Characterization of a hepatic haemangioma with contrast-enhanced ultrasound in an infant

Marta Anna Piorkowska, Rok Dezman, Maria E Sellars, Annamaria Deganello and Paul S Sidhu

Ultrasound
2018, Vol. 26(3) 178–181
© The Author(s) 2017
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/1742271X17733298
journals.sagepub.com/home/ult

Abstract

Focal liver lesions are uncommon in the paediatric population, majority are benign but need to be clearly identified as benign. Contrast-enhanced ultrasound has recently received approval for paediatric hepatic use and represents an inexpensive and safe alternative to computed tomography and magnetic resonance imaging for focal liver lesion characterization. We report a case of an incidental focal liver lesion in a four-month-old infant, indeterminate on B-mode ultrasound but successfully characterized with contrast-enhanced ultrasound as a haemangioma, without recourse to other imaging techniques, and with minimal patient discomfort.

Keywords

Contrast-enhanced ultrasound, focal liver lesion, haemangioma, paediatrics

Date received: 18 July 2017; accepted: 26 August 2017

Introduction

Focal liver lesions (FLLs) are usually incidental findings during an abdominal ultrasound (US) examination. The prevalence of FLL in adult population is estimated at 18.4% and they are nearly always benign.¹ However FLLs are a rare finding in the paediatric population. The main diagnostic goal is differentiating benign lesions, which require no further workup, from potentially malignant lesions. B-mode US findings are not always conclusive in the paediatric population and further characterization is considered essential requiring either computed tomography (CT) or magnetic resonance (MR) imaging for confident FLL characterization. These modalities have significant disadvantages for use in paediatric population. Contrast-enhanced ultrasound (CEUS) is a recognized method for FLL characterization in adults² and has recently been approved for paediatric hepatic use by the Food and Drug Administration (FDA) in the United States. With the lack of ionizing radiation, and absence of necessary sedation, CEUS presents a

safe and pragmatic alternative to CT and MR imaging in FLL characterization in paediatric population. We report a case where an indeterminate FLL in a four-month-old infant was successfully characterized on CEUS obviating the need for any further imaging.

Description of the case

A five-week-old previously healthy male infant presented to Accident and Emergency Department with projectile vomiting. The clinical examination and the laboratory findings were unremarkable. The baby was born at term and there were no labour-related complications. No significant antenatal or family history was

King's College Hospital NHS Foundation Trust, London, United Kingdom of Great Britain and Northern Ireland

Corresponding author:

Marta Anna Piorkowska, King's College Hospital NHS Foundation Trust, London SE5 9RS, United Kingdom of Great Britain and Northern Ireland.
Email: m.piorkowska@nhs.net

Figure 1. B-mode US appearance of the focal liver lesion. The liver demonstrates a 22 × 21 mm well-defined, round focal liver lesion, mostly hyperechoic but with marked heterogeneity (between cursors).

Figure 2. Colour Doppler US appearances of the liver lesion. The colour Doppler US shows no central colour Doppler signal within the lesion.

identified. A possible diagnosis of pyloric stenosis was made and an abdominal US performed. There were no US signs of pyloric stenosis; however, an incidental liver lesion in the right lobe was noted on B-mode US. The lesion measured 22 × 21 mm, was rounded, well defined and predominantly hyperechoic with heterogeneity (Figure 1). The colour Doppler US examination showed no increased vascularity within the lesion (Figure 2). The background liver showed no evidence of parenchymal disease and the remaining abdominal viscera were normal. The appearance of the FLL was regarded as non-specific and further characterization was advised.

CEUS was performed at the age of four months for further evaluation. Following intravenous application of 0.6 ml of the US contrast agent SonoVue (SonoVue™, Bracco, SpA, Milan), the lesion exhibited peripheral nodular enhancement in the arterial phase (Figure 3(a)), followed by progressive centripetal fill-in pattern in the early portal venous phase

(Figure 3(b)), and with gradual in-filling in the late portal venous phase (Figure 3(c) and (d)). No wash-out of contrast was observed. The CEUS appearances were thought diagnostic of a hepatic haemangioma, as commonly described in the adult population.² The child had a follow-up US examination at six weeks, and this demonstrated no change in lesion size and appearance, confirming the benign nature of the lesion and the diagnosis of haemangioma. No further imaging with CT or MR was thought necessary with continued onward surveillance with B-mode US only.

Discussion

We present a case of a successful FLL characterization with the use of CEUS in a four-month-old infant, allowing for confident surveillance with US only without recourse to CT and MR imaging, reducing morbidity associated with these imaging techniques. The appearances on CEUS of an infantile haemangioma mirror the classical appearances seen with adult haemangioma.

FLLs are extremely uncommon in the paediatric population and whilst the majority are benign (approximately 66%), any malignant lesions need to be identified.³ Most common benign paediatric liver tumours include haemangiomas and mesenchymal hamartomas. The most common malignant liver tumours are metastases from a variety of primary malignancies, including neuroblastoma, Wilm's tumour, rhabdomyosarcoma and lymphoma, whilst the most common primary liver malignancy is a hepatoblastoma.

Haemangiomas are benign vascular tumours usually identified within the first six months of life.⁴ They can vary from small incidental findings to large lesions. Haemangiomas are a heterogeneous group divided into hepatic infantile haemangiomas and congenital hepatic vascular malformations with associated capillary proliferation (HVMCP). The first type is a true neoplasm and often presents as multiple masses that show rapid progression in size. Commonly, involution and regression in the first two years of life is seen. If the neonatal hemangiomatosis is diffuse, including skin and liver manifestations, the prognosis is less advantageous, due to an increased risk of haemorrhage. The second type corresponds to the common adult liver lesion usually simply referred to as haemangioma.⁴

B-mode US is often the first imaging modality used for evaluation of FLL in the paediatric population, but the differentiation between benign and malignant lesion is not always possible.¹ Although in a haemangioma, the endothelial-lined vascular spaces constitute multiple interfaces producing a characteristic hyperechoic appearance on B-mode US, the B-mode US appearances may vary. It is suggested that lesions with the classical appearance and measuring less than 3 cm require no further

Figure 3. CEUS appearances of the liver lesion. Enhancement pattern of the lesion following intravenous application of 0.6 ml of US contrast agent SonoVue (SonoVue™, Bracco, SpA, Milan) is shown. Peripheral nodular enhancement was noted 12 seconds after injection (a), followed by progressive centripetal fill-in pattern at 21 seconds (b) and 52 seconds (c). Almost complete infilling and no contrast washout was seen in the late portal venous phase (150 seconds) (d).

imaging. Large haemangiomas often have complex US appearances whilst, and on a background of a fatty liver, a haemangioma may appear hypoechoic. This places the examiner in a difficult position as the differential diagnosis for heterogeneous or hypoechoic liver lesions on US is broad and includes primary benign and malignant tumours as well as metastases.⁴

Characterization of FLL in paediatric patients traditionally has depended on contrast-enhanced computed tomography (CECT) or contrast-enhanced magnetic resonance imaging (CEMRI), both having significant disadvantages. CT is a major source of ionizing radiation, which is a concern in the adult population, but poses a significant issue in the paediatric population, with the potential cumulative dose from multiple follow-up examinations building up.⁵ Iodinated contrast that nearly always is a part of CT imaging is a risk; contrast-induced nephropathy (CIN) is important. CIN is currently one of the leading causes of hospital-acquired acute kidney injury in adults and best avoided in children.⁶ MR imaging lacks ionising radiation, but in children has multiple limitations. MR examination in paediatric patients (and CT imaging in infant patients) invariably requires sedation or general anaesthesia, limiting the practicality of the examination and carrying

inherent risks. Recent studies have raised concerns regarding exposure to general anaesthetics during childhood and its potential association with an increased risk for deficits in learning, memory and cognition.⁷ Recently reported accumulation of gadolinium-based contrast agents in the brain is also of a concern in paediatric MR imaging.⁸

CEUS is an imaging modality that is widely used in adults and has an established role in FLL evaluation. Guidelines for hepatic and non-hepatic use have been issued by the European Federation of Societies in Ultrasound in Medicine and Biology (EFSUMB).^{2,9} At present, the contrast agent SonoVue™ is used off-label in Europe in children (<18 years), but has been approved by the FDA for FLL characterization in paediatric population.¹⁰ CEUS accuracy in characterization of FLL in adult and paediatric populations has been proven to be comparable with CECT and CEMRI in large studies.^{11,12}

US contrast agents are safe since their components (sulphur hexafluoride lipid-type A microsphere with a phospholipid shell) are essentially inert. A large study of CEUS with second-generation contrast agent SonoVue™ in adults showed an extremely low prevalence of side effects (0.0086%). Most of the side effects reported were mild or moderate and no deaths related

due to the use of the contrast agent were observed.¹³ Use of CEUS has also been reported to be safe in paediatric patients. A recent safety analysis of 305 paediatric patients undergoing CEUS examination revealed only two potential adverse reactions, transient hypertension and transient tachycardia. None of these reactions were symptomatic and no serious adverse reactions were recorded.¹⁴ A recent analysis of the use of SonoVueTM in paediatric population has also confirmed its safety.¹⁵

Conclusion

CEUS presents a perfect imaging modality for FLL characterization in children. The successful characterization of a FLL as a haemangioma in the presented case eliminated the need for secondary imaging (CT or MR) and eliminated the potential associated risks.

CEUS is a well-established imaging modality for characterization of FLL in adults with a growing role in paediatric imaging. Lack of ionizing radiation or the need for sedation makes this modality ideal for use in children. The safety of the procedure has been proved in adult and paediatric population and we believe that CEUS will be an imaging modality of choice for characterization of FLL in adult and paediatric patients.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics approval

Consent was obtained from the parents of this infant for publication of this case report.

Guarantor

Paul S Sidhu.

Contributors

N/A.

References

- Willits I, Burn J, Cole H, et al. What proportions of focal liver lesions detected by unenhanced ultrasound are inconclusive? *Ultrasound* 2015; 23: 78–84.
- Claudon M, Dietrich CF, Choi BI, et al. Guidelines and good clinical practice recommendations for contrast enhanced ultrasound (CEUS) in the liver – update 2012. *Ultraschall in Med* 2013; 34: 11–29.
- Meyers RL. Tumors of the liver in children. *Surg Oncol* 2007; 16: 195–203.
- Chiorean L, Cui X-W, Tannapfel A, et al. Benign liver tumors in pediatric patients – review with emphasis on imaging features. *World J Gastroenterol* 2015; 21: 8541–8561.
- Brenner DJ and Hall EJ. Computed tomography – an increasing source of radiation exposure. *N Engl J Med* 2007; 357: 2277–2284.
- Verghese P. Contrast nephropathy in children. *J Pediatr Intensive Care* 2015; 3: 045–052.
- Vlisides P and Xie Z. Neurotoxicity of general anesthetics: an update. *Curr Pharm Des* 2012; 18: 6232–6240.
- McDonald RJ, McDonald JS, Kallmes DF, et al. Intracranial gadolinium deposition after contrast-enhanced MR imaging. *Radiology* 2015; 275: 772–782.
- Piscaglia F, Nolsoe C, Dietrich CF, et al. The EFSUMB guidelines and recommendations on the clinical practice of contrast enhanced ultrasound (CEUS): update 2011 on non-hepatic applications. *Ultraschall in Med* 2012; 32: 33–59.
- Sidhu PS, Cantisani V, Deganello A, et al. Role of contrast-enhanced ultrasound (CEUS) in paediatric practice: an EFSUMB position statement. *Ultraschall der Medizin – Eur J Ultrasound* 2017; 38: 33–43.
- Seitz K, Strobel D, Bernatik T, et al. Contrast-enhanced ultrasound (CEUS) for the characterization of focal liver lesions – prospective comparison in clinical practice: CEUS vs. CT (DEGUM multicenter trial). *Ultraschall Med* 2009; 30: 383–389.
- Seitz K, Bernatik T, Strobel D, et al. Contrast-enhanced ultrasound (CEUS) for the characterization of focal liver lesions in clinical practice (DEGUM Multicenter Trial): CEUS vs. MRI a prospective comparison in 269 patients. *Ultraschall Med* 2010; 31: 492–499.
- Piscaglia F and Bolondi L. The safety of Sonovue in abdominal applications: retrospective analysis of 23188 investigations. *Ultrasound Med Biol* 2006; 32: 1369–1375.
- Yusuf GT, Sellars ME, Deganello A, et al. Retrospective analysis of the safety and cost implications of pediatric contrast-enhanced ultrasound at a single center. *Am J Roentgenol* 2017; 208: 446–452.
- Rosado E and Riccabona M. Off-label use of ultrasound contrast agents for intravenous applications in children. Analysis of the existing literature. *J Ultrasound Med* 2016; 25: 487–496.