Echo enhancing agents in ultrasound

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Echo enhancing micro bubble agents show great promise for blood pool imaging in diagnostic ultrasound.[1] Their applications include vascular enhancement of both large vessels such as the renal and carotid arteries as well as small arteries in the kidneys, brain and liver. They are being used as contrast agents in hysterosalpinography, micturating cystourethrograms and as oral contrast agents. Targeted echo enhancers have been used to delineate thrombus and the endocardial lining of the heart.[1]

These micro bubbles are a few microns in diameter and they resonate extremely well with 3-10mhz transducers used in diagnostic ultrasound. This resonance causes extensive cross sectional scattering and excellent reflectivity. The micro bubbles are small enough to pass through the pulmonary capillaries allowing arterial enhancement via intravenous injection.

There are three generations of micro bubble agents.[2] The first generation agent has a very short life of a few seconds. Echovist (Schering) is such an example. In second generation micro bubbles a stabilizing agent (palmitic acid) is added to increase the intravascular half life and produce ultrasound detected vascular enhancement. Levovist (Schering) and Albunex (Nycomed) are examples.[3,4] The third generation of micro bubbles have greater intravascular stability and life and higher reflectivity. These include Echogen (Sonus), NUS (Nycomed) and SHU 563A (Schering).[5]

Practical applications will be initially limited to colour flow ultrasound but the third generation agents have such significant reflectivity that they may be used with grey scale as well. Promising applications include:

- transcranial imaging of cerebrovascular disease and vascular tumours such as meningiomas
- examination of breast masses by evaluating tumour perfusion
- diagnosis of coronary artery disease by documenting perfusion defects
- improved ultrasound diagnosis of liver, spleen, kidney, prostate, testicular and thyroid tumours (Figures 1a and 1b)

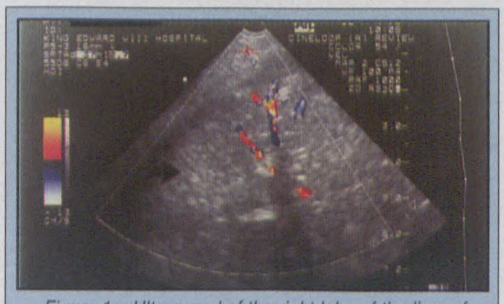

Figure 1a: Ultrasound of the right lobe of the liver of a 60 year old man with RUQ pain demonstrates an ill defined echogenic mass (arrow).

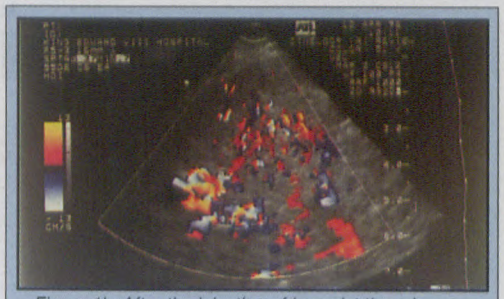

Figure 1b: After the injection of Levovist there is a marked intratumoral enhancement of the mass confirming its hypervascularity (arrow). This was confirmed to be a hepatoma.

- improved visualisation of blood flow in carotid, vertebral, renal and peripheral arteries

Echo enhancing agents will be particularly useful to enhance Doppler signals which are very weak or difficult to obtain or in situations of very slow blood flow. In situations of slow flow such as critical carotid stenosis, enhancement of a weak signal will be very helpful to distinguish between critical stenosis and total carotid occlusion.

The first micro bubble contrast agent to be approved by the Medicines Control Council will be on the market in South Africa later this year. Cost may be a critical factor in their initial acceptance.

References

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