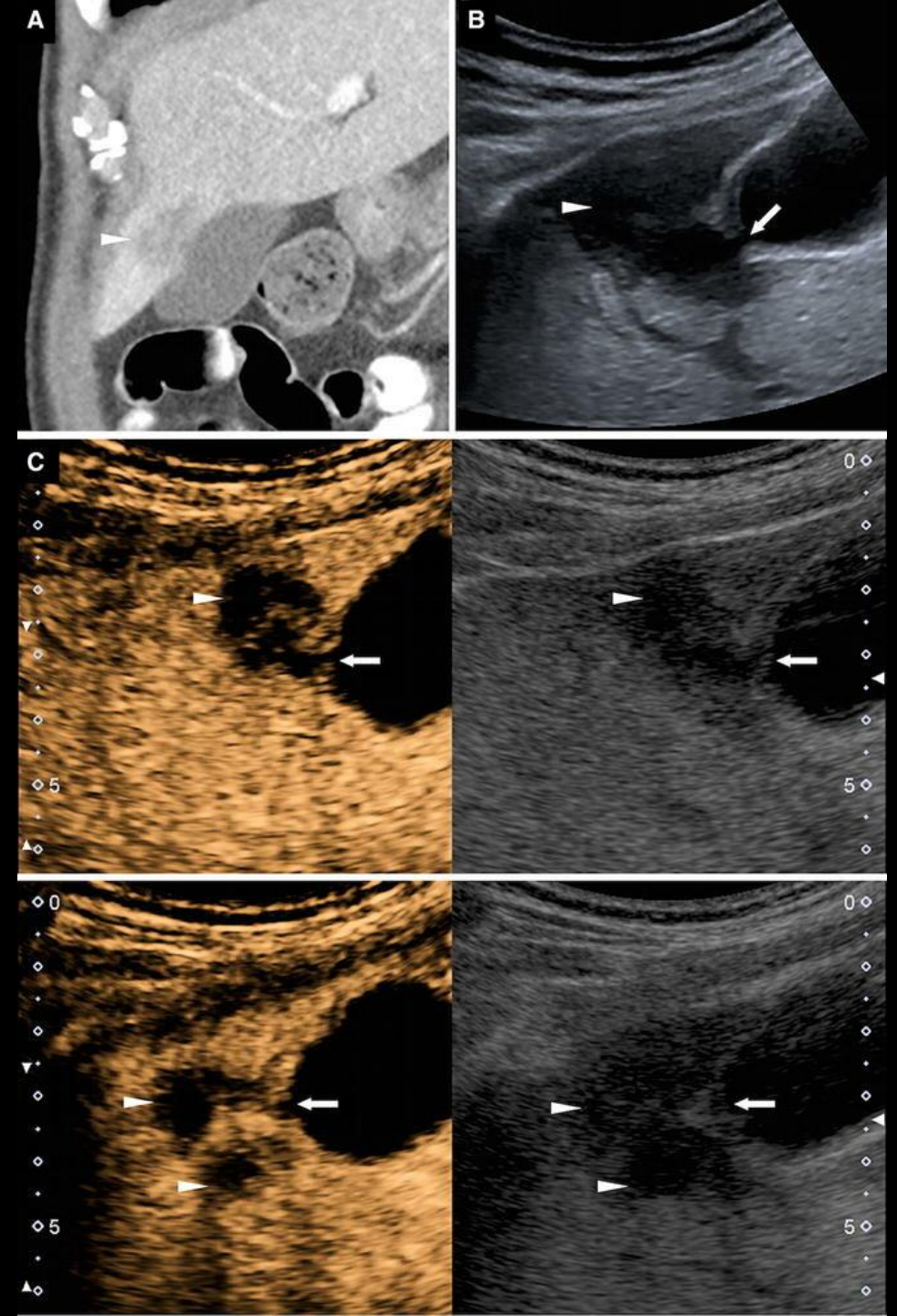
Játra – AV malformace



Využití – žlučník (EFSUMB)

RECOMMENDATION 62

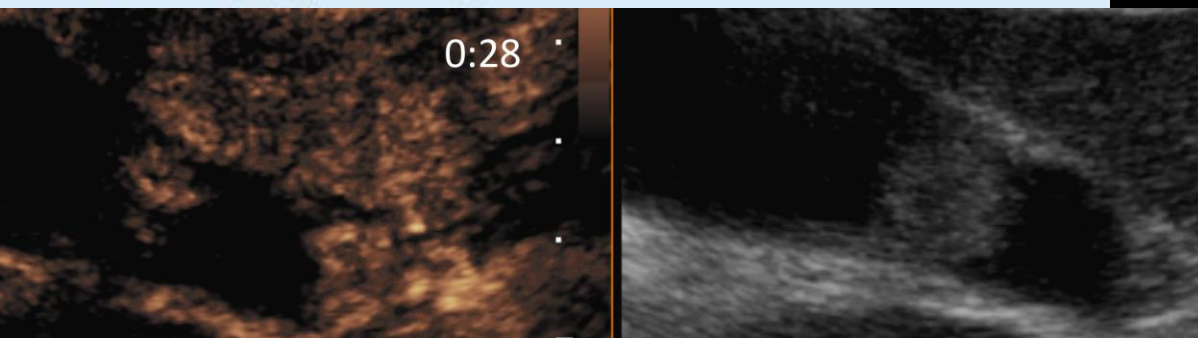
CEUS can be used in acute cholecystitis to better detect local complications (LoE 2b, GoR B). Strong Consensus (19/0/1, 100 %)



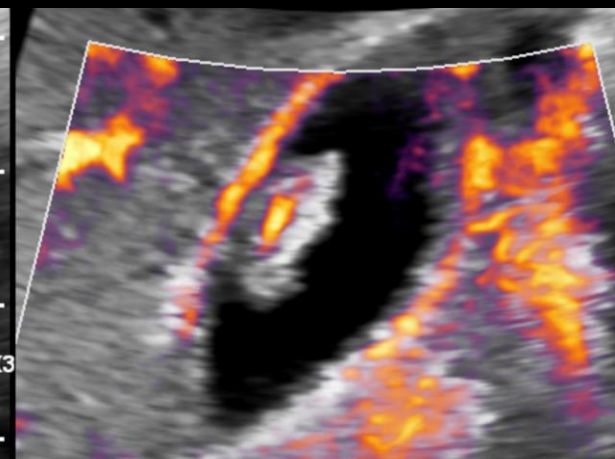
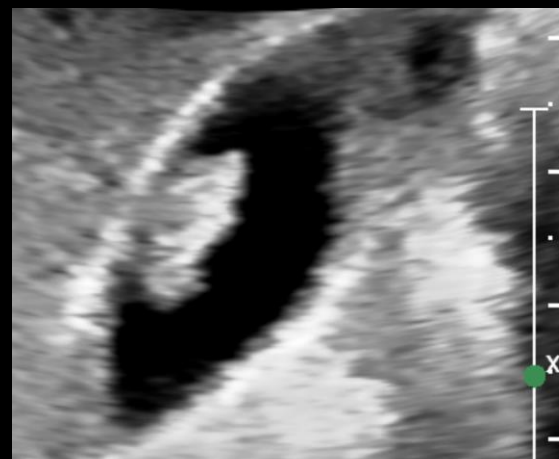
Využití – žlučník (EFSUMB)

RECOMMENDATION 64

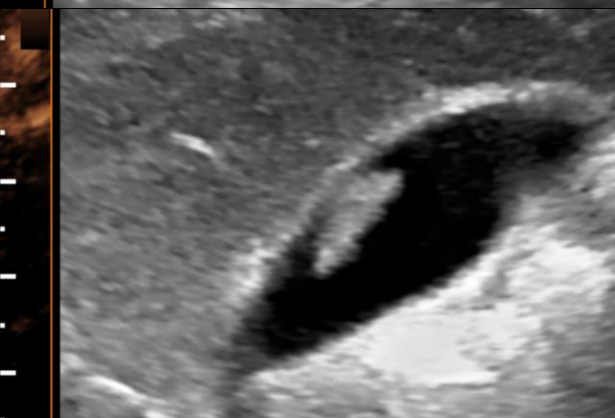
CEUS is able to differentiate between a perfused gallbladder lesion and motionless **biliary sludge** (LoE 4, GoR C). Strong consensus (20/0/0, 100%)



**Cholesterolóza
žlučníku**



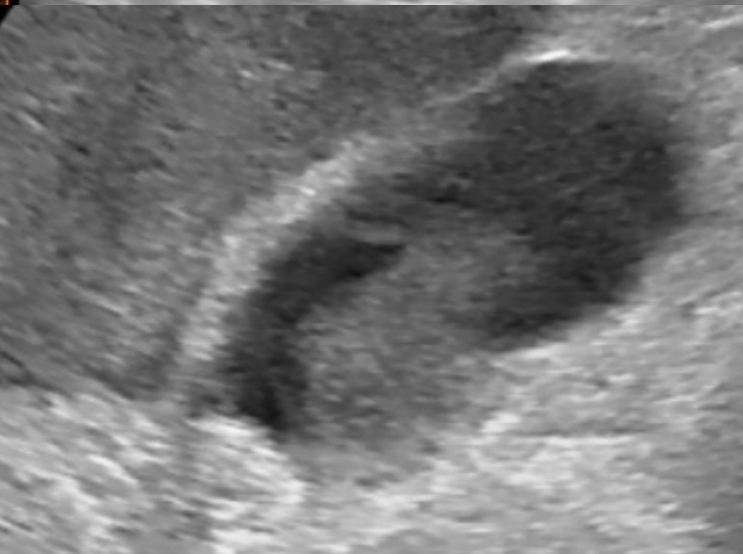
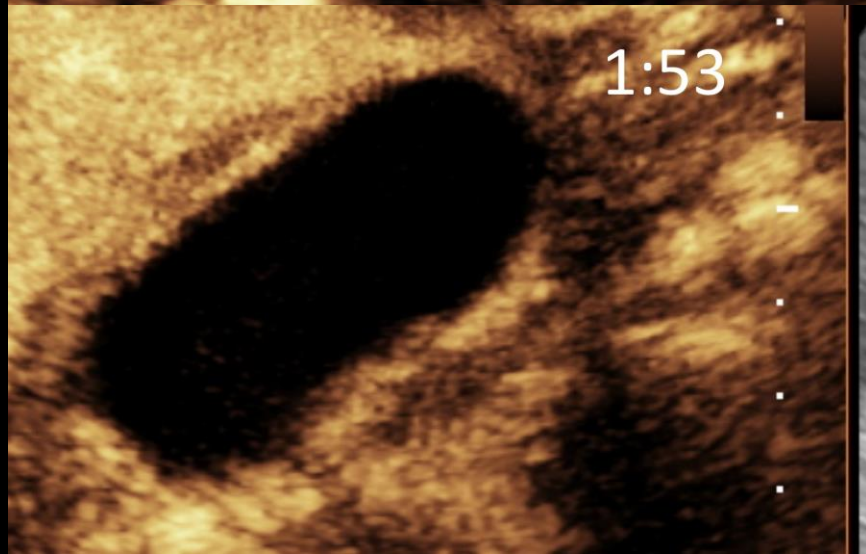
**Cholesterolový
polyp**



Využití – žlučník (EFSUMB)

RECOMMENDATION 64

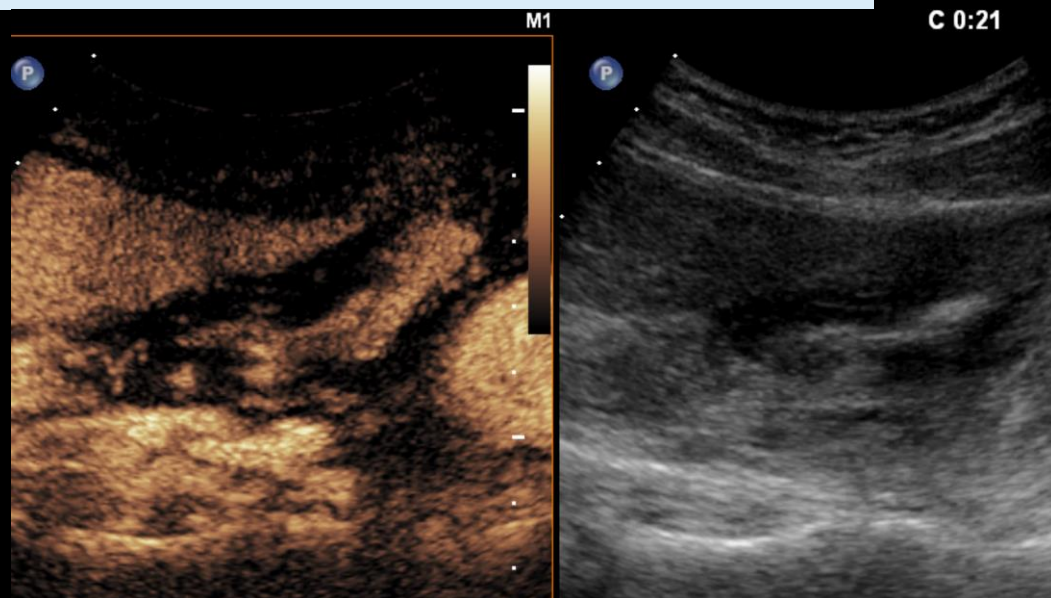
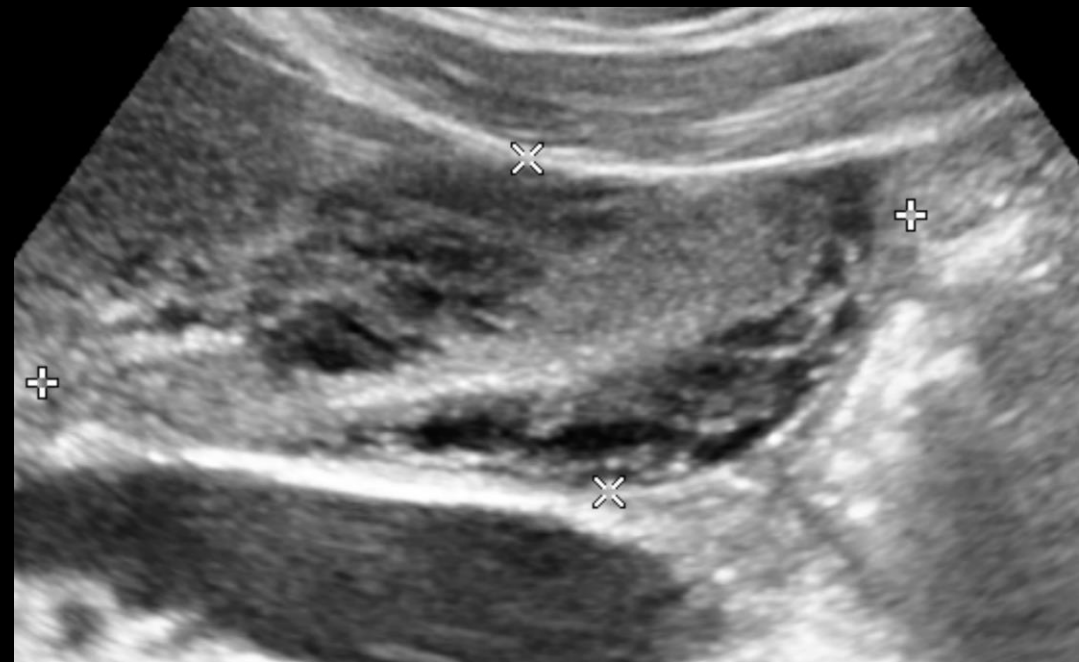
CEUS is able to differentiate between a perfused gallbladder lesion and motionless biliary sludge (LoE 4, GoR C). Strong consensus (20/0/0, 100%)



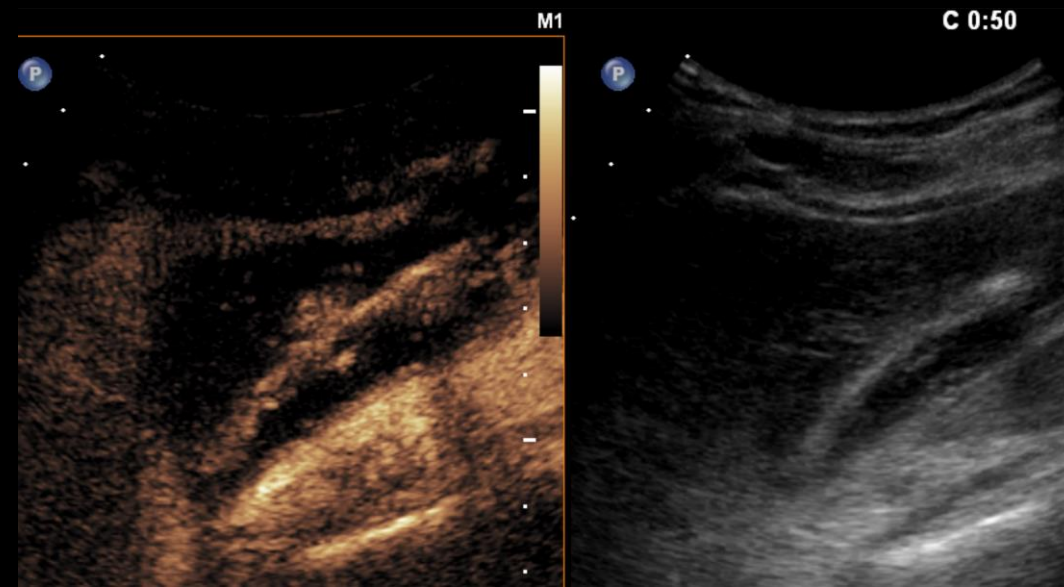
Využití – žlučník (EFSUMB)

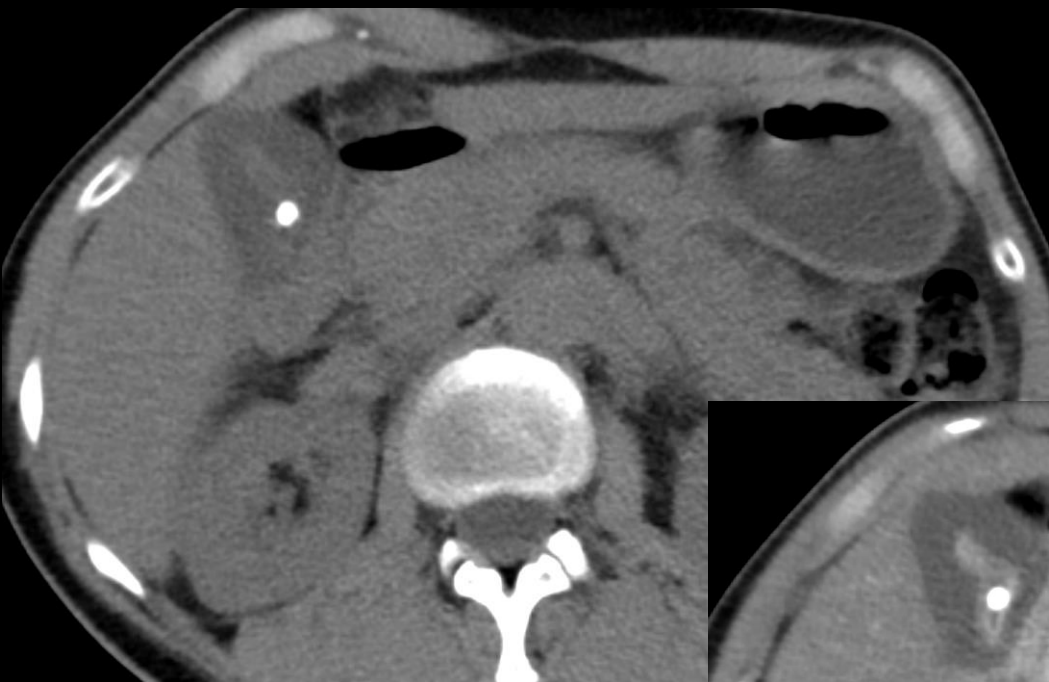
RECOMMENDATION 63

CEUS may differentiate **chronic cholecystitis** from gallbladder carcinoma (LoE 2b, GoR B). Strong Consensus (19/0/1, 100 %)



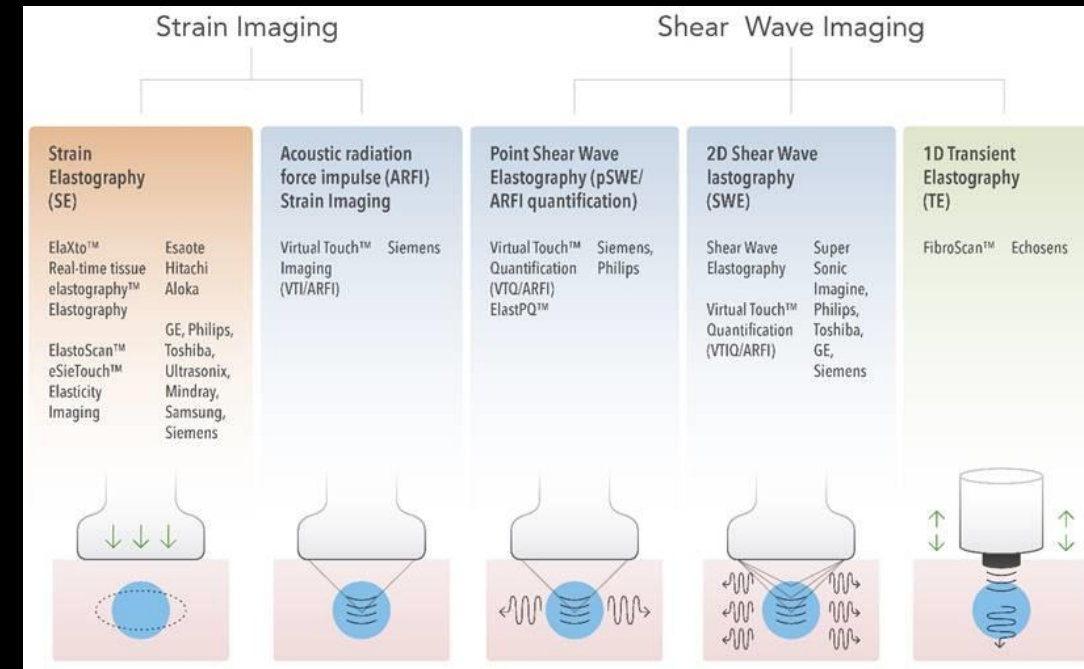
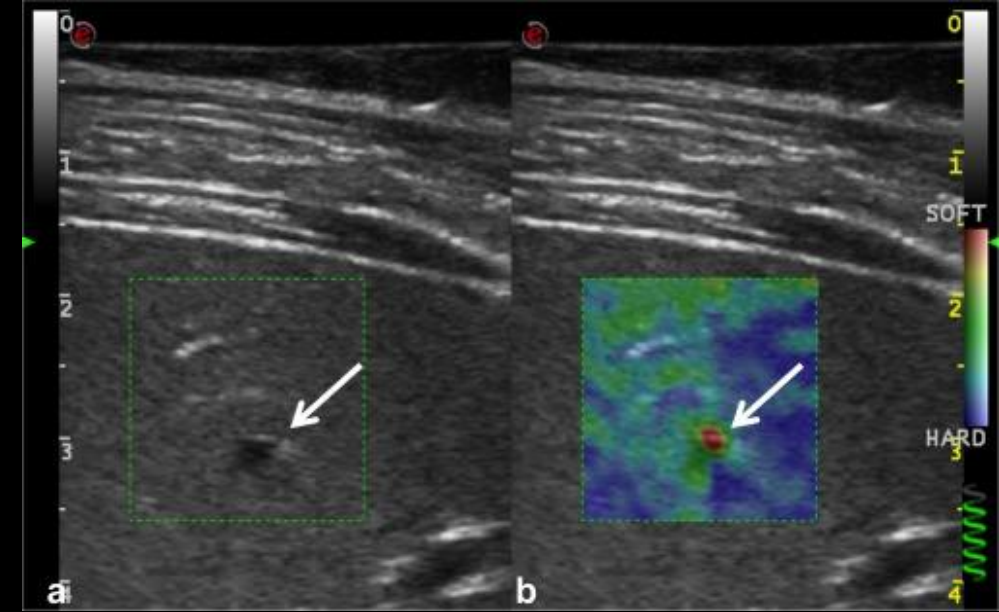
Hepatitida A





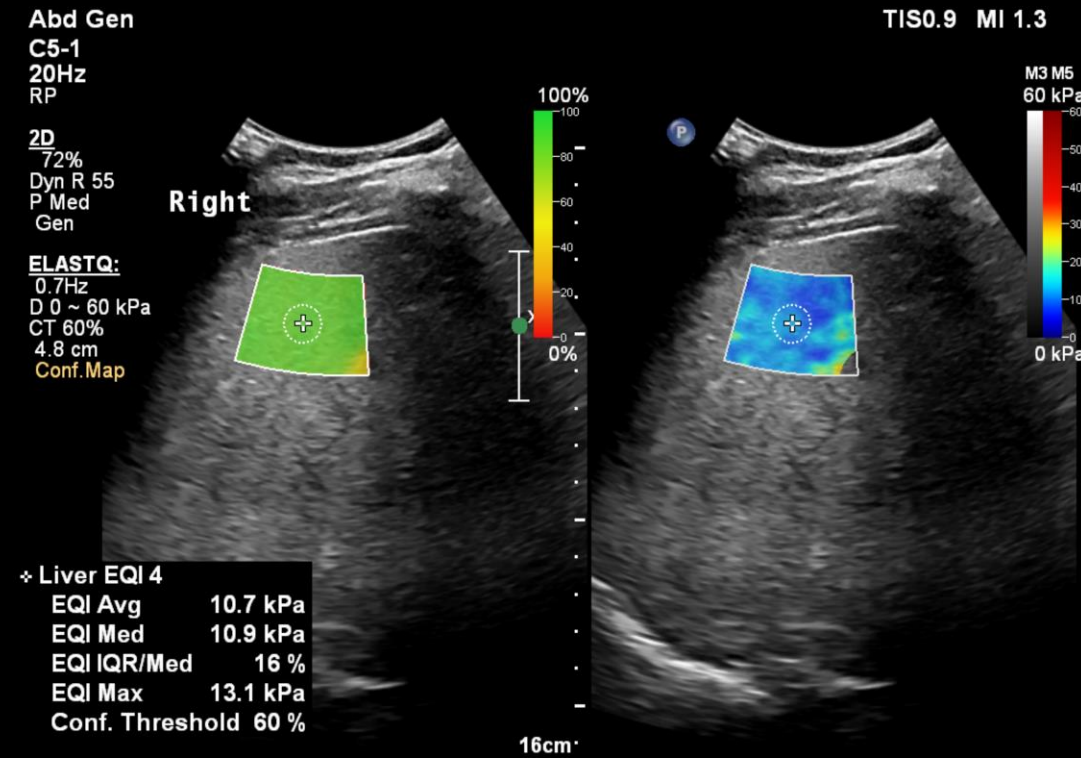
Elastografie

- měření tuhosti tkáně
 - hodnocení pohybu tkáně, který je vyvolán její deformací
- strain elastography
 - signál vzniká aktivně pohybem sondy
 - signál vzniká pasivně od vnitřních struktur (pulzace cév, srdce, dýchání...)
 - kvalitativní/semikvantitativní hodnocení
- shear-wave elastography - UZ vlna
 - Transient elastography (TE)
 - point shear-wave elastography (pSWE)
 - 2D shear-wave elastography (2D SWE)



Shear-wave elastography

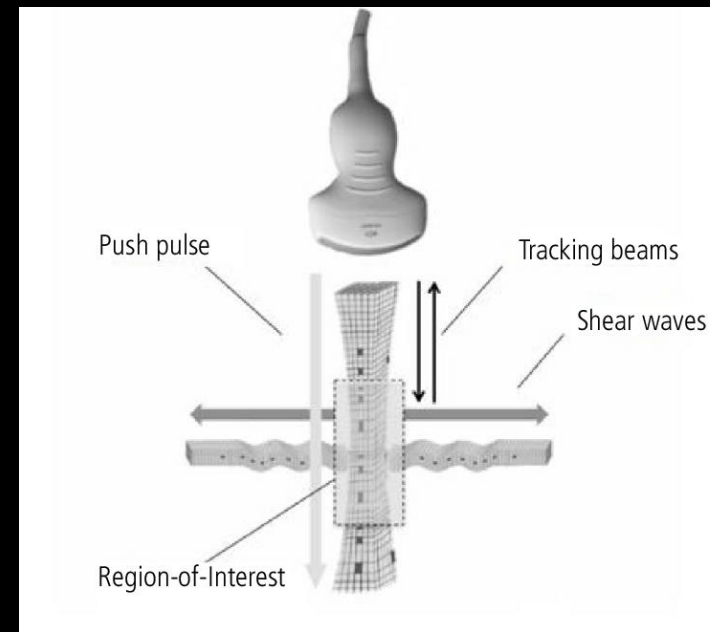
- pSWE
 - měříme jen výslednou rychlost či tuhost
- 2D SWE
 - získáme barevnou mapu, ve které je každý pixel kódován do odstínu barvy podle tuhosti odpovídajícího bodu tkáně
 - Confidence map (Philips Epiq) – ověření kvality měření



Shear-wave elastography

- signál vzniká pasivně působením pulzů akustického tlaku (Acoustic Radiation Force)
- ty způsobují vibrace tkání, které generují příčné UZ vlny
- výsledkem vyšetření je rychlost (m/s) šíření příčné vlny - rozdíl v časech, kdy došlo k posunu tkáně v různých místech
 - přepočtem lze převést na tuhost (Pa)

$$E = 3\rho c^2$$



Transient elastography

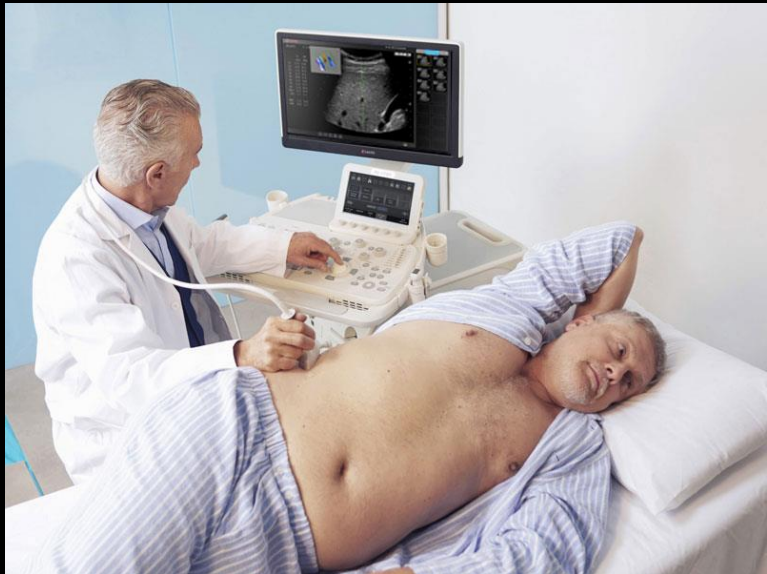
- navíc můžeme měřit u útluh ultrazvukového vlnění vyslaného sondou (CAP=controlled attenuation parameter) - odpovídá množství tuku v játrech
- nevýhodou je absence klasického B-módu



Provedení (EFSUMB)

RECOMMENDATION 3

Measurement of liver stiffness by SWE should be performed through a right intercostal space in supine position, with the right arm in extension, during breath hold, avoiding deep inspiration prior to the breath hold (LoE 2b, GoR B) [1, 32]. Strong consensus (18/0/0, 100%)



RECOMMENDATION 6

Patients should fast for a minimum of **2 hours** and rest for a minimum of 10 minutes before undergoing liver stiffness measurement with SWE (LoE 2b, GoR B) [1]. Majority consensus (13/2/3, 72%)

Patient should fast for 4 h before examination.



RECOMMENDATION 5

Measurement of liver stiffness by pSWE and 2D-SWE should be performed at least **10 mm below the liver capsule** (LoE 1b, GoR A) [24 – 27, 32 – 35]. Strong consensus (18/0/0, 100%)



Provedení (EFSUMB)

RECOMMENDATION 12

The median value of at least **10 measurements** should be used for liver elastography by pSWE (LoE 2b, GoR B) [102] Strong consensus (18/0/0, 100%)

RECOMMENDATION 13

For 2D-SWE a minimum of **three measurements** should be obtained; the final result should be expressed as the median together with the interquartile range (LoE 2b, GoR B) [27, 117]. Strong consensus (18/0/0, 100%)

Ten measurements should be obtained from 10 independent images, in the same location, with the median value used for transient elastography and point shear wave elastography techniques. **Three or five measurements** may be appropriate for 2-D shear wave elastography when a quality assessment parameter is used.

	EQI Avg	EQI Std	EQI Med	EQI IQR	EQI IQR/Med	EQI Max	Conf. Threshold
Liver EQI 1	33.1 kPa	2.85 kPa	32.5 kPa	3.18 kPa	10 %	43.1 kPa	60 %
Liver EQI 2	24.5 kPa	2.55 kPa	24.7 kPa	3.88 kPa	16 %	30.4 kPa	60 %
Liver EQI 3	24.6 kPa	3.52 kPa	24.0 kPa	5.29 kPa	22 %	31.1 kPa	60 %
Liver EQI 4	24.6 kPa	3.28 kPa	23.6 kPa	4.59 kPa	19 %	32.1 kPa	60 %
Liver EQI 5	21.9 kPa	2.49 kPa	21.9 kPa	3.18 kPa	15 %	29.6 kPa	60 %

EQI Liver Stiffness Measurements Velocity

	EQI Avg Vel	EQI Std Vel	EQI Med Vel	EQI IQR Vel	EQI IQR/Med Vel	EQI Max Vel	Conf. Threshold
Liver EQI 1	3.32 m/s	0.139 m/s	3.29 m/s	0.161 m/s	5 %	3.79 m/s	60 %
Liver EQI 2	2.86 m/s	0.148 m/s	2.87 m/s	0.228 m/s	8 %	3.18 m/s	60 %
Liver EQI 3	2.86 m/s	0.208 m/s	2.83 m/s	0.307 m/s	11 %	3.22 m/s	60 %
Liver EQI 4	2.86 m/s	0.189 m/s	2.81 m/s	0.268 m/s	10 %	3.27 m/s	60 %
Liver EQI 5	2.70 m/s	0.153 m/s	2.70 m/s	0.197 m/s	7 %	3.14 m/s	60 %

Liver EQI Avg	25.74 kPa
Liver EQI Med	24.60 kPa
Liver EQI IQR/Med	23 %
Liver EQI IQR	5.65 kPa
Liver EQI Std	3.82 kPa
Liver EQI Avg Vel	2.92 m/s
Liver EQI Med Vel	2.86 m/s
Liver EQI IQR/Med Vel	11 %
Liver EQI IQR Vel	0.31 m/s
Liver EQI Std Vel	0.21 m/s

Využití – játra (EFSUMB)

- hodnocení fibrózy a cirhózy jaterního parenchymu
 - zlatý standard -> biopsie

RECOMMENDATION 16

TE can be used as the first-line assessment for the severity of liver fibrosis in patients with **chronic viral hepatitis C**. It performs best with regard to the ruling out of cirrhosis (LoE 1b, GoR A) [25, 150, 152]. Broad consensus (17/0/1, 94%)

RECOMMENDATION 17

pSWE as demonstrated with VTQ® can be used as the first-line assessment for the severity of liver fibrosis in patients with **chronic viral hepatitis C**. It performs best with regard to the ruling out of cirrhosis (LoE 2a, GoR B) [155]. Broad consensus (17/0/1, 94%)

RECOMMENDATION 18

2D-SWE as demonstrated with SSI can be used as a first-line assessment for the severity of liver fibrosis in patients with **chronic viral hepatitis C**. It performs best with regard to the ruling out of cirrhosis (LoE 1b, GoR A) [139, 158, 159]. Broad consensus (17/0/1, 94%)

RECOMMENDATION 21

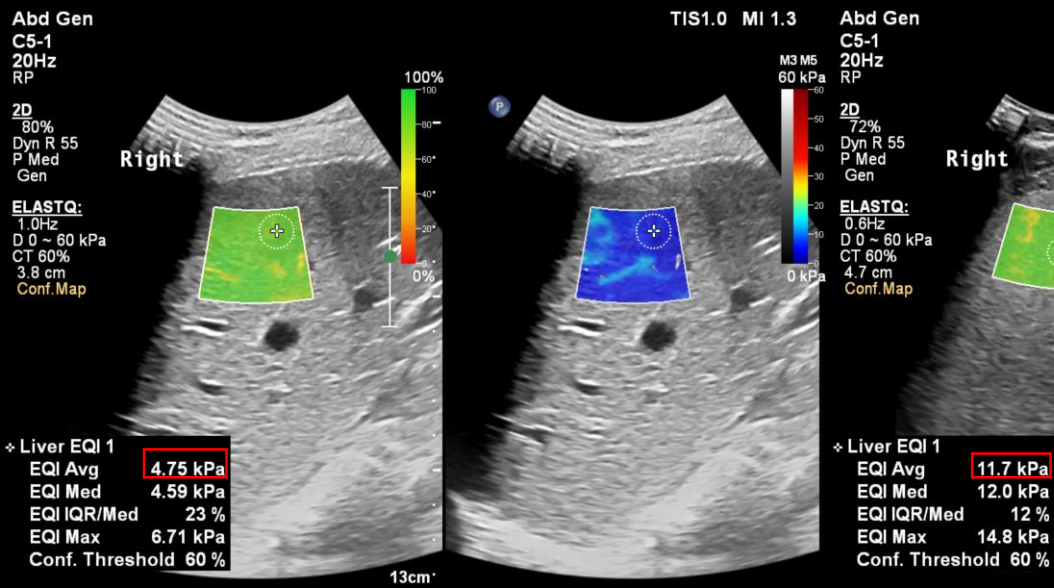
TE is useful in patients with **CHB** to identify those with cirrhosis. Concomitant assessment of transaminases is required to exclude flare up (elevation > 5 times upper limit of normal). (LoE 1b, GoR A) [178 – 180]. Broad consensus (17/1/0, 94%)

RECOMMENDATION 23

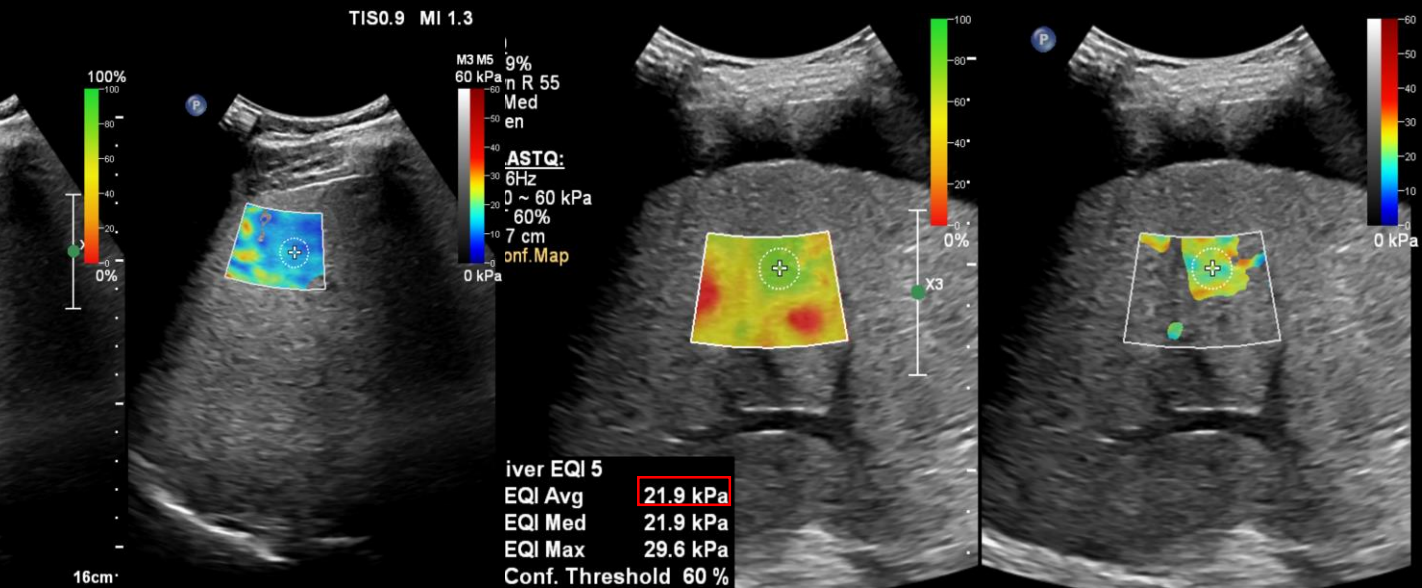
pSWE as demonstrated with VTQ® is useful in patients with **CHB** to identify those with cirrhosis (LoE 2a, GoR B) [191]. Strong consensus (18/0/0, 100%)

RECOMMENDATION 24

2D-SWE as demonstrated with SSI is useful in patients with **CHB** to identify those with cirrhosis (LoE 3a, GoR C) [196, 197]. Broad consensus (17/0/1, 94%)



Normální nález



fibróza

cirhóza

NAFLD/AFLD (EFSUMB)

RECOMMENDATION 26

TE can be used to exclude cirrhosis in NAFLD patients (LoE 2a, GoR B) [76, 210]. Broad consensus (13/0/3, 81 %)

RECOMMENDATION 27

TE can be used to exclude cirrhosis in patients with alcoholic liver disease, provided that acute alcoholic hepatitis is not present (LoE 2b, GoR B) [56, 214, 219, 220]. Strong consensus (15/0/0, 100 %)

[World J Gastroenterol](#). 2015 Jan 21; 21(3): 953–960.

Published online 2015 Jan 21. doi: [10.3748/wjg.v21.i3.953](#)

PMCID: PMC4299349

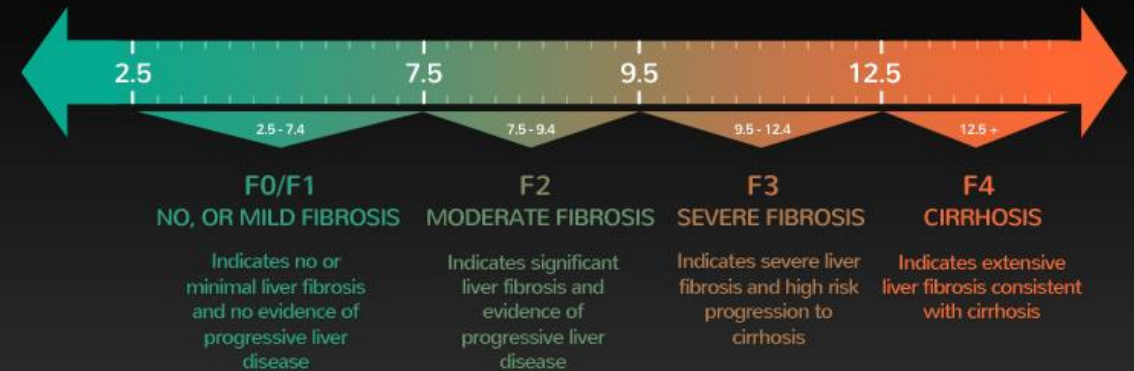
PMID: [25624730](#)

Transient elastography improves detection of liver cirrhosis compared to routine screening tests

[Thomas Göbel](#), [Janine Schadewaldt-Tümmers](#), [Lucas Greiner](#), [Christopher Poremba](#), [Dieter Häussinger](#), and [Andreas Erhardt](#)

CONCLUSION: Transient elastography is superior to routine diagnostic tests allowing detection of liver cirrhosis in **additional 10%-16%** of patients with chronic liver disease that would have been missed by clinical examinations.

FIBROSCAN SCORE



Hepatology
Original research

Diagnostic accuracy of FibroScan-AST (FAST) score for the non-invasive identification of patients with fibrotic non-alcoholic steatohepatitis: a systematic review and meta-analysis

[Federico Ravaioli](#)^{1, 2, 3}, [Elton Dajti](#)^{2, 3}, [Alessandro Mantovani](#)⁴, [Philip Noel Newsome](#)^{5, 6}, [Giovanni Targher](#)⁴, [Antonio Colecchia](#)¹

Correspondence to Professor Antonio Colecchia, Department of Medical Specialities, University of Modena and Reggio Emilia, Modena, 41121, Italy; antonio.colecchia@unimore.it

Results We included 12 observational studies for a total of 5835 participants with biopsy-confirmed non-alcoholic fatty liver disease. The pooled prevalence of fibrotic NASH was 28% (95% CI 21% to 34%). The FAST score's pooled **sensitivity was 89%** (95% CI 82% to 93%), and the pooled **specificity was 89%** (95% CI 83% to 94%) according to the aforementioned rule-in/rule-out cut-offs. The negative predictive value and positive predictive value of the FAST score were 92% (95% CI 91% to 95%) and 65% (95% CI 53% to 68%), respectively. Subgroup analyses and influential bias analyses did not alter these findings.

NAFLD/AFLD (WFUMB)

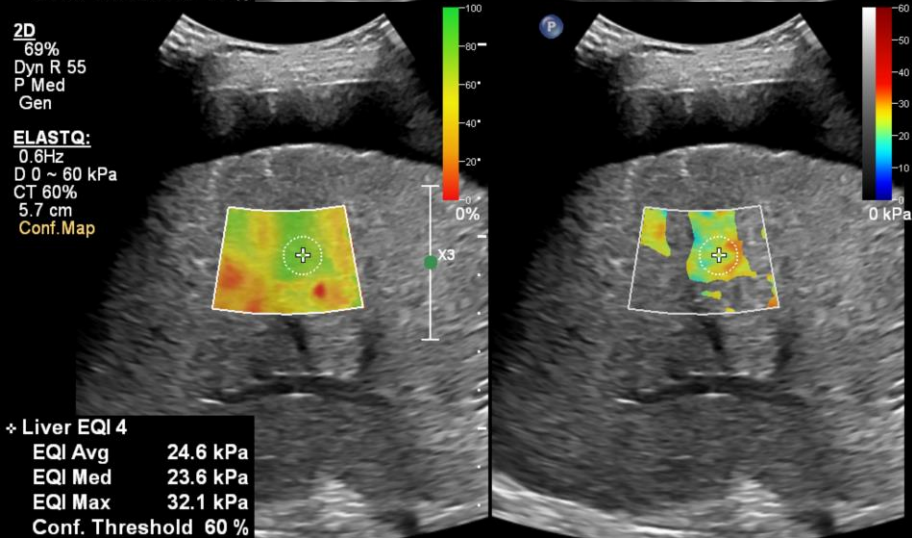
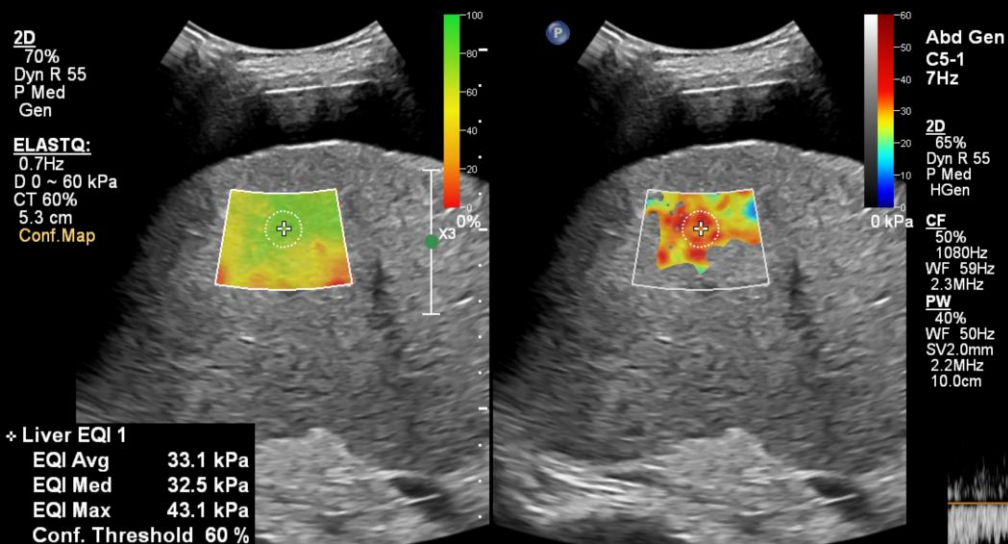
RECOMMENDATION 7: SWE can be used for liver stiffness assessment in NAFLD patients to rule out advanced fibrosis and select patients for further assessment. (LoE 1a, GoR A) (10,0,0)

RECOMMENDATION 9: SWE has high diagnostic accuracy for detecting cirrhosis, better at ruling out (high negative predictive value >90%) than ruling in. (LoE 1a, GoR A) (10,0,0)

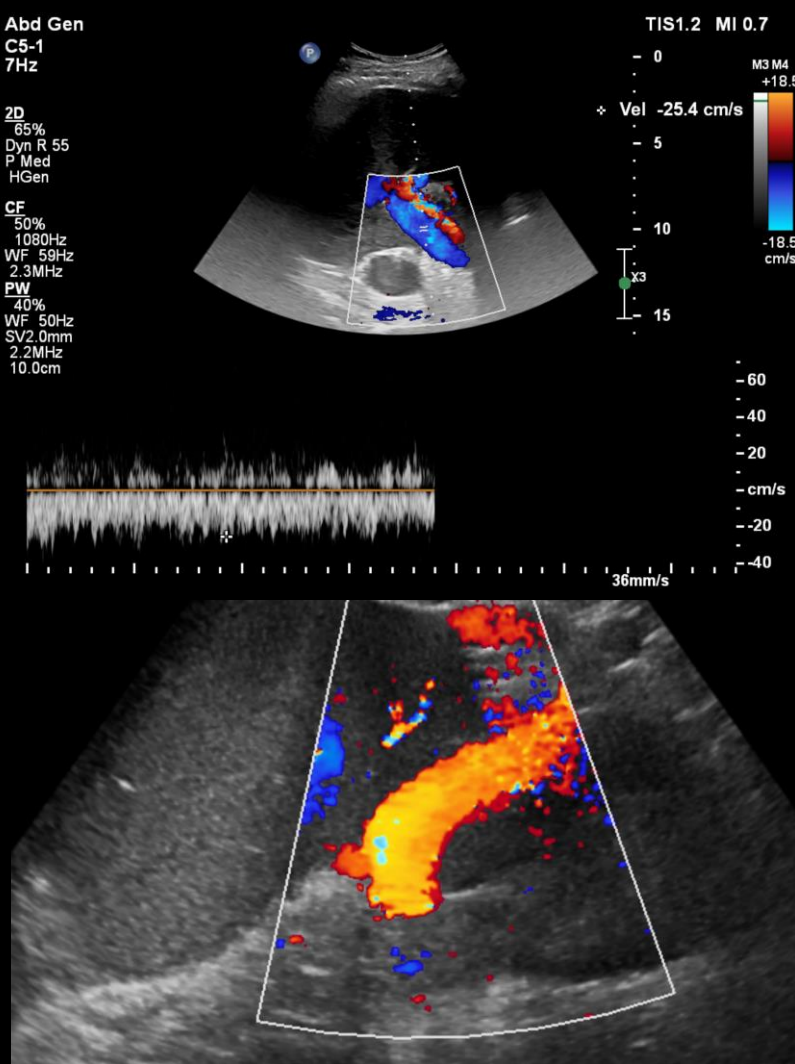
Recommendation 8: SWE can be used for liver stiffness assessment in patients with ALD to rule out advanced disease. Caution is needed in patients with ongoing alcohol abuse or with acute alcoholic hepatitis. (LoE 2a, GoE B) (10,0,0)



NAFLD/AFLD



cirhóza



Portální hypertenze



HCC

Limitace (EFSUMB)

- zánět
- obstrukční cholestáza
- stav po jídle
- cvičení
- žilní kongesce

RECOMMENDATION 7

The major potential confounding factors (liver inflammation indicated by AST and/or ALT elevation > 5 times the normal limits, obstructive cholestasis, liver congestion, acute hepatitis and infiltrative liver diseases) should be excluded before performing LSM with SWE, in order to avoid overestimation of liver fibrosis (LoE 2b, GoR B), and/or should be considered when interpreting the SWE results (LoE 1b, GoR B) [41 – 46, 49 – 51, 56 – 59]. Broad consensus (15/0/1, 94 %)

Hodnocení

Performance and cutoffs for liver fibrosis staging of a two-dimensional shear wave elastography technique

Ferraioli, Giovanna^{a,b}; Maiocchi, Laura^b; Dellafiore, Carolina^{a,b}; Tinelli, Carmine^c; Above, Elisabetta^b; Filice, Carlo^{a,b}

Author Information

European Journal of Gastroenterology & Hepatology 33(1):p 89-95, January 2021. | DOI: 10.1097/MEG.0000000000001702

Three hundred sixty-seven patients (198 males and 169 females) were studied. [REDACTED] respectively, were 0.97 (95% confidence interval, 0.91–0.98) and 0.97 (95% confidence interval, 0.95–0.99). The best cutoffs for significant fibrosis and severe fibrosis, respectively, were > 7 and > 9 kPa. Shear-wave-speed dispersion showed a high correlation with fibrosis ($r = 0.85$, $P < 0.0001$), whereas there was a very weak correlation with steatosis.

Two-dimensional shear wave elastography for assessing liver fibrosis in patients with chronic liver disease: a prospective cohort study

Hae Won Yoo¹, Sang Gyune Kim¹, Jae Young Jang², Jeong-Ju Yoo¹, Soung Won Jeong², Young Seok Kim¹, and Boo Sung Kim^{1,2}

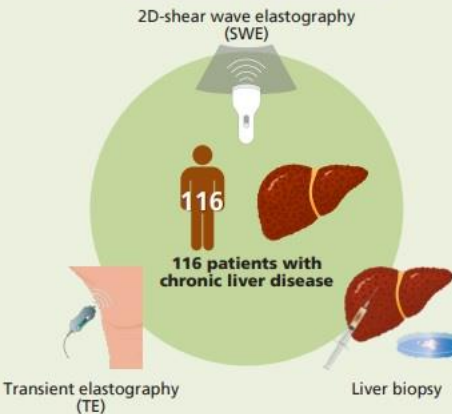
Which are the cut-off values of 2D-Shear Wave Elastography (2D-SWE) liver stiffness measurements predicting different stages of liver fibrosis, considering Transient Elastography (TE) as the reference method?

Ioan Sporea  , Simona Bota¹ , Oana Gradinaru-Tașcău² , Roxana Șirli² , Alina Popescu² , Ana Jurchiș² 

Our prospective study included 383 consecutive subjects, with or without hepatopathies, in which LS was evaluated by means of TE and 2D-SWE. To discriminate between various found between TE and 2D-SWE measurements ($r=0.68$). The best LS cut-off values assessed by 2D-SWE for predicting different stages of liver fibrosis were: $F \geq 1$: >7.1 kPa (AUROC=0.825); $F \geq 2$: >7.8 kPa (AUROC=0.859); $F \geq 3$: >8 kPa (AUROC=0.897) and for $F=4$: >11.5 kPa (AUROC=0.914).

Two-dimensional shear wave elastography for assessing liver fibrosis in patients with chronic liver disease: a prospective cohort study

Patients & Methods



Results

	$\geq F2$	$\geq F3$	$\geq F4$
Cut off, kPa			
2D-SWE	5.83	7.55	9.58
Fibroscan	5.75	7.30	10.90
AUROC			
2D-SWE	0.85	0.91	0.88
Fibroscan	0.85	0.88	0.93
Sensitivity (%)			
2D-SWE	88.9	95.5	95.0
Fibroscan	93.1	95.5	95.0
Specificity (%)			
2D-SWE	74.4	81.7	82.1
Fibroscan	69.8	67.6	81.1

2D-SWE is comparable to TE in diagnosing significant fibrosis and liver cirrhosis with high reliability.

Hodnocení



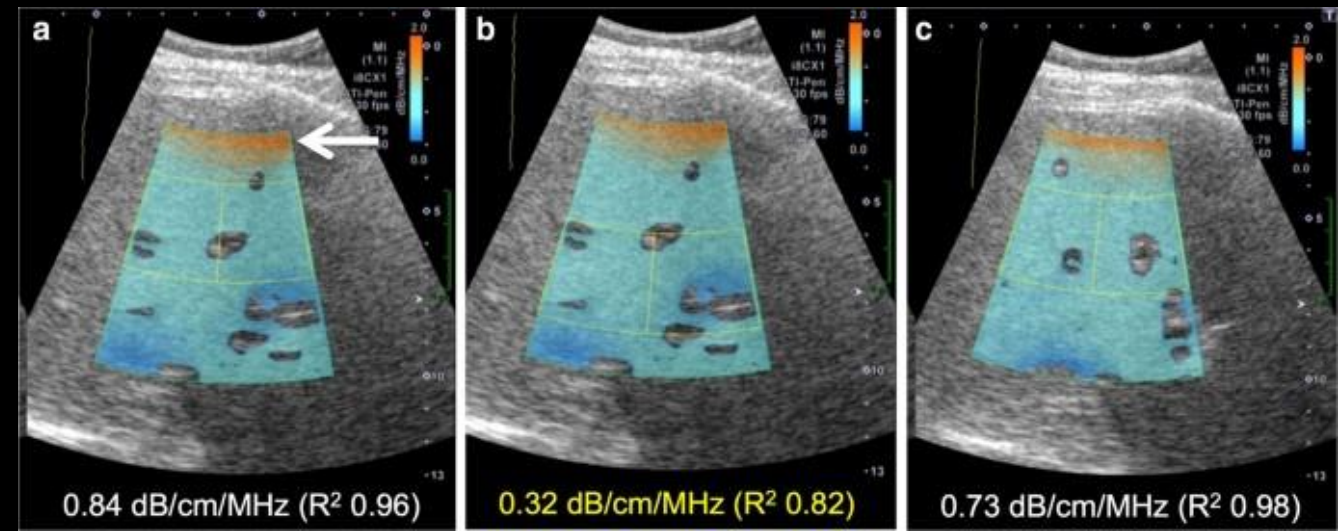
Table 2: Recommendation for Interpretation of Liver Stiffness Values Obtained with ARFI Techniques in Patients with Viral Hepatitis and NAFLD

Liver Stiffness Value	Recommendation
≤ 5 kPa (1.3 m/sec)	High probability of being normal
< 9 kPa (1.7 m/sec)	In the absence of other known clinical signs, rules out cACLD. If there are known clinical signs, may need further test for confirmation
9–13 kPa (1.7–2.1 m/sec)	Suggestive of cACLD but need further test for confirmation
> 13 kPa (2.1 m/sec)	Rules in cACLD
> 17 kPa (2.4 m/sec)	Suggestive of CSPH

Note.—ARFI = acoustic radiation force impulse, cACLD = compensated advanced chronic liver disease, CSPH = clinically significant portal hypertension, NAFLD = non-alcoholic fatty liver disease.

Kvantifikace steatózy

- attenuation coefficient
 - energie ultrazvukového vlnění je utlumena při průchodu tkání
 - tento útlum se zvyšuje, pokud tkáň obsahuje tuk
- Controlled attenuation parameter (Fibroscan)
 - B-mode Ultrasound-Guided Attenuation Imaging
 - princip mírně odlišný podle výrobce



Závěr

- CEUS
 - ideální metoda u incidentalomu jater
 - diff.dg. Maligní vs benigní ložisko (v korelaci s anamnézou (onkologické onemocnění))
 - u benigního ložiska přesné určení typu
 - odlišení komplikace cholecystitidy (absces) od prosáknutí v lůžku žlučníku
 - odlišení charakteru patologického obsahu (sludge vs tumor)
- Elastografie
 - 2D-shear wave -> hodnocení změny elasticity jaterního parenchymu
 - posouzení tíže hepatopatie při nálezu steatózy
- Kvantifikace steatózy
 - hodnocení efektu léčby? režimových opatření?

Děkuji za pozornost