SAMSUNG

The Clinical Practice Review

CEUS as a problem solving tool in clinical practice.

RS80A with Prestige

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How to use CEUS as a problem solving tool in clinical practice? A series of case studies for best practice.

- Prof. Paul S. Sidhu EFSUMB President Elect (2015 – 2017)

Introduction

A B-mode sonographic examination is normally the first line investigation in a number of clinical scenarios in the assessment of abdominal symptoms, particularly in the presence of abnormal liver function biochemical profile. In addition, investigation of the renal tract, particularly in acute renal impairment, nearly always commences with a sonographic examination of the kidneys. However, in the current climate of rapid advancement and availability of superb diagnostic imaging techniques, and in particular the demand for axial imaging with Computed Tomography (CT) and Magnetic Resonance (MR) imaging to facilitate the diagnostic patient pathway, sonography is perceived by many physicians to take a "back-seat" when a diagnosis is paramount. Both CT and MR imaging are inherently more expensive than a sonographic examination, with recognised patient morbidity related to ionising radiation, iodinated contrast administration[1] with well documented anaphylactoid reactions and the largely uncharted long term effects of gadolinium administration[2]. All the more pertinent in the investigation of the paediatric patient; the CT examination involves a radiation dose, an important issue with the younger patient, as an accumulative radiation dose potentiates malignancy[3,4].

Previously sonographic examinations were performed without the addition of a contrast agent, but the widespread availability of sonographic contrast microbubbles, a safe, rapid and dynamic real-time method to "problem-solve" at the patient's bedside is at hand.

A sonographic examination has limitations, when the patient's body habitus precludes visualization of the abdominal structures, organs cannot be clearly and fully examined. Bowel gas and calcification prevents examination of structures deep to these areas and therefore an abnormality easily seen on CT cannot be visualised. However, with the inherent superior spatial and temporal resolution of a sonographic study, in comparison to CT and MR imaging, when you do appreciate an abnormality with sonography, you visualise it in more detail than with CT or MR imaging. This combined with the temporal ability of continuous scanning without harmful patient effects, facilitates more detailed examination of an abnormality, albeit at the cost of increased physician time and availability, often necessitating newly acquired skills. Both CT and MR imaging rely on the administration of contrast to aid diagnosis; in nearly every circumstance a CT examination is performed with iodinated contrast to be interpretable.

It would be beneficial to the patient, as well as logical, that if an abnormality is present on the initial sonographic examination, microbubble contrast is administered to obtain information that would negate the need for further, more expensive and potentially harmful imaging. Conversely, if an abnormality, for example an incidental focal liver lesion, is identified on a CT examination, protocoled

incorrectly for contrast administration, this can be further examined with a microbubble contrast examination, potentially confirming benign disease and removing the need for another CT examination. The introduction of microbubble contrast agents has improved the characterization of focal liver lesions to such a level to rival CT and MR imaging[5] recognised in current guidelines[6]. In patients referred from the community or without known underlying primary malignancy elsewhere, a focal lesion in the liver is benign nearly 80% of the time[7]. The addition of a microbubble contrast agent immediately, as an adjunct to the B-mode sonographic examination has tremendous benefits in terms of diagnosis, alleviating patient anxiety, planning of management and is also cost effective[8].

Microbubble contrast administration would also be useful when an incidental renal abnormality is not fully characterised by CT imaging, use of microbubble enhanced sonography prior to MR imaging may provide the diagnosis[9]. Furthermore, in routine sonographic directed intervention, the addition of a microbubble contrast agent clearly depicts the distinction between vascularised and non-vascularised tissue to facilitate needle placement, and safe deployment of a drainage catheter in an abscess collection. This is again particularly relevant to the management of tumours during percutaneous tumour ablation, combined with fusion imaging[10].

Figure 1A Figure 1B

Although the administration of the microbubble agent needs the insertion of an intravenous line, and a second trained person to inject the agent, the whole examination requires no more than 5 minutes of extra examination time. The safety profile of the microbubble contrast agent used most often in Europe and Asia for the detection and characterisation of focal liver lesions is SonoVue/Lumason™ (BraccoSpA, Milan), and has an excellent safety profile, with an adverse incident rate of 0.0086%[11].

A series of cases are detailed, where the addition of a microbubble agent has facilitated the management of the patient, with little disruption to the management of the work flow of the sonographic department.

Case I

A 44 year old patient with a liver transplantation following chronic autoimmune hepatitis.

The patient recovers well following the transplantation, but by day12 post-transplantation has rapidly worsening liver biochemical profile, and is returned to the intensive care unit for management. Previous sonographic examinations had demonstrated no abnormalities of note. A bed-side sonographic examination demonstrates a heterogeneous right liver lobe lesion (arrowhead), a right pleural effusion and an incidental pleural lesion (arrow) (Fig. 1A). A colour Doppler sonographic examination fails to identify the hepatic artery, with good vascular flow in the portal vein. There is no vascularity present in the previously imaged heterogeneous right lobe lesion (Fig. 1B). A microbubble contrast examination was performed, with no enhancement along the line of the expected course of the hepatic artery (arrows)[12] (Fig.1 C). The right lobe liver lesion demonstrates minor patchy enhancement (arrow) in the late portal venous phase, and the pleural based nodule demonstrates normal benign enhancement consistent with a fibroma. The sonographic examination has been able to identify hepatic artery occlusion at the bedside, and an area of hepatic necrosis with poorly vascularised liver parenchyma in a focal distribution. The entire examination was performed in less than 5 minutes.

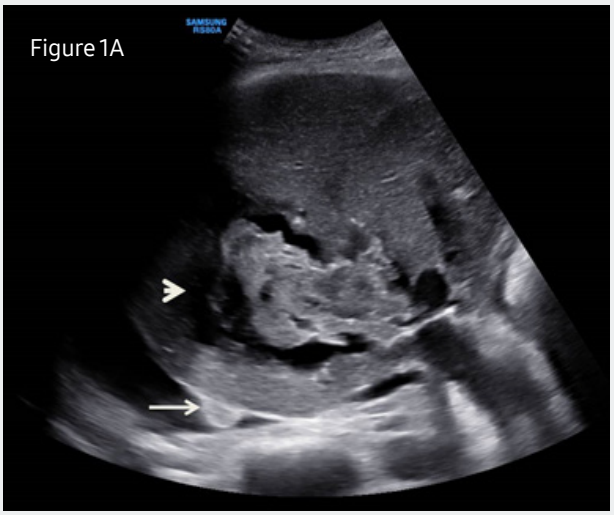
Figure 1A

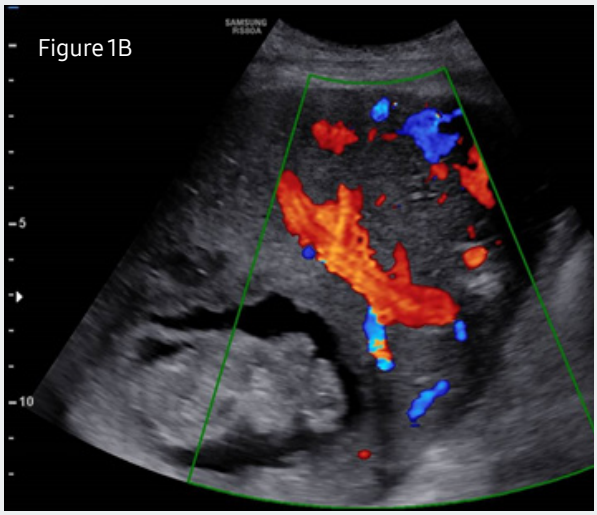
Figure 1B

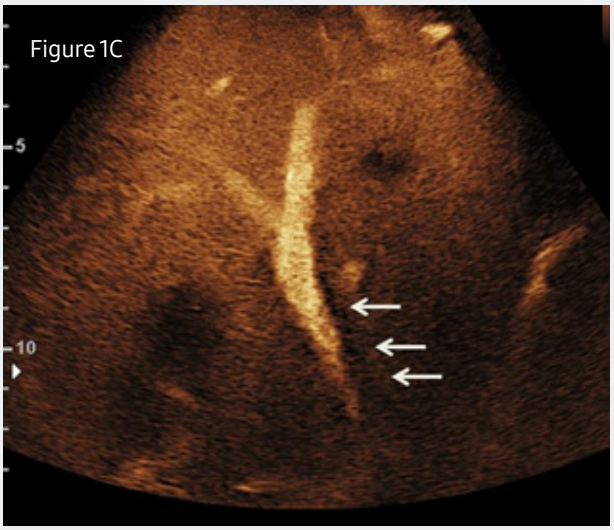
Figure 1C

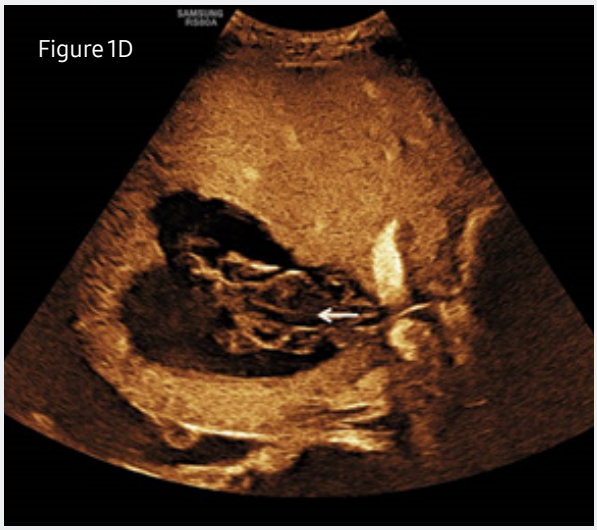
Figure 1D

Case II

An 80 year old patient with an obstruction of the left kidney with an in-dwelling nephrostomy catheter placed percutaneously

An elderly patient admitted to the intensive care unit following insertion of a percutaneous nephrostomy catheter for an obstructed left kidney. An intensive care unit sonographic examination was performed 5 days following the nephrostomy procedure as the patient was still too unstable to transport for imaging unnecessarily. The sonographic examination was requested for the functioning of the nephrostomy catheter, the status of the underlying kidney. A B-mode sonographic examination confirmed the absence of continuing kidney obstruction (Fig.2A). Microbubble contrast was than administered via the in-dwelling nephrostomy catheter, diluted as previously described[10], to demonstrate the pelvicalyceal system (Fig. 2B). The microbubbles could be seen filling the dilated upper ureter, and a calibre change in the mid-ureter noted (arrow) indicating an area of ureter abnormality (Fig. 2C), possibly from previous inflammation following a known history of renal calculus. The microbubble contrast could then be visualised in real-time entering the bladder, allowing for the in-dwelling nephrostomy catheter to be safely removed with established normal functioning (Fig. 2D). The examination was performed in under 10 minutes.

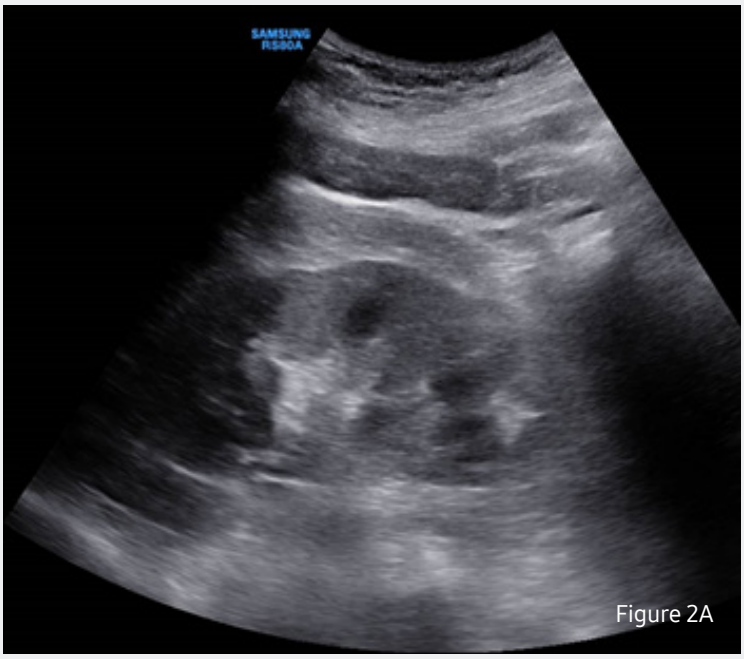

Figure 2A

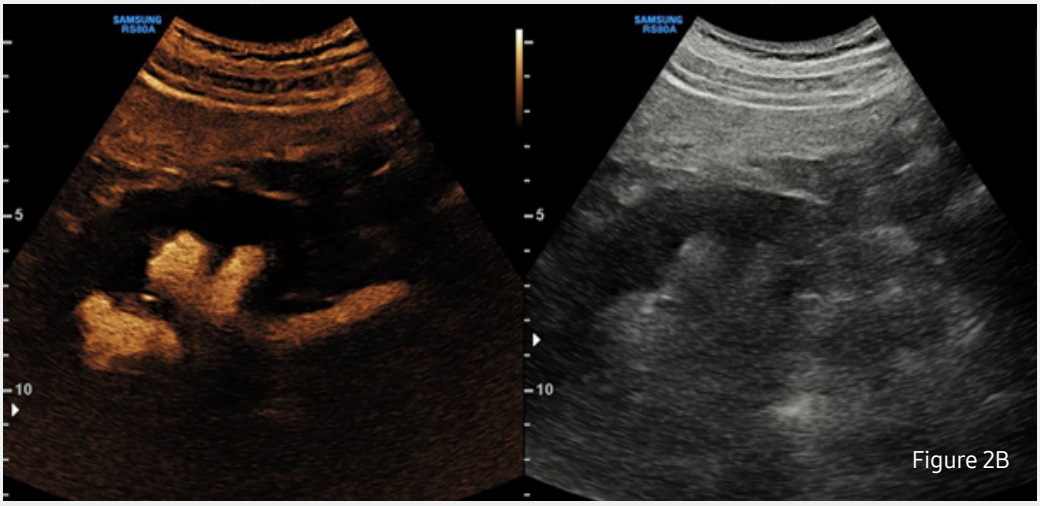

Figure 2B

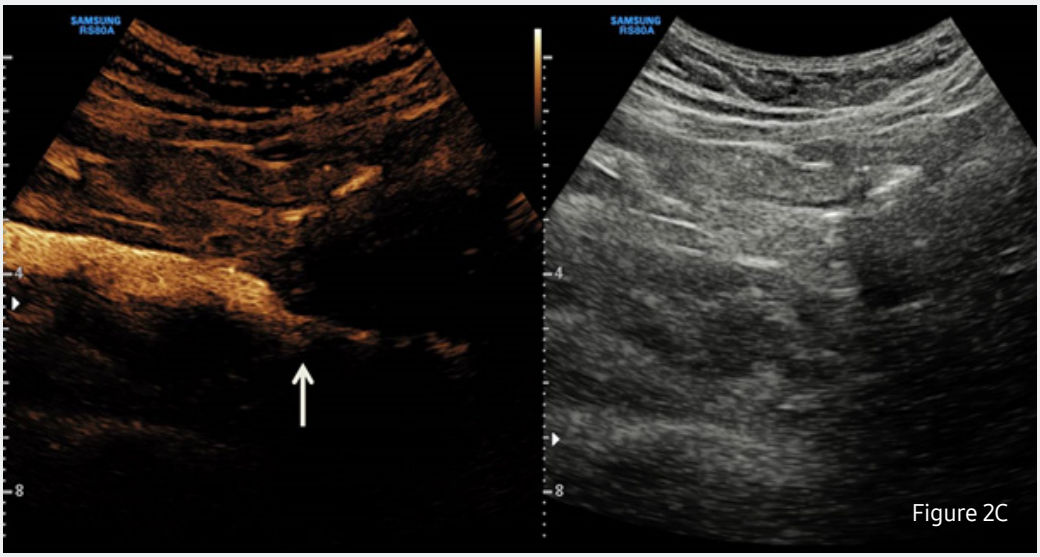

Figure 2C

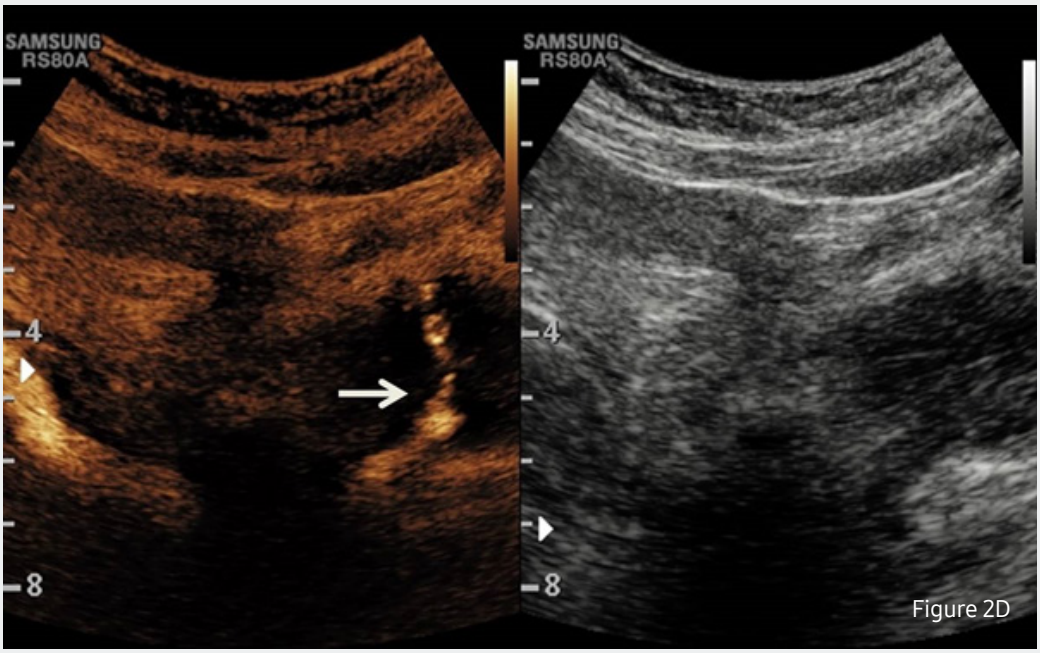

Figure 2D

Supported Systems

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Samsung Satellite Symposium

Date Friday, March 3 Time 12:30 - 13:30
Venue Studio 2017, First Level

TOPIC

Contrast-enhanced ultrasonography:
Advances and current status in medical practice

Program

Time	Title / Speaker
12:30 - 12:50	New tools in Multiparametric ultrasound from guidelines to clinical practice **Prof. Vito Cantisani** Sapienza University of Rome
12:50 - 13:10	Pediatric CEUS Indications and Cost Effectiveness **Dr. Maria Sellars** King's College London
13:10 - 13:30	CEUS as a problem solving tool in clinical practice **Prof. Paul S. Sidhu** King's College London

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