Dynamic contrast-enhanced MR

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The medical device industry is continually improving diagnostic imaging systems in order to lower radiation dose without compromising image quality, and both company articles and studies by cardiologists published in peer-reviewed journals stress the benefits for patients. However, much less emphasis is given to radiation exposure of relevant healthcare workers, a problem that is particularly acute in the catheterization lab where the use of albeit low radiation dose imaging approaches has increased exponentially. Diagnostic procedures utilizing ionizing radiation, such as coronary angiography, are now standard, as are interventions such as coronary artery angioplasty and stenting. Interventions such as atrial fibrillation ablation can take several hours and require up to an hour’s screening time. And the huge growth in the number of trans-catheter aortic valve implantation (TAVI) procedures carried out in the cath lab also impacts on the cumulative radiation dose to which operators are exposed. The potential hazards of operator exposure include skin erythema from hands being constantly within the primary beam, and damage to eyes. Relatively low radiation doses can irreversibly damage the lens; higher doses can affect the conjunctiva, iris, sclera and retina. And of most concern, increasing radiation exposure can result in irreversible damage to cellular DNA and carcinogenesis; the brain, thyroid and skin are most susceptible to cancers. A survey published earlier this year in the American heart association journal compared 466 healthcare personnel with an average of ten years cath lab experience with 280 personnel working in cardiology but without radiation exposure. The prevalence of skin lesions, cataracts and cancers were all significantly higher in the radiation-exposed group, as were hypertension and orthopedic problems such as back pain. But in the high stress environment of the cath lab, exacerbated because these healthcare workers are frequently ‘on call’ after completing their regular shifts, it is understandable that monthly reports of radiation exposure are not scrutinized by staff, and that effective protective measures such as special glasses, thyroid collars, gloves and lead aprons– the wearing of which has been linked to lower back pain– are not always utilized. So surely it is essential that hospitals provide intensive training in radiation protection for the whole cath lab team, ensure that all staff know the relevant protocols and adhere to them, and regularly examine shielding equipment for defects. In addition radiation protection supervisors should monitor exposure on a monthly basis, via operator badges and ideally by the systems available that can provide real-time data throughout every procedure involving ionizing radiation.

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Watching the brain in action

Watching millions of neurons in the brain interacting with each other is the ultimate dream of neuroscientists! A new imaging method now makes it possible to observe the activation of large neural circuits, currently up to the size of a small-animal brain, in real time and three dimensions. Researchers at the Helmholtz Zentrum München and the Technical University of Munich have recently reported on their new findings. Nowadays it is well recognized that most brain functions may not be comprehended through inspection of single neurons. To advance meaningfully, neuroscientists need the ability to monitor the activity of millions of neurons, both individually and collectively. However, such observations were so far not possible due to the limited penetration depth of optical microscopy techniques into a living brain. A team headed by Prof. Dr. Daniel Razansky, a group leader at the Institute of Biological and Molecular Imaging (IBMI), Helmholtz Zentrum München, and Professor of Molecular Imaging Engineering at the Technical University of Munich, has now found a way to address this challenge. The new method is based on the so-called optoacoustics, which allows non-invasive interrogation of living tissues at centimetre scale depths.

“We discovered that optoacoustics can be made sensitive to the differences in calcium ion concentrations resulting from neural activity and devised a rapid functional optoacoustic neuro-tomography (FONT) system that can simultaneously record signals from a very large number of neurons”, said Dr. Xosé Luis Deán-Ben, first author of the study. Experiments performed by the scientists in brains of adult zebrafish (Danio rerio) expressing genetically encoded calcium indicator GCaMP5G demonstrated, for the first time, the fundamental ability to directly track neural dynamics using optoacoustics while overcoming the longstanding penetration barrier of optical imaging in opaque brains. The technique was also able to trace neural activity during unrestrained motion of the animals.

“So far we demonstrated real-time analysis on whole brains of adult animals with roughly 2x3x4 millimetre dimensions (approximately 24 mm3),” says the study’s leader Razansky. State-of-the-art optical microscopy methods are currently limited to volumes well below a cubic millimetre when it comes to imaging of fast neural activity, according to the researchers. In addition, their FONT method is already capable of visualizing volumes of more than 1000 cubic millimetres with temporal resolution of 10 milliseconds. Large-scale observation of neural activity is the key to understanding how the brain works, both under normal and diseased conditions. “Thanks to our method, one can now capture fast activity of millions of neurons simultaneously. Parallel neural networks with the social media: in the past, we were able to read along when someone (in this case, a nerve cell) placed a message with a neighbour. Now we can also see how this message spreads like wildfire,” explains Razansky. “This new imaging tool is expected not only to significantly promote our knowledge on brain function and its pathophysiology but also accelerate development of novel therapies targeting neurological and neuropsychiatric disorders,” he concludes.

Technical University of Munich
http://tinyurl.com/goxtrm5

Needle-sized imaging probe improves image quality, surgical outcome

To provide a better view of difficult to see tissue, Japanese researchers have miniaturized an imaging probe to fit inside a needle that can be inserted into the eye during eye surgery. The probe was used without complications in three human patients. First, unlike hand-held instruments, the images via probe are generated during surgery to provide real-time information to surgeons. Second, the miniaturized probe can easily scan more of the eye’s interior than microscope-based instruments. The new technology “demonstrated the precise tissue abnormality objectively during surgery, which means the quality of surgery will become better for the patient,” said author Hiroko Terasaki, MD, PhD, of Nagoya University Graduate School of Medicine.

Future work will involve improving image resolution and further shrinking of the probe to fit even smaller needles.

ARVO
http://tinyurl.com/z2e7c24

New catheter lets doctors see inside arteries for first time

Removing plaque from clogged arteries is a common procedure that can save and improve lives. This treatment approach was recently made even safer and more effective with a new, high-tech catheter that allows cardiologists to see inside the arteries for the first time, cutting out only the diseased tissue. Interventional cardiologists at Sulpizio Cardiovascular Center at UC San Diego Health are the first in the region to use this technology. The new image-guided device, Pantheris Luminvascular atherectomy system, allows doctors to see and remove plaque simultaneously during an atherectomy – a minimally invasive procedure that involves cutting plaque away from the artery and clearing it out to restore blood flow.

The new technology treats patients suffering from the painful symptoms of peripheral artery disease (PAD), a condition caused by a build-up of plaque that blocks blood flow in the arteries of the legs and feet, preventing oxygen-rich blood from reaching the extremities. Patients with PAD frequently develop life threatening complications, including heart attack, stroke, and in some severe cases, patients may even face amputation.

“Peripheral artery disease greatly impacts quality of life, with patients experiencing cramping, numbness and discoloration of their extremities,” said Mitul Patel, MD, cardiologist at UC San Diego Health. “This new device is a significant step forward for the treatment of PAD with a more efficient approach for plaque removal and less radiation exposure to the doctor and patient.”

X-ray technology was previously used during similar procedures, but those images are not nearly as clear and do not allow visualization inside the blood vessel. The new catheter, with a fibre-optic camera the size of a grain of salt on the tip, is fed through a small incision in the groin that does not require full anaesthesia. Once inside, the interventional cardiologist is able to see exactly what needs to be removed without damaging the artery wall, which can cause further narrowing.

UC San Diego Health
http://tinyurl.com/jh8r23f
New imaging technique in Alzheimer’s disease

Tau PET is a new and promising imaging method for Alzheimer’s disease. A case study from Lund University in Sweden now confirms that tau PET images correspond to a higher degree to actual changes in the brain. According to the researchers behind the study, this increases opportunities for developing effective drugs.

There are several different methods of producing images showing the changes in the brain associated with Alzheimer’s disease. The tau PET method reveals the presence of a protein in the brain, tau, with the help of a gamma camera and a specially selected radioactive molecule (F-AV-1451).

Tau has an important function in assisting the transport of various substances within the brain’s nerve cells. People with Alzheimer’s disease have raised levels of tau, leading to accumulation of the protein in the brain cells and gradually to cell death.

Until now, no one has had precise knowledge of how well the new imaging method reproduces the actual changes in a brain affected by Alzheimer’s disease. The current case study, however, shows that image and reality match up well. The study has enabled researchers to compare tau PET images and brain tissue from the same person for the first time. The brain tissue came from a person who died having recently undergone examination with the new imaging method.

“Tau PET can improve diagnosis, but above all, the imaging method can be of great significance in the development of new drugs to combat Alzheimer’s disease”, explains Ruben Smith, researcher at Lund University and physician at Skåne University Hospital. He continues:

“There are new candidate drugs which aim to reduce the accumulation of tau. The imaging method opens up opportunities to investigate the development of the disease at a detailed level, and to observe how tau aggregates are affected by the drugs.”

“The person who was examined had a mutation which led to the same type of accumulation of tau in the brain as in Alzheimer’s disease. A single case study might seem insignificant, but since there are areas with a lot of tau stored and others with less tau in the same brain, it is sufficient to examine one person in order to verify whether the imaging method works”, explains Oskar Hansson, professor at Lund University and consultant at Skåne University Hospital.

Interest from the research community in imaging methods focusing on tau is strong and growing. A reliable reproduction of tau protein in the brain is considered a more relevant marker and a better diagnostic tool than competing methods which are already in use.

Lund University
http://tinyurl.com/hvbyfgw

Novel imaging technique with potential for medical diagnostics

A unique new imaging method, called “polarized nuclear imaging” – combining powerful aspects of both magnetic resonance imaging and gamma-ray imaging and developed by physicists in the University of Virginia’s departments of Physics and Radiology – has potential for new types of high-resolution medical diagnostics as well as industrial and physics research applications. “This method makes possible a truly new, absolutely different class of medical diagnostics,” said Wilson Miller, who, along with his colleague Gordon Cates, directed the research. “We’re combining the advantages of using highly detectable nuclear tracers with the spectral sensitivity and diagnostic power of MRI techniques.”

“We have demonstrated the feasibility of the new technique by producing a proof-of-principle image in a manner never before accomplished,” Cates said. “In our technique, rather than imaging protons in water, as in MRI, we image a radioactive isotope of xenon that has been polarized using laser techniques.”

Cates and his colleagues believe that the technique, once refined, could provide a new, relatively inexpensive way to visualize the gas space of the lungs by having patients inhale a gas containing the isotopes and using PNI to produce an image. The method likewise might work to image targeted areas of the body by injecting isotopes into the bloodstream. Because the technique would use such small quantities of tracer material, when it comes to medical use, the radioactivity would pose little to no danger to people.

MRI, is effective because it uses a variety of contrast mechanisms to sort out specific characteristics in an image. And highly sensitive gamma-ray detectors can resolve minuscule amounts of...
radioactive tracer material, key to homing on points of particular interest. The new UVA technique uses magnetic resonance to obtain the spatial information, and then collects image information by detecting gamma rays produced by the tracer material – an isotope of xenon Xe-131m, which is a by-product of Iodine 131 (used for treatment of thyroid problems).

“Unlike MRI, which detects faint radio waves, we detect gamma rays that are emitted from the xenon isotope,” Cates said. “Since it is possible to detect a gamma ray from even a single atom, we gain an enormous increase in imaging sensitivity, and dramatically reduce the amount of material needed for performing magnetic-resonance techniques.”

As an example, had Cates and Miller filled their imaging subject – in this case a small glass cell shaped like the Chinese symbol for the word “middle” – with water rather than the radioactive isotope, they would have needed about 10 billion times more water molecules than the number of isotope atoms they used to achieve the same image quality. This means that with minute quantities of material, they can achieve detailed imagery using magnetic-resonance techniques that would otherwise be impossible using a radioactive tracer. The authors note that considerable work still needs to be done to demonstrate the utility of the new technique in living subjects, but the unique approach “represents an exciting new technology.”

To develop it for practical use, the researchers say they would need to increase the size of the detectors or the amount of tracer material, and they are seeking alternative radioactive isotopes that would retain their polarization once inside a living subject.

University of Virginia
http://tinyurl.com/zpobeo7

Researchers map prostate cancer relapse using C-11 choline PET and MRI

A team of Mayo Clinic researchers has, for the first time, successfully mapped patterns of prostate cancer recurrence, following surgery. Using C-11 choline PET imaging and multi-parametric MRI, researchers found an anatomically diverse pattern of recurrence, which may help optimize treatment of patients whose prostate cancer returns after surgery.

“This study has important implications for men who have a rising prostate-specific antigen (PSA) test, also known as biochemical recurrence, after radical prostatectomy for prostate cancer,” says Jeffrey Karnes, M.D., a urological surgeon at Mayo Clinic. "In men with biochemical recurrence, determining where the disease has recurred is quite challenging, especially when the PSA level is low."

According to Dr. Karnes, in the U.S., approximately 30 percent of patients who have had an initial prostate cancer surgically excised will suffer a recurrence and seek treatment. "Current imaging tests like conventional bone and CT scans are not sensitive enough to identify sites of recurrence, especially when the PSA value is lower than 10,” he says.

Dr. Karnes says the combination of C-11 choline PET scanning and multiparametric MRI, helps physicians accurately identify sites of recurrence at an average PSA of 2. More importantly, he says, “This type of staging allows us to identify sites of recurrent disease that can be potentially treated either surgically or with radiation.”

Dr. Karnes and his team also were able to describe patterns of prostate cancer recurrence. They found that nearly two-thirds of men in the study had recurrence limited to the pelvis, which potentially can be targeted for radiation therapy.

Mayo Clinic
http://tinyurl.com/h9ot93x

Chemists devise revolutionary 3D bone-scanning technique

Chemists from Trinity College Dublin, in collaboration with RCSLI, have devised a revolutionary new scanning technique that produces extremely high-res 3D images of bones without exposing patients to X-ray radiation. The chemists attach luminescent compounds to tiny gold structures to form biologically safe ‘nanoagents’ that are attracted to calcium-rich surfaces, which appear when bones crack – even at a micro level. These nanoagents target and highlight the cracks formed in bones, allowing researchers to produce a complete 3D image of the damaged regions.

The technique will have major implications for the health sector as it can be used to diagnose bone strength and provide a detailed blueprint of the extent and precise positioning of any weakness or injury. Additionally, this knowledge should help prevent the need for bone implants in many cases, and act as an early-warning system for people at a high risk of degenerative bone diseases, such as osteoporosis.

The research was led by the Trinity team of Professor of Chemistry, Thorri Gunnlaugsson, and Postdoctoral Researcher, Esther Surender. Professor Gunnlaugsson said: We have demonstrated that we can achieve a three-dimensional map of bone damage, showing the so-called microcracks, using non-invasive luminescence imaging. The nanoagent we have developed allows us to visualize the nature and the extent of the damage in a manner that wasn’t previously possible. This is a major step forward in our endeavour to develop targeted contrast agents for bone diagnostics for use in clinical applications.”

Professor Lee said: “Everyday activity loads our bones and causes microcracks to develop. These are normally repaired by a remodelling process, but, when microcracks develop faster, they can exceed the repair rate and so accumulate and weaken our bones. This occurs in athletes and leads to stress fractures. In elderly people with osteoporosis, microcracks accumulate because repair is compromised and lead to fragility fractures, most commonly in the hip, wrist and spine. Current X ray techniques can tell us about the quantity of bone present but they do not give much information about bone quality.”

He continued: “By using our new nanoagent to label microcracks and detecting them with magnetic resonance imaging (MRI), we hope to measure both bone quantity and quality and identify those at greatest risk of fracture and institute appropriate therapy. Diagnosing weak bones before they break should therefore reduce the need for operations and implants – prevention is better than cure.”

Trinity College Dublin
http://tinyurl.com/hcvjtd2
Dose reduction in medical radiation - regulators, industry and healthcare professionals seek common front

Ionizing radiation, from the sun and even the earth, is a daily fact of life. There is little that can be done about this, except to stay away from too much sunlight and protect the skin with sunscreens. On the other hand, people are also sometimes exposed to radiation for medical reasons - such as diagnostic X-Rays or CT scans, or a range of interventional radiology procedures. These procedures offer tremendous benefits for patients and for healthcare providers. The evidence for such benefits has become indisputable in recent years, and covers a wide range of diseases and conditions.

Medical imaging has profound impact on patient management
The ‘American Journal of Roentgenology’ reported in 2011 that abdominal surgeries reduced significantly after CT scans. Physicians planned to admit 75% of patients to hospital before CT. This level was changed to hospital discharge with follow-up in 24% of patients after CT. The conclusions of the researchers, from Massachusetts General Hospital, were conclusive: CT “changes the leading diagnosis, increases diagnostic certainty, and changes potential patient management decisions.”

Massachusetts General Hospital was indeed one of the first institutions to study the impact of medical imaging. In 1998, a team from the hospital reported that CT was 93.98% accurate in confirming or ruling out appendicitis. The condition accounted for 1 million patient-days per year in the US, with a similar level eventually found to have other conditions.

From emergency rooms to lung cancer
More recently, the ‘New England Journal of Medicine’ published a study on non-invasive coronary CT imaging in the emergency room. The study found that out of the 8 million visits per year to emergency rooms by patients with chest pain, only 5-15% were eventually found to be suffering from heart attacks or other serious cardiac diseases. As many as 60% of patients faced unnecessary admission and testing to exclude acute coronary syndrome. Meanwhile, it has also been reported that low-dose CT screening reduced lung cancer deaths by at least 20% in a high risk population of current and former smokers aged 55 to 74. These findings were reported by the National Lung Cancer Trial in the US.

Fight against Alzheimer’s, speeding up clinical trials
In the future, medical imaging holds forth significant promise as a tool in the fight against diseases ranging from osteoporosis to Alzheimer’s, whose incidence is likely to grow sharply as the population ages. Medical imaging also offers increasing promise as a surrogate endpoint in clinical trials, allowing measurement of the effect of a new drug far earlier than traditional endpoints, such as survival times or clinical benefit.

Concerns about over-use, some alarmist
Nevertheless, there are several concerns about ‘over-use’ - especially for imaging accompanied by radiation such as CT. In the US, according to a June 2012 review in the ‘Journal of the American Medical Association,’ CT scans tripled in the period 1996-2010, corresponding to a 7.8% annual increase. Although this was less than a near four-fold increase in MRI and a 30% fall in nuclear medicine use, CT has been the target of sometimes emotive campaigns.

One good illustration of this was an Op-Ed in the ‘New York Times’ on January 31, 2014. The article was titled “We Are Giving Ourselves Cancer.” It opened with the observation that we are “silently irradiating ourselves to death,” while its closing sentence urged finding ways to use CTs “without killing people in the process.”

The ‘Times’ Op-Ed cited a British study which “directly demonstrated” evidence of the “harms” of CT, and it is here that its authors over-stretched their credibility. The study they referred to was published in ‘Lancet’ in August 2012 and titled ‘Radiation exposure from CT scans in childhood and subsequent risk of leukemia and brain tumours: a retrospective cohort study.’ Its authors used data on 175,000 children and young adults and found that the cumulative 10-year risk was higher in relative terms, but translated into one extra case of leukemia and one extra case of brain tumour per 10,000 head CT scans.

ALARA and the principle of necessity and justification
In other words, while few would argue that there is no risk from radiation, it is clear that such risks are small and that even these small potential risks could be controlled further by reducing exposure to radiation. Both industry and healthcare professionals are endeavouring to ensure that such a goal is achieved.

Manufacturers of CT and other radiation imaging equipment seek to keep exposure to radiation for both patients and medical staff to a minimum – and below their regulatory limits – by using the ALARA (As Low As Reasonably Achievable) principle to design their products. Key methods include use of the most dose-efficient technologies available and seeking to ensure that optimum
scan parameters are used for a patient and examination type. Meanwhile, in the clinical setting, doctors seek to ensure that radiation imaging examination is ordered only when absolutely necessary and justified, while radiographers optimize the radiation dose used during each procedure.

Safety, information and awareness
Since the mid-2000s, radiologists and medical physicists have taken steps to increase controls on radiation risks to patients. These have essentially focused on promoting the safe use of medical imaging devices, supporting informed clinical decision making and increasing patient awareness.

One of these initiatives is known as Image Wisely, a collaborative initiative by radiology professional organizations and other concerned groups. Its target is to specifically lower radiation dose during the imaging of children. A related initiative, led by the American College of Radiology (ACR) and the Radiology Society of North America (RSNA), is Image Wisely. This is essentially an awareness campaign whose goals are to eliminate ‘unnecessary’ procedures and lower doses to minimal levels required for clinical effectiveness when necessary. One aspect of Image Wisely is collaboration between medical radiologists and manufacturers to improve performance of radiology equipment and allow physicians to make real-time assessments of whether radiation levels are acceptable.

Initiatives by professional societies
Such initiatives are closely supported by professional radiology societies. The ACR has developed Appropriateness Criteria (corresponding to the federal requirements on appropriate use) to assist referring physicians and radiologists in prescribing the best imaging examination for patients - based on symptoms and circumstances. One tool consists of the display of imaging options and associated radiation levels for a specific procedure. The aim is to reduce imaging examinations by ensuring that the most suitable exam is done first.

In Europe, the European Society of Radiology’s flagship EuroSafe Imaging has the same objective, to maximize radiation protection and quality/safety in medical imaging. The initiative was launched at the European Congress of Radiology in 2014 and has so far attracted over 50,000 individual supporters (known as ‘Friends of EuroSafe Imaging’). Over 200 institutions (industry and healthcare providers) have also endorsed the initiative.

Accreditation programmes
Accreditation programmes are also being targeted by the ACR and ECR, in order to assess facilities based on imaging competence, adherence to latest dose guidelines, and personnel training. Given the pace of technology development in imaging, certified radiology and nuclear medicine professionals are increasingly recommended or (in some cases) required to earn continuing education credits on radiation safety. In Europe, the ECR has joined forces with the European Federation of Organizations for Medical Physics (EFPOM), the European Federation of Radiographer Societies (EFRS), the European Society for Therapeutic Radiology and Oncology (ESTRO), the European Association of Nuclear Medicine (EANM), as well as the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) on an EU-promoted radiation education project called MEDRAPET. The findings, published in 2014, revise the previous Radiation Protection 116 Guidelines on Education and Training.

The Bonn Call for Action sets roadmap for the future
Many of these initiatives have been inspired by a conference held in Bonn, Germany, at the end of 2012, which was sponsored jointly by two United Nations bodies - the International Atomic Energy Agency (IAEA) and the World Health Organization (WHO). The outcome of the conference, which was attended by participants from 77 countries, is known as the Bonn Call for Action, and aims to strengthen medical radiation practices into the 2020s.

The Bonn Call consists of ten major actions. These are described below:

• To enhance implementation of the principle of justification. There is explicit emphasis on the use of clinical decision support (CDS) technology towards such a goal.
• To enhance implementation of the principle of optimization of protection and safety. There is a specific call to ensure the establishment, use and regular updating of diagnostic reference levels for radiological procedures, including interventional procedures, and to develop and apply technological solutions for patient exposure records, harmonize dose data formats provided by imaging equipment and increase utilization of electronic health records.
• Strengthen manufacturers’ role in contributing to the overall safety regime. This seeks to enhance radiation protection features in the design of both physical equipment and software, and to make these available as default features rather than optional extras.
• Strengthen radiation protection education and training of health professionals.
• Increase availability of improved global information on medical exposures and occupational exposures in medicine, with specific attention to developing countries.
• Improve prevention of medical radiation incidents and accidents. One interesting facet here is a call to work towards including all modalities of medical ionizing radiation as part of a voluntary safety reporting process, with specific emphasis on brachytherapy, interventional radiology, and therapeutic nuclear medicine, in addition to external beam radiotherapy.
• Strengthen radiation safety culture in healthcare.
• Foster an improved radiation benefit-risk-dialogue.
• Strengthen the implementation of safety requirements globally.
• Develop practical guidance to provide for the implementation of the International Basic Safety Standards in healthcare globally.

Although some of the Bonn Call points are repetitive, the document is noteworthy in terms of setting a minimal set of common rules for a very wide range of stakeholders - manufacturers, health professionals and professional societies.

Point 6 seeks new work on ‘effective’ dose
Point 6 of the Bonn Call is both ambitious and timely. Although the concept of ‘effective dose’ (or effective dose equivalent) was introduced in the mid-1970s to provide a common framework for evaluating the impact of exposure to ionizing radiation via any means, technology’s uneven leaps have not made it easy to follow through. Data for doses by different radiographic imaging modalities used in radiation therapy are scattered widely through literature, making it difficult to estimate the total dose that a patient receives during a particular treatment scenario. In addition, interventional systems are often configured differently from diagnostic set-ups and imaging systems do not distribute radiation in similar ways. For example, planar kV imaging attenuates rapidly along the line of sight, while CT dose is uniformly distributed through a patient. This makes it difficult to sum dose in a radiobiologically consistent manner.
Dynamic contrast-enhanced magnetic resonance - new frontiers against cancer, but some way still to go

Dynamic contrast-enhanced magnetic resonance (DCE-MRI) is a functional imaging technique. It consists of MRI scans coupled to the injection of a contrast agent. The latter leads to a decrease in relaxation time and provides extremely detailed characteristics of the micro-circulation of blood through tissue.

DCE-MRI assessments typically use the characteristics of signal intensity (SI) and time-intensity curves (TIC) regarding regions of interest (ROI). Early DCE-MRI efforts assumed a linear relationship between signal enhancement and contrast uptake. However, given that signal enhancement depends to a very great degree on intrinsic tissue and acquisition parameters, more complex models have been developed to control the effect of tissue characteristics such as the pre-contrast longitudinal relaxation time and the longitudinal or transverse relaxivities of the contrast agent.

Two-phased process

DCE-MRI is a two-phased process. Typically, at first, a T1-weighted MRI scan is conducted. This is followed by injection of the contrast agent, and then repeated acquisition of T1-weighted fast spoiled gradient-echo MRI sequences to obtain measurements of signal enhancement as a function of time.

The contrast agents are usually based on gadolinium and include gadoterate meglumine (Gd-DOTA), gadobutrol (Gd-BTDO3A) gadoteril and albumin-labelled Gd-DTPA.

Image acquisition and voxel comparison

Typically, 3D image sets are obtained sequentially every few seconds for up to 5–10 minutes. Shorter intervals allow for detection of early enhancement, although many researchers consider 10 seconds to be good enough. Longer intervals than this typically makes it tougher to identify early enhancement.

At the moment, the debate about the upper limit for intervals continues. After image acquisition, the comparison of T1 values per voxel in each scan allows identification of permeable blood vessels and tumour tissue. Both spatial and temporal resolution must be adjusted to obtain an adequate sampling of the contrast enhancement over time, for each tissue voxel. The speed with which MRI images must be acquired necessitates larger voxels, so as to maintain adequate signal-to-noise ratios. Thus, DCE-MRI is often not as high in resolution as conventional T2-weighted sequences.

Range of biomarkers

Although DCE-MRI can be performed on conventional scanners (typically 1.5 T), it requires specialist image analysis to analyse the enhanced biomarker information which is to be provided. Such information includes tissue perfusion, vascularity, endothelial permeability, cellularity etc. The biomarkers can be used to provide measurements of tumour vascular function and to improve the diagnosis and management of diseases in a variety of organs.

DCE-MRI in the brain

Clinical applications of DCE-MRI have principally focused on in-vivo characterization of tumours.

One of its earliest applications was to analyse blood vessels in a brain tumour, since the blood-brain barrier (BBB) blocks the contrast agent in normal brain tissue, but not in vessels generated by a tumour. The contrast agent's concentration is measured as it passes between the blood vessels and the extracellular space of tissue, and then as it returns to the vessels. In tissues with healthy cells or high cell density, the re-entry of the contrast agent into vessels is quicker since it cannot pass cell membranes. In tissues which are damaged or have a lower cell density, the agent is present in the extracellular space for a longer duration.

Numerous DCE-MRI studies on the brain have researched the correlation between BBB disruption and diseases such as acute ischemic stroke, pneumococcal meningitis, brain metastases, multiple system atrophy, multiple sclerosis and Type-II diabetes. One of the most exciting areas of research is the difference in signal intensity profiles over time between Alzheimer's disease patients and controls.

Tumours and DCE-MRI

Elsewhere, researchers have also established the benefits of DCE-MRI for differential diagnosis of tumours in the head and neck region, such as salivary gland tumours and lesions in the jaw bone. DCE-MRI has also been used to demonstrate the nature of a lymphoma and making a differential diagnosis versus other lesions.

Prostate cancer is becoming a major area of application for DCE-MRI. One of the key limitations to standards of care in the past was the need for random prostate biopsies after discovery of elevated PSA values. This often led to discovery of inconsequential tumours. Meanwhile, the very same biopsies sometimes missed out on significant disease. DCE-MRI, in conjunction with PSA, can identify tumours likely to cause death if left untreated.

Assessing response to chemotherapy

DCE-MRI is also being used to assess responses to chemotherapy. One example of an ongoing project in this area is CHERNAC (Characterizing Early Response to Neoadjuvant Chemotherapy with Quantitative Breast MRI), which is funded by the Breast Cancer Campaign in the UK.

Elsewhere, DCE-MRI has shown promise in detecting cancer recurrence. For example, biochemical relapse after radical prostatectomy can occur in as much as 15 to 30% of prostate cancer patients. Detection
of tumour recurrence in such cases can be difficult due to the presence of scar tissue. Determining the precise site of recurrence since patients with isolated recurrence could benefit from less-invasive treatments, such as radiation to the resection bed. Other areas for DCE-MRI application include cardiac tissue viability - for example, to evaluate sub-clinical fibrosis and microvascular dysfunction. Researchers have also shown its utility in measuring renal function and partial/segmental liver function.

A full spectrum of methods
In general, the analysis of DCE-MRI is based on a full spectrum of methods from the qualitative to quantitative, with an intermediary semi-quantitative approach.

Qualitative analysis
Qualitative analysis is visual and depends on clinical experience and expertise. It assumed that tumour vessels are leaky and more readily enhance after IV contrast material is expressed. As a result, DCE-MRI patterns for malignant tumours show an early and rapid enhancement of the time-intensity curve (TIC) after injection of the agent, followed by a rapid decline. On the other hand, normal tissue shows a slower and steadily increasing signal after agent injection.

Quantitative analysis
Quantitative analysis is based on the pharmacokinetics of contrast agent exchange. It is complex, but allows for a degree of comparability. The limitation is due to a lack of standards. However, better and wider use of software has led to a growing consensus on approaches to quantitative analysis of DCE-MRI data.

One of the most widely used tools is the Toft and Kermode (TK) model, which is showing considerable promise in predicting and monitoring tumour response to therapy.

TK provides data about the influx forward volume transfer constant, KTrans, from plasma into the extravascular-extracellular space (EES). KTrans is equal to the permeability surface area product per unit volume of tissue, and represents vascular permeability in a permeability-limited situation (high flow relative to permeability), or blood flow into tissue in a flow-limited situation (high permeability relative to flow). KTrans is known to be elevated in many cancers.

Pharmacokinetic modeling for analysing DCE-MRI dates to the early 1990s, and was followed by a consensus paper at the end of the decade (‘Tofts PS., Brix G., Buckley D.L., Evelhoch J.L., Henderson E., Knopp M.V. Contrast-enhanced T 1 -Weighted MRI of a diffusible tracer: Standardized quantities and symbols. Journal of Magnetic Resonance Imaging. 1999’). Over the years, improvement of imaging techniques (e.g. higher temporal resolution and contrast-to-noise ratio) and greater knowledge of the underlying physiology have catalysed development of more complex pharmacokinetic models.

The TK model, for example, had been developed for measuring BBB (blood-brain barrier) permeability, and overlooked the contribution of the plasma to total tissue concentration. However, as the model gained popularity in assessing tumours throughout the body, vascular contributions to signal intensity were also included.

Semi-quantitative models
The semi-quantitative model seeks to fit a curve to data. Like the visual/qualitative, this approach also assumes early and intense enhancement and washout as a predictor of malignancy. However, semi-quantitative analysis also calculates a variety of dynamic curve parameters types after initial uptake, such as the shape of the time-intensity curve (TIC), the time of first contrast uptake, time to peak, maximum slope, peak enhancement, and wash-in and washout curve shapes. Broadly speaking, there are three types of curve: Type 1 (persistent increase), Type 2 (plateau) and Type 3 (decline after initial upslope). One of the most attractive features of the semi-quantitative model is its relative simplicity in using parameters to differentiate malignant from pathologic but benign tissue.

For example, in the head-and-neck region, a rapid increase in TIC (fast wash-out pattern) indicates a strong possibility of Warthin’s tumour - a benign, sharply demarcated tumour. A persistent increase suggests the possibility of pleomorphic adenoma. A plateau pattern with a slow washout is characteristic of both a malignant tumour and adenoma.

In spite of enthusiasm about the semi-quantitative approach, it cannot be generalized across acquisition protocols and sequences as well as several other factors which impact on MR signal intensity. In turn, these affect curve metrics, such as maximum enhancement and washout percentage. Differences in temporal resolution and injection rates can also change the shape of wash-in/washout curves, making comparison difficult. Finally, such descriptive parameters provide no physiologic insights into the behaviour of the tumour vessels.

The limitations of DCE-MRI
DCE-MRI itself faces some major limitations. Firstly, there is a lack of standardization in DCE-MRI sequences and analysis methodology, making it difficult to compare published studies. In general, shorter acquisition times lend themselves to more comparability.

One frequent problem is movement by the patient and organ motion (e.g. in the gut, the kidney, bladder etc.). Since a DCE-MRI study procedure is over 5 minutes, there can be considerable misregistration between consecutive imaging slices, leading to noise in the wash-in and washout curves, and problems fitting pharmacokinetic models to the curve.

New DCE-MRI postprocessing software seeks to correct this by automatically repopulating sequential images for better alignment. However, these too do not use common algorithms to process the data and generate parametric maps and can show differences - e.g. in tumour vascularity. To enable further investigation of the value of DCE-MRI of the prostate, the technique of DCE-MRI and the pharmacokinetic model used to analyse it must become more standardized.

One of the most serious problems with DCE-MRI, however, is its non-specificity which can lead to both false negatives and false positives. Other sources of uncertainty in DCE-MRI studies include a lack of data. For example, one typical assumption is fast water exchange between compartments in spite of suspicions about the influence of restricted water exchange. Indeed, many quantitative models disregard intracellular space since it is assumed that there is no contrast media exchange. However, others have pointed out that water itself can exchange between the cell and the extracellular space, thereby influencing signal changes in the extracellular space. This is clearly an areas which calls for more study.

Further research is also required in areas such as relaxivity values for a contrast agent, field strength and tissue/pathology. Currently, relaxivity across tissues and compartments is generally assumed to be uniform.

To conclude, DCE-MRI is a significant and promising diagnostic modality. However, for most clinical applications, it cannot be used on a standalone basis, regardless of curve shape or intensity of enhancement. DCE-MRI needs to be viewed in the context of other MRI parameters such as diffusion-weighted MRI and MR spectroscopic imaging as well as T2-weighted MRI.
Test detects elevated risk for Alzheimer’s disease

Researchers today unveiled results from a new blood test to help identify which patients are at an elevated risk of Alzheimer’s disease. The findings showed that the biochip test, which allows multiple tests to be run on one blood sample, was as accurate as existing molecular tests that analyse DNA.

“This is the first time that we have used this biochip technology to test for an increased risk of Alzheimer’s disease,” said Emma C. Harte, PhD, a research scientist.

“This type of testing is important in our quest to understand and diagnose Alzheimer’s and empower patients to understand risks, consider medication, and even make early lifestyle changes.”

This test detects the presence of a protein in the blood produced by a specific variation of the apolipoprotein gene (ApoE4), which is associated with increased risk of developing Alzheimer’s disease. The apolipoprotein gene is inherited from each parent and when a patient inherits the ApoE4 variant from one parent they have a three times greater risk of developing Alzheimer’s disease, whereas a patient who inherits ApoE4 from both parents is eight-to-12 times more likely to develop the disease.

To verify the accuracy of the biochip test, 384 samples were analysed and results compared to those from a standard molecular diagnostic test. Researchers from Randox Laboratories collaborated with research colleagues at the Medical University of Vienna and found that results from the two tests were in 100% agreement. As biochip tests allow clinicians and researchers to quickly run multiple tests on one sample of blood, this new test is also faster and more affordable than the standard DNA test, producing results in only three hours. This enables doctors to predict the risk of an individual developing Alzheimer’s disease.

“Pairing this test with medical and family history for risk of Alzheimer’s disease has the real potential to advance personalized medicine,” said Harte. “This fast, accurate testing will allow doctors and patients to make more informed choices earlier to potentially slow the possible progress of Alzheimer’s.”

AACC
http://tinyurl.com/zeanaf2

Smartphone device can diagnose bacterial infections

MGH researchers are testing a system for identifying bacterial infections that could save lives, speed recovery and reduce healthcare costs.

Ralph Weissleder, MD, PhD, director of the Massachusetts General Hospital Center for Systems Biology, and Hakho Lee, PhD, also a principal investigator at the centre, are leading a team of researchers that has created such a device. Called Polarization Anisotropy Diagnostics (PAD), it has shown promising results in a small study.

“We developed a system that is practical and easy to use,” Dr. Weissleder says. “PAD takes the guesswork out of treating patients for bacterial infections.”

The PAD device is about the size of a Rubik’s Cube. And it can make a diagnosis within two hours of receiving a patient sample. By comparison, getting similar results back from a testing lab, can take anywhere from a couple of days to a few weeks. In the meantime, doctors must make a diagnosis based on the patient’s symptoms.

Dr. Weissleder gives this example: A patient comes to the hospital shivering, short of breath and in extreme pain. Healthcare providers suspect a bacterial infection is causing sepsis, a life-threatening infection. They immediately begin treatment, which includes antibiotics—but they don’t know yet which bacteria are making the patient sick. So they prescribe the antibiotic most likely to help or give several types of antibiotics.

When the lab results return two weeks later, the healthcare providers learn if they suspected the right bug. If they were wrong, they must change the course of antibiotics. But if PAD identifies the bacteria within two hours, physicians can prescribe the right antibiotics sooner. Patients can recover faster, with fewer side effects.

To use the PAD device, a sample from the patient is placed into a tiny vial along with a special detection probe. The vial is slid into a box that snaps onto the PAD cube. Inside the box, probes search the patient sample for matching bacterial DNA. When a match is detected, the probes glow, sending a signal that specific genes are present.

The system uses those genes to identify the bacteria. That data is sent to a smartphone. On the smartphone screen, PAD identifies whether a bacterial infection is present. The researchers’ current device can already specifically identify nine common infections and determine whether the one involved is resistant to antibiotics.

“I think over the next couple of years, there will be a switch to rapid diagnostics like our new device.”

In a small study, the team tested its device against the gold standard of having a lab grow a bacteria culture to identify it. PAD did just as well as a lab culture in testing for the presence of the bacteria E. coli, Klebsiella, Acinetobacter, Pseudomonas and Staphylococcus aureus, and in reporting how much bacteria was present and whether it was antibiotic-resistant.

Massachusetts General Hospital
http://tinyurl.com/jdbyowh

Lab-on-a-Stick: fast detection of antibiotic resistance

A portable power-free test for the rapid detection of bacterial resistance to antibiotics has been developed by academics at Loughborough University and the University of Reading.

The new test termed Lab-on-a-Stick is an inexpensive microfluidic strip – comprising of tiny test tubes about the size of a human hair – capable of identifying bacteria found in urine samples and checking if they are resistant to common antibiotics. Simple to use and cheap to manufacture, the Lab-on-a-Stick is a ‘dip and read’ method using a transparent micro-capillary film suitable for naked eye detection or measurement with portable, inexpensive equipment such as a smartphone camera.

The test, which is at least 12 times faster than current microbiological tests, is the result of research by Dr Nunó Reis, Lecturer in Chemical Engineering at Loughborough University, and Dr Al Edwards, Associate Professor in Biomedical Technology at the University of Reading. The study showed that dipstick tests routinely used for testing in a variety of scenarios from soil pH strips for the garden to pregnancy tests, could be updated using the latest approach in miniaturized testing technology to help form the basis of a new generation of advanced, yet affordable, point-of-care tests for global diagnostics.

As part of the study, different cellular tests were carried out to demonstrate the full potential of Lab-on-a-Stick devices for a range of clinical situations:

Anti-microbial resistance – this was measured with E. coli samples typical of common...
urinary tract infection (UTIs). UTIs can be hard to treat with antibiotics because antibiotic resistance is so common and lab testing takes at least two days. The assay detects antibiotic resistance – in other words, can the cells grow in the presence of the antibiotic, and how much antibiotic is needed to stop cell growth? This demonstrated the advantage of using the microcapillary film which enables 10 different concentrations of antibiotic per sample to be tested with a single test strip. The research team are currently optimizing this so that the test, which currently requires overnight incubation in a multi-well plate, could in the future be completed in less than two hours in a single test strip.

**Bacteria identification** – classical analytical microbiology tests used for the identification of bacteria were miniaturized and performed in parallel microcapillaries, resulting in simple and rapid identification of bacteria. To identify bacteria, many different tests must be performed on every sample, illustrating again the benefits of microcapillary film which performs 10 tests per test strip. This study demonstrated a four-hour test to distinguish two very closely related bacteria – a harmless laboratory strain of E. coli from a type of Salmonella that causes food poisoning.

**ABO blood typing** – a simple blood test that takes only two minutes was miniaturized and the results were recorded using an everyday digital camera. Dr Reis said: “This is a major step towards miniaturizing complex, routine microbiological and clinical tests that cannot at the moment be performed outside of the laboratory setting. “Our secret is simplicity. We have shown how micro-engineered film material made from a very transparent plastic with special optical properties, makes it easy to perform laboratory tests without lab equipment. Previously, we showed how a portable Lab-in-a-briefcase made it possible to record blood test results with the assistance of a simple smartphone.”

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Loughborough University
http://tinyurl.com/hb4mrph

New test could improve diagnosis of tuberculosis in developing nations

In developing nations, the current test to diagnose tuberculosis (TB) is error-prone, complicated and time-consuming. Furthermore, patients in these resource-limited areas can’t easily travel back to a clinic at a later date to get their results. To make diagnoses simpler, faster and more accurate, chemists have developed a quick and easy diagnostic tool. Field trials of the experimental new test began in June in South Africa, which has a high incidence of TB. In wealthier countries, a patient suspected of having TB can be examined with a chest X-ray. Or a sample of the patient’s sputum, or saliva, can be sent to a lab for testing by techniques such as polymerase chain reaction (PCR).

But in developing nations with limited resources and spotty access to electricity, patients are often checked for TB with the Ziehl-Neelsen (ZN) test, which was
developed in the 1880s. Technicians using this 11-step procedure put a saliva sample on a microscope slide, then dye it and rinse it multiple times. The process takes several hours. Even worse, “the ZN test is not very sensitive. It misses some cases of TB, and it gives a lot of false positives,” says Carolyn R. Bertozzi, Ph.D. These limitations led Bertozzi and her team at Stanford University to develop a new test. But that wasn't the researchers' initial goal when they began studying TB 16 years ago. At the time, they were investigating molecules, known as glycolipids, in the cell walls of the bacteria that cause the disease. Each glycolipid consists of the sugar trehalose linked to a lipid, or fat. The researchers discovered that if they provided slightly modified forms of trehalose to the bacteria, the microbes would metabolize the sugar molecules and integrate them into their glycolipids. Other researchers showed that the bacteria can take up forms of trehalose in which each sugar is attached to a fluorescent dye molecule. A cell that picks up these sugars glows green. “We thought we could use this to detect the bacteria in sputum samples,” Bertozzi says. Unfortunately, the other researchers' dye also sticks to other components in saliva, making it tough to distinguish the bacteria. Bertozzi's team solved this problem by attaching trehalose to a "solvatochromic" dye that doesn't glow until it's incorporated into the cell walls. As a result, there's no background glow. In addition, the process couldn't be easier: the technician takes a sputum sample, squirts a little of the dye mixture onto it, and then after an hour looks at it under a microscope to see if anything is glowing. Even better, only live bacterial cells can metabolize the trehalose/dye molecules. The dyes in the ZN test, however, label both live and dead cells. That means the traditional test can't determine whether the number of live cells is decreasing, so it can't be used to tell whether a patient's treatment is working. Because many strains of TB bacteria are now resistant to the standard treatments, “if the drugs aren't working, you want to switch the patient to the next treatment as quickly as possible so you don't contribute to drug resistance,” Bertozzi explains. The group is now working with a collaborator in South Africa to see how the new test performs in real-world conditions. In the meantime, Bertozzi's team is studying other fluorescent dyes that could work even better in a TB test. They are also using their current trehalose/dye molecule to explore the molecular structure and physical properties of the cell wall of TB bacteria. That knowledge could shed light on the bacteria's drug-resistance mechanism, as well as potential new ways to kill the cells.

American Chemical Society
http://tinyurl.com/jp7yel4

Revolutionary rapid blood-testing technology

New blood-testing technology is being developed by Lancaster academics. The new small-scale technology, called 'E-Bio-LacSens', would rapidly measure blood characteristics to monitor for sepsis or toxins. It would be a good indicator of the success of treatments following operations and it could ensure the early detection of sepsis in chemotherapy patients. In addition it could help evaluate the status of fetuses. The device does this by taking pinprick samples of blood and providing rapid chemical analysis – in less than a minute. This quick processing of samples, when compared to the traditional process where samples that have to be sent for analysis at hospital laboratories (a process that can take hours), enables medical staff to quickly adjust treatments in response to the improved data.

Michael Mumford, from eBiogen, said: “This project passed its feasibility stage and it is now progressing well in its prototype stage with encouraging results. We are starting the human blood testing soon before proceeding to market. Lancaster University has enabled us to develop a rich and supportive expert network.” By bringing blood diagnostics closer to the patient there are additional benefits of reduced risk of contamination and cost savings.

Dr Mukesh Kumar, the project Research Fellow, said, “Although the existing point-of-care testing kits have resolved a few conventional problems, they have not had a great impact in most clinical testing. The new technology would circumvent many current problems through miniaturization, enabling an economical, portable analyser to be used 'by the bedside'. The prospect of being able to significantly reduce the time between taking a sample and the delivery of the analysis is exciting and rewarding.”

Lancaster University
http://tinyurl.com/zbk7v4
Point-of-care testing - enhancing throughput in emergency departments

Point-of-care testing (POCT) refers to diagnostic tests which are performed physically close to a patient, with the results obtained on site. They are conducted at primary care centres and at hospital bedside (increasingly, in emergency departments and intensive care units, too). POCTs are also used in the field in settings such as natural or man-made disasters, and accompanied by telemedicine, in patients’ homes.

Saving time and space
While traditional diagnostic tests involve taking patient specimens, transporting them to a laboratory for analysis and then returning the results to a physician, POCTs cut out both the transport and laboratory. As a result, they provide quicker turnaround time (TAT), sometimes near-instantaneously.

In the past, the traditional laboratory-centric process was unavoidable due to the sheer size of equipment required for diagnostic tests. In recent years, technology developments - especially in terms of miniaturization - have made it possible to perform a growing number of tests outside of the laboratory. One recent book on biomedical engineering (D. Issadore and R.M. Westervelt (eds.), 'Point-of-Care Diagnostics on a Chip, Biological and Medical Physics, Biomedical Engineering', Springer-Verlag, Berlin 2013) notes the array of sophisticated, low-power and small “microfilters, microchannels, microarrays, micropumps, microvalves and microelectronics ... integrated onto chips to analyse and control biological objects at the microscale”, that have made decentralized diagnostics possible.

Impact on efficiency, outcomes - and costs
Such time savings can have a dramatic impact on downstream clinical efficiency and patient outcomes. In many cases (although not universally or under all circumstances), they also save costs.

For example, POCT can reduce revenue losses due to workflow delays of test-dependent medical procedures - such as disruptions in magnetic resonance imaging (MRI) or computer tomography (CT) queue. This is not a rare occurrence, and delays in radiology testing have been shown to extend total length of stay in the emergency department (ED).

From lab downscaling to targeted solutions
Early POCTs were based on the simple transfer of traditional methods from a central laboratory, accompanied by their downscaling to smaller platforms. At a later stage, unique, innovative assays were designed specifically for POCT (such as the rapid streptococcal antigen test). This was accomplished by the development of wide arrays of POCT-specific analytic methods, ranging from the simple (such as pH paper for assessing amniotic fluid) to the ultra-sophisticated (for example, thromboelastogram for intra-operative coagulation assessment).

Today, the typical POCT test arsenal includes cardiac biomarkers, hemoglobin concentrations, differential complete blood count (CBC), blood glucose concentrations, coagulation testing, platelet function, pregnancy testing as well as tests for streptococcus, HIV, malaria etc.

Beside and near-bedside POCT
POCT devices are used in a wide range of healthcare settings. They can be divided into two broad groups, depending on size and portability - bedside and near-bedside.

Bedside POCT devices are smaller, usually hand-held, and offer the greatest mobility. Due to their compact nature they are often more specialized and limited in overall functionality. Many are enclosed in test cassettes (such as easy-to-use membrane-based strips) and based on portable, sometimes handheld, instruments. This family of POCT requires only a single drop of whole blood, urine or saliva, and the tests can be performed and interpreted by a general physician in minutes. Nevertheless, some of them can be quite sophisticated.

New POCTs for early detection of rheumatoid arthritis, for example, require only a single drop of whole blood, urine or saliva, and can be performed and interpreted by any general physician within minutes. Two of the earliest efforts in this area were made in Europe. The first, from Sweden’s Euro-Diagnostica detects antibodies to CCP, while Rheuma-Chec from Orgentec in Germany combines two biomarkers - rheumatoid factor and antibodies to MCV. These tests are targeted at primary care.

Near-bedside (or neighbourhood) devices are larger and typically located in a designated testing area. They provide higher calibration sensitivity and quality control and are used for more complex diagnostic tests than their smaller bedside counterparts. They are themselves also far more complex, with high degrees of automation in
From ACS to pregnancy tests, and overcrowding

Favourable perspectives on POCT in the ED have strengthened over time. One recent study in 'Critical Care' found POCT increased the number of patients discharged in a timely manner, expedited triage of urgent but non-emergency patients, and decreased delays to treatment initiation. The study quantitatively assessed several conditions such as acute coronary syndrome (ACS), venous thromboembolic disease, severe sepsis and stroke, and concluded that POCT, when used effectively, ‘may alleviate the negative impacts of overcrowding on the safety, effectiveness, and person-centredness of care in the ED.’

A great deal of attention has been given to the use of POCT in emergency settings for screening patients who presented with symptoms of acute coronary syndromes (ACS). The rapid identification and treatment of ACS patients is critical. Due to the time-sensitive nature of ACS, reduced TATs can offer a clear advantage. POCT has been shown to increase the speed at which positive cases of ACS are accurately identified, allowing physicians the ability to admit and initiate treatment at a faster rate than previously possible. Decreased TATs also can result in the earlier identification of negative cases of ACS, thereby increasing the number of successful discharges, and allowing for more efficient use of hospital resources.

The ICU and POCT

Unlike the ED, the use of POCT in intensive care units is still in its infancy. In 2013, researchers at Germany’s Klinikum rechts der Isar in Munich sought to retrospectively investigate whether POCT predicted hospital mortality in over 1,500 ICU admissions. The results were mixed. Lactate and glucose seemed to independently predict mortality. So did some forms of metabolic acidosis, especially lactic acidosis. However, anion gap (AG)-acidosis failed to show any use as a biomarker.

One of the most important areas for POCT focus in the ICU consists of sepsis - which is directly correlated to poor outcomes. ICU patients often have other ongoing disease processes whose biomarkers are shared with sepsis, such as raised white blood cell count and fever. More crucially, many ICU patients are already on antibiotics at admission, making microbiological cultures redundant.

POCT as part of health management strategy

Overall, POCTs have an impact and make most sense when utilized as part of an overall health management strategy which enhances the efficiency if clinical decision-making. Indeed, the rapid TAT provided by POCT allows for accelerated identification and classification of patients into high-risk and low-risk groups, improving quality of care and increasing clinical throughput. POCT results are often available in minutes. However, decreased TATs on their own mean nothing, until they provide clinical pathways means to impact on workflow. The latter varies widely across healthcare settings.

Differences in practice

Such a scenario is by no means straightforward. In Europe, for example, POCT use is highly irregular and differs greatly between institutions and countries. Though differences in operating procedures are natural by-products of institutional cultures, there are some oversight and quality control issues which healthcare leaders must address to take maximum advantage of POCT.

Answers to the above are not a question of ‘if’ but ‘when’.

Regulation - the future?

The future of POCT may well be shaped by regulators, and their response to the kind of pressures mentioned above. In Europe, POCT devices are regulated under the 1998 European Directive 98/79/EC on in vitro diagnostic medical devices, which became operational in 2001. POCT devices are not specifically mentioned or referred to in this directive, and at the European level, coverage of POCT is referred by international standard ISO 22870:2006, used in conjunction with ISO 15189 which covers competence and quality in medical laboratories.

The joint effort of the American Clinical Laboratory Improvement Amendments of 1988 (CLIA88) provided a major impetus for growth in POCT. The rules, published in 1992, expanded the definition of ‘laboratory’ to include any site where a clinical laboratory test occurred (including a patient’s bedside or clinic) and specified quality standards for personnel, patient test management and quality. One of CLIA88’s biggest contributions to POCT growth was to define tests by complexity (waived, moderate complexity and high complexity control), with minimal quality assurance for the waived category.

CLIA88 has been followed by US federal and state regulations, along with accreditation standards developed by the College of American Pathologists and the Joint Commission. These have established POCT performance guidelines and provided strong incentives to ensure the quality of testing.
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IHF/DR KWANG TAE KIM GRAND AWARD

WINNER
Integrating Medical and Social Support for the Elderly – System and Technology Enabled Service Innovations
HOSPITAL AUTHORITY (HONG KONG)
This project has developed new, sustainable models of care for elderly patients in Hong Kong, guided by their 2011 “Strategic Service Framework for Elderly Patients.” The aim of this project was to find a solution to the future challenges and strain on the healthcare system, which would come as a result of the rapidly aging population of Hong Kong. The Hospital Authority, which provides the majority of hospital services in Hong Kong, used self-evaluations and consultations from overseas experts and community partners to formulate their new approach. A stratified care approach was used to address elderly care and the management of chronic diseases. After implementation, evaluations have proven effective in reducing unnecessary hospitalisations and improving health outcomes and disease control.

HONOURABLE MENTION
Myong Ji Hospital MERS Preparedness and Response Project (The emergence of new infectious disease response system)
MYONGJI HOSPITAL (REPUBLIC OF KOREA)
The project aimed at preparedness for and prevention of new infectious diseases. Shortly after the 2015 MERS outbreak the Myong Ji hospital began their project. This project included the following stages: preparation, response, recovery, and enhancement. During the life of this project a response team and isolation room were formed, trainings conducted, and a new response system was established. Special attention was given during the recovery stage to address the extreme stress of healthcare providers and society. The Myong Ji hospital established the emergency infectious disease response research institute (ICER). A website and an international infectious disease symposium were also created to share the project process and other pertinent information with the public. The success of this infectious disease response project was recognized by the Ministry of Health and Welfare, as well as other local governments, and provided a model for strengthening public hospitals in Korea.

IHF EXCELLENCE AWARDS

LEADERSHIP AND MANAGEMENT IN HEALTHCARE
WINNER
Tan Tock Seng Hospital (TSSH)’s Collective Leadership Journey
TAN TOCK SENG HOSPITAL (SINGAPORE)
The overarching goal of this project is “better people, better care”. By creating a work environment where leadership is engaging and demands that leaders from all organizational levels assume responsibility for the excellence of the hospital, TSSH has greatly improved the quality of care provided to their patients. TSSH has created programs within the hospital to facilitate the shift from hierarchical management to collective leadership - engaging doctors, nurses, allied health professionals, and community hospitals. TSSH predicts that in 2022, about 777,000 days will be required to address projected patient care demands, but with the implementation of the Collective Leadership project, the hospital is decreasing bed demand by 20%, thus reducing costs for the hospital, so more funds can be allocated to patient care. Due to this project, TSSH is regarded as one of the best hospitals to work in Singapore, and has achieved an 86.1% patient satisfaction rate.

HONOURABLE MENTION
R.K. Khan Hospital Pharmacy Decongestion Project – An Innovative Partnership in Service Delivery
KHAN HOSPITAL (SOUTH AFRICA)
In effort to reduce the congestion in the R. K. Khan Hospital pharmacy, the hospital has created a project that allows for patients to pick up prescriptions at 13 different community centres in the area. The excessive congestion in the hospital lead to decreased patient and employee satisfaction, due to large wait times. Now, pharmacy staff pre-dispense chronic medications for patients and take them to the community venues where patients can collect them. With this innovative and original program, pharmacy attendance has gone down from 1800 to 900 patients per day, thereby increasing patient satisfaction and reducing employee stress. Now, patients are given more focused attention, and employees find the R.K. Khan Hospital pharmacy to be a healthy and rewarding work environment.
QUALITY & SAFETY AND PATIENT-CENTERED CARE
WINNER
Saving Blood, Saving Lives Project
EDENDALE HOSPITAL (SOUTH AFRICA)
This project aimed to create an effective and efficient system of handling blood products, with zero funding. Enderdale had previously been known to be of the least efficient provincial hospital in regards to the utilization and cost of blood products. With an already existing blood shortage in South Africa, monitoring the proper use of blood products was essential to the hospital functioning successfully. The hospital’s new protocol for blood product utilisation was devised from literature research, and was presented regularly through video media. A blood accountability form was then implemented, ensuring for reliable monthly audits and accountability of healthcare workers in charge of ordering. The hospital was able to increase effectiveness and efficiency by reducing expenditures through reducing unnecessary tests, improper blood usage, and waste. In the first two years 4400 units of blood were saved, allowing for an increase in availability of blood for other hospitals in the area. The project managed to reduce blood usage by almost 25% and expenditure by over 32%. The project was endorsed by the hospital management and the provincial Department of Health, and has been replicated successfully in other hospitals.

HONOURABLE MENTION
Improving Patient Safety & Patient Outcomes by Implementing ENHANCED ANESTHESIA RECOVERY PROGRAM (EARP) MAX SMART SUPER SPECIALTY HOSPITAL (INDIA)
The program was implemented to improve anesthesia related patient outcomes by reducing stress of surgery on the patient, increasing patient safety through preparedness for surgery, and accelerating the recovery process. Evidence based interventions were carried out to improve operative care of the patient from before the surgery began to the recovery period. The result was a new emphasis on anesthesia care, and a series of approaches to improve the use of anesthesia on patients. This clinician-led program was shown to have led to improved patient outcomes and a reduction in the cost of care for the hospital. There was also a reduction in the median length of stay post-anesthesia by 8 minutes and a substantial cost reduction of anesthesias for patients.

CORPORATE SOCIAL RESPONSIBILITY
WINNER
Comprehensive Corporate Social Responsibility Health Programs: Providing Quality, Affordable and Accessible Healthcare for Financially-Challenged Patients
MANILA DOCTOR’S HOSPITAL (PHILIPPINES)
A program implemented through the Manila Doctor’s Hospital (MDH) to ensure that there is equitable health access to patients who are not financially capable of receiving treatment in the Philippines. With the introduction of a “one-day blue card”, patients in the Philippines are given access to seven medical departments and are given a 50-70% discount on laboratory procedures. MDH makes an active effort to serve communities that are afflicted by natural calamities, or are completely barren of medical resource and care. Furthermore, MDH involves the patients in taking care of their own health decisions by providing health education. With the implementation of this program, a total of 17,316 consultations and 53 surgical procedures were provided, meaning that more patients now have access to quality healthcare in the Philippines.

HONOURABLE MENTION
Special Needs Oral Health Care Model
TAIPEI MEDICAL UNIVERSITY SHUANG-HO HOSPITAL (TAINAN)
This project aims to provide oral health care to those afflicted with any type of disability, from young children with developmental delays to the disabled elderly. In Taiwan, the decayed tooth rate is 91.96%, and those who cannot receive treatment are most often those with disabilities, who make up roughly 4.87% of the Taiwanese population. This program, through the implementation of oral health education, home visits, and a specialized shuttle bus service for the disabled to and from dental hospitals, has expanded access to oral hygiene in Taiwan. Since the program’s conception, 49,500 persons have been served and the rate of dental decay has declined due to the comprehensive education regarding teeth cleaning, oral massage and flossing provided by Taipei Medical University Shuang-Ho Hospital.
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Montreal 2017: Hospital Executive Study Tour

International Hospital Federation (IHF) Montreal 2017 Hospital Executive Study Tour (June 5 to 8, 2017) will showcase the latest state of the art and innovation in hospital service delivery from Canada. Quebec has been a leader in innovative delivery systems and models for quality care. Since Montreal will be celebrating a year-long birthday party in the upcoming year, the 150th anniversary of Canadian Confederation and the 50th anniversary of the 1967 World’s Fair in Montréal, Expo67, are also to be International Hospital Federation (IHF) Montreal 2017 Hospital Executive Study Tour (June 5 to 8, 2017) will showcase the latest state of the art and innovation in hospital service delivery from Canada. Quebec has been a leader in innovative delivery systems and models for quality care. Montreal will also be celebrating the 50th anniversary of the 1967 World’s Fair in Montréal, Expo67, and the 150th anniversary of Canadian Confederation.

The Montreal Executive Study Tour is part of a series of premium events offered by the IHF. We collaborate closely with regiona member and partner organizations in hosting various events that pave the way for effective advocacy and strategies that will result in implementation and exchange of ideas on best practices in leadership and management in health service delivery by hospitals and healthcare facilities.

These multidisciplinary exchanges of knowledge and experiences are facilitated together with dialogue on best practices in leadership in hospital and healthcare management and delivery of services. See more details about the Montreal 2017 Hospital Executive Study Tour.

Early Bird Offer

We offer a special Early Bird Discount of US$800 to IHF C-Suite members who register before December 3, 2016. This is equivalent to one year of membership fees. Once you apply the IHF C-Suite Member Discount Code your price will be US$2,000 rather than US$2800.

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Email: Montreal2017@ExecutiveStudyTour.com

Non IHF members may also consider encouraging their hospitals to become an IHF Associate Member (for 800 Swiss Francs a year). This would allow you to register for the Executive Study Tour at the full IHF Member Discount price in addition to receiving other member privileges ... a very good deal if there are two or more non IHF members form the same organization planning to attend.

REGISTER NOW
Sony’s newest medical monitor combines 4K and 3D imaging to deliver enhanced visualisation in Operating Room and training applications

Sony has announced the launch of the industry’s first medical monitors to combine 4K and 3D imaging technologies, delivering high brightness, enhanced resolution and increased depth of field for a range of medical applications.

The new LMD-X550MT (55”) and LMD-X310MT (31”) 4K 3D surgical monitors are designed for use with 4K or 3D endoscopes and surgical microscopes in operating rooms, as well as in medical facilities for training and education. The new monitors display 2D and 3D content in 4K or HD resolution. With 4K and next generation 3D endoscopes now being launched on to the market, Sony has recognised the demand for high quality, flexible display solutions that can match the image quality of these new systems.

With a slender chassis and narrow bezel, the new 4K 3D monitors offer many of the same features and technologies found in Sony’s award-winning medical monitor line up. 4K offers four times the resolution of HD, resulting in enhanced clarity, higher contrast and more accurate colour reproduction. The increased number of pixels in a 4K image means that objects displayed are more defined compared to a high-definition image, which helps improve surgical vision. 3D visualisation is clinically proven to improve surgical accuracy with increased depth perception from 3D visualisation.”

The new monitor series can display an increased number of 3D signal formats, compared to existing models, in both HD and 4K resolutions. In the case of dual-channel 3D HD video format, used by many 3D endoscopes, these new monitors can combine and reproduce the full HD resolution of both left and right channels, whereas conventional 3D monitors have to discard 50% of the vertical resolution as they are limited to using an HD panel.

The monitors also include Sony’s original OptiContrast™ panel, an advanced optical technology that reduces glare and reflection, and increases contrast to assure sharp, vivid images with deep black reproduction. By enhancing the contrast ratio under direct lighting, OptiContrast™ technology ensures that colour reproduction is also improved, again helping visualisation accuracy for surgical staff. Unique AIME™ (Advanced Image Multiple Enhancer) allows operators to adjust the structure and colours of 4K and 3D images from endoscopes and surgical microscopes in real time, for more comfortable viewing.

The new LMD-X550MT and LMD-X310MT 4K 3D monitors will be showcased for the first time at MEDICA in Düsseldorf from 14-17 November 2016 (Hall 10 Stand H57) and will be available in Europe in December 2016. The LMD-X550MT and LMD-X310MT monitors comply with the Medical Device Directive 93/42/EEC as amended by 2007/47/EC.

For more information, visit: www.pro.sony.eu/medical.
Immunotherapy - promise of dissolving and melting tumours

In spring 2015, the ‘New England Journal of Medicine’ reported the case of a patient with Stage IV metastatic melanoma – a disease considered close to untreatable. Although three growths in the skin had been surgically removed, one tumour under her left breast had grown deep into her chest wall. The 49-year old woman received a single treatment of an experimental combination of two drugs.

When she returned in three weeks for a second dose, the tumour had “kind of just dissolved”, according to Paul Chapman, the physician treating her at Memorial Sloan Kettering Cancer Center in the US.

Over one-fifth patients show complete response
The results were not an exception. 22% of the 142 patients enrolled in the Memorial Sloan Kettering trial showed a complete response (with their cancer ‘melting’ away), while 53% had at least 80% tumour shrinkage. However, there were downsides, too. Half the patients had side effects that were severe or life-threatening. The drugs used in the trial were Yervoy (ipilimumab) and Opdivo (nivolumab). Approved by the Food and Drug Administration (FDA) for melanoma, the two belong to a small, new arsenal of drugs which supercharge the immune system to attack tumours. The process is known as immunotherapy, and brings together experts from several fields, ranging from oncology and immunology to cell biology and genomics.

Another well-known immunotherapy medication is Keytruda, sometimes called the ‘Jimmy Carter drug’. Combined with surgery and radiotherapy, Keytruda has halted recurrence of melanoma in the former US president, although the disease had spread to his liver and brain.

Single drugs work too
One analysis of 4,846 advanced melanoma patients treated with Yervoy alone found 21% still alive after three years. Patients who make it to three years “do not die of melanoma,” according to James Allison of the MD Anderson Cancer Center in Houston, Texas, who is widely credited with pioneering modern immunotherapy.

Meanwhile, beyond melanoma, the combination of Yervoy and Opdivo has also shown extraordinary potential in bringing about remission in advanced stages of non-small-cell lung cancer, a leading cause of cancer-related mortality.

Leveraging the immune system
Leveraging the immune system to fight cancer, once little more than a medical dream, is becoming real. Using gene sequencing technologies to classify tumours, the immune system is now becoming primed with drugs and genetically-engineered cells. The immune system itself consists of a biochemical network which defends the body against viruses, bacteria and other invaders. Cancer, however, finds ways to hide from the immune system, or block its ability to fight.

Immunotherapy seeks to help the immune system recognize cancer as a threat, and attack it.

The medical equivalent of atomic fission
At the moment, there are hundreds of immunotherapy clinical trials under way for almost all types of cancer, individually or combined with other treatments. Eventually, researchers hope to develop blood tests that allow for the early detection of cancer, determine which medicines can be effective and monitor the response in real time.

For some oncologists, immunotherapy is the medical equivalent of splitting the atom. John Heymach, a lung cancer specialist at MD Anderson, has described immunotherapy as a “complete game-changer.” Several others concur. At an AACR press conference in 2015, Louis Weiner of Georgetown University observed: “We are in the middle of a revolution,” and added that “I don’t think that is hyperbolic.”

The media too has leaped into the fray, latching on to the enticing concept of dissolving the tumours that physically embody one of humanity’s most intractable struggles against disease. ‘Forbes’, for example, headlines an article: “Immune System Drugs Melt Tumours In New Study, Leading A Cancer Revolution.”

Checkpoint inhibitors
In practical terms, there are two contemporary approaches to immunotherapy. The first (and more-widely used) method involves the use of drugs that block a so-called ‘checkpoint’ mechanism used by cancers to shut down the immune system. This type of drug, known as a checkpoint inhibitor, is used to treat advanced melanoma, Hodgkins lymphoma and cancers.

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of the lung, kidney and bladder. The drugs work in 20-40% of patients. In many such cases, the results are nothing short of spectacular, with prolonged remissions that persist, even after treatment is halted.

Checkpoint inhibitors harness T-cells, the white blood cells which could be described as the special force soldiers of the immune system. The T-cells can, however, run out of control and attack normal, healthy tissue, leading to autoimmune disorders like rheumatoid arthritis, Crohn’s disease and lupus. To avoid this, built-in brakes or ‘checkpoints’ slow or shut down T-cells. One type of checkpoint inhibitor stops T-cells from multiplying. Another weakens them and shortens their life span. The two drugs in the Yervoy-Opdivo study reported by the ‘New England Journal of Medicine’ were both checkpoint inhibitors. Yervoy (ipilimumab) interferes with a molecule which switches off T-cells. Opdivo (nivolumab) prevents the death of T-cells.

Limitations with checkpoint inhibitors
Nevertheless, for the bulk of patients, checkpoint inhibitors do not show any results, or work for a while and then stop. In the Yervoy-Opdivo study, 126 of 142 patients did not see their cancer vanish entirely. One of the theories being researched to explain this setback is that other, to-be-discovered checkpoints are playing a role, and these would lead to new drugs that increase the scope of their effectiveness.

Meanwhile, harnessing an immune system in overdrive can also be very risky. As mentioned earlier, one out of two patients in the Yervoy-Opdivo study had side effects that were severe or life-threatening. In many cases, treatment for such patients needs to be discontinued.

Conversely, checkpoint inhibitors can also slow down vital glands such as the pituitary and thyroid, thus creating a lifelong need for hormone treatment. This can have an impact in other areas. For example, kidney transplant patients have suffered rejection after taking checkpoint inhibitors since the latter spurred their immune system to attack the grafted organ. Checkpoint inhibitors can also take months to begin working, and sometimes cause inflammation that make scanner data show what may, confusingly, look like a growing tumour.

CART: personalized immunotherapy
The second approach involves highly personalized treatments known as CART, with the abbreviation arising from the use of a protein chimeric antigen receptor (CAR) to modify a T-cell, which are first removed from a patient, genetically altered to kill cancer, and then re-infused.

CARTs effectively synergize antibodies, which provide precise recognition of disease targets, with the power of T-cells. Unlike antibodies, however, the modified T-cells continue to multiply, serving as a living therapy.

In autumn 2013, researchers at Fred Hutchinson Cancer Research Center in Seattle launched a (preliminary) safety trial with a CART on a lymphoma patient, who had failed to respond to elevated doses of chemotherapy. It was the first trial of its kind to be conducted on a human. At the end of a fortnight, the patient was reported telling his physicians that the lymph nodes in his neck felt like “ice cubes melting.”

Beyond leukemia and lymphoma
CARTs have largely worked so far in cases of leukemia or lymphoma, albeit dramatically. However, Fred Hutchinson is also working on several other cancer types, including Merkel cell carcinoma, melanoma and several sarcoma subtypes.

Elsewhere, researchers at the University of Pennsylvania are working on a CART which targets mesothelin, a protein often encountered on the surface of tumour cells. Trials involve patients with serious ovarian cancer, epithelial mesothelioma, and pancreatic cancer.

Challenges with CART
Nevertheless, many practical challenges remain to be overcome with CARTs too. They require extensive research and refinement in the lab before patient trials. Production is also labour-intensive, requiring isolation of specific T-cells from a blood sample, followed by multiplication in an incubator and the use of a hemacytometer for counting, and then concentration in a centrifuge. Apart from fine-tuning their therapeutic effects, means to cost-effectively scale the technology will also be required to bring CARTs to market.

Like checkpoint inhibitors, CART therapy also has clinical limitations, even in its mainstay application in leukemia. 20-30% of patients are not helped, and are likely to die.
Some way to go
In the final analysis, immunotherapy still has some way to go.
In spite of their often near-miraculous performance, immunotherapy drugs have worked in what is still a minority of patients.
Researchers are clearly aware that immunotherapy is unique, potent and extraordinary, but they cannot fully understand why - or yet control it adequately.

The risks of hype
Physicians also urge caution. Media-hype has led many patients to believe the age of chemotherapy is past. There are cases of unresponsive immunotherapy patients (or those suffering from unacceptable side effects) being switched back to chemotherapy, successfully. Though this may be due to a delayed effect of immunotherapy, it is too early to tell. Indeed, one explanation is that chemotherapy and immunotherapy may be working synergistically in such cases.

Industry too may need a reality check. Asset management companies like Piper Jaffray have forecast immunotherapy boosting the cancer treatment market to half a trillion dollars a year. This may of course face a collision with reality. Yervoy costs over USD 120,000 (€110,000) for a four-course treatment, while Keytruda is billed at about USD 150,000 (€138,000) for a year. At current prices, the combination of Opdivo and Yervoy would result in an annual cost of USD 270,000 (€248,000). On their part, CART therapies may cost even more. How exactly these sums will be financed is indeed the trillion dollar question.

History of immunotherapy
Dr. William Coley, an American surgeon born in 1862, is widely considered the father of cancer immunotherapy. He believed in a concept known as erysipelas - that bacteria from an infection could destroy tumours. Such a view was also held by the Russian playwright (and physician) Anton Chekhov.
In the 1890s, Dr. Coley injected terminally-ill cancer patients with streptococcal bacteria. His first patient, a drug addict with an advanced sarcoma, was expected to die within weeks, but the disease went into remission and he lived eight years. Other patients were treated, with mixed results. Many did not respond.
‘Coley’s toxins’ were produced in the late 19th century by leading drugs firms such as Parke-Davis, and were used by hospitals in Europe and the US until the end of the World War I. The emergence of radiation treatment, with more predictable results, followed by chemotherapy after World War II, were a death knell to Coley immunotherapy. In 1965, the American Cancer Society added Coley’s toxins to its list of unproven treatments.
Today, researchers think the Coley system involved a powerful infection which set off an intense immune response. In turn, this killed both the germs and the cancer.
Continuous cardiac monitoring reveals increased stroke risk among patients with greater burden of atrial fibrillation

Continuous heart monitoring for up to 14 days revealed a higher risk of ischemic stroke among patients who experienced a higher burden of atrial fibrillation, according to Kaiser Permanente research. Patients with a specific irregular heartbeat, called atrial fibrillation (AFib), who were not taking medication to prevent blood clots (anticoagulants), were monitored using a special electrocardiogram (ECG) patch that continuously records the heart’s electrical activity for two weeks and is then analysed for the occurrence and burden of different arrhythmias.

Atrial fibrillation is a major risk factor for stroke and is the most common cardiac irregularity seen by physicians. It currently affects up to an estimated 6 million people in the United States. Researchers monitored 771 adults with paroxysmal (intermittent) atrial fibrillation treated in Kaiser Permanente’s Northern and Southern California regions over a 3-year period. They found that for each doubling of the amount of time that a patient’s heart was in atrial fibrillation during the monitoring period, there was a 33 percent increased risk of subsequent stroke, independent of other known risk factors.

The burden of atrial fibrillation was defined as the percentage of time spent in this irregular heart rhythm during the monitoring period, which averaged 13.8 days. The findings were derived by linking detailed clinical outcome data from Kaiser Permanente’s electronic medical records with the patch manufacturer’s database of analysed heartbeat data.

“The availability of data collected from continuous, non-invasive ECG monitoring strategies allows for more comprehensive identification of atrial fibrillation burden, which in turn can help at-risk patients and their providers better evaluate treatment options for reducing the risk of stroke,” said Alan Go, MD, chief of cardiovascular and metabolic conditions research.

Kaiser Permanente Northern California Division of Research.
http://tinyurl.com/h8gbb8b

New wireless heart pump makes no contact with blood

EPFL researchers have developed an innovative cardiac support system in the form of a small ring placed on the aorta. This device is less invasive than traditional methods and avoids problems of hemolysis and the need for regular transfusions because it does not come into direct contact with the blood.

The heart is sometimes in a weakened state when recovering from certain diseases or while waiting for a transplant. To help the tired heart pump blood, researchers at EPFL’s Integrated Actuators Laboratory (LAI) came up with a clever solution. Their device is made up of three tiny rings made out of a material with special electrical properties. The device, called a Dielectric Electro Active polymer (DEAP), dilates when a current is applied and contracts when it is switched off. Because the reactions are immediate, the back-and-forth movement can be controlled in real time.

The researchers’ innovation was to place these rings around the aorta – the body’s main artery – at the exact spot where it exits the left ventricle. Each ring has two electrodes that are drawn together by an electrostatic force whenever the electric field is activated. “The electrodes squeeze the polymer as they come together,” said Jonathan Chavanne, a PhD student at the LAI. “Yet because this material is incompressible, its volume remains constant. So its surface area increases and stores up elastic energy.”

The electrical pulse is provided to the device by magnetic induction. Each of the three rings contracts in turn, in a movement reminiscent of an earthworm. This series of contractions, called peristalsis, creates a wave that moves the liquid inside the artery. This double action – simultaneously vertical and horizontal – helps the heart pump and transport blood.

“This method does not require us to enter the heart,” said Yves Perriard, the director of the LAI. “This means it is significantly less invasive than other cardiac support systems, which work by implanting valves or screw pumps inside the ventricle.”

In addition, by avoiding direct contact with the blood, this new solution eliminates the risk of excessive hemolysis, in which enough red blood cells are destroyed that regular transfusions may be required. And because the system is powered by magnetic induction, there are no wires coming out of the body.

The invention is currently in the prototype stage and has several more hurdles to overcome. The researchers plan to improve the device’s performance before testing it on a liquid with similar fluidic properties to those of the blood, such as glycerol. The team has been in contact with the University Hospital of Bern, where clinical trials could be conducted.

EPFL
http://tinyurl.com/hxa53ss
Long-acting cardioplegia solution results in better outcomes for pediatric patients

During heart surgery, it is sometimes necessary to temporarily stop cardiac activity, a process known as cardioplegia. Specific myocardial protection techniques are necessary for pediatric use. At the 96th AATS Annual Meeting, cardiac surgeons present the results of a prospective, randomized trial of pediatric heart surgery patients that shows that the del Nido cardioplegia solution, a new, long-acting agent, offers significant advantages over conventional cardioplegia, including reduced cardiopulmonary bypass and aortic cross-clamp times and faster onset of action. “Overall, del Nido cardioplegic solution is a simple and safe cardioprotective strategy. Cardiac performance is satisfactory in the postoperative period with a better cardiac index profile, lesser troponin-I release, and decreased morbidity,” explained Sachin Talwar, MCh, of the Department of Cardiothoracic and Vascular Surgery at the All India Institute of Medical Sciences (New Delhi, India).

The del Nido solution was first proposed by researchers at the University of Pittsburgh in 1990. It offers several advantages, including prolonged action with single dose administration, which helps to avoid the harmful effects of dose repetition. It also contains lidocaine to slow down energy consumption and calcium-competent ions like magnesium to prevent damaging intracellular build-up of calcium. In practice, it can be given as a single dose through the aortic root. In comparison, the conventional method of cardioplegia tested was St. Thomas cold blood cardioplegia. This requires an initial dose of solution, followed by repeated dosing at 25-30 minute intervals during surgery.

In the first study of its kind, the investigators randomized 100 pediatric patients younger than 12 years old to del Nido and cold blood cardioplegia (STH) groups. The patients underwent elective repair of ventricular septal defects and tetralogy of Fallot between August 2014 and July 2015. Intraoperative parameters and postoperative events were recorded. Cardiac index was calculated at four different time points, while troponin-I, interleukin-6, and tissue necrosis factor-alpha were estimated. The right ventricle was biopsied in order to examine the ultra-structural changes using electron microscopy.

The del Nido group had significantly shorter mean cardiopulmonary bypass time (67 min vs. 78 min) and mean aortic cross-clamp time (40 min vs. 48 min) than the STH group, respectively. “This is very important because long aortic cross-clamp time is an independent risk factor for increased duration of mechanical ventilation, high incidence of low cardiac output syndrome, renal complications, and immediate post-operative mortality,” commented Dr. Talwar.

The total amount of cardioplegia given was significantly higher in STH group (673 mL), compared with the del Nido group (372 mL), according to Dr. Talwar. Overall, the postoperative course was better in the del Nido group with shorter mechanical ventilatory time and ICU stay, faster recovery of cardiac index, and less need for inotropic support. The researchers biopsied the heart muscle to see if there were microscopic effects of the different cardioplegia agents. Ultrastructural study of myocardium showed no statistically significant difference in data obtained for nuclear changes, mitochondrial changes, sarcoplasmic reticulum, and glycogen depletion. Myofibrillar disarray was significantly more evident in the STH group, while cellular edema was significantly greater in the del Nido group.

American Association for Thoracic Surgery
http://tinyurl.com/jcqsqvdl

Immunotherapy reduces cardiovascular risk in rheumatoid arthritis

Extra-low dose combination of two anticytokines reduces disease activity and cardiovascular events

Immunotherapy reduces cardiovascular risk in patients with rheumatoid arthritis, according to research presented by Professor Aida Babaeva, head of the Department of Internal Medicine, Volgograd State Medical University, Volgograd, Russia. The combination of two extra-low dose anticytokines drugs reduced rheumatoid arthritis disease activity and cardiovascular events.

“Rheumatoid arthritis is an autoimmune disease in which cytokines such as tumour necrosis factor (TNF) and interferon (IFN), which normally protect the body, attack healthy cells,” said Professor Babaeva. “Patients have painful and inflamed joints. They are also at increased cardiovascular risk, particularly if their rheumatoid arthritis is not controlled.”

Professor Babaeva’s previous research showed that treatment with anticytokine drugs can decrease the activity of rheumatoid arthritis. Extra-low dose anti-TNFα reduced levels of inflammatory mediators and cytokines including C-reactive protein (CRP), rheumatoid factor, TNF, interleukin-1 (IL-1), and interleukin-6 (IL-6). The effect was more apparent and developed earlier when patients were treated with a combination of anti-TNFα and anti-IFNγ both at extra-low doses. The current study investigated the impact of the combination of drugs on cardiovascular events. It included 68 patients who had suffered from active rheumatoid arthritis for at least five years. Patients were randomized to receive the combination of anti-TNFα and anti-IFNγ plus standard disease-modifying therapy (38 patients) or placebo plus standard therapy (30 patients). During the three year follow up period the investigators monitored rheumatoid arthritis disease activity and cardiovascular events.

Patients taking the combination of anticytokines had a lower rheumatoid arthritis disease activity score, as measured by the DAS28,2 and more dramatic decreases in IL-1, IL-6 and TNFα than the group on standard therapy alone.

The incidence of cardiovascular events (unstable angina, severe hypertensive crisis, and deterioration of chronic heart failure) was more than double in the group on conventional disease-modifying drugs alone (37%) compared to those also taking the combination of anticytokines (13%).

Professor Babaeva said: "Our findings suggest that the decreased rheumatoid arthritis disease activity with the combination of anticytokines translates into decreased cardiovascular risk. Rheumatoid arthritis promotes the development of cardiovascular disease in a number of ways. Therefore, decreasing disease activity may also reduce cardiovascular risk by slowing down or halting these processes." For example, rheumatoid arthritis is associated with dysfunction of the blood vessel lining (called endothelium), which leads to lipid accumulation in the artery.
High resolution measurement of brain temperature

The brain is the most temperature-sensitive organ in the body. Even small deviations in brain temperature are capable of producing profound effects—including behavioural changes, cell toxicity, and neuronal cell death. The problem faced by researchers and clinicians is how to measure and understand these changes in the brain and how they are influenced by complex biochemical and physiological pathways that may be altered by disease, brain injury or drug abuse.

In a new paper Stefan Musolino of the University of Adelaide and the ARC Centre of Excellence for Nanoscale BioPhotonics, Australia, and his colleagues describe a new optical fibre-based probe capable of making pinpoint brain temperature measurements in moving lab animals.

“Within our centre we house physicists, chemists, and medical researchers and one of the interests of our centre’s ‘Origin of Sensation’ theme is temperature change in the central nervous system,” Musolino said. “It is only recently that more studies in my area of research—drug-induced hyperthermia—have started looking at changes in brain temperature in addition to changes in core body temperature within drug-treated animals. We wanted to further investigate these drug-induced brain temperature changes using centre-developed probes in order to develop a better understanding of the mechanisms driving them.”

The probe developed by Musolino and his colleagues consists of an optical fibre, sheathed within a protective sleeve and encased within a 4-millimeter-long 25-gauge needle. The end-face of the approximately 2-mm-long probe tip is dipped into molten glass made of tellurite, doped with a small amount of the rare-earth oxide erbium. When inserted into the brain, the colour of the light emitted from the erbium ions will vary depending on the temperature of the surrounding tissue; the temperature of that tissue can thus be determined by monitoring the light of these colour changes. This method allows for measurements to be performed with a precision of a fraction of a degree (0.1°C). “The area that can measure temperature is less than 125 micrometers in size,” said study co-author Erik Schartner “making it highly spatially precise and able to isolate temperature readings from very small brain areas.” The researchers say it is possible to make the temperature-sensing area of the probe tip smaller still—as small as a few microns across—by modifying the probe’s design.

The probe’s immediate application will be to investigate changes in brain temperature within moving lab animals exposed to certain drugs of abuse, such as MDMA (or ‘ecstasy’). “We will also look at the possible therapeutic properties of the tetracycline antibiotic minocycline and its ability to attenuate the changes in temperature caused by the administration of MDMA,” said Musolino. “In the future we will also be looking into combining this probe with other optical sensors in the hopes of developing new optical fibre-based sensing techniques for use in medical science labs that are examining real-world medical problems.” Eventually, a fully developed probe could be used in human brain temperature monitoring after traumatic brain injury, stroke or hemorrhage—times when the brain is extremely sensitive and small deviations in temperature can lead to additional brain injury.

“Continuous monitoring of brain temperature after brain injury would allow for the effects of hyperthermia management techniques such as anti-pyretics—drugs that reduce fever—and hypothermia to be observed and evaluated by clinicians in real time,” Musolino said. “These new tools and this deeper understanding will ultimately give us better understanding of the brain and how to more quickly react to brain injury.”

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Carestream surpasses one billion square meters of DRYVIEW film

Carestream Health's focus on the radiology profession has earned it the No. 1 market position for its DRYVIEW Laser Imaging Film, resulting in the production of more than one billion square meters of this and other specialty films at its White City, Oregon facility - enough film to circle the Earth 70 times. CARESTREAM DRYVIEW film for medical imaging use is sold in more than 140 countries. It contains more than 25 different components, including nanoparticles, with four layers coated simultaneously on the top of a PET film base and two layers on the back. The six-layer DRYVIEW film for medical imaging use is sold in more than 140 countries. It contains more than 25 different components, including nanoparticles, with four layers coated simultaneously on the top of a PET film base and two layers on the back. The six-layer DRYVIEW film is coated in one pass at a rate of hundreds of feet per minute with in-line quality inspection to meet FDA-regulated Class 1 medical device requirements. The company's manufacturing capabilities include its Contract Manufacturing operations that apply specialized manufacturing processes using high-technology coating assets to help contract-coating customers and partners develop better products at a competitive cost using coated or cast film-based advanced materials. Carestream Contract Manufacturing offers optimal product design, technology integration, manufacturing support, distribution, and finishing (slitting and packaging) capabilities with facilities in Asia and North America. The company can create structures of up to 20 precision-coated layers in a single pass, with options for two-sided coating, radiation cure, on-line inspection and lamination. Carestream adheres to top global standards for quality and certification including ISO 9001, ISO 13485 and ISO 14001.

www.carestream.com

ECR all set to become annual meeting for radiographers too

A steady rise in the number of radiographers attending the European Congress of Radiology (ECR), and in particular their enthusiastic feedback, has led the ESR to offer more to cater especially to their needs and make the ECR the annual meeting and the place to be for all radiographers from 2017 onwards. The greatly expanded scientific programme reflects this development: nine Refresher Courses, two Professional Challenges sessions (both about different aspects of the significance of teamwork between radiologists and radiographers), and one Special Focus session about the role of radiographers in pediatric imaging constitute the core of this programme. A dedicated Pros & Cons session on ultrasound service, and the EFRS Workshop, organized by the European Federation of Radiographer Societies and dealing with authorship and reviewing, will add to the diversity of the sessions on offer. The 'EFRS meets' session, which has been a regular part of the congress for the last four years, will feature Belgium as its guest country at ECR 2017, with the Association des Professionnels en Imagerie Médicale and the Vereniging Medisch Beeldvormers presenting radiographers’ achievements in their home country. The ESR's well-established 'Rising Stars' programme, which has aimed to reach trainee radiographers from the very beginning, has added the EFRS Radiographers’ Basic Session to its programme. The Voice of EPOS, the ECR's platform for poster authors to present their work in moderated poster sessions, will also offer a separate session for radiographers for the first time.

www.myESR.org

EVENT PREVIEW

MEDICAL FAIR THAILAND 2017 to emphasize connected healthcare and geriatric rehabilitative care

The 8th edition of MEDICAL FAIR THAILAND, the leading medical and healthcare event in Thailand and the region, will take place at the Queen Sirikit National Convention Centre (QSNCC) in Bangkok, Thailand from 6-8 September 2017.

Since its inception in 2003, MEDICAL FAIR THAILAND has grown in size, stature and is recognized as Thailand's most important resource and business platform for both international and regional suppliers from the medical and healthcare sectors.

In 2015, MEDICAL FAIR THAILAND held its largest edition to date as it welcomed 600 exhibitors from 42 countries including 15 national pavilions and country groups and attracted 7,226 quality trade buyers and decision makers from mainly Thailand and the ASEAN region.

The event focuses on equipment and supplies for the hospital, diagnostic, pharmaceutical, medical and rehabilitation sectors and brings together new and innovative technologies, solutions, products and services from around the world.

In its upcoming 2017 edition, MEDICAL FAIR THAILAND will put the emphasis on connected healthcare and geriatric rehabilitative care across two dedicated platforms and numerous concurrently held events. For one, the Connected Healthcare platform aims to demonstrate innovative digital solutions such as wearables that are transforming the understanding of patient’s health statuses, improve care and deliver greater results. At the same time, and returning for its 3rd edition, the Advanced Rehab Technology Conference (ARTeC) will focus on innovative and effective technological solutions to decrease mobility-related disabilities. Co-organized by the Thai Rehabilitation Medicine Association, the Royal College of Physiatrists of Thailand and Messe Düsseldorf Asia, the academic conference will welcome international key thought leaders to share insights on robotic transfer systems, robotic arm training devices, robotic gait training and wearable devices.

Serving as a converging point for healthcare providers, medical suppliers, industry professionals, government bodies, hospital administrators, doctors, nurses and other healthcare professionals sourcing for the latest innovations in medical and healthcare, MEDICAL FAIR THAILAND 2017 is expected to draw 700 exhibitors, 17 national pavilions and country groups and 8,500 quality trade visitors.

mda.messe-dusseldorf.com
PRODUCT NEWS
– November 2016

FRONT COVER PRODUCT

Universal resuscitation device

The b-card (Boussignac Cardiac Arrest Resuscitation Device) is a non-invasive ventilation system providing continuous oxygen delivery during CPR (CardioPulmonary Resuscitation). The device dynamically ventilates the need to pause chest compressions. Recent international scientific recommendations advocate chest compressions should not be interrupted when treating a cardiac arrest, in order to ensure continuous blood flow. However, it is still desirable to provide oxygen. Therefore, emergency responders currently alternate between chest compressions and ventilation at a rate of 30 compressions to two rescue breaths. The new b-card device eliminates the need to stop compressions to ventilate. Connected to a source delivering oxygen at a flow rate of 15L/minute, the b-card generates a virtual valve. This acts as the ‘heart’ of the device, optimizing the pressure created during the chest compression and decompression phases of resuscitation. Each chest compression has a dual action: helping to expel the air contained in the alveolae and simultaneously pumping blood from the chest cavity into general circulation. In the decompression phase, the virtual valve creates negative intrathoracic pressure, optimizing gas exchange in the alveoli. At the same time, it improves venous return towards the heart. This increases the blood flow ejected from the heart during the next chest compression. b-card has the dual effect of optimizing hemodynamics and ventilation when lifesavers are performing chest compressions. As a simple device requiring minimal training, it can be used by first responders, allowing them to treat cardiac arrests more effectively. The device is being successfully used by a number of pre-hospital medical teams in France and elsewhere. It includes the option to use it with a face mask and can be fitted by professional emergency first responders – emergency workers, qualified first aiders and nurses – who often provide the first-line response to an out-of-hospital cardiac arrest.

VYGON
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New family of detectors

Carestream is shipping its new DRX Core family of DRX detectors designed to make reliable, high-quality DR imaging affordable for imaging centres, small to mid-size hospitals, urgent care facilities, specialty clinics and providers that perform mobile imaging exams. The DRX Core portfolio includes wireless gadolinium (GOS) and cesium (CsI) scintillators in 35 x 43 cm and 43 x 43 cm sizes—as well as fixed 43 x 43 cm detectors with both scintillators. DRX Core detectors can be used with Carestream’s DRX-Ascend System, DRX-Mobile Retrofit Kits and DRX-Motion Mobile X-ray System. Up to two DRX Core detectors can be registered with each system at any time. Facilities can combine DRX Plus, DRX-1 and DRX Core detectors to have a combination of eight detectors registered with DIRECTVIEW Software on each imaging system for simultaneous use. The ability to integrate DRX Core, DRX Plus and DRX-1 detectors offers exceptional flexibility for healthcare providers of all sizes. Providers can select a detector that offers the desired features and budget requirements for each imaging area. DRX Core detectors deliver a preview image in three seconds and full-resolution display in 12 seconds. These detectors use the same battery as DRX Plus and DRX-1 detectors to maximize return on investment and streamline imaging operations. DRX Core detectors can be used with Carestream’s DIRECTVIEW software or Image Suite software. Image Suite software offers beam detection advantages that eliminate the need for a cable connection to the generator. Image capture will automatically start when the detector senses the X-ray exposure. DIRECTVIEW users can employ direct connection or beam detection methods. Carestream supports more than 180 different generator connection types. DRX Core detectors offer a Level 4 liquid rating that provides protection against water spray from any direction. Tri- and bi-colour LED lights offer improved feedback of detector status. The detectors are available in the United States, Canada and many countries in Europe, Asia and Latin America.

CARESTREAM HEALTH
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Surgical monitors

Sony has launched the industry's first medical monitors that combine 4K and 3D imaging technologies, delivering high brightness, enhanced resolution and increased depth of field for a range of medical applications. The new surgical monitors, LMD-X550MT (55”) and LMD-X310MT (31”) are designed to be used with 4K or 3D endoscopes and surgical microscopes in operating rooms. They are also suitable for training and education purposes. Recognizing that there is a demand for 4K and next generation 3D endoscopes, the company has produced equipment that reflects these needs. As such, both of the monitors display 2D and 3D content in stunning 4K or HD resolution. The new 4K 3D monitors have a slim chassis and thin bezel, and also offer many of the features and technology that are featured in Sony's award-winning medical monitor lineup. The use of 4K offers users image quality that is much more defined than high-definition images, and the use of 3D visualization is key to providing surgeons with improved accuracy, helping them to reduce procedure times while delivering realistic depth perception.

SONY
MEDICA Hall 10 / H57
www.ihe-online.com & search 47122

Robot-supported angiography system

Ideally suited to the hybrid OR working environment, the innovative robot-supported Artis pheno angiography system was developed for use in minimally invasive surgery, interventional radiology and interventional cardiology. The zen40HDR flat panel detector and the GIGALIX X-ray tube give the Artis pheno outstanding image quality. Resolution for 2D imaging is four times higher compared to the company's prior systems – in all recording processes thanks to the system's new 2k recording technology. The StructureScout feature can adapt and optimize imaging parameters to best suit the material structure of the area being X-rayed, which enables even less radiation to be used compared to the company's prior systems. Artis pheno is designed to support treatment of multimorbid patients and can be fitted with a comprehensive range of optional software applications to deal with complex cases. Thanks to the hygiene approach developed especially for Artis pheno, the system has large, sealed surfaces with fewer spaces, which helps customers with system cleaning. An antimicrobial coating prevents bacteria and viruses from multiplying on the system.

Because it can scan up to 15 percent faster in the body area compared to prior systems, syngo DynaCT is able to produce 3D images that need less contrast agent for the imaging process. If the patient is sensitive to the contrast agent, Artis pheno can also support CO₂ imaging of the extremities. The system follows the tilted table and increases CO₂ visibility using the new StructureScout. The C-arm is 13 centimeters wider and has a free inner diameter of 95.5 centimeters, which offers more space for handling adipose patients and means longer instruments can be used without difficulty. The Siemens Healthineers multi-tilt table is also designed to accommodate patients weighing up to 280 kilograms. The end of the table can be tilted both up and down, to stabilize the patient's blood pressure, for example, or to make breathing easier when necessary. The robotic construction of the Artis pheno gives it a flexible isocenter that it shares with its predecessor, the Artis zeego. This means the angiography system can follow all table positions and provide the best possible imaging support for the patient’s treatment, while representing the target area of the body from virtually any angle.

Artis pheno can also be combined with surgical tables from Maquet und Trumpf which enable patients to be specially positioned for operations. Typical positions involve patients lying on their side, stretched out on their side, or even sitting. Surgeons can move the easy-float tabletop on the new multi-tilt table with minimal effort, regardless of how much the tabletop has been tilted on either of its axes, or how heavy the patient is. Artis phenol recognizes the position of the tabletop at all times, and automatically aligns itself to the tabletop with every movement. The memory positions let the system move the C-arm out of the operating area quickly if necessary, giving the surgeon and the operating team free access to the patient, and then move it back to exactly the same position again for further imaging. This means results can be checked directly, even while the operation is still in progress. Many additional optional application packages can be used with the Artis pheno. In spinal fusion procedures, for example, up to ten vertebrae can be visualized in 3D imaging using syngo DynaCT Large Volume. Syngo Needle Guidance then makes it possible to plan extensive procedures using screws or needles. Screw paths can be planned with precision, and the Automatic Path Alignment function automatically aligns the C-arm to follow them. The laser integrated in the image detector shows the surgeon the planned path, which helps improve both accuracy and speed in the OR. Using this software application can help minimize the rate of screw positioning errors in the spine and also speed up the work process in this area.

A number of applications on the Artis pheno support transarterial chemoembolization (TACE) of tumours. TACE involves supplying embolic particles coated with a chemotherapeutic drug via a catheter directly into the arteries leading to the tumour. Using syngo DynaCT 360, it takes just six seconds for the Artis pheno to generate a large-volume image of the liver or lung, for example, including the anatomy of the tumour and the vessels leading to it. Rapid rotation is vitally important in reducing movement artifacts, since the patients are given only local sedation for the TACE procedure. The syngo Embolization Guidance application renders arterial vessels visible and helps distinguish the vessels and treatment paths using colour-coding. Graphic overlaying of the selected vessel paths with the real-time X-ray images makes the vessels that supply the tumour visible for simplified microcatheter navigation which can save on the dose of both radiation and contrast agent.

SIEMENS HEALTHINEERS
MEDICA Hall 9 / E33
RSNA Hall A / 1667, Hall A / 1936
www.ihe-online.com & search 47124
Point-of-care ultrasound

The Edge II point-of-care ultrasound system provides exceptional imaging performance in even the most demanding settings. Ideally suited to emergency medicine and critical care applications, it uses an innovative transducer technology—DirectClear—to increase penetration and contrast resolution, providing fast and reliable high quality imaging when it matters. The Edge II offers a wide-angle display and a rugged construction. Its Armoured Cable Technology helps to maintain performance over time by protecting transducers from common accident scenarios, such as being rolled over, stepped on or twisted. The system also features a fully sealed keypad designed to provide liquid ingress protection and allow easy cleaning while still being simple to operate in a busy environment.

FUJIFILM SONOSITE
RSNA Hall B Stand / 6713
www.ihe-online.com & search 47105

Compact mechanical ventilator

Requiring only a minimum of space, the HAMILTON-C1 mechanical ventilator combines maximum mobility with invasive and noninvasive modes, as well as high flow oxygen therapy. The integrated high-performance turbine enables the ventilator to be completely independent of compressed air. This makes it an ideal companion for all patient groups in the intensive care unit, emergency ward, recovery room or intermediate care, long-term acute care facilities, and during intrahospital transport. The HAMILTON-C1 offers the option of an integrated high flow oxygen therapy mode. With this enhancement, it provides a variety of ventilation and therapy options in one device, including invasive and noninvasive ventilation, and high flow oxygen therapy. In just a few steps, it is possible to change the interface and use the same device and breathing circuit to accommodate the patient’s needs. In pressure-controlled modes (PCV+, SPONT, PSIMV+), an optional feature enables the use of conventional speaking valves with the ventilator. Monitoring, triggering, and alarm management have been adjusted to allow their use.

HAMILTON MEDICAL
www.ihe-online.com & search 47114

Automated external defibrillators

The ZOLL AED 3 and AED 3 BLS (basic life support) offer enhanced Real CPR Help and give rescuers the power to know when they are providing high-quality chest compressions. Also introduced is a 5-year universal electrode for both adult and pediatric patients, further improving cost of ownership. Every ZOLL AED 3 comes with Program Management Onboard, which notifies users immediately if the device fails a self-test, or if the battery is due to be replaced. The ZOLL AED 3 BLS model is designed specifically for the needs of first responders with the CPR Dashboard and the ability to deliver the patient record directly to healthcare providers.

ZOLL MEDICAL CORPORATION
MEDICA Hall 11 / E55
www.ihe-online.com & search 47096

Second generation ECG device

Building on the solidly proven AT-1 and enhanced with the latest technology, the AT-1 G2 device distinguishes itself by its outstanding signal quality and the newest interpretation algorithm. User-friendliness is guaranteed with step-by-step workflow and easy patient data entry. A colour screen and an easy-to-clean keyboard complete this intuitive and reliable electrocardiograph. The high-resolution thermal printer is compatible with roll and z-folded paper, accommodating customer’s preference. Further, thanks to very high sampling frequency and a large frequency band, the CARDIOVIT AT-1 G2 provides optimal signal quality for adult and pediatric ECG. Connectivity via USB is also available for software updates. In addition to signal quality check and lead reversal detection, the renowned 12-lead ECG interpretation ETM program is available.

SCHILLER
MEDICA Hall 09 / E05-2
www.ihe-online.com & search 47106
Choosing the right treatment for the right patient is especially important. Owlstone Medical, a diagnostics company, has developed and received CE mark approval for a pediatric version of the company’s disease breathalyser, ReCIVA. The marking extends the scope of breath testing in early stage diagnostics and therapy response to include children and in particular, the difficult to manage group of child asthma patients. Both the adult and pediatric versions of the breathalyzer are now being used in EMBER (East Midlands Breathomics Pathology Node), a £2.5 million (£2.8 million) project, funded by the Medical Research Council (MRC) and the Engineering and Physical Sciences Research Council (EPSRC). The primary aim of EMBER is to develop breath-based systems for molecular pathology of disease and clinically validate breathomics as a new diagnostic modality. Volatile organic compounds (VOCs) in breath have been shown to correlate to inflammatory subtype in asthma, which helps guide better treatment decisions. Owlstone Medical uses the Respiration Collector for In Vitro Analysis (ReCIVA), in combination with the Field Asymmetric Ion Mobility Spectrometer (FAIMS) sensor platform, to accurately and selectively detect volatile organic compounds (VOCs) in breath. The pediatric version of ReCIVA is suitable from ages 5 and up and has been developed as breath sampling offers a completely non-invasive way to test children. Breath analysis presents a significant opportunity to better predict how a child will respond to certain treatments, including steroids and expensive biologics. Choosing the right treatment for the right patient is especially challenging in children as obtaining samples such as blood to measure disease activity can be difficult. Breath analysis offers an excellent opportunity to sample the airway by simply breathing into a mask. This presents a new approach to understand disease and make better treatment decisions.

**Pediatric disease breathalyser**

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