Abstract

Purpose. This study aimed to evaluate the diagnostic value of contrast-enhanced ultrasound (CEUS) in characterising focal liver lesions in cirrhosis and to validate its use in lesions discovered during surveillance for hepatocellular carcinoma (HCC).

Materials and methods. Between 2003 and 2006, 128 cirrhotic patients with focal liver lesions at baseline ultrasonography (US) were studied by power colour Doppler US (Doppler US) and CEUS. Serum alpha-fetoprotein (AFP) levels were assessed in all patients. Fine-needle biopsy or other reference modalities such as computed tomography (CT), magnetic resonance imaging (MRI) or digital subtraction angiography (DSA) were used as the gold standard. The accuracy of baseline US, Doppler US, AFP levels, combined US and Doppler US, and combined US and CEUS in characterising focal liver lesions was assessed. Diagnostic performance was compared using the McNemar test.

Results. A total of 207 focal liver lesions (101 benign and 106 malignant) were identified in 128 patients. CEUS sensitivity and specificity for lesion characterisation were 96.2% and 97.0%, respectively, whereas its positive and negative predictive values were 97.1% and 96.1%. CEUS accuracy was 96.6%, higher than that of US (72.0%), Doppler US (70.0%), AFP levels (65.7%), combined US and Doppler US (70.0%) and combined US and AFP levels.

Riassunto

Obiettivo. Valutare il valore diagnostico dell’ecografia con McD (CEUS) nella caratterizzazione delle lesioni focali epatiche in cirrosi, cercando di validarne l’utilizzo qualora le lesioni focali epatiche siano scoperte in corso di sorveglianza per HCC.

Materiali e metodi. Dal 2003 al 2006, 128 pazienti affetti da cirrosi con lesioni focali epatiche sono stati sottoposti ad ecografia color-power Doppler (eco Doppler) e ad ecografia con mezzo di contrasto (CEUS). In tutti i pazienti sono stati valutati i livelli di alfa-fetoproteina sierica (AFP). La biopsia ad ago sottile o altre metodiche di riferimento quali la tomografia computerizzata, la risonanza magnetica o l’angiografia (TC, RM, DSA) sono state utilizzate come gold standard. È stata valutata l’accuratezza dell’ecografia, dell’eco Doppler, del livello di AFP, dell’associazione di ecografia con il livello di AFP, dell’associazione di ecografia con eco Doppler e CEUS nella caratterizzazione delle lesioni focali epatiche. Le capacità diagnostiche sono state comparative mediante il test di McNemar.

Risultati. Duecentosette lesioni focali epatiche (101 benigne e 106 maligne) sono state riscontrate in 128 pazienti. La sensibilità e la specificità del CEUS nella caratterizzazione delle lesioni sono state rispettivamente del 96,2% e 97,0%; i valori predittivi positivo e negativo sono stati del 97,1% e 96,1%. L’accuratezza del CEUS è stata del 96,6%, più elevata dell’ecografia (72,0%).
The differences between US and CEUS were statistically significant (p<0.05).

**Conclusions.** CEUS can characterise focal liver lesions with 96.6% accuracy, a value higher than US, Doppler US, AFP levels, combined US and AFP levels and combined US and Doppler US. CEUS should therefore be used to characterise focal liver lesions detected during HCC surveillance of cirrhotic patients.

**Keywords** Contrast-enhanced ultrasonography (CEUS) · Ultrasonography (US) · Hepatic Cirrhosis · Focal liver lesions · Hepatocellular carcinoma (HCC) · Alpha-fetoprotein · Doppler US

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**Introduction**

Cirrhosis is the main risk factor for hepatocellular carcinoma (HCC) [1], the most common primary malignancy of the liver and one whose incidence has nearly doubled over the last 20 years [2–5]. The most reliable feature of HCC is hypervascularity compared with the surrounding liver during the arterial phase of contrast-enhanced imaging [6]. Ultrasonography (US) and serum alpha-fetoprotein (AFP) testing are the main screening methods for the early detection of HCC in patients with chronic liver disease and cirrhosis, even in the early stages [4, 7–11]. Although the good spatial resolution of US ensures high sensitivity in detecting focal liver lesions, the technique has less capability for characterising small lesions, particularly in the cirrhotic liver [10, 12]. In the past 10 years, hepatic US imaging has experienced a technological revolution [13] brought about by the introduction of microbubble contrast agents that have made it possible to overcome the limitations of baseline ultrasound in identifying and characterising lesions [14–20].

The purpose of this study was to assess the value of contrast-enhanced US (CEUS) in characterising focal lesions in liver cirrhosis and to attempt to validate its use in focal lesions detected in the course of HCC surveillance programmes.

**Materials and methods**

Between 2003 and 2006, 128 cirrhotic patients (80 men and 48 women; age range 21–83 years; mean age, 46) with focal liver lesions identified at baseline US were studied with colour power Doppler US (Doppler US) and CEUS. All