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The clinical impact of magnetic resonance imaging in diagnosing focal hepatic lesions and suspected cancer

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Abstract

Aims: To compare the clinical utility of contrast enhanced magnetic resonance imaging (MRI) to ultrasound (USS) and computed tomography (CT) in focal hepatic lesions (FHLs) **Methods:** This retrospective study analysed 125 consecutive iron oxide enhanced (SPIO) MRI. **Results:** MRI made a difference in 74% of patients who had USS and in 42% of patients who had a CT scan. In suspected cancer, MRI changed diagnosis in 58% and 37% (13/35), respectively. **Conclusions:** MRI is superior to other noninvasive imaging modalities for lesion identification and characterisation.

Keywords: Focal hepatic lesion; MRI; CT; USS; Cancer

1. Introduction

The term *incidental liver lesion* refers to the unexpected detection of a focal hepatic nodule in a patient. The widespread use of imaging modalities for liver investigation, particularly ultrasound, has led to an increased detection of focal hepatic lesions (FHLs), which may prompt further assessment for suspected malignancy. In addition, in patients with definitive malignancy, focal liver lesions need to be characterized in order to plan further treatment, as benign liver lesions are very common [1,2]. Liver-imaging strategies should ideally incorporate liver lesion characterisation in addition to quantifying and identifying the anatomical location of the lesion.

Several imaging modalities are now available for detection and characterisation of focal liver lesions, including ultrasonography (USS), spiral computed tomography (CT), and magnetic resonance imaging (MRI). With the appropriate use of imaging techniques, guided biopsies can be targeted to cases where malignancy cannot be excluded by imaging alone.

CT and MRI play a major role in the evaluation of FHLs, using state-of-the-art techniques and dedicated contrast agents. Since technological advances in imaging modalities and associated contrast media continue to occur, no broad consensus exists over which modality should usually be used.

Various contrast materials have been used in MRI which includes gadolinium chelate, manganese, and, more recently, tissue-specific agents such as superparamagnetic iron oxide (SPIO) particles. SPIO is taken up by the reticuloendothelial system and SPIO particles have an affinity for hepatocyte receptors [3–5]. The selective signal loss of healthy liver tissue that is produced by administration of SPIO particles enhances the lesion-to-liver contrast and thus improves the detection of liver metastases [3,4,6].

The aim of our study was to explore the clinical utility of SPIO-enhanced MRI in the characterization of FHL and to find out if it influenced the staging of cancer when compared to USS and multislice CT scan.

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2. Methods

We report a retrospective study based on 2 years over 2005–2006. The radiology computer records over a 2-year period at the Bristol Royal Infirmary were analysed for all MRI scans of the liver for hepatic lesions, and patient details were noted. In all identified patients, case notes and clinic letters were retrieved. The clinical history and examination including laboratory investigations were noted and documented. The radiological investigations and their outcomes were also documented. All decisions taken at a multidisciplinary team meeting (MDT) or an X-ray meeting were recorded. Since all patients had a MRI, it was retrospectively compared to the findings of an USS or CT or both. The degree of certainty with which the radiology report suggested a diagnosis was graded 1 to 3 (1=definite diagnosis, 2=suggestive diagnosis, 3=uncertain diagnosis). A gold standard was set against which the report of the investigation was compared to the eventual outcome. All results were recorded on a Microsoft Excel datasheet and a database was prepared. The results were evaluated on the basis of utility of MRI to add/confirm/negate the findings of the previous USS/CT scan for all lesions and whether it altered the diagnosis or made a difference in the management of these patients.

2.1. Standard comparison

Pathological diagnosis with histology either by surgical resection or a biopsy was considered as the main standard to compare the eventual or final diagnosis as reported on the USS/CT/MRI. Clinical follow-up of more than 6 months, which included a repeat radiological investigation, was the next standard when histology was not available.

2.2. MRI Technique

MRI was performed with the help of a 1.5-T imaging system (Siemens, Erlangen, Germany) by using 30 mT/m gradients and a phased-array body coil. The MR examination protocol usually involved baseline T1-weighted spin-echo, T1-weighted gradient-recalled-echo (GRE), T1-weighted GRE in-phase sequence, and T1-weighted GRE out-of-phase sequence.

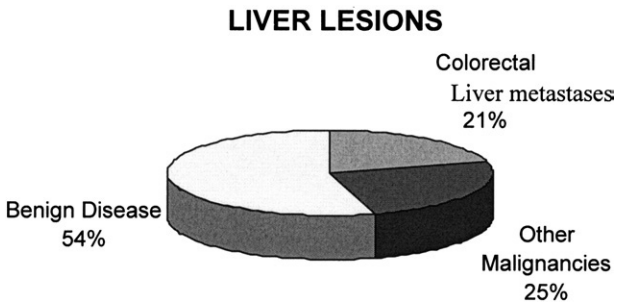

Fig. 1. Liver lesions (final diagnosis).

Table 1
Degree of certainty with which a diagnosis is made by each imaging modality

	Percentage of total		
	Definite diagnosis	Suggestive diagnosis	Uncertain diagnosis
Ultrasound (n=89)	11 (12%)	40 (45%)	38 (43%)
CT (n=50)	13 (26%)	27 (54%)	10 (20%)
MRI (n=125)	93 (74%)	31 (25%)	1 (1%)

We used Endorem as the contrast agent (SPIO). The particles were administered in a dose of 15 μmol Fe/kg. T2-weighted GRE MR images and fast (or turbo) spin-echo sequences were then obtained.

2.3. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences version 14.0. McNemar's test for binomial distribution was used to calculate the probability of observing a difference and a P value was calculated. A P value of less than .05 (P<.05) was considered statistically significant, and a P value of less than .001 (P<.001) was considered extremely significant.

3. Results

There were 125 patients who underwent MRI of the liver to characterise liver lesions.

Sixty-four (51%) of these patients were female with a median age of 49 years (range 17 to 81 years), and the remaining 61 (49%) male patients had a median age of 60 years (range 10 to 78 years). Eighty-nine (71%) of the liver lesion patients had an ultrasound scan, and 50 (40%) had a CT scan prior to having the MRI.

Out of the 125 liver lesion patients, 68 (54%) were suspected to have benign disease and 57 (46%) were under investigation for malignancy (Fig. 1).

In the benign disease group, 59/68 (86.8%) patients had an USS, 17 (25%) patients had a CT, and 14 (21%) had both USS and CT.

Twenty-six of 57 patients suspected to have cancer were under investigation for possible colorectal metastases, and of these, 19 (73%) had undergone a CT scan, 10 (39%) an US scan, and 8 (31%) had both imaging modalities performed.

Twenty (64%) of the remaining 31 'cancer' patients underwent ultrasonography and 14 (46%) had a CT.

For each imaging modality, the percentage number of scans which fell within each category of the degree of certainty was calculated and is listed in Table 1 and shown in Fig. 2. This has been calculated for all liver lesions (both benign and malignant). Based on the results of the MRI, the diagnosis and management of the patient changed in 66 out of the 89 patients who underwent ultrasonography, representing a 74% change in practice. In patients in whom a