



Contrast enhanced ultrasonography in the detection of liver metastases from colorectal cancer

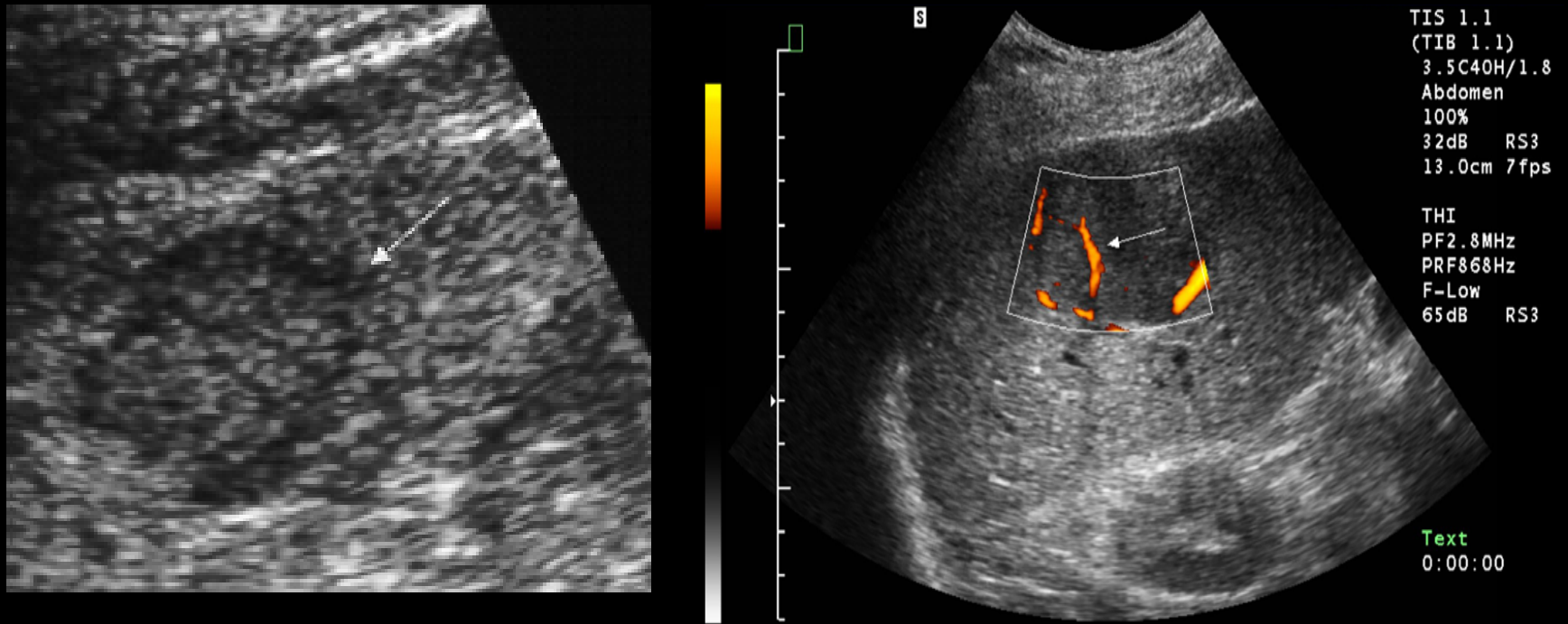
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Liver mets from colorectal cancer



Detection of Liver Mets in 295 Patients

Sensitivity:



- Ultrasound (without CEUS) 70 %
- IOUS 97 %

Rafaelsen SR, Kronborg O, Larsen C, Fenger C.

Intraoperative ultrasonography in detection of hepatic metastases from colorectal cancer.

Dis Colon Rectum 1995;38:355-360.



AIM

- To compare the sensitivity and specificity of CEUS and MDCT in the detection of synchronous liver metastases in patients with colorectal cancer
- To use CEUS to evaluate the time from injection to arrival in the hepatic vein (ATHV).



CEUS



- Non-CEUS US using a 5 MHz transducer
Acuson Sequoia 512
- CEUS was performed after a bolus injection of 2.4 ml SonoVue followed by 10 ml NaCl injected into the cubital vein
- Low mechanical index ($MI = 0.11$) using CPS software
- The interval from injection to arrival time in the hepatic vein (ATHV) was noted.
- Experienced radiologists

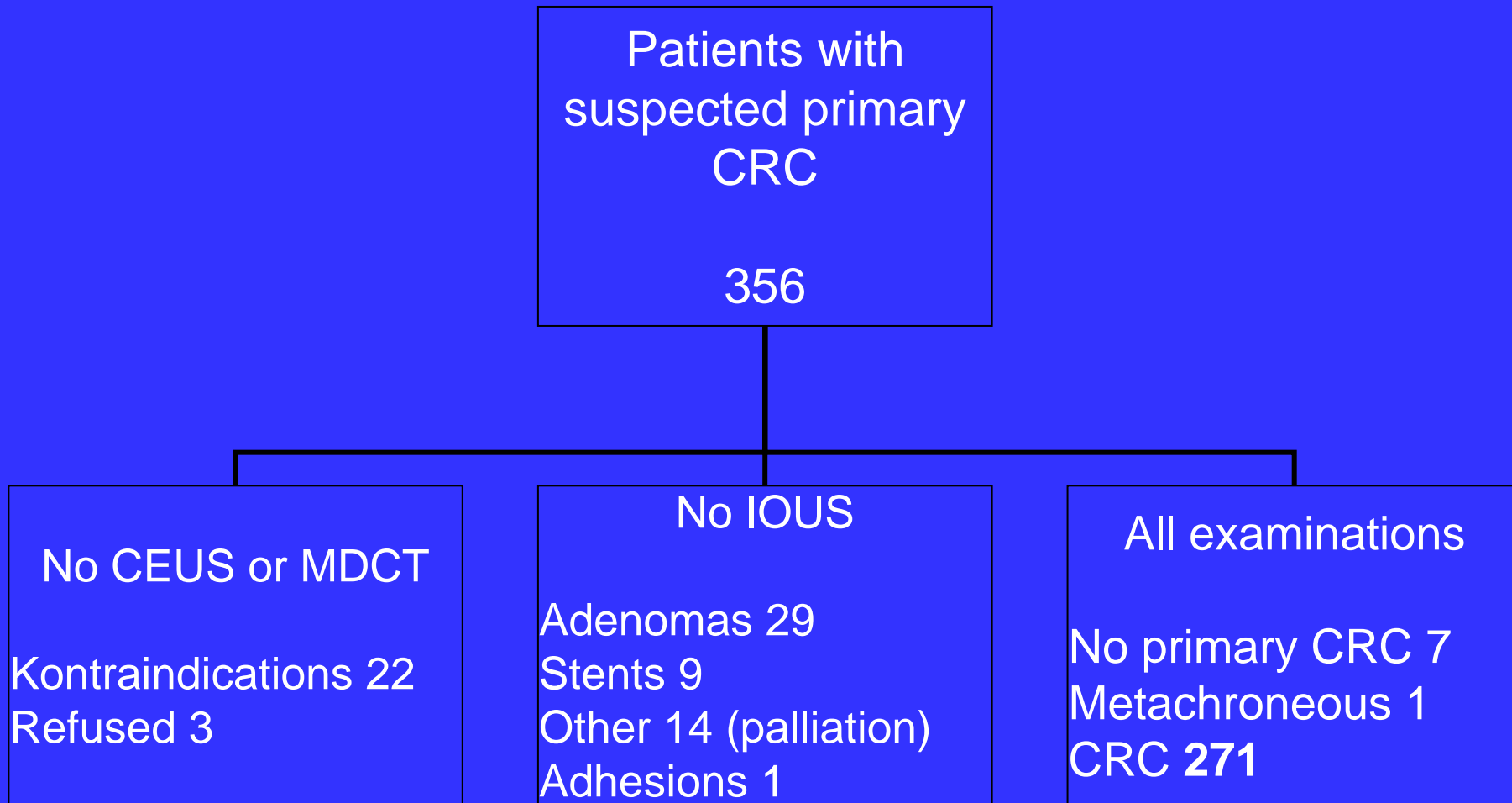


MDCT



- CT scans were performed with a 64-slice CT system
- The effective dose: 8-9 mSv
- Images were obtained after IV injection of 100 ml Iomeron 300 mg I/ml using an automatic injector at an inj. rate of 4 ml/sec
- Contrast-enhanced CT scanning in the portal phase
- An additional arterial phase was performed until June 2006 using a Somatom Sensation 4 MDCT scanner
- CT images were interpreted by 2 radiologists blinded to CEUS

Flowchart



September 2004 to December 2008

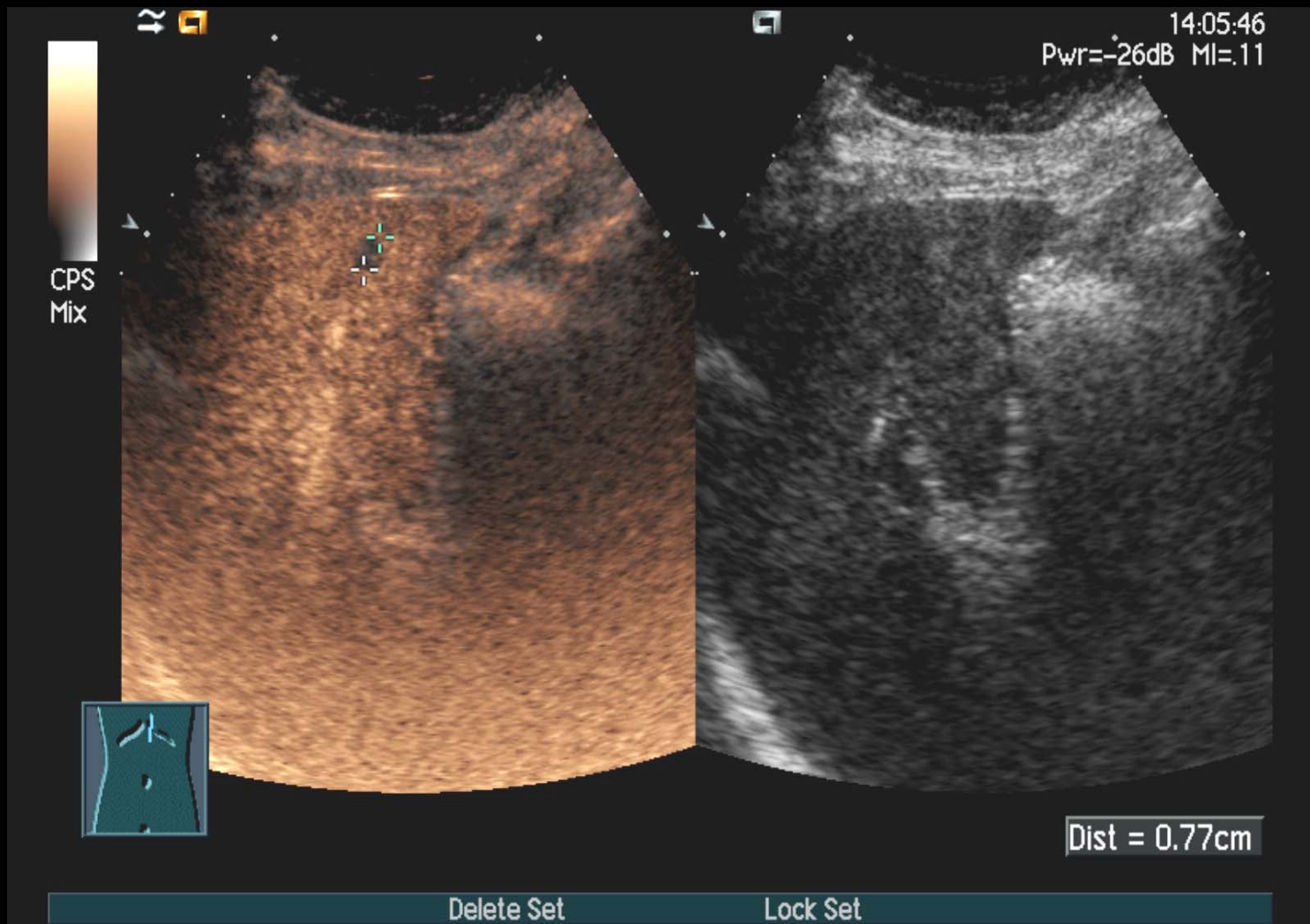


Gold standard

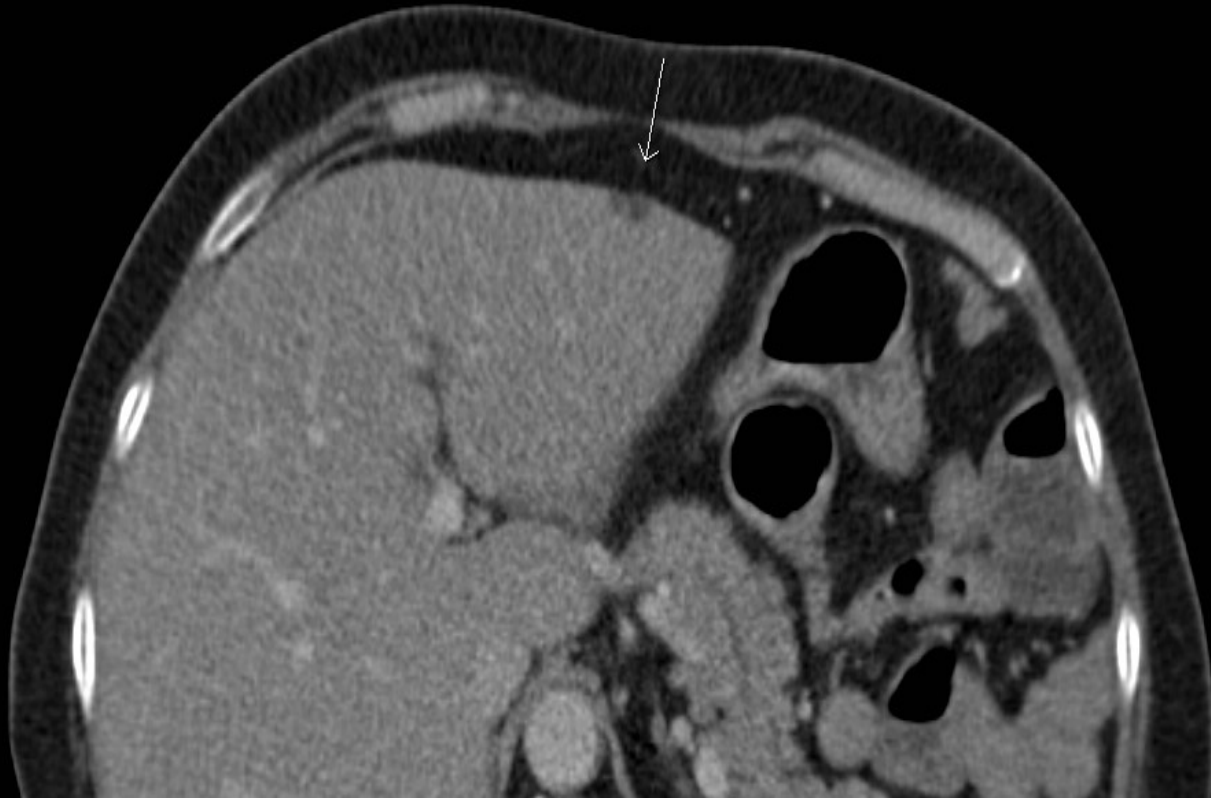
- Intraoperative ultrasound (Hitachi, EUB-650) of the liver was used as gold standard in all 271 patients.
- Additional **follow-up**, dynamic contrast enhanced **MRI**, **PET/CT** or ultrasound guided **biopsy** was performed on all suspicious lesions or if there was any inconsistency in the results.
- When liver resection was performed, the pathological examination contributed to the gold standard.
- Any new metastases detected after three months after CEUS and CT were not considered synchronous liver metastases.
- When all modalities showed a benign lesion, the lesion was considered true negative in regard of hepatic metastases.

Data

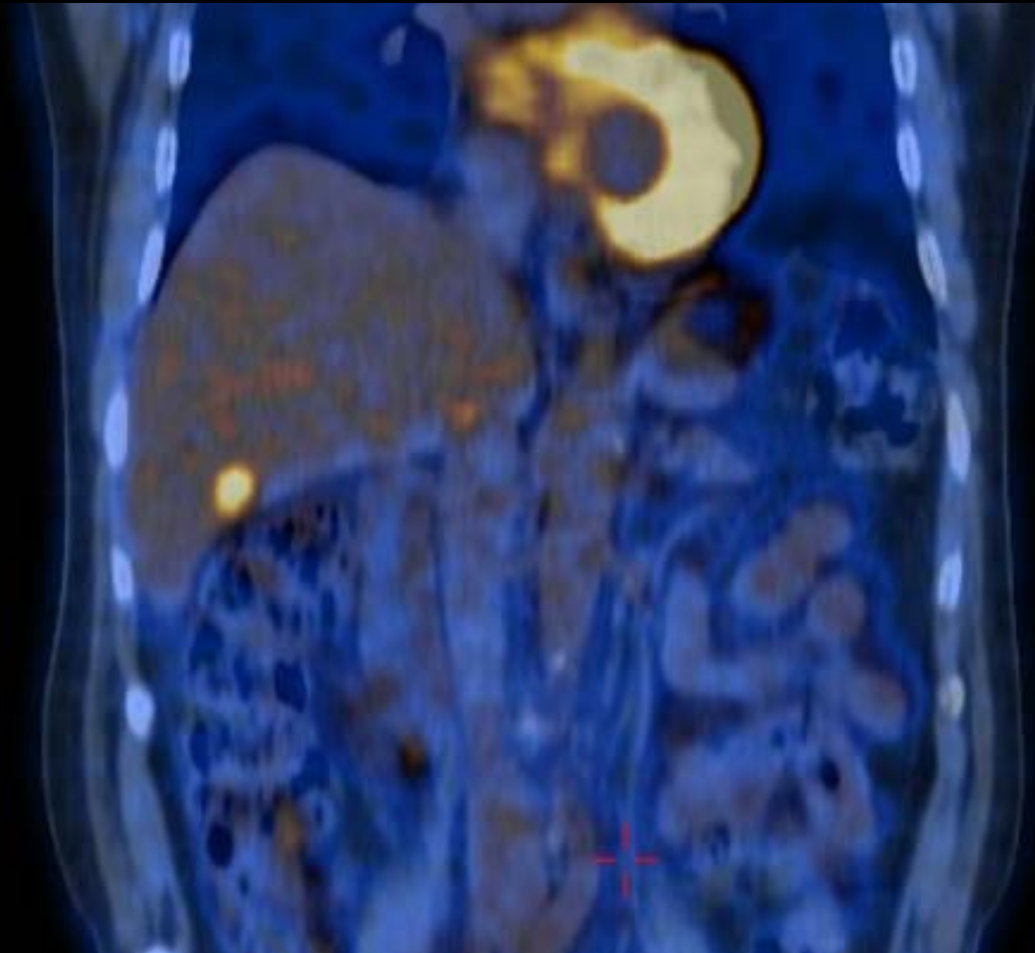
- Data were analyzed using descriptive statistics and proportions were compared by **Fisher's exact test**.
- Difference in medians was assessed by the **unpaired Mann-Whitney test**.
- All patients signed the informed consent form.



- Liver met detected by CEUS



A 68 year old female with one 10 mm liver met . CEUS failed detection.
The finding was confirmed by IOUS.



A 70 year old male with hepatic metastasis detected by IOUS and PET/CT. Preoperative CEUS and MDCT were negative.

	CEUS	MDCT
Sensitivity	85.7% (62.6 – 96.2%)	85.7% (62.6 – 96.2%)
Specificity	97.6% (94.6 – 99.0%)	95.6% (92.0 – 97.7%)
Positive predictive value	75.0% (52.9 – 89.4%)	62.1% (42.4 – 78.7%)
Negative predictive value	98.8% (96.2 – 99.7%)	98.8% (96.1 – 99.7%)

The sensitivity of combined CEUS and MDCT was 90.1% (95% CI: 68.2 – 98.3%)

Liver Mets CRC: Sensitivity

Author	N (Met %)	CEUS	MDCT
Piscaglia 2007	92 (60%)	96 %	91 %
Larsen 2009	274 (14%)	80%	89 %
Cantisani 2010	110 (64%)	96%	97 %
Rafaelsen 2010	271 (8%)	86 %	86 %

6 FP CEUS

- 4 of these were cysts confirmed by either, IOUS, CT or follow-up.
- 2 false positives were haemangiomas confirmed by dynamic MRI and negative PET/CT.

11 FP at MDCT

- 6 cysts confirmed by IOUS and follow-up.
- 3 had a haemangioma confirmed by dynamic MRI and negative PET/CT.
- 2 false positives on MDCT showed no abnormalities with CEUS, IOUS and follow-up

CEUS - ATHV

- Patients without liver mets had a median ATHV: **22 sec.**(IQR: 20 – 25 sec.)

$P < 0.05$

- Patients with liver mets had a median ATHV: **18 sec.** (IQR: 15 – 21 sec.)

- Patients with more than 5 liver mets ATHV: **16 sec.**(IQR: 11 – 18 sec.)

Strength and Limitation

- Prospective and blinded
- State of the art CEUS and CT same day
- No patient was excluded because of extreme obesity or steatosis of the liver
- All patients had IOUS
- Uniform population
- The low number of patients with liver mets
- The standard reference of IOUS could probably have been improved by mobilizing the liver prior to scanning
- No use of CEUS - IOUS

Conclusion

- CEUS showed sensitivity and specificity comparable to that of MDCT
- Higher PPV of CEUS
- ATHV was shorter in the metastatic group than in patients without liver metastases.



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