Retrospective analysis to assess the diagnostic value and accuracy for characterisation of focal lesions with contrast enhanced ultrasound (CEUS)

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Background

The characterisation of focal abdominal lesions has traditionally been performed using contrast enhanced computed tomography, magnetic resonance imaging and histological diagnosis. In combination, the results yielded have a high level of diagnostic accuracy. While biopsy and histological assessment are still considered the gold standard, imaging, in particular contrast enhanced MRI, has become an integral part and sometimes replaced histology in the diagnosis and staging of certain disease processes, for example hepatocellular carcinoma. However, there is increasingly robust evidence of the pivotal role of contrast enhanced ultrasound (CEUS) in characterisation of such lesions (1).

CEUS was developed to overcome the limitations of conventional Doppler & B-mode ultrasound and to utilise the enhancement characteristics of focal liver lesion which are more traditionally assessed using CT and MRI. In recent years, there has been significant experience gained as well as technological improvements, in this technique.

Aim

The aim of this study was to assess the diagnostic accuracy for characterisation of focal lesions using CEUS by comparing the findings of those on CT/MRI & histology.

Method

The Radiology Information System database was searched and identified all patients within the Newcastle Upon Tyne NHS FoundationTrust who had a CEUS performed between January 2014 & December 2016.
Initially 589 studies were identified; however, 201 of those were excluded as they were not relevant to this study.
Patient demographics, CEUS reports as well as biopsy results (if performed) and follow up MRI and CT findings (if performed) were collected.
A total of 125 CEUS studies also had further imaging (CT/MRI) and histology. Concordance between the CEUS findings with histological diagnosis and CT/MRI follow up was assessed.
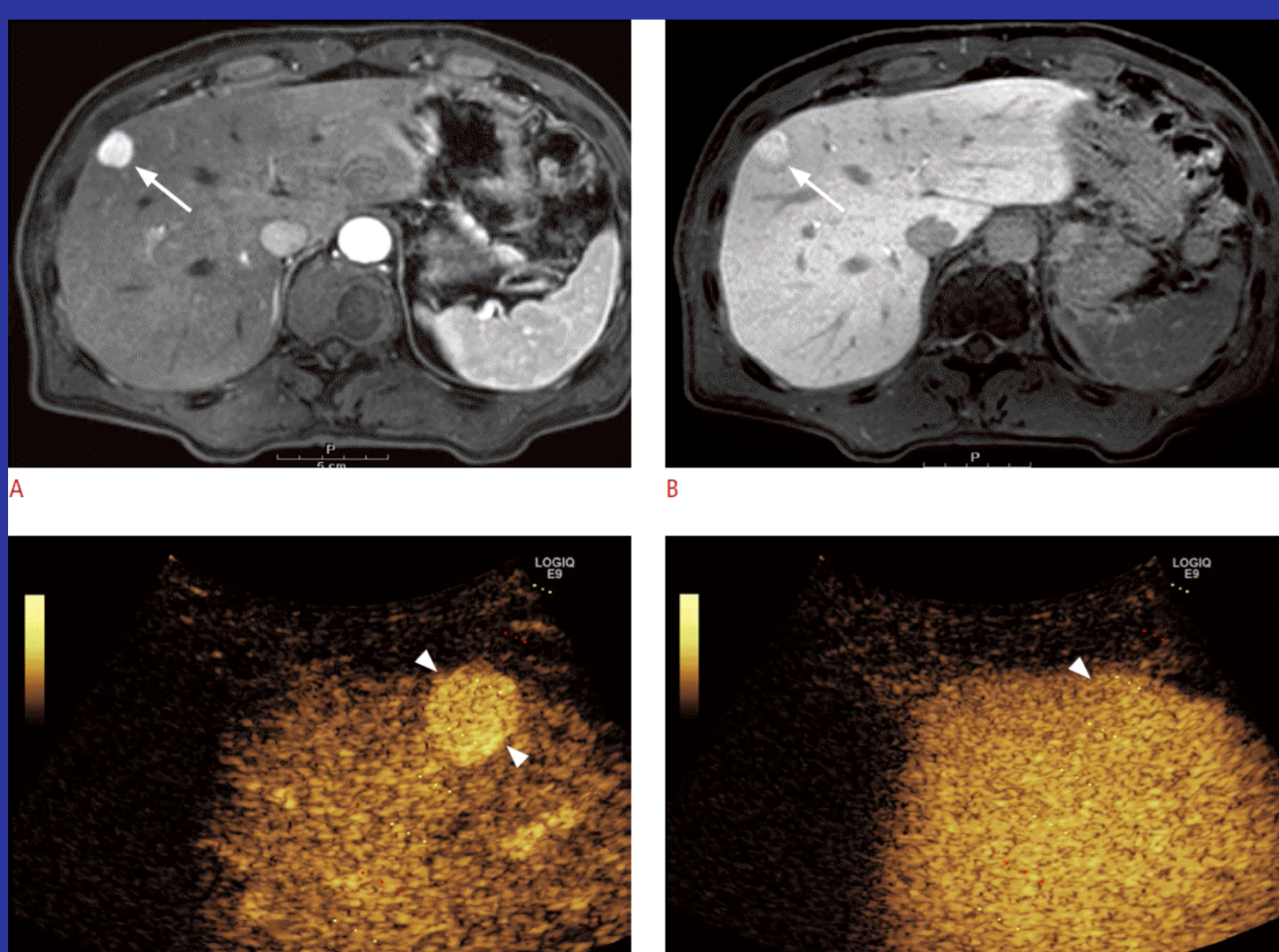

Figure 1.0
Focal liver lesion in the right lobe of the liver – demonstrating high T1 signal and post gadolinium enhancement on MRI.

On CEUS, the lesion enhances in the arterial phase and is iso-echoic on delayed imaging (2)

Results

A total of 333 CEUS studies were analysed – 291 of these offered a definitive diagnosis.
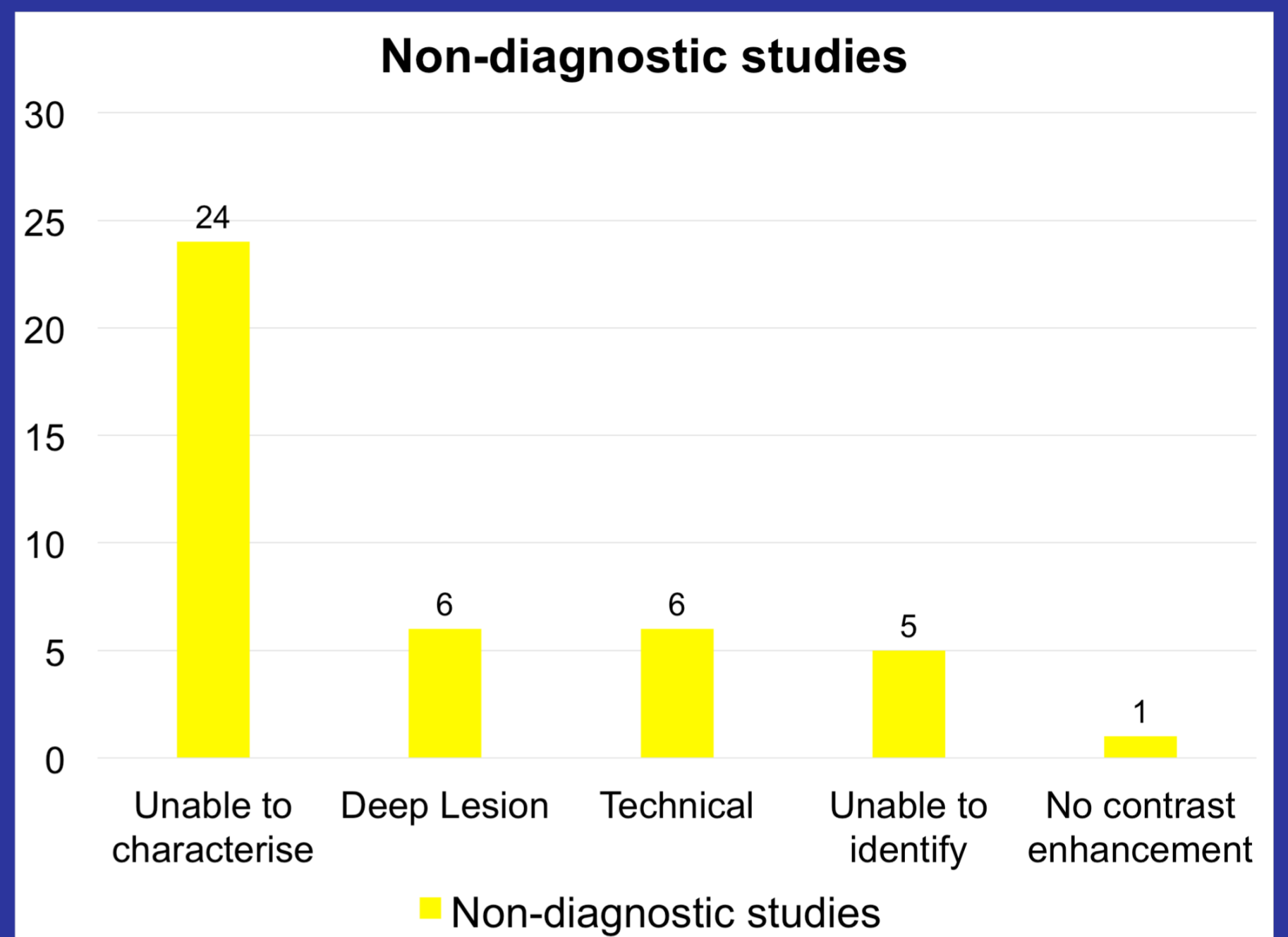192 benign lesions and 109 malignant lesions were identified.

Figure 2.0: A summary of non diagnostic studies

125 of the 301 conclusive studies had further subsequent histological and radiological characterisation (CT+MRI). The positive predictive value was 90% and the negative predictive value was 95%, with a sensitivity of the CEUS findings concurring with further imaging and histology of 97% and a specificity was 84%.

Conclusion

- In this study, CEUS demonstrated an excellent specificity and sensitivity for the detection of focal lesions. CEUS, when technically feasible, can be used as a surrogate for contrast enhanced CT & MRI in the assessment of focal liver lesions and it can play a fundamental role in their identification and characterisation.
- CEUS offers a highly cost effective option for the characterisation of straight forward lesions such as haemangiomas.
- CEUS is a highly sensitive technique (97%) with excellent negative predictive value (95%). It should be used as the initial investigation in focal liver lesions to determine benignity and avoid unnecessary additional investigations.
It can also be used as a good surrogate for other radiological investigation in characterising liver lesions, particularly in those with contraindications for other tests such as renal impairment.

References
(1) Contrast enhancement ultrasound application in focal liver lesions, Dietrich CF, Mertens JC, Braden B, Schuessler G, Ott M, Ignee A , Hepatology, Vol 45,NO5, 2007
(2) Contrast-enhanced ultrasonography: advance and current status in abdominal imaging, Ultrasonography 2015; 34(1): 3-18, Chung YE, Kim KW
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