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Comparison of Contrast Enhanced US with CT in Assessment of Focal Liver Lesions

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Abstract: **Background: Medical imaging techniques are important for patients with liver disease. An unenhanced ultrasound examination recognizes the normal from the abnormal liver that may require further examination. One crucial variable in selecting an imaging modality test is the capacity to give a quick finding. Choices for extra imaging modalities incorporate Computed Tomography (CT), which requires breath holding that sometimes be contraindicated.**

Objective: To compare clinical effectiveness of using contrast-enhanced ultrasound (CEUS) for assessment of adults with focal liver lesions, with that of computed tomography (CT) in patients those had non-conclusive previous studies.

Method: Systemic review for previous studies through databases, including MEDLINE (PubMed), EMBASE, Cochrane of Systematic Reviews and database of Abstracts of Reviews. Search was performed for studies published up to 2015. Studies were selected depending on evaluation of the effectiveness of contrast enhanced US in comparison with CT in assessment of different focal liver lesions.

Results: Ultrasound (US) is frequently the first-line imaging modality for liver study. It is operator dependent. Some of the drawbacks are degradation of the images especially in obese patients. Regular considerate lesions, for example hemangiomas are normally have a trademark appearance on US, frequently preclude other assessment in non-oncology patients.

Lately, with the presence of microbubble technique, which is a dynamic imaging that develops rapidly, Contrast Enhanced US (CEUS), offers the novel capacity to perform constant, continuous evaluation of typical hepatic parenchyma, hepatic vessels and liver lesions.

Conclusion: Contrast-enhanced ultrasound using a low mechanical index is the modality of choice for detection of liver malignancy. In this study showed that contrast-enhanced ultrasound imaging is highly accurate in characterizing malignant and benign focal liver lesions, than CT and is considered safer than CT.

Keywords: **Contrast enhanced US, CT scan, liver lesions.**

1. INTRODUCTION

Focal Liver Lesions (FLLs) are quite frequently discovered in daily practice, due to the routine use of imaging methods (ultrasound - US, computed tomography – CT). On the other hand, due to screening programs for patients with liver cirrhosis, FLLs are discovered very early in these patients, and they must be evaluated in order to establish a therapeutic strategy (including transplantation, surgical resection or percutaneous echo-guided procedures). Ultrasound and CT scans are commonly performed as the first line of imaging studies in the evaluation of patients with abdominal complains. It is not uncommon to discover incidental focal liver lesions.

The term 'focal lesion in the liver' refers to any focal area of perceived difference seen on an imaging study and occurring in one specific area of the liver. FLLs can be broadly classified as benign [e.g. hemangioma, focal nodular hyperplasia, focal fatty infiltration or sparing and adenoma] or malignant [e.g. primary HCC, cholangiocarcinoma (CCC) or liver metastases], with the identification or exclusion of malignancy being the primary aim of diagnostic imaging. The

distinction between benign and malignant determines the individual's prognosis and the subsequent treatment strategy. Benign, asymptomatic FLLs usually do not require any treatment. Depending on the specific type of lesion, the individual may be monitored and the lesion rescanned in 6–12 months. Once a malignant lesion is identified it is important to distinguish between primary and secondary cancers as this is likely to impact on how the individual is managed. Malignant lesions may be treated by a range of interventions including chemotherapy, liver resection (surgery) and local ablative therapy.

The powerful recognition of focal liver lesions (FLL) can fundamentally modify understanding administration. Early discovery of liver malignancies builds the likelihood of therapeutic surgical resection or percutaneous removal. It's turning out to be progressively apparent that difference upgraded ultrasonography (CEUS) utilizing non-dangerous low-acoustic-force ultrasound filtering with second era contrast operators, for example, perfluorocarbon or sulfur hexafluoride-filled microbubbles, permits enhanced characterization of strong focal liver lesions. CEUS has high affectability in the recognition and characterization of hyper- and hypo-vascular liver malignancies with precision similar prevalent to, helical CT. CEUS might likewise empower complete analysis of hemangiomas and focal nodular hyperplasia.

In other hand imaging, characteristics of liver metastases are nonspecific and biopsy is required for histologic analysis. CT imaging is a method of choice for assessing liver metastases. This inclination is inferable from the impacts of the double blood supply on the upgrade attributes of metastases, as contrasted and ordinary liver parenchyma. For location and assessment of liver lesions, CT is superior to CEUS.

Pathological examination is another important aspect in the evaluation of an FLL. The evolution of CT technology has improved their diagnostic capability to often permit making an accurate diagnosis without the requirement for a liver biopsy. In fact, HCC can be diagnosed with ≥ 90 % accuracy with imaging alone when a lesion is 2 cm, thus obviating the need for liver biopsy in nearly all cases under the right clinical circumstances (Di Martino M, De Filippis G, 2013).

2. METHODOLOGY

We conducted a Systemic review for previous studies through databases, including MEDLINE (PubMed), EMBASE, Cochrane of Systematic Reviews and Database of Abstracts of Reviews search was performed for studies published up to 2015. Studies were selected depending on evaluation of the effectiveness of contrast enhanced US in comparison with CT in assessment of focal liver lesions. Search terms for MEDLINE, such as: focal liver lesion, Ultra Sound, CT, clinical effectiveness. Literature review of previous studies has been performed concerning this topic.

Two independent reviewers of titles, abstracts and / or full-text.

3. RESULTS

One of the included studies (*M Westwood, M Joore*,2013) were testing the accuracy of several studies; of the 20 test accuracy studies, seven concerned the use of SonoVue CEUS for the characterization of FLLs detected at routine surveillance of patients with cirrhosis, four assessed the performance of SonoVue CEUS for the detection of liver metastases in patients with known primary cancers (CRC), six concerned the use of SonoVue CEUS for the characterization of incidentally detected FLLs and three considered the use of SonoVue CEUS to assess response to treatment in patients with liver cancer. The remaining study was a controlled trial that compared assessment with conventional imaging (CECT or CEMRI) plus unenhanced US with assessment with conventional imaging (CECT or CEMRI) plus SonoVue CEUS prior to RFA. This study reported the following patient-relevant outcomes: successful ablation, tumors progression, and incidence of new HCC, incidence of repeat RFA, local progression-free survival, new tumor-free survival and post-therapy complications.

With the widespread use of cross-sectional imaging examinations, physicians from a wide array of specialties are becoming involved with questions regarding the management of patients with focal liver lesions. To formulate a practical approach to these patients, several factors must be incorporated into a clinical decision-making algorithm (**Figure 1**), including the particular clinical setting (eg, known comorbidities, underlying cirrhosis, or a known primary neoplasm), the presence of clinical signs and symptoms, the results of laboratory tests and the critical information provided by imaging studies (Bruix, J., Sherman, M. 2005).

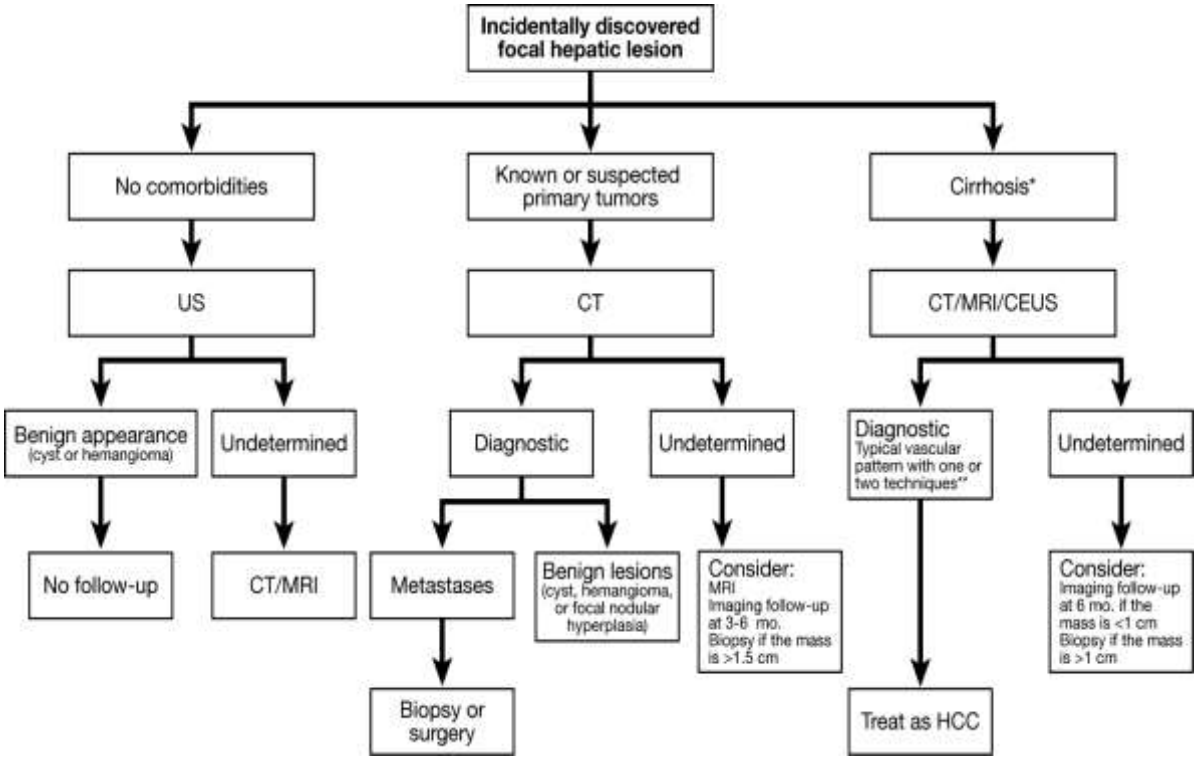

Figure 1

Suggested algorithm for the investigation of patients with incidental focal liver lesions. *HCC*, hepatocellular carcinoma. Diagnostic work-up of incidentally discovered focal hepatic lesions in patients with cirrhosis is based on the data-supported recommendations endorsed by the American Association for the Study of the Liver Diseases

In the differentiation between benign and malignant lesions, CEUS yielded a sensitivity of 79.4% and a specificity of 88.1%. In the subgroup of patients with cirrhosis, the kappa value for off-site diagnosis between CEUS and reference modality was slightly lower compared to the non-cirrhotic group: 0.42 and 0.66 ($p = 0.0002$), respectively. The concordance rate and kappa value of CEUS for benign to malignant differentiation between on-site and blinded review were 90.2% and 0.80%, respectively, compared to 83.4% and 0.66%, respectively, for the reference imaging technique (*A. Le Gouge, J.M. Correas,2008*). (Enrique Lopez Hänninen, MD, 2010) conducted study that concluded evaluation of focal liver lesions remains a noteworthy sign for stomach CT. With the presentation of winding CT, different specialists have concentrated on the impact of iodine measurements, contrast material volume, and infusion parameters on hepatic improvement and sore perceptibility. Though immediate appraisal of sore to-liver complexity is impacted by an assortment of elements (counting sore limitation, sore distance across, injury vascularity, iodine measurements and CT procedure), the level of vascular and hepatic improvement offers a reproducible, round about evaluation of sore perceptibility.

(*M Mandai, M Koda, 2011*) showed in their study that The 92 nodules of newly developed HCC were also observed at the post-vascular phase on CEUS examination. Looking at the entry period of element CT with the post-vascular period of CEUS, 70 (82%) of the 85 with low thickness on element CT showed hypo-enhancement at the post-vascular period of CEUS. The other 15 (18%) exhibited low improvement at the gateway period of element CT (Table 1) and iso-enhancement at the post-vascular period of CEUS. Six (86%) of seven with iso-density at the entryway period of element CT demonstrated hypo-enhancement at the post-vascular phase of CEUS.

Table 1. Detectability of tumours at the post-vascular phase of contrast-enhanced US compared with dynamic CT

Post-vascular phase of CEUS						
	Iso	Hypo		Total		
Portal phase of dynamic CT	Isodensity	1	(14%)	6	(86%)	7
	Low density	15	(18%)	70	(82%)	85
	Total	16	(17%)	76	(83%)	92

Hypo, hypo-enhancement; iso-, iso-enhancement; CEUS, Contrast-Enhanced Ultrasound:

From the 379 assessments, in 294 cases CEUS was performed for a new FLL (141 ladies - 48% and 153 men - 52%, mean age 57.4, territories 23 to 86 years. Out of the 294 cases, in 214 (72.8%) CEUS built up a positive determination, while for whatever remains of 80 cases (27.2%) the examination was not convincing. In 261 cases (88.8%), CEUS permitted the differential analysis of amiable versus harmful, while in 33 (12.2%) cases it was not decisive (Figure.2). The definitive after effects of CEUS included 129 (49.4%) benevolent and 132 (50.6%) harmful lesions.

Figure.2. CEUS enhancement pattern of a hemangioma: a) arterial phase - peripheral, nodular enhancement; b) portal phase – peripheral, nodular hyper-enhancement with a non-enhanced central area due to necrosis; c) late phase - peripheral, nodular hyper-enhancement with a non-enhanced central area due to necrosis.

4. CONCLUSION

Focal liver lesions are usually detected incidentally during abdominal ultrasound. The injection of microbubble ultrasound contrast operators enhances the portrayal of focal liver lesions that are uncertain on traditional ultrasound. The utilization of CEUS is prescribed in authority rules and recommended as a second symptomatic stride after ultrasound discovery of uncertain focal liver lesions to promptly build up the determination, particularly for considerate liver lesions, for example, hemangiomas. Contrast Enhanced US (CEUS) has turned into a dependable imaging technique for the evaluation of FLL. Coincidental lesions found on standard US must be assessed by method for distinctive imaging strategies and, in some cases, this can be a distressing occasion for the patients amid the sitting tight time for another imaging strategy (contrast CT or MRI). The use of CEUS instead of CT was considered cost-effective in the surveillance of the characterization of incidentally detected FLLs, as well as different metastatic liver lesions.

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