

Regional anaesthesia is quicker, safer and mo...

Point-of-care ultrasound

Ultrasound guidance has proven invaluable for the regional neurosurgical centre at the Salford Royal Hospital, helping to improve safety, save time and enhance the patient experience. Here, Jim Corcoran, consultant neuroanaesthetist and clinical director for perioperative care at the hospital, outlines the uses of this technique.



When I joined the Salford Royal in 2006, my initial interest in ultrasound grew out of a need to alleviate the delays experienced by trauma patients needing a cardiac echo. Training opportunities for regional anaesthesia in the North West were very limited, but we realised that training clinicians to use point-of-care (POC) echo could significantly reduce delays in excluding aortic stenosis. At the same time, we took the opportunity to introduce training on the use of ultrasound for regional anaesthesia.

Interest in this field has grown considerably since then, and for the past nine years we have worked with Fujifilm SonoSite to run twice-yearly courses in ultrasound-guided regional anaesthesia.

Before ultrasound guidance became commonplace, regional

anaesthesia was performed using nerve stimulators. Although this worked, the procedure wasn't slick. Ultrasound offers an improved way of administering the anaesthetic, which is quicker, safer and more comfortable for the patient. It allows you to visualise the nerve, giving assurance that the needle is correctly positioned, and gives you confidence that the block will work; there is always a degree of uncertainty if ultrasound is not used.

We can also dramatically reduce the amount of anaesthetic used with ultrasound-guided procedures, decreasing the likelihood of side effects. Whereas previously 30 or 40 ml of anaesthetic would be injected – because it was hard to target a specific area with certainty – you now know exactly where the needle is, and can see the anaes-

thetic spreading across the area. As a result, as little as 10 to 20 ml of anaesthetic is required, which is a huge reduction.

Today, we use ultrasound-guided regional anaesthesia for both awake surgery and analgesia, for example, interscalene blocks for patients having shoulder surgery under general anaesthesia. Regional anaesthesia has totally transformed shoulder surgery, significantly reducing the length of patient stays. Ten years ago, patients were admitted for one or two days, but subacromial decompressions, for example, are now treated as day cases, and even a shoulder replacement is only an overnight stay.

I also use ultrasound to place catheters in some of the more challenging shoulder replacement cases, which makes a big difference; the interscalene groove is a difficult area, and knowing the exact location of the needle is really important.

The efficiency of our hand sur-

Versatile invention tackles several routine exams

4G CMUT – opening the door to the next stage in ultrasound

Holding Hitachi's newest ultrasound probe in your hand, it looks and feels like any other ultrasound transducer. Yet, you are actually holding a marvel of ultrasound engineering, a true break-through in transducer architecture that performs so well across so many types of exams that you may never want to let it go,' the manufacturer reports.

Hitachi's next generation linear matrix transducer is the first and only commercially available in daily practice. Capacitive Micro-machined Ultrasound Transducer (CMUT), a technology so advanced that the

inventors at the prestigious Stanford University in Palo Alto, California could take it no further than a prototype. After more than 12 years' work, the engineers at the Hitachi Ultrasound Research & Development Centre, in Tokyo, overcame the technical challenges to bring this innovative probe into daily practice.

No switch from high to low frequency sessions

'The most important thing about this new transducer is that clinicians no longer need to switch probes between high frequency and low

frequency sessions,' said Hiroki Tanaka, one of the lead developers. 'Physicians can now use Hitachi's 4G CMUT for superficial examinations of the breast, for example, by applying a high frequency; then with this same probe, they can perform low frequency exams of the abdomen, liver or pancreas, for example. With this one probe, they can cover almost all applications in daily routine.'

Introduced at the 2017 European Congress of Radiology, the Hitachi 4G CMUT is actually the fourth generation of this technology, he pointed out.

Hitachi released the first-ever CMUT in 2009, which could generate excellent B-mode images using low power, but which limited its application primarily to breast exams.

The next generation offered an increased bandwidth, enabling higher two-dimensional quality with Tissue Harmonic Imaging and an increased sensitivity for Doppler and Colour Doppler to image blood flow.

The new linear matrix probe expands even further the bandwidth capacity to a range from 22 MHz down to 2 MHz, the low frequency needed to examine deeper structures in the human body.

All on a single wafer

Open up any other ultrasound transducer and you will find hard ceramic crystals that have been hard-wired to generate and receive sound waves. Inside the CMUT you will find a soft membrane embedded with electrodes that vibrate to transmit an ultrasound signal.

The break-through with 4G CMUT is the micro-machined architecture on a silicon wafer. The membrane is less than three microns thick and behind this is a cavity of just 100 nanometres. The transducer array is constructed by combining a large number of these CMUT cells.

'The CMUT membrane is very close to the human body for its softness,

so the ultrasound pulses smoothly from the probe and through the human body,' Tanaka explained. 'This architecture is more direct and precise with no deflection using very short pulses with no refraction wave. Because it transmits broadband, all frequencies are sending pure signals and nothing gets lost.'

Hitachi engineers also solved the problem of applying high power levels to the CMUT cell, an achievement that has created a stir in the engineering community and has further enhanced the reputation of Hitachi as the most innovative developer in the field of ultrasound, the com-

pany points out. 'Hitachi released the world's first diagnostic ultrasound system in 1960, the world's first real-time colour flow Doppler in 1983, and invented ultrasound elastography in 2003.'

With high-energy pulses, the 4G CMUT is able to generate higher amplitude signals, which allow Tissue Harmonic Imaging thanks to yet another Hitachi innovation for modulating the amplitude, the company adds. In addition, matrix array allows control of the short axis focus and to

One probe, yet the device can perform many examinations

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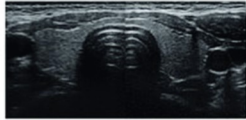
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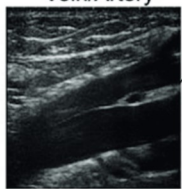
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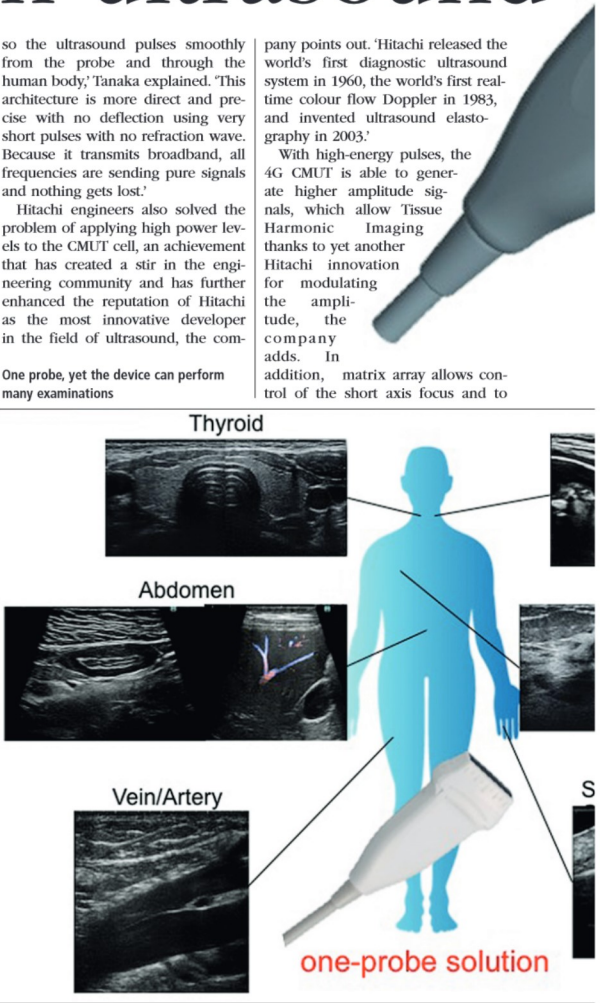


Abdomen



Vein/Artery





one-probe solution

more comfortable

gery lists has improved too, as we work almost in parallel with the surgeon; while one patient is in theatre, we administer a block to the next person, reducing the impact of anaesthetic time and increasing throughput. In addition, we've trained our A&E colleagues to administer ultrasound-guided fascia iliaca blocks to trauma patients. This has really improved the quality of care, ensuring patients are comfortable during transfer between A&E and the X-ray department, and minimising the morphine dose required.

When ultrasound guidance first became mandatory for vascular access, we set up a training course for all doctors within the organisation who were placing central lines. Over time, as the use of ultrasound became commonplace, this knowledge began to be handed down informally, rather than through attendance at training courses. The risk with this approach is that messages get diluted, and so we prefer trainees to undergo more formalised

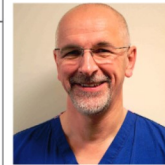
training for this procedure, as they do for ultrasound-guided regional anaesthesia. It is important that they realise that they are looking at a computer-generated image and are aware of the potential for artefact formation, as well as understanding how this occurs. We also run basic level training courses for senior house surgeons across the region, plus more advanced courses that are open to clinicians from outside the area.

Ultrasound guidance is now an established procedure at the Salford

Royal, and we have a considerable number of SonoSite systems shared across 20 theatres – including two X-Portes, an Edge, two M-Turbos, three S-Nerves, a MicroMaxx and three iLooks – which are used for both regional anaesthesia and vascular access. The systems are reliable and user friendly, and the customer service is good. The X-Portes have become particularly popular, not only for anaesthesia, but also for central line placement. People like the big screen and wipe-clean surface, and the training features

are really good. If a trainee wants to refresh their knowledge of particular anatomical landmarks, they can simply watch the relevant video, which acts as a mini tutorial.

The big advantage of ultrasound guidance is the safety and reliability it offers, even when you are treating a patient with difficult vascular access; a large lumen line, for example, can be safely inserted using the Seldinger technique. Ultrasound makes a huge difference; it allows you to do things differently – and is saving lives.



Jim Corcoran is a consultant neuroanaesthetist and the clinical director of perioperative care at Salford Royal Hospitals NHS Trust, a trauma centre in the Manchester conurbation and the busiest neurosurgical centre in the UK.

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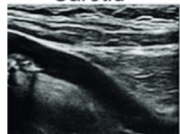
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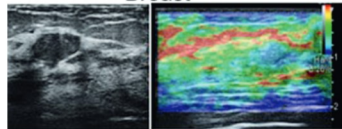
optimise the slice beam in any depth automatically to obtain the high image quality at wide range of depth.

The 4G CMUT is one of the leading features of the ARIETTA 850, the premium ultrasound platform also introduced at ECR 2017. Combined with eFocusing, a dynamic transmission and reception technology, and a 22-inch wide Organic Light Emitting Diode (OLED) monitor the ARIETTA 850 maximises the performance of wide bandwidth 4G CMUT and opens the door to the next stage in ultrasound.

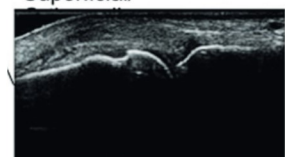
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Breast



Superficial/



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