

# IS CEUS (CONTRAST ENHANCED ULTRASONOGRAPHY) A USEFUL TOOL IN A BEGINNER'S HANDS? HOW MUCH CAN CAD (COMPUTER ASSISTED DIAGNOSIS) PROTOTYPE HELP US IN THE CHARACTERIZATION OF MALIGNANCY IN FOCAL LESIONS OF THE LIVER?

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**Key words:**

**OBJECTIVES**

CEUS improved the characterization of focal lesions of the liver (FLLs), but it remains an operator-dependent method. The goal of this scientific paper was to test a computer assisted diagnosis (CAD) prototype.

**MATERIALS AND METHODS**

97 CEUS videos [34% hepatocellular carcinomas (HCC), 12.3% hypervascular metastases (HiperM), 11.3% hypovascular metastases (HipoM), 24.7% hemangiomas (HMG), 17.5% focal nodular hyperplasia (FNH)] were used to develop a CAD prototype based on an algorithm that tested a binary decision classifier. Two young MDs, two experts and the CAD prototype, reevaluated 50 CEUS videos (diagnosis of benign vs. malignant lesions), in order to evaluate the beginner vs. expert diagnostic gap, the first being blinded by clinical data.

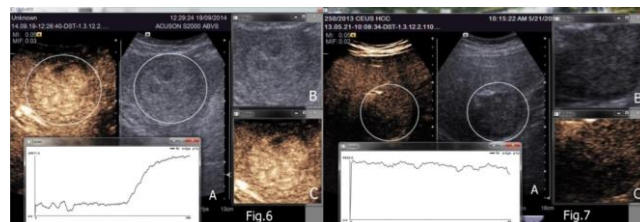
**RESULTS**

I-Beginner misdiagnosed 4/10-FNH, 3/10-HCC, 2/10-HMG, 1/10-HiperM, 1/10-HipoM. After being informed about the clinical data 2/10-FNH, 1/10-HCC. II-beginner misdiagnosed: 3/10-FNH; 3/10-HCC, 2/10-HMG, 1/10-HiperM. Unblinded: 1/10-HCC, 1/10-HMG. I-Expert: only 1/10-FNH, 1/10-HCC, 1/10-HMG misdiagnosed. Unblinded: all lesions were correctly diagnosed. II-Expert: 1/10-FNH, 1/10-HCC misdiagnosed. Unblinded: only 1/10-FNH was misdiagnosed. The CAD classifier managed a 75.2% overall correct classification rate. The overall classification before and after the uncovering of clinical

data was: I beginner 78 %; 94%, II 82%; 96%. I expert 94%; 100%. II 96%; 98%.

**CONCLUSIONS**

The CAD prototype can assist a beginner for a better CEUS diagnostic accuracy. The integration of clinical data in the CAD algorithm is essential.



**Graphical abstract:** Average Intensity variation in Arterial and Late Phase with supra unitary (meaning wash in) and sub unitary pattern (meaning washout).

**REFERENCES**

- 1.Sugimoto K, Shiraishi J, Moriyasu F, Doi K. Computer-aided diagnosis for contrast-enhanced ultrasound in the liver. World J Gastroenterol. 2010;2:215-223.
2. Gatos I, Tsantis S, Spiliopoulos S, Skouroliakou A, Theotokas I, Zoumpoulis P, Hazle JD, Kagadis GC. A new automated quantification algorithm for the detection and evaluation of focal liver lesions with contrast-enhanced ultrasound. Med Phys. 2015;42:3948-59.