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loskeletal strain up to 70%, and the scanner comes with image optimisation and automation tools (easyMode and easyTrace) plus single-touch automated intelligent Doppler steering and angle correction, according to the vendor.

Other features include Virtual Navigator real-time Fusion, a touch-screen based multimodality application; microV+, a non-invasive haemodynamic evaluator to characterise lesions; QPack, a multimodality quantification tool of curve analysis of CnTI contrast-enhanced ultrasound perfusion, as well as colour and power Doppler haemodynamics; solid-state hard disk, IntelCore i7 processor, and Windows 10; upgradable, remote service, long-term maintenance options, and transducer compatibility.

Samsung is featuring the HS60 and HS40 ultrasound systems. Visitors to the booth can also learn about RS80A with Prestige, the company's established premium general imaging ultrasound system, during daily educational demonstrations featuring live scanning.

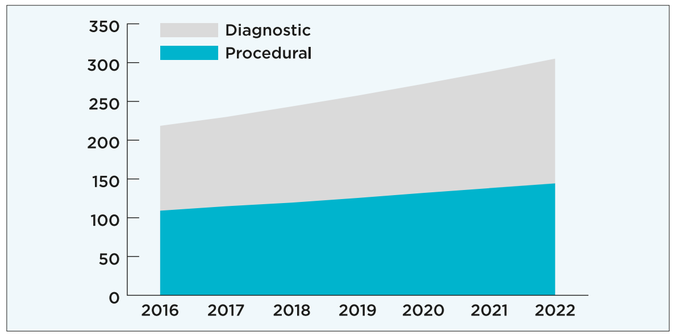
Technical Exhibition Opening Hours

Thursday, March 1 to Saturday, March 3	*10:00–17:00*
Sunday, March 4	*10:00–14:00*

BY SIMON HARRIS

AI to expand the use of diagnostic ultrasound at the point of care

There is already a well-established market for ultrasound systems in procedural applications at the point of care (POC), including line placement for vascular access and nerve blocks. Ultrasound is also routinely used as a primary screening tool in the emergency department and critical care units. However, its use in primary care remains limited, mainly because most primary care physicians are not trained in how to use and interpret ultrasound. The relatively high cost of ultrasound systems has also been prohibitive.



Europe, Middle East & Africa Market for POC Ultrasound Revenue Forecast ($m), Source: Signify Research

In the last couple of years, tremendous progress has been made with improving the image quality and form factor of handheld ultrasound devices, with a wave of ultra-portable scanners that connect to smartphones entering the market. The addition of artificial intelligence (AI) will be the next step in the evolution of these devices and the enabler for more widespread use of ultrasound in primary care. Artificial intelligence is being applied at various stages of the ultrasound diagnosis workflow, from image optimisation to clinical tools to help users to make faster and more accurate diagnoses.

Automated system optimisation

Point of care users require diagnostic ultrasound devices that are easy to use and that enable fast diagnoses. This is particularly true for inexperienced users, such as primary care physicians, and users in developing countries who often have limited access to training. AI can automatically optimise ultrasound images for individual patients, by making automated adjustments to the system settings. It can also provide guidance to the user on how best to position the probe for optimal image quality. For more experienced ultrasound users, automatic system configuration will reduce the time required to perform an exam, leaving more time to spend with the patient. The first ultrasound devices with this capability are expected to be released within the next year or two.

Automated quantification

Quantitative analysis tools provide automatic measurements of anatomical features, to assist with diagnosis. For example, software tools enable fast assessment of the heart's dynamic performance at the point of care, by providing automatic measurement of key metrics such as cardiac volume and ejection fraction. Rather than refer patients to an echocardiologist, primary care physicians and point of care clinicians will be able to perform basic cardiac echo exams and make faster and more accurate diagnoses.

Several companies offer post-processing tools that provide quantitative analysis of ultrasound images and, increasingly, this capability will be embedded in ultrasound devices, enabling quantitative imaging at the point of care. Several companies are applying deep learning technology to segment and quantify ultrasound imaging features and the first commercially available products, including cart, compact and handheld form factors, are likely to hit the market this year.

Automated detection

Machine learning models can identify and highlight areas that may reveal abnormalities during interpretation of medical imaging scans. Much of the product development effort in this field is focused on MRI and CT, partly due to the additional challenges associated with applying detection algorithms to comparatively noisy ultrasound images and in real-time. The first automated detection tools for ultrasound entered the market in 2017 but these are currently only available on premium systems. Over time, this capability will migrate to lower-end systems, but it will likely be another two or three years before handheld devices have automated detection capability.

Conclusion

AI will increasingly be applied to ultrasound devices in several ways, from automated system set-up and configuration, to image manipulation and interpretation. That said, the uptake of AI in ultrasound will be gradual over the coming years, as there are several factors that first need to be addressed, including the availability of annotated data to train the algorithms, the 'black box' nature of deep learning (the traceability and transparency of results is somewhat opaque) and acceptance by physicians and clinicians. As handheld ultrasound devices becoming increasingly smart, alongside continued improvements in image quality, battery management and form factor, ultrasound will continue to gain acceptance for diagnostic applications at the point of care.

For radiologists, this may lead to a loss of market share for certain types of ultrasound exams. In recent years, an increasing proportion of MSK ultrasound has been performed by specialists, including podiatrists, rheumatologists and sports medicine physicians, rather than radiologists. As ultrasound becomes increasingly easier to use, and as handheld ultrasound gains traction in primary care, the same could happen for other exam types. If this transpires, radiologists can maintain their value by supporting their colleagues in diagnostic decision making.

Simon Harris is Principal Analyst & Managing Director at Signify Research, a UK-based independent supplier of market intelligence and consultancy to the global healthcare technology industry.

BY ULRIKE MAYERHOFER-SEBERA

EIBIR coordinates multidisciplinary European project to enhance radiation protection in medicine

The MEDIRAD kick-off meeting took place in Barcelona in June 2017. The four-year project is led by the European Institute for Biomedical Imaging Research (EIBIR).

Implications of Medical Low Dose Radiation Exposure (MEDIRAD) is a multidisciplinary, cross-cutting project funded under the Euratom research and training programme of Horizon 2020. The four-year MEDIRAD project kicked off in June 2017 and is led by the European Institute for Biomedical Imaging Research (EIBIR). The consortium brings together a wide range expertise with 33 partners from 14 European countries, and involves research groups focusing on radiology, nuclear medicine, radiotherapy, dosimetry, epidemiology, biology, bioinformatics, modelling, radiation protection and public health. Prof. Guy Frija (Professor Emeritus of Radiology at Paris Descartes University France and chair of EuroSafe Imaging) acts as Clinical Coordinator and Prof. Elisabeth Cardis (ISGlobal, Spain) serves as Scientific Coordinator of the project.

MEDIRAD has three major operational objectives which include improving organ dose estimation and registration; evaluating and understanding the mechanisms of the effects of medical radiation exposures, focusing on two outcomes of public health relevance (cardiovascular effects of radiotherapy in breast cancer treatment and cancer risks following CT scanning in children and adolescents); and developing science-based policy recommendations for the effective protection of patients, workers and the general public. To achieve these objectives, the MEDIRAD Project consists of six interdependent and complementary work packages, each of which contains tasks and deliverables vital to the project's success.

MEDIRAD is supported by five European medical associations – the European Association of Nuclear Medicine (EANM), European Federation of Organisations for Medical Physics (EFOMP), European Federation of Radiographer Societies (EFRS), European Society of Radiology (ESR) and the European Society For Radiotherapy And Oncology (ESTRO) – and builds upon their existing partnership with the Multidisciplinary European Low Dose Initiative (MELODI), the European Radiation Dosimetry Group (EURADOS) and the European Alliance for Medical Radiation Protection Research (EURAMED).

These organisations, together with the World Health Organisation (WHO) and the European Patients' Forum (EPF) constitute the MEDIRAD Stakeholder Board, which coordinates the wider Stakeholder Forum. They will provide input, in particular to the recommendations that will be developed while bringing together medical and nuclear scientific communities. In addition, a Scientific Advisory Board has been set up with world-renowned experts in the fields of imaging, radiobiology, dosimetry, medical physics, radiation protection, epidemiology and ethics.

The expected impact of the MEDIRAD Project is multifaceted. MEDIRAD will achieve significant progress in the interaction between the radiation protection and medical scientific communities at EU level, leading to cross-fertilisation of research efforts and the provision of more consolidated and robust science-based policy recommendations to decision-makers in the relevant sectors. The project will also allow a better evaluation of the risks from radiation and better quantification of the necessary precautionary measures, leading to a stronger system of protection for patients, workers and the general public. MEDIRAD will endeavour to positively modify the public perception of risks associated with ionising radiation thanks to the results of such combined nuclear and medical research. MEDIRAD's long-term impact will lead to new and improved practical measures for the effective protection of people in the medical and nuclear sectors.

More information about the project can be found at www.medirad-project.eu

MEDIRAD

MEDIRAD has received funding from the Euratom research and training programme 2014–2018 under grant agreement No 755523.

BY DANIEL PAECH

Dynamic glucose-enhanced MRI (DGE MRI): clinical perspectives and challenges

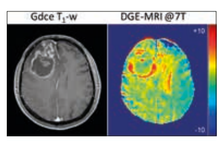


Figure 1: Comparison of DGE MRI at 7.0 T and Gadolinium contrast-enhanced T1-weighted (Gdce T1-w) imaging in a patient with newly-diagnosed untreated glioblastoma. DGE MRI displays regions of increased signal intensity (overlapping with ring enhancement on Gdce T1-w) and beyond the borders of blood-brain barrier disruption.

Glucose is the most important source of energy for the human organism, and changes in glucose metabolism can be an indicator of cellular dysfunction. Increased glucose consumption is a hallmark of cancer cells. The increased glucose turnover in tumours is used, for example, for cancer diagnosis by positron emission tomography of radioactively labelled fluorodeoxyglucose (FDG-PET). The aim of our work was to develop an MRI-based approach that enables imaging of natural glucose without the limitations of ionising radiation and the expenses of radioisotopes.

The recently reported dynamic glucose-enhanced MRI (DGE MRI) technique at ultra-high field strength (7.0 Tesla) allows for visualisation of non-radioactively labelled glucose after intravenous administration. DGE MRI uses the chemical exchange between the protons of water and the hydroxyl protons of the glucose molecules to amplify the very weak glucose signal. In a prospective clinical study, published in *Radiology*, it was thus possible to detect the pathologically increased glucose uptake of tumours in patients with glioblastoma employing the newly-developed imaging technology.

Unlike gadolinium-based contrast agents, which are confined to the intravascular space and intercellular spaces, glucose is taken up into the cell interior. Consequently, glucose-enhanced MR imaging could in principle provide information on both tumour perfusion and region-specific glucose consumption. Results from investigations of DGE MRI in healthy volunteers and tumour patients indicate contributions of both mechanisms to the measured signal.

Tumour regions with increased glucose uptake at DGE MRI of patients with glioblastoma showed a partial overlap with the corresponding conventional gadolinium-enhanced T1-weighted (Gdce T_1-w) images. However, particularly in areas beyond a disrupted blood brain barrier, increased signal intensities were additionally observed at glucose-enhanced images (Figure 1). These findings need to be further investigated in larger study cohorts to better understand the signal origin and to assess the clinical value of possible complementary information provided by DGE MRI.

In summary, DGE-MRI could enable high-resolution glucose-enhanced imaging without the limitations of ionising radiation and the expenses of radioisotopes. In his talk, Dr. Daniel Paech from the German Cancer Research Center in Heidelberg, Germany, will present the results of recent investigations of DGE-MRI in humans and discuss clinical perspectives and challenges of the newly-developed imaging technology.

Dr. Daniel Paech is Head of Clinical 7 Tesla MRI at the German Cancer Research Center (DKFZ) in Heidelberg, Germany.

Further reading:

Schuenke P, Paech D, Koehler C, Windschuh J, Bachert P, Ladd M, et al. Fast and Quantitative T1ρ-Weighted Dynamic Glucose Enhanced MRI. Scientific Reports. 2017;7:42093.

Paech D, Schuenke, P., Koehler, C., Windschuh, J., Mundiyanapurath, S., Bickelhaupt, S., Bonekamp, D., Bäumer, P., Bachert P., Ladd, M.E., Bendszus, M., Wick, W., Unterberg, A., Schlemmer H.-P., Zaiss, M., Radbruch, A. T1ρ-weighted dynamic glucose-enhanced MRI in the human brain. Radiology. 2017:1-9.

My Thesis in 3 Minutes

Wednesday, February 28, 14:00–15:30, Sky High Stage
MY 3 Oncologic Imaging
Moderators: G. Brancatelli; Palermo/IT
S. Gourtsoyianni; Athens/GR

» **Dynamic glucose-enhanced MRI: clinical perspectives and challenges**
D. Paech[1], P. Schuenke[1], C. Köhler[1], P. Bachert[1], M. Ladd[1], M. Bendszus[1], H.-P. Schlemmer[1], M. Zaiss[2], A. Radbruch[1]; [1]Heidelberg/DE, [2]Tübingen/DE