Developments cost money and indication for beta-blockers. Such the past, heart failure, is now an for ACE blockers and, unlike in specialists, requires new treatment methods and a large number of drugs. These days, renal artery stenosis is no contraindication for ACE-blockers and, unlike in the past, heart failure, is now an indication for beta-blockers. Such developments cost money and require transparent and efficient treatment.

Where can we save costs? Processes are an obvious choice – short distances, having all data electronically stored and networked, right down to the chef’s menu planner. Each department is set up as a separate profit centre; solar panels on the roof provide energy. Calculations for energy savings are being made in all kinds of areas. ‘Before each ward round my students and I wash our hands’ – so said Ignaz Philipp Semmelweis in the mid-19th century, in his drive to reduce the hospital mortality rate. Today, the World Health Organisation states that ‘Clean care is safer care’ – and yet, particularly in recent times, the lack of hygiene in numerous hospitals has resulted in mortalities. Who is to blame? What can be done, apart from regular hand washing? Over the past year, these questions and many more regarding cost savings have been raised at various quality, health and hospital congresses, Anja Behringer reports.

Hospit...
Hygiene problems in European hospitals

Worldwide, antibiotic resistance is one of the three major challenges for public health according to the European Society of Clinical Microbiology and Infectious Diseases (ESCMID). What needs to be done? Anja Behringer reports

Every year, 57,000 people die of nosocomial infections in European hospitals. 4.1 million patients contract healthcare-associated infections – that is every tenth patient. But that's not the point. Crucial is the material expenses, costs for further education, training, and demand for additional qualifications and even more specialised knowledge.

The German ‘physician landscape’, for example, clearly shows that specialists are understaffed and that projects to link in- and out-patient care are urgently needed. As far as outpatient care is concerned, German States record a shortage of physicians, whereas in the clinical sector only large institutions are adequately staffed.

In the next few years the care demand at the interface of in- and outpatient care is expected to increase further and care management will play a crucial role. The entire process needs to be optimised and its inherent problems need to be mastered.

No doubt new skills and competencies will be required – what exactly these skills will or should be is currently being hotly debated in the different professional associations.

Qualification and certification are buzzwords but no one dares to venture type of issues as to how the results. The demands are not new, today the discussion is all about implementation. As long as hand-shakes are common in hospitals and as long as simple hygiene principles are neglected due to staff and time pressures, the strictest framework cannot be expected.

‘The German Hospital Society has quite a dry perspective on the discussion, and as long as hand-shakes are common in hospitals they cannot train the number of hygiene specialists that we need. At the University of Witten/ Herdecke teaching hospital the hygiene department raised a hygiene group to raise awareness of the dangers the invisible bacteria pose. A hygiene specialist monitors compliance with the guidelines, which is important in the possibility offered by data visualisation to involve employees in improvement initiatives, rela-

Quality management has been an integral part of the German healthcare sector for years. Does it work, but is unmanageable, particularly in terms of increasing emergency and competitive pressures on hospitals.

Does investments in quality management pay off? Costs and benefits, the state-of-the-art and a glimpse into the future led discussions at the two-day National Quality Congress held in Berlin in November. Here, Bettina Döbermann highlights the results.

In visualising ordinary procedures, Michael Bückelmann, CEO of the regional hospital corporation Schwäbisch Hall, during his lecture at the National Quality Congress. To reduce the costs for the annual costs for full-time staff in charge of on-site QM, material expenses, costs for further education, training, and development.

But that’s not the point, crucial is the opportunity to use QM as a professional tool to monitor, evaluate and test in the field. In this way, innovations can be implemented within a short period - or even be rescinded if they prove a failure.

As an example of a successful innovation, Bückelmann described the restructuring of work at the integrated cardiac centre Schüchtermann Klinik Bad Mergentheim.

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Let’s raise hand-shakes are common in hospitals, they cannot train the number of hygiene specialists that we need.

At the University of Witten/Herdecke teaching hospital the hygiene department raised a hygiene group to raise awareness of the dangers the invisible bacteria pose. A hygiene specialist monitors compliance with the guidelines, which is important in the possibility offered by data visualisation to involve employees in improvement initiatives, relatively prompt feedback, without upsetting them e.g. by finger-pointing, due to the obvious frustration.

The digitally verified clinical concept

All the gathered expertise in process management could be applied in the new building and the renovation of the Ebeldklinikum Riesa in south-east Germany, according to a presentation by Meik Eusterholz, project manager of the private Unity AG management consulting.

Since April 2011, the firm has been developing process management customised for the hospital’s givers and needs, in close and mutual cooperation with the staff and architect. Initially, computer simulations were modelled, then optimised and, finally, implemented in the construction plan. For example, within only a few minutes the simulation helps to see the number of surgical operations could be reduced by 66%, while the number of cancellations reduced by 70%.

Meik Eusterholz explained. He believes these figures already make the digitalisation research concept effective after a very short period and will prove successful in the long term.
"Nowadays, there are not that many opportunities for EU countries to expand technological progress," said ambassador Dr Jan Koukal when he called for the trans-border utilisation of ‘neighbourly’ potential during his opening speech at the joint Czech-Austrian seminar. As former Chairman of the Scientific Council of the Institute for Physics at the Czech Academy of Sciences, Dr Koukal had actively contributed to a new era of technological change following the political shift in Eastern Europe.

In their keynote speeches such renowned figures as Petr Očko (Head of the Department for Research and Development at the Czech Ministry of Trade and Industry), Milan Piték (CzechInvest Agency), Tomáš Halva (South Moravian Innovation Centre) provided a good overview of opportunities for investment, sponsorship, corporate partnerships and research cooperation between Austrian and Czech participants. Dr Gerhard Hawa, of ecoplus, presented the structure and management of this Lower Austrian business agency as well as its three Technopoles in Tulln (agro-ecological biotechnologies), Krems (medical biotechnologies) and Wiener Neustadt (modern industrial technologies).

At the centre of this top-level event were technologies for surface processing (nanotechnologies) and Life Science. The Austrian as well as Czech companies and institutions introduced selected sectors, products and services. Professor Friedrich Franek (Vienna University of Technology) presented the ACT Centre of Excellence in Tribology, which acts as a research and development provider – not least in medical technology – for numerous international companies within the context of the top-level research programme COMET.

Two specialist workshops led to detailed discussion based on best practice examples. The Centre for Clinical Research of the Palacky University in Olomouc and the Departments for Medicine and Pharmaceuticals and Biotechnology at the Danube University Krems were represented in the field of Life Science, and the Czech Association of Surface Technologies as well as the Austrian Tribology Society, CEST GmbH and Technopol Wiener Neustadt represented the Surface Technologies sector.

Further details: Ivan Brož, graduate engineer. Email: commerce_vienna@mzv.cz

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**Trans-border Research**

The Czech Republic and Austria hold a joint seminar

Administrators struggle to find cost savings

continued from page 1

The number of mistakes made during work processes reduce significantly. More and more entities in the healthcare sector are looking at saving costs by entering into business partnerships. The German medical insurer DAK, for instance, has put together the Care Guide to Pain, with the pharmaceutical company Grünenthal in an attempt to develop effective treatment approaches in pain therapy. Other partnerships between hospitals and manufacturers have resulted from the installation of medical devices.

In Germany, the Government is also trying to improve quality in the healthcare service. In the summer of 2011, the country’s parliament decided to implement a change in the Infection Protection Act to achieve an improvement in the quality of hospital hygiene. A commission for hospital hygiene and infection prevention is to be set up at the Robert-Koch Institute for this purpose. Dr Klaus-Dieter Zastrow, Director of the Institute for Hygiene and Environmental Medicine at the Vivantes Hospital in Berlin stresses that this necessitates an adequate number of qualified staff and also calls for the creation of a new role, i.e. that of a certified hospital hygienist.

Professor Uwe Frank, at the Department for Infectiology, University Hospital Heidelberg, has worked out the following calculations on this issue:

Based on conservative estimates there are around four million cases of hospital-acquired infections (HAI) resulting from AMR (antimicrobial resistance) across the European Union every year, with an estimated 37,000 fatalities directly attributable to this problem. Add to this around 10 million additional in-patient hospital days annually and the direct yearly costs run to around €5.5 billion – an average of €344 a day (Source: ECDC Annual Epidemiological Report 2008 and Model HL, ECDC).

This does not include the follow-on costs arising from patients not being able to work, or the possible long-term effects or indirect effects on society through loss of productivity, or even death.

This is only one example of hospital administrators’ cost concerns.

Height and weight are not enough.

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Shopping for bargains at a virtual trade show

Strackers, beds, furniture, defibrillators, scanners, pumps, sterilizing units, indeed equipment for all medical disciplines and departments, you name it, a browse around the website and a bit of bidding could provide your hospital with just what it needs – and save money. Having established a link on our European Hospital website, we asked Philip Jacobus, founder and President of DOTmed, to explain for our readers how buying and selling second hand medical equipment online actually works.

‘Yes and no. More people in the US buy used equipment than in Europe, and there are probably more people in India and South America buying used equipment than in Europe. However, there are more people in Europe buying used equipment than there were 10 years ago. Based on the traffic that we see on DOTmed.com from European hospitals, we know that interest in used equipment in Europe by hospital personnel is on the rise.

How can European Hospital readers use the Internet to sell their used equipment?

‘Nowadays anybody can use the Internet to do just about anything. We have about 20,000 people a day that visit our website from around the world. You go to the website, do a search, find companies that specialise in the products that you’re selling, and then you contact them.

‘We offer auctions that allow people to list their equipment and take bids semi-anonymously. You can use our site to price things and it doesn’t cost you anything. You see what price other people are selling a similar product for and that gives you some idea of what your product is worth.’

What percentage of used equipment is sold on the Internet?

‘I’d say probably 70 per cent of all used equipment sales outside of the equipment that’s sold by OEMs – originates on the Internet.

How does selling via the Net help sellers to gain a higher price and speed up the sale?

‘The Internet is more efficient; it allows a seller to expose their equipment to more people, and because the equipment is exposed to more people you’re more likely to get bids. When you have competitive bids, the price is more likely to go up.’

How are the logistics handled in the United States?

‘In the United States, the dealers, brokers and refurbishing companies specialize in used equipment and they know what they’re doing. If you sell to a doctor in Nigeria, he may have no clue as to how he’s going to de-install that machine. That’s why hospitals in the United States turn to industry professionals who can handle that work for the doctor in Nigeria. It’s easier for the hospital to sell to the industry professional – and let them handle those problems – than it is to sell to the doctor directly. Our company handles that sort of work for the hospitals.

Are there companies in Europe that can help sellers, including DOTmed, to de-install, etc.?

‘Yes. A hospital can use DOTmed to find companies that buy and sell equipment. They can use DOTmed to auction the equipment and check ratings. We have a whole ethical component to our website, so a European hospital can go to DOTmed.com to investigate a company and determine if they think that company is qualified. They can find other companies and they can even turn that work over to DOTmed and we will handle it for them.

How simple is it to go through European Hospital and list equipment on DOTmed?

‘DOTmed has an established relationship with European Hospital that affords users special access to our website, including free registration and a discount off of our normal rates. You just go to European Hospital’s website (www.european-hospital.com), click on the DOTmed link, and then you’ll be taken to a special page where you can register.

‘We have about 200 people that register on our site every day; it only takes a few minutes to do and it costs nothing to list. It’s one of the easiest ways to attract competitive bidding on your equipment so you get a fair market price.’

Just one click to whitepapers & user reports...

www.european-hospital.com
Ambulance paramedics switch to on the spot electronic reporting

A British ambulance service has successfully made the transition from paper-based patient reporting to a fully electronic system enabling paramedics to capture patient data at the scene of an incident and transmit it to the receiving hospital ahead of arrival at the Accident and Emergency (A&E) unit.

Using Panasonic Toughbooks with touch-sensitive screens to record and transmit on the spot medical information means that A&E staff is better informed and prepared to receive the patients for treatment via ambulance.

The East Midlands Ambulance Service NHS Trust (EMAS) began the move from paper-based patient reporting to electronic reporting in 2009, initially working with the Royal Derby Hospital in Derbyshire and then implementing the system and training paramedics in its use across Nottinghamshire, Lincolnshire, Leicestershire and Northamptonshire.

Eventually, England’s 11 ambulance trusts will replace their paper-based reporting systems with the electronic system as part of the National Programme for IT (NPfIT) in the NHS, though EMAS is the first to complete a full-scale implementation, using mobile technology and devices.

Now, other ambulance trusts are following suit with the electronic patient record (EPR) system, which is being implemented at West Midlands Ambulance Service, Yorkshire Ambulance Service, East of England Ambulance Trust, North West Ambulance Service and North East Ambulance Trust.

EMAS clinical change manager Mick Conibear explained that, at its most basic, the EPR is primarily used to capture information that would have been written on the existing paper Patient Report Form (PRF), such as location, incident details, condition of patient and vital signs. However, additional functionality has been added to the system to enhance and support the capture of diagnostic data from defibrillators. “This enables diagnostic data – specifically a “frame grab” of an ECG trace – to be incorporated within the patient record as a PDF file, for onward transmission to the receiving hospital and for storage within the central database for subsequent review and analysis.”

The captured data is known as an ePRF (Electronic patient report form), and through the Toughbooks the system interfaces with the ambulance trust’s CAD (command & dispatch system).

Control-room dispatchers can access information loaded by crew members in order to prepare hospitals for patients’ arrival, or to pass on relevant information to other ambulance crews or GPs. Paramedics can also access resources such as treatment and medication guidelines.

Hospital staff at receiving locations such as A&E, cardiac centres, medical assessment units and maternity departments can access ePRFs via a facility called WebView, in “near real time”, while a patient is still en route.

Generally Panasonic Toughbooks are used as ‘laptop’ devices but they can operate within a vehicle using a mounting kit and associated power supply.

Report: Mark Nicholls
The 500-bed Warrington Hospital in the north-west of England has introduced rapid, accurate POCT to wards and theatres. The hospital was one of the first in the UK to install Siemens RapidLab 1200 Blood Gas analysers and the RapidComm v3.0 Data Management System. More recently, it has installed Clinitek Status Connect systems to further enhance its operations.

A key factor in the decision to upgrade to Blood Gas analysers was because existing equipment was experiencing problems and letting down staff.

The point of care (POC) team at the hospital - with a full-time POC coordinator and two medical scientists - is responsible for ensuring the smooth running of RapidLab Blood Gas analysers at seven locations throughout the hospital, all connected to RapidComm to enable remote management. From the laboratory, the POC team can monitor analyser status and manage user operations, enabling it to pre-empt problems before they impact on clinical users.

Accordingly, if there were problems, the POC representative would have to talk issues through with clinical staff by phone. Now, using RapidComm, analysers on the ward can be viewed and issues resolved remotely. This positively affects the team's workflow management, especially out-of-hours.

Focusing on emergency and specialist care, the Warrington conducts more than 50,000 POC tests a year. Monthly test totals include 500 from the A&E department, 100 from the operating theatre, 1100 from the haematology and transfusion unit, 1200 from the intensive therapy unit, 400 from the neonatal ward and 259 from the maternity unit. The RapidLab 1200 Blood Gas Analyser delivers results for all parameters within 60 seconds with a comprehensive test menu (pH, pCO2, pO2, Na+, K+, Ca++, Cl-, Glucose, Lactate, Neutrophil (Bivuline); and full Coag Haem).

The RapidComm v3.0 Blood Gas and United Data Management and Connectivity Solution allows centralised management of multiple Siemens analysers and laboratories. When the United Status Connect System brings connectivity and testing oversight to POC analytics, the analysers are compact in design for placement on wards or specialist units. Results from samples are delivered promptly on-screen and are recorded on-board.

POC co-ordinator Colia Critchley said: 'The first major benefit of IT powered integration is less manual maintenance and less walking around the hospital.' For example, with the RapidLab analysers in locations such as A&E and ITU linked by RapidComm, we can see how they are operating at any time, simply by logging onto the user interface screen on the workstation inside the Lab.' This has saved time on maintenance, she added, because the software monitors that all is well and undertakes problem solving processes if needed.

The benefits of modernised POC systems and processes include: remote monitoring and management of analysers; increased compliance control; password protection (only trained authorised staff access RapidLab analysers); reduced use of consumables e.g. individual reagent bottles; better quality control; a clear audit trail; and ease of use.

Report: Mark Nicholls

The German Association of the Diagnostics Industry (VDGH) announces encouraging results from a new member survey, Susanne Werner reports

German diagnostics firms expect a marked increase in business this year. Among the companies, two thirds (78.3 %) expect an increased turnover and more than half (56.6%) announced their intention to employ more staff. This optimistic growth prognosis, the result of a survey amongst its members announced in January by the German Diagnostics Industry Association (VDGH) is surprising, given that statistics previously presented a rather paradoxical picture.

In terms of growth, in previous years Germany lagged behind the rest of Europe. Whilst the diagnostics sector in Great Britain in 2009 and 2010 saw a growth of 6.2%, Germany saw a negative growth of 0.5% over the same period. However, in Europe, Germany leads in market volume.

Overall, the 27 EU member states turn over more than €10 billion, a fifth of which is generated in Germany alone. In Great Britain the sector has a turnover of around €770 million. Germany’s volume goes way beyond that figure, with the market volume for 2011 estimated at around €2.18 billion.

This is the result of a projection carried out by the VDGH based on turnover in the first quarters of the previous year. ‘Germany is the European leader regarding to the conventional healthcare market. However, the picture is different when it comes to growth dynamics. Germany lags way behind some of the most important national markets here,’ said VDGH Chairman Matthias Borst.

With around 20,700 employees in the diagnostics sector, Germany intends to increase employee numbers by 3% to 4% per year primarily through investments. Two thirds of its companies plan to expand their operations, 3% plan to maintain them at the same level (38%). Innovations particularly help the sector to grow. 78% of the firms in the sector are already achieving up to 28% of their turnover through products marketed for less than three years, and 9.3% of firms generate half of their turnover from innovations.

Does Germany offer the right economic environment for diagnostics firms? The VDGH survey reveals a split opinion among its members. The companies surveyed listed the high qualifications of staff, good pay morale, high levels of patient care, fast regulatory approval for new products and the high standard of clinical research among the country’s strengths. Negative aspects mainly include cuts in the entire healthcare sector, such as the comparatively low level of reimbursement in the scale of fees, as well as hospital budgeting.

41% of companies surveyed quoted the high pricing pressure in the market as the biggest obstacle for growth. ‘We are used to freely negotiate prices and happy if we can keep them at the same level. Prices can only be increased through innovations,’ the chairman said. This also explains the hope amongst the sector to promote financial growth through increased investments into R&D.

One central hope for the future is personalised medicine. ‘Companion diagnostics makes it possible to identify patient groups who either respond particularly well to certain drugs, or don’t respond, or even suffer undesired side effects, all based on genetic mutations,’ Matthias Borst explained. A third of diagnostics companies are looking for small start-ups to large enterprises – are already generating turnover in personalised medicine. More than half of companies surveyed expect personalised medicine to develop medium-to high-level dynamics.

The conference – Topics will include Telehealth for Chronic Disease Management, Telehealth Service Standards, Telehealth Mapping, PRO, Open Source in Healthcare, eHealth in Low Resource Settings, the 2nd edition of the eHealth Strategies Symposium, and more.

Education – This year Med-e-Tel is running over 150 presentations and workshops, led by international experts covering expertise, current applications, and predictions of future trends in Telemedicine and eHealth, and their effects on the healthcare system as a whole. Medical specialists can benefit from up to 16 hours of CME credits.

The exhibition – The Med-e-Tel 2012 exhibition will feature Telemedicine and eHealth products and solutions from leading companies and providers.

Networking – The organisers report that the event ‘…actively promotes and enhances cooperation opportunities, and is the place to establish partnerships and contacts, both globally and locally. Meet and network with healthcare and industry stakeholders, use the dedicated meeting areas and events at Med-e-Tel to exchange ideas. Attend meetings from a number of international and regional associations, and expand your network.

Electrophoresis is one of the standard molecular-biological procedures used to separate and classify DNA components. The procedure is used in the development of personalised medicine.

Business – Meet with industry representatives and see the solutions and technology at work in the expo and networking area. Participate in demonstrations that will give you a better view on the potential behind Telemedicine and eHealth tools.

The final organiser’s message is: ‘Ten years ago, we were on the verge of new technological developments opening the field for more and improved Telemedicine and eHealth applications. This time around, we are on the verge of mainstreaming Telemedicine and eHealth into regular health and care services. Join us in Luxembourg for the 10th edition of Med-e-Tel and be part of the progress.’

Details: www.med-e-tel.eu
The 32nd International Symposium on Intensive Care and Emergency Medicine

So much to discuss...

Neuromonitoring new medical emergency teams, organ harvesting, pandemics and much more

When the ISICEM 2012 opens this March, Brussels will again experience a healthy influx of medical specialists intent on hearing the most recent, clinically relevant developments in research, therapy and management of the critically ill.

The physiopathology of catheter infection is now clearly understood. Colonisation of the endovascular tip of the catheter precedes infection and arises by two main pathways: the extraluminal and intraluminal routes, explains Dr Olivier Mimoz, Head of the Centre Hospitalier universitaire, Erasme Hospital, Belgium.

The best way to prevent catheter infection is to use all the recommended interventions, advises Dr Mimoz, giving five main recommendations:

1. The most important includes the use of a checklist to guide catheter insertion and maintenance.
2. Catheter-related bloodstream infections are reported to occur in 3-8% of inserted catheters and are the first cause of nosocomial bloodstream infection in ICUs.
3. Current mortality rates range from 0-15%, depending on the degree of control for severity of illness.
4. Catheter material is also an important determinant in the prevention of catheter-related infections. Catheters coated with antimicrobial or antibiotic agents decrease microorganism adhesion and biofilm formation.
5. The preference for a chlorhexidine-based solution skin antiseptic and cleansing hands with an alcohol-based hand rub solution before any catheter manipulation is the key intervention.

The best way to prevent catheter-related infections is to use all the recommendations in a bundle, Dr Mimoz explains, giving five main recommendations:

1. The most important includes the use of a checklist to guide catheter insertion and maintenance.
2. When inserting a catheter, clinicians should use maximum sterile barrier precautions, including a sterile mask/cap/gowns/gloves and large sterile drapes.
3. The preference for a chlorhexidine-based solution skin antiseptic and cleansing hands with an alcohol-based hand rub solution before any catheter manipulation is the key intervention. In most of the studies, the superiority of chlorhexidine has been explained, at least in part, by a synergistic effect with alcohol, even for low chlorhexidine concentrations.
4. The subclavian vein being the vein with lesser infection risk should be preferred if there is no contra-indication (severe respiratory failure, severe coagulopathy).
5. The need to reduce CVCS only to situations without any alternative. In many cases, a peripheral venous access to the native route can be used and CVCS that are no longer needed should be removed.

Catheter-related bloodstream infections reduce the risk of catheter-related infections and catheter-related bloodstream infections. If non-adherent dressings increase these risks; therefore, the use of these new dressing materials needs to be considered an essential component of the rapid change of every non-adherent dressing.

Last but not least, educating and training medical teams who insert and maintain CVCS is essential for preventing complications.

Make a note: ISICEM 2012
20-23 March
Session: Nosocomial bloodstream infections Catheter-related infections
Olivier Mimoz MD (CHU Poitiers)

Professor Vincent is deservedly pleased. Participants at this year’s ISICEM will hear details of a number of new clinical trials – published for the first time in Brussels. Among these is a new study results comparing several types of immunomodulators in intensive care (IV) solutions including albumin, hydroxethyl starch or saline solutions. "Due to the lack of solid data approving the benefit or superiority of some agents for IV therapies," Professor Vincent explained.

Other clinical research engages in comparing several types of intravenous catheters. Among these are new study results concerning catheters marketed for IV therapy and management of the critically ill.

Probably no other European medical event is so intertwined with its Congress President than ISICEM. Professor Jean-Louis Vincent, Head of the Department of Intensive Care at Erasme University Hospital in Brussels, not only initiated the meeting in 1980, but has grown into the biggest gathering of its kind worldwide. In 2012, more than 6,000 visitors from 100 countries will participate.

In the lead up to this year’s event, EH reporter Karoline Laarmann interviewed the professor about the fate of sepsis studies and the advent of intensive care without catheters.

The best criterion defining a catheter tip is to remove the catheter and look at the infection site. ‘Many studies have shown the catheter tip being colonised at the insertion site. For long-term catheters and are the first cause of nosocomial bloodstream infections, and that the need to reduce CVCS only to situations without any alternative. In many cases, a peripheral venous access to the native route can be used and CVCS that are no longer needed should be removed.

Catheter-related bloodstream infections are the third most frequent infection in the intensive care unit (ICU) after pneumonia and ventilator infections. The incidence of CVCS infections lies between 1-4 for 1,000 catheter-days. This means for the USA, as an example, that 100,000 of them develop an infection. Catheter-related bloodstream infections are reported to occur in 3-8% of inserted catheters and are the first cause of nosocomial bloodstream infection in ICUs. attributable mortality rates range from 0% to 15%, depending on the degree of control for severity of illness.

The negative prediction value of this technique is very high – close to 100%, he explains. The best way to prevent catheter infections is to use all the recommendations in a bundle, Dr Mimoz advises, giving five main recommendations:

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Better safe than sorry

Five recommendations to prevent central venous catheter-related infections

Catheter-related bloodstream infections are the third most frequent infection in the intensive care unit (ICU) after pneumonia and ventilator infections. The incidence of CVCS infections lies between 1-4 for 1,000 catheter-days. This means for the USA, as an example, that 100,000 of them develop an infection. Catheter-related bloodstream infections are reported to occur in 3-8% of inserted catheters and are the first cause of nosocomial bloodstream infection in ICUs. attributable mortality rates range from 0% to 15%, depending on the degree of control for severity of illness.

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Another big ethical issue to be extensively debated will be future pandemics. ICUs are small departments already working with full capacities and resources at all times. What can we do when there are not enough beds, machines or medical staff to treat a critically ill patient population? We have to answer these questions now, because we don’t know when the next pandemic will come – but we know it will come.

The 32nd International Symposium on Intensive Care and Emergency Medicine
Traumatic brain injury

The SILENT EPIDEMIC

Traumatic brain injury (TBI) is one of the world’s biggest public health problems. In the USA, for example, about 1.7 million people sustain TBI every year, costing healthcare $76.5 billion. Yet, the public knows little of the significance of TBI and also its management and treatment. TBI is caused by an external force, but what it also means is that understanding and controlling TBI is not simple. It takes a team of experts to address the issue, including neurosurgeons, intensivists, and neurologists. Secondary injury occurs during the initial insult and results from displacement of the physical structures of the brain leading to contusion, concussion, etcetera. Secondary injury happens immediately after that. These are actually normal reparative mechanisms, such as haematoma and swelling, which in other body parts create no problem, but because the brain is located in an enclosed space, it has devastating effects on the surrounding organs. If these are not controlled, the swelling hemi-lates down through the brain stem and causes unconsciousness. Therefore, clinicians today concern themselves with the management of severe brain injury and the difficult cases that follow worldwide. For instance, in the USA, where the guidelines were originally developed in 1995, only 60% of clinicians follow them. That is not acceptable.

Secondary care, so far, there is a lot of excitement about the potential of new therapeutic interventions, he reveals. ‘The brain is much more delicate than other body tissue. When you injure any other organ, or a muscle or skin, they are all made up of millions of fibres that do all the same function. Therefore, if you lose 10% of them, it is no problem – but the brain works like a computer circuit board. When you destroy 10% of the neurons, you can completely shut down critical functions. Therefore, the goal is to design treatments that will decrease brain swelling or slow down the damage caused by secondary injury.’

In TBI research, the greatest hope in neuroprotection is on progesterone, a hormone with potential neuroprotective effects. It appears to decrease brain swelling by shutting down what experts call the neurotoxic cascade. Classically, this mechanism is described as a two-stage process. The first stage involves the brain and release neurotransmitters like breaking the flood gates of a dam; the second stage involves the environment service cells to clean up the damage. Thus, cleaning process is what actually leads to oedema and therefore swelling. So, if we can block this linkage effect with intravenous progesterone, we probably can improve patient outcome.’

Currently underway are two Phase III clinical trials with progesterone: the ProTECT trial in the USA and the SuperCare trial in Europe. These studies, sponsored by BHR Pharma, LLC, as principal investigator of ProTECT, Dr. Wright will present the preliminary results of the trial during the ISICEM in Brussels.

The Starled® EVO single light examination lamp

Mark Nicholls reports

The advantages for anaesthetists using the Venner A.P. Advance Video Laryngoscope, outlined in January at the Association of Anaesthetists of Great Britain and Ireland (Winter Scientific Meeting) by consultant anaesthetist Dr. Patel, co-inventor of the system (A.P. = his initials), include more controlled access and better visibility to access complex airways and to achieve airways to difficult airways, whereas an endotracheal tube may be used to facilitate endotracheal intubation to aid tracheal intubation and ventilation. The venner A.P. Advance video laryngoscope enables a view of the glottis to aid tracheal intubation and ventilation. The venner A.P. Advance video laryngoscope enables a view of the glottis to aid tracheal intubation and ventilation.
It helps ensure patient safety in the ICU – and beyond

Integrated information management reduces risks and cuts cost, Finn Snyder reports

In this context, tele-ICU is a further approach telemedicine technology can bring. ‘Tele-ICUs extend both productivity and the reach of specialists. The report, with data collected from three sites, describes a demonstration project that tested the clinical and financial benefits of tele-ICU technology on ICU mortality and ICU length of stay.

The outlook

Availability of patient data to physicians, anywhere and anytime, promises to benefit patient outcomes, adequate use of staff resources and cost. According to medical engineer Jimmy Johansson, at Skåne University hospital in Lund, Sweden, major barriers to integration of information sources are organisational problems in healthcare and competition among medical devices manufacturers, many of which promote proprietary standards. Conformance with standards such as HL7 and IHE profiles, he underlined, will provide the necessary basis for data exchange.

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The 40th International Congress of Intensive Care Medicine

Maximising hand hygiene protocols and introducing central line care bundles reduces nosocomial infections and mortality rates, Moira Mizza reports

The 40th International Congress of Intensive Care Medicine, sponsored by Société de Réanimation de Langue Française (SRLF) – the French Society for Intensive Care – is, with more than 3,500 participants, one of the major intensive care meetings to take place in 2012, Finn Snyder reports

The SRLF is undergoing major organisational changes, including a new website (www.srlf.org) and publication of the English language publication Annals of Intensive Care, available in open access, and set up as a triple group. These measures aim to improve communication and thereby, shared experience between French-speaking intensivists and their international colleagues.

For its 40th anniversary, the SRLF chose the theme of The Future of intensive care and the format of 2012 congress reflected this, allocating a major part of the meeting to the discussion of research and innovative ICU techniques.

During the session chaired by Professors Duget and Payen de la Garanderie, The Future of Intensive Care, the first presentation, by Professor Jean-Louis Vincent (Brussels), discussed the ICU clinical cassuaries during the Libyan crisis, not to mention the ever-present availability offered to other foreign patients, including tourists and illegal immigrants – certainly a commendable effort towards the wider cross-border healthcare towards which the European Commission for Health is working.

As in other European countries, the major challenge facing on ICU is sepsis – increasingly severe systemic infections acquired either in the community or while in hospital. This is followed with ever-increasing antibiotic resistance is the major cause of mortality in most European hospitals, important abilities to look after the many human lives than cancers and accidents.

Thus patient safety is now by far one of the major concerns of hospital staff, especially in an intensive care setting when the patient is at his or her most vulnerable.

The unit has thus embarked on initiatives to acquire hospital (nosocomial) infections, including maximising hand hygiene protocols and introducing central line care bundles. Through this, the Maltese hospital’s ICU has gained its greatest achievement by significantly decreasing the incidence of bloodstream MRSA infections. In addition, although the target weight – greater numbers of patients per annum, we have not observed a higher mortality rate – in fact this decreased slightly in 2010 to 18%.

The experience of the intensive care has shown that the small size of our nation (400,000) and the currently tight resources, while making the challenge bundle more difficult, did not stop the health professionals involved from achieving a sterling standard of care and offering it to the widest spectrum of patients possible. This has also been possible through European funded projects that also created opportunities to link with other European ICUs. This is what, after all the EU’s campaign, Europe for patients in all about better healthcare for all in Europe - and hopefully beyond.

Medical Lighting System

Light for diagnosis

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Light for general use

Light for major use

Moira Mizza (Brussels), again suggested the need to enlarge the skill set of the intensivist by encouraging the use of echography, especially colour and Doppler instead of relying on MRI and CT-scans that may not always be readily available. Portable scanners, some no bigger than an i-Phone, are now available and their use can save lives by enabling real-time use at the bedside. It’s been estimated that technology is in place for ICUs – but are the future intensivists?

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EUROPEAN HOSPITAL www.european-hospital.com Vol 21 Issue 9/12
The Max Harry Weil Lecture at the ISICEM 2012

With his clinical and experimental research on the acute care of critically ill patients through round-the-clock monitoring of the vital functions Max Harry Weil revitalised intensive care medicine and became known as its founding father. He died in 2002 in California, aged 84. Thus the first Max Harry Weil Lecture will be held in his honour at this ISICEM. The Quality of ICU care: Science and humanity lecture will be delivered by Professor Peter M Suter, who has delivered outstanding services to the promotion and development of intensive and critical care medicine. As former president and current vice president of the Swiss Academy of Medical Sciences (SAMW) he is committed to the establishment of ethical guidelines for borderline situations at the beginning and end of life.

MRI will improve the treatment of wake-up strokes

Neurointensivists need to act quickly and carefully – as well as consider later complications or the psychological impact on stroke victims. This potentially debilitating disease was a central discussion among 1,400 participants from 10 countries during the three-day 29th Annual Conference of Neurointensive Medicine (ANIM), an event hosted in January by The German Society for Neuro-Intensive Care and Emergency Medicine (DGNI) and the German Stroke Society (DSG). The ANIM 2012 Conference Secretary, Dr Gerhard Jan Jungehülsing, a consultant neurologist at the Clinic for Neurology at the Charité Berlin, is head of Clinical Studies at the Centre for Stroke Research (CSB). Susanne Werner of European Hospital asked the expert about new developments in stroke diagnosis and treatment.

"Neurothrombectomy is becoming increasingly established as an alternative to lytic therapy. With this procedure, doctors remove the clot mechanically from the cerebral vessel with the help of a catheter. This is often more efficient, particularly in the case of large or proximal occlusions. Whether or not better recalibration also means a better result for the patient is currently being investigated in a number of international studies. The central issue is that processes in the entire field of stroke- and neurointensive medicine must be well organised. No individual was introduced to attending interventionists. This ambulance is additionally equipped with a CT scanner. The vehicle brings the technology to the patient, saving time and helping to accurately assess the emergency, he explained. "Patients can then be transferred to a specialised hospital where they will receive the best possible care – more quickly. The ambulance crew is interdisciplinary. The neurologist must more quickly. The ambulance crew is interdisciplinary. The neurologist must more quickly. The ambulance crew is interdisciplinary. The neurologist must more quickly. The ambulance crew is interdisciplinary. The neurologist must more quickly. The ambulance crew is interdisciplinary. The neurologist must more quickly.

"Doctors are always very interested in progressive technologies and will often spend hours trying to fit special catheters or to understand complex medical terms. This can be more about the technology by the bedside should always contribute towards a situation where we can create more time for the patient and should not lead to a situation where we lose contact with people."
Centralising critical care to save funds

Professor Timothy Evans, a leading intensive care specialist believes regionalising critical care into major centres across England and Wales is an ‘inevitable step’ as the UK’s National Health Service sorts of services. Respiratory physicians fewer larger centres is the response from critical care support in community or dis-
or anything else. As the services that is an increasing focus on regionalising ise critical care in the same way that there said, ‘In my view, we do need to regional-
ise critical care as inevitable,’ he added, ‘and if you
pared to travel to get a first class service
for their child.
pared to travel to get a first class service
your hospital but you will get something
will have to be clearly communicated to
patients greater access to excellent qual-
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one intends to study.'
The third domain of risk modi-
Postoperative complications –
Who is at risk?
Daryl J Kor (Mayo Clinic, Rochester)

Post-operative care

The work of ISICEM-referent Dr
Daryl J Kor, a physician in the
Department of Anaesthesiology
Division of Critical Care Medicine at Mayo Clinic,
Rochester, USA, is dedicated to
the prevention of acute lung injury
after surgery. His efforts centre on two
key aims: Identification of high-risk
patient populations with advanced
modelling techniques and the iden-
tification of intermediate biologic
markers that accurately and reli-
ably predict the development of the
fully established syndromes.

To begin defining risks for
adverse postoperative events, he
believes the first key step is to
specifically define what are the
complications of interest. To this
end he says, ‘The term “postopera-
tive complication” is very vague
and non-descript. When attempting
to study risk profiles for postopera-
tive complications, it is essential
to understand the specific population
of interest. Moreover, it is critical
to define very clearly the specific
complication or complications that
one intends to study.’

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Professor Bonomo points out that whilst, over the last few decades, 'radiology has experienced a happy phase, rich in important technological innovations and clinical applications' the need to increase the number of radiologists acquainted with novel diagnostic technologies and interventional procedures is significant. Thus, he adds, 'My motto this year is innovation within tradition, since we aim both to continue successful initiatives and at the same time improve the ECR’s quality, keeping the programme exciting, and offering a complete learning experience, with options to suit every delegate’s professional needs.’

Education and training

The Foundation Course will focus on ultrasound in order to underline the necessity for radiologists to know and carry out ultrasound scanning better than other specialists, and the importance of including ultrasound in the curriculum of radiological sciences and bioimaging at the Catholic University of Rome, A. Gemelli Hospital, in Italy.

Emergency and oncology

Reflecting on two ever-expanding fields within radiology – and the creation of two new radiological subspecialty societies, the European Society of Emergency Radiology (ESER) and the European Society of Oncologic Imaging (ESOI) – the ECR is this year launching Refresher Courses and Satellite Symposia on oncologic imaging and emergency radiology.

Radiation oncology, with its very close connections to radiology and medical imaging, is being represented at ECR 2012 by the European Society for Radiotherapy and Oncology (ESTRO). Also fitting into this theme, the multidisciplinary lecture series ‘Managing patients with cancer’ is now into its third year. In the future, specialists from various disciplines will discuss their close cooperation at the hospitals where they work together as cancer teams.

Radiation protection

One of the great attractions of the ECR is, of course, the enormous trade show that is showing the most innovations spread over 26,000m² of exhibition space. ‘They will benefit from the new subspecialty refresher courses entitled ‘How I report’, which have one thing to report in a way that is more understandable and useful to referring physicians.’

Several other initiatives will be dedicated to the younger generation, such as ESR Rising Stars, Junior Interpretation Quiz, the Radiology Trainsees Forum and the ESOR Session, and Invest in the Youth.

Other societies, other countries

Close cooperation with national radiological societies and other medical disciplines is the cornerstone of the ESR meets programme, which sees an exchange of knowledge with three different national radiological societies each year, in the name of building stronger connections with radiological organisations throughout the world, the organisers point out.

Alongside Italy, which is always among the best represented nations at the ECR, and Romania, the ESR reports its ‘delight’ in welcoming the first African nation to take part in the programme Egypt. ‘The invited partner discipline is our sister discipline, radiation oncology, in which imaging plays a growing role in defining and assessing patients’ response to treatment.’

Technology

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Catch up with ECR online

For those unable to attend this year’s ECR, certain selected sessions – e.g. the opening ceremony, honorary lectures and the ESR Meets sessions – will be broadcast at one via the ESR website, thanks to an initiative introduced this year called ‘ECR goes to...’ As usual, all presentations will also be available after the congress via the ESR website, Prof. Bonomo points out.

Social

The ESR website already lists a wide-ranging selection of cultural and social recommendations, including concerts, exhibitions, opera and theatre productions, the professor reminds us. ‘Congress attendees will find even more to guide them through the city’s cultural landscape in the specially produced Arts & Culture Brochure, given to every participant.'

Here we go...

It’s ECR 2012 – another year, another meeting of the world’s largest radiological society – and it’s Vienna!

20,000 participants attended ECR 2011 – a record for its organising body, the European Society of Radiology (ESR), which represents more than 56,000 radiologists worldwide, is keen to surpass. Thus, for 2012, it set out to create an even more attractive, versatile programme, which is led by Congress President Lorenzo Bonomo, Professor of Radiology and Chairman of the Department of Radiological Sciences and Bioimaging at the Catholic University of Rome, A. Gemelli Hospital, in Italy.

www.european-hospital.com
CLASSIFYING COPD

Multi-detector CT scanners acquiring high-res 3-D data volumes offer new possibilities for diagnosis/ CT scanning

Security checks – the necessary evil for air and land travellers. While luggage scans and body pat-downs are ubiquitous, drug smugglers have increasingly used their own bodies as a means to conceal and transport their goods. However, the police send suspected ‘body packs’ post haste to a radiologist for an X-Ray. Locating the illegal substances with the hit rate of a sniff dog, however, is not an easy feat.

‘Up to fifty percent of the drug bags are not detected by X-ray,’ says Michael Scherr MD, junior physician at the Institute of Cardiovascular Imaging at the Medical University of Graz, Austria. ‘If drug smugglers use other packing materials, the hit rate may drop to only 30 percent, which means that there will be false findings. Drugs often have a low density, very similar to soft tissue or stools. In addition, drug traffickers today know how to configure the packs so the X-rays will not detect them. Thus, in our institution, we’re now using CT.’

Creating a CT topogram is often sufficient to be able to ascertain whether drug packs are present or not. If the answer is yes, an actual CT scan is performed. A normal dose CT achieves a hit rate close to one hundred percent, he says. Often enough a low dose protocol – e.g. as used to detect kidney stones – will do. ‘It’s important to search the entire gastro-intestinal tract from the diaphragm to the spinchter,’ the radiologist emphasises. ‘We try to distinguish between drug packs and stools by looking at unusual structures in the body, for example strange shapes or coverings.’ According to Dr Scherr even very low dose CT yield excellent detection results.

Currently the Munich team can reduce the radiation dose for a CT with several hundred individual slices to that of a conventional single plane X-ray. However, there is not the only factor that influences body pack detection. Success strongly depends on the individual settings used, the ‘windowing’. ‘The radiologist should use at least the same settings for all examinations as is the case if the patient normally chooses for a lung scan. This will detect packs much better. The CT windowing used for abdominal scans makes detection much more difficult if not impossible,’

the radiologist adds. Despite the drug traffickers’ cunning packaging and baling of their wares, bags do rupture from time to time inside the body and the substances cause

70-year-old man with new chest pain following a bypass operation. Dynamic CT perfusion examination (a, b, d, and e) shows lack of perfusion (arrow) in the anterior wall of the heart, which is of good correlation with the results of the nuclear-medical SPECT examination (c). The flow of blood in healthy and diseased tissue can be measured with high accuracy and good precision (d). The examination also facilitates the assessment of the patency of the bypasses (e)

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of blooming effects

the coronary arteries, a contrast medium injection at the maximum stress point facilitates a good assessment of the heart muscle under stress in the second CT. Therefore, the MRI examination remains Prof. Schoepf’s preferred procedure only for the examination of myocardial perfusion. However, as soon as an examination of the coronary arteries is called for, the CT can be used for both - and

the change of signal intensity and the real myocardial blood flow in ml/g tissue/min for MRI. This is the case for CT – it is quantifiable via the selective distribution of the iodine-containing contrast medium in the heart. This, in turn, has great advantages, he emphasises, as for the detection of therapeutic effects. All doctors are permanently under pressure to prove the efficiency of their treatments. From this point of view CT is also important, and not only in his institute. There are worldwide efforts to increase this and other potentials of CT – in cardiological as well as radiological working groups.

For Prof. Schoepf this also means that CT cannot be considered the speciality of either cardiology or radiology, but that those with the most experience of this type of examination must always carry it out. In his clinic in Charleston it happens to be the radiology department, at Johns Hopkins it is the cardiology department. Worldwide, the majority of CT scanners are operated by radiologists, which, going forward, should ensure a strong involvement of radiology in the most modern procedures of cardiac imaging.

Unfortunately, not everyone shares Prof. Schoepf’s enthusiasm for CT as the method of choice for the examination of coronary disease, certainly not medical insurers. In the US, and in most centres in Europe, it is still mainly considered a research field. In Asia, however, CT is being fully reimbursed by insurers in the same way as NUM used to be – which it has now completely replaced. For Prof. Schoepf, this is further ‘ammunition’ for ‘his’ CT.

45-year-old man with known coronary disease. Stents after stent implantation into the right coronary artery. The CT examination - dual energy procedure under adenosine stress - shows the thrombotic occlusion of the anterior interventricular artery (a) as well as the open stent in the right coronary artery (b). The newly occurring occlusion causes reversible ischemia of the anterior wall of the heart (arrows in c, d, e), which could be detected with the stress dual energy CT in a comparable manner to the SPECT (d), but in the context of the overall thoracic anatomy (e)

without the interpretation of images based on their intensity scales as carried out with the MRI.

This becomes particularly obvious with the dual energy CT, which offers many opportunities of image reconstruction. With this procedure one basically looks directly at the iodine in the heart muscle via material differentiation, and the real composition of the cardiac tissue becomes apparent.

CT is also superior to MRI when it comes to the quantification of blood flow. Whilst there is no exact, linear connection between intoxication. Then, suddenly the body packer is a patient. These different definitions are important from a legal point of view”, Dr Scherr explains. “Since a patient’s medical care is subject to medical confidentiality, the physician is not obliged to involve the police.”

While a ruptured 10g pack of cocaine is usually lethal because there is no antidote, heroin intoxication can be treated. Thus, in an emergency, the physician needs to know which drug was carried.

Since early 2009, Dr Scherr has used pig models and in vitro tests to find out how drugs in the body can best be imaged and distinguished. He applies state-of-the-art dual energy technology, which allows him to characterise the drugs and the filler due to their chemical structures. These studies, which are internationally unique, could soon help radiologists worldwide to improve diagnostic methods and hit rates when imaging body packers.

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A head of AMSD, Prof. Christoph Hoeschen’s motivation is easily explained: ‘Our objective is to improve the image quality of computer scanners whilst reducing the dose.’ Whoever believes this is a matter for physicists is wrong. When it comes to achieving dose reduction, there is in fact a lot of as yet undiscovered potential in the field of mathematics, as Prof. Hoeschen explains: ‘Radiation is required to generate images. The fewer data we need for mathematically correct image reconstruction the more we can lower the dose.’

Using a diagram, he clarifies a further advantage of parallel beam geometry: ‘The resolution of an image remains constant across the entire sectional plane. Furthermore, with Watch you have the ability to vary the focus-to-object distance to adapt the resolution according to requirements. With CT gantry systems the focus-to-object distance is fixed through the iso-centre.

Lower dose
In Germany, the collective radiation dose across the population from medical examinations is almost as high as the exposure to natural radiation. CT scanning is responsible for more than 50% of medical radiation exposure, although only 7% of all X-ray examinations are computer tomograms,’ explains Prof. Hoeschen, stressing that radiation dose reduction for patients during CT examinations is particularly important.

For Thomas Förster, the essential objectives in the further development of CT are to lower the dose still further through shorter scanning times while also increasing image quality. The Watch geometry is a further step in the right direction for AMSD scientists. The exclusive sampling of parallel, useful beams allows them to connect an effective collimator near the focus alongside the scattered radiation grid. Aided by the collimator, the scientists can blend out the X-rays that hit the gaps between the detector elements, thereby blending out the proportion of radiation that does not contribute towards imaging – which in turn lowers the radiation dose for patients.

The variable spatial resolution, or variable sampling respectively – through a change of the angular velocity or integration time – as well as the homogeneity of the spatial resolution in the entire field of view are positive characteristics of future scanners.

Open and compact
The laboratory at the Helmholtz Centre has two Watch scanners set up because the geometry can be achieved with two different configurations: open and compact. The prototype of the open scanner is installed on a robot arm. The tube-detector-unit can be moved in any direction on a circular path around the fixed coordinate system of the object. In the compact version, the tube and detector are located in a fixed coordinate system, whilst the object moves around the focus in a circular path.

The functioning prototypes have laid the theoretical base for a new CT concept. Now the scientists need to find cooperation partners who will help to take this project to a point where the equipment can go into serial production.

The ideas for the new generation of scanners developed from a joint project between AMSD and the ‘German Mouse Clinic’, which also has laboratories in the grounds of the Helmholtz Centre in Munich. The clinic’s objective is the characterisation of human diseases using mouse models to better understand the molecular mechanisms of disturbed cell processes and to develop new treatments.

Having previously presented the CT D’OR (CT with Double Optimal Reading) and ‘Oped’ (Orthogonal Polynomial Expansion on the Disc), a detector mask and a reconstruction algorithm that improve image quality whilst simultaneously lowering the radiation dose, Professor Christoph Hoeschen, at the Department of Medical Radiation Physics and Diagnostics (AMSD) at the Helmholtz Centre Munich, is currently preoccupied with the development of new technologies for CT scanning. With ‘Watch’ (Well Advanced Technique for CT with High Resolution) scientists now have a further technological highlight available, which has a lot of potential.
As an ultrasound professional, ALPINION has developed a range of diagnostic to therapeutic (HIFU) ultrasound systems based on ALPINION’s unique and sophisticated acoustic engineering. The E-CUBE series, created by ALPINION as innovative diagnostic ultrasound systems, perform best in uniform imaging performance, product durability, and friendly user-interface experiences that offer an accurate and rapid diagnosis for patients. Please come and see the E-CUBE series of cutting edge products firstly introduced in Europe and a demonstration of ALPINION’s Pre-Clinical HIFU system for Drug Delivery Research at ECR 2012.

E-CUBE 15 - The Optimized Solution

For Dr Müller this new high-end machine is the obvious choice for all his female patients. ‘PEM is the method of choice for the reliable diagnosis of breast cancer,’ he con- firms. The examination is particu- larly suitable for women with sus- pected breast cancer, breast cancer patients during treatment and after-care, for those patients with breast implants and for younger women with dense breast tissue. Presently, patients who only have statutory medical insurance have to pay for this examination themselves. However, Dr Müller and his colleagues are campaigning for PEM to be cov- ered by all statutory medical insurers.

€CR 2012

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 Europeans first Positron Emission Mammography

Experts confirm reliable diagnoses and treatment monitoring

Early this year the radiology and nuclear medicine practice of Doctors Andreas Blynow, Frank Müller, Jörg Kowalski in Ludwigshafen, Germany, began to offer breast examinations using Europe’s first Positron Emission Mammography (PEM) scanner. With 15 years experience with Positron Emission Tomography (PET), Dr Muller intro- duced the new PEM scanner to the partners’ practice to detect and assess early stage breast cancer.

The first examination results are more than convincing, they con- clude: The new procedure saves the affected women valuable time and also offers more reliability in the diagnosis of breast cancer compared to all other examination procedures. One example is the monitoring of the effectiveness of chemo and radiotherapy. According to study results from the USA, whereas with other diagnostic pro- cedures it takes about three months before treatment can be assessed, using PEM treatment results can be assessed in just two weeks.

Dr Müller, who is Chair of the national German Association for the Promotion of Positron Emission Tomography (PET e.V.) is convinced of the superiority of PET technology in breast cancer diagnosis. ‘PEM is of particular advantage as it con- firms with 90% probability wheth- er or not suspicious lesions that show up on the examination screen are in fact breast tumours. With other procedures these suspicions often turned out to be false alarms. Women are then worried because of these false positive results and have to undergo a barrage of examina- tions.’

Tumour or cyst

With the new system (offered in Germany by Medicor) the Ludwigshafen radiology practice can provide affected patients with a reliable diagnosis within a day.

Once a radiological mammog- raphy has detected a suspected tumour, PEM then confirms whether the lesion is actually a tumour or a harmless cyst. If the PEM breast examination confirms that it is a tumour, the patient can immediately undergo a PEM-guided biopsy. In addition, the practice can then offer a whole-body PET scan to check whether any suspicious tumour cells have already spread into the body via the lymph nodes in the armpits – if this examination is required it can be done without additional exposure to radiation because the FDG tracer not only concentrates in the tumour cells in the breast tissue but also in tumour cells all over the body.

This practice has been at the fore- front of all things PET for more than a decade. The convenience of having to undergo just one examination to confirm the final diagnosis is com- plemented by the high level of com- fort during the examination. The patient sits in front of the scanner, she doesn’t need to be positioned in an examination tube, and the pres- sure on the breast during the exami- nation is a lot lower than during a mammography.’

In terms of radiation dose, PEM also fares very well compared with other examination procedures. Based on body weight, the dose is only around half or a quarter of what the patient is exposed to during a CT scan.

The Critical Moment when a Conclusive Diagnosis is Required.

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Breast tomosynthesis

Finding early stage cancers that could have been missed

In Europe, 350,000 women are diagnosed with breast cancer annually. About 90% of them can be cured if the cancer is detected at a very early stage. To improve early detection almost all European countries have gradually initiated regional screening programmes, even though the benefits are discussed controversially from time to time. In 2009, mammography technology took a big step forward, when breast tomosynthesis entered Europe.

European Hospital reporter Brigitte Dinkloh asked breast radiologist Dr Anne Pascale Schillings, from the CHU Saint-Pierre Hospital in Brussels, Belgium, about her experience with tomosynthesis in her clinical practice.

In September 2010, a Hologic Selenia Dimensions breast tomosynthesis system was installed at the Hospital’s Breast Clinic, where around 9,000 mammographies are performed annually. Since the introduction of tomosynthesis, three quarters of the women have introduced of tomosynthesis, performed annually. Since the introduction of tomosynthesis, three quarters of the women have

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Iterative reconstruction
A field report from the user’s viewpoint

About two years ago iterative image reconstruction was officially introduced for CT imaging. Since then, no other technological innovation has raised more hope that the dose of X-ray based, cross sectional imaging can be significantly lowered. The introduction of spiral CT or modulated MD-CT.

However, at the moment there is only one manufacturer who offers this technologically completely new procedure, and that is GE Healthcare with their VEO product. However, taking into account the actual characteristics, such as X-ray tube focus and beam/detector geometry, makes MBIR very intensive regarding the computing time required. Even with extremely powerful, and therefore expensive, servers currently this image reconstruction still takes half an hour. Moreover, MBIR cannot retrospectively be installed on older machines.

So, do you still see this solution as extremely promising?

Definitely. We have tested the product for half a year and will include it in our clinical routine from this year. In studies we have already seen that the image quality improvement from FBP to IR is around a quarter of the image quality improvement from IR to MBIR.

Additionally, MBIR processes the data set as a complete volume, which, based on existing experience, has very positive effects on artefacts in particularly problematic regions of the body. Different image convolution kernels are no longer necessary for MBIR. The really big advance in technology is therefore to be expected with MBIR.

However, image reconstruction must still become much faster so that it can become widely used in clinical practice.

Asked what iterative reconstruction does, Dr Stefan Wirth explained that CT images are basically overlays of real information and image noise. This image noise consists of an unavoidable part, such as tissue homogeneities and quantum mottle, as well as an avoidable part of noise which results from less than exact calculations. This new innovation specifically tackles this last component by minimising its ratio and therefore increasing image quality, or, more importantly, facilitating a radiation dose reduction.

Why have the mathematical calculations not been exact, so far?

SW: The FBP (filtered back projection) algorithm, which has been used for last 30 – 40 years for the retrospective calculation of the image data from the value of attenuation, is based on a large number of very simplified assumptions. It is, for example, based on the assumption that the radiation source and the detector are both punctiform. In reality, these components are actually of a defined size. On the other hand, the FBP algorithm assumes a right-angle beam incidence. With the detector arrays these days being many centimetres wide, this is also not geometrically correct.

How does the new procedure solve this problem?

The initial approach is iterative construction (IR), which uses a noise pattern and calculates image data step by step, separates image information in one part and noise in another and then minimises the latter based on the pattern until the point where it falls below the level of tolerance.

The manufacturers offer different varieties here. IR is possible with a comparatively small additional amount of computing time and lasts a maximum of two minutes longer than FBP. The different manufacturers’ products differ mainly in that some of them (IRIS-Siemens, AIDR-Toshiba) work exclusively with the data in the image space, whilst others (ASIR-GE, IDOSE-Philips, SAFIRE-Siemens) additionally work with the raw-data space. Whilst the first group works like a filter-based smoothing, an optimisation step in the second group additionally also effects a change in the raw data.

Independent of that, the norm is to present an overlay of start and end data in the final image set. Based on existing experience, IR makes it possible to save between 30-60% of the required dose. Mostly manufacturers also offer a retrospective upgrade for existing CT scanners with this technology, which presents a good alternative and encouragement for users to benefit from it as early as possible.

What other approaches are being followed?

I’m convinced that the additional consideration of exact geometry with the so-called model-based iter-
The diako's universal medical archive

Embracing on a large-scale refurbishment and building programme, which included building four new high-tech operating theatres, planning for medical video and photographic documentation became a key issue at the diako hospital in Augsburg, Germany.

Continuity of care

Employing around 250 people, the 135-bed diako hospital is used by external general practitioners and medical specialists who admit and tend to their patients within its walls. There are 7,500 in-patients and 2,500 out-patients annually seen through our physician from the beginning to the end of their treatments. Details: www.diako-augsburg.de.

Successful PACS integration in Mauritius

As a new hospital, the Apollo Bramwell Hospital (ABH) sits in a unique position in the Indian Ocean. On the attractive and important island of Mauritius, it serves patients from six small neighbouring states and has emerged as a centre of excellence and a regional reference centre since it opened two years ago.

Selecting the right equipment to meet the needs of patients and enable the clinical staff to deliver high-level care was a crucial part of the early development of the hospital. Among those decisions was selecting the best PACS (picture archiving and communication system). In looking for a PACS supplier cardiovascular surgeon Dr Miodrag Todorovic, the Clinical Advisor of Medical Services and Quality Control ABH, said that Visus offered the best quality and price required software solution to link everything. "The images and videos had to be safely archived and closely networked with our Agfa HIS for our users, and had to be available across the entire hospital."

"We obviously had specific requirements for a software solution for operating theatre documentation. It had to offer interfaces, still image functions and HD-sup- port. However, we also acknowledged the growing requirement all across the hospital for the comprehensive and all-encompassing administration of all data relating to patients."

"The IT head cites ultrasound scan images, photographic documentation, the results of previous examinations brought into the hospital by patients on CDs, scanned patient files and the results of examinations carried out with DICOM devices, such as C-arms, as examples."

"We deemed it compulsory to look at all data relating to patients in the center of attention and, independent of the data format and origin. Peter Lederhofer continued. "We wanted a universal medical archive to administer this data in a standardised form, distribute it all across the hospital and also make it available to doctors and facilities outside the hospital."

"That approach also appeared to be the most economic because it was available to doctors and facilities outside the hospital."

"We also have plans to implement a scanning project in the retirement and residential care homes for the elderly, which are part of the diako. This will entail the integration of the synedra AIDM system with the resident management system so that the film can be stored in the universal archive with legal compliance."

Cardiovascular surgeon Dr Miodrag Todorovic explains how an island hospital - which is a medical centre of excellence and regional reference centre – is further improving medical care for patients there and in six neighbouring states with the help of a new picture archiving system from Visus.

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IT is making surgical procedures safer

Image guidance and information management are turning into essential components of operating theatre workflow. Integrating the operating theatre (OT) with the help of IT systems positively affects many aspects of surgery – including its safety. The right handling of patient data flow and communication ‘…is crucial to containing human error, and to limiting effects when errors do occur,’ according to Andrea Pietrabissa MD, Director of General Surgery at Policlinico San Matteo, University of Pavia, Italy. ‘Risk managers know that a digital OT is a much safer place than a paper-based one.’

Modern medicine, including surgery, would not exist without advanced imaging. Today, both diagnosis and treatment are image-based and image-driven, he added. Just like in other hospital, before surgery most of the patients at the Policlinico San Matteo undergo examinations with one modality or more – not only for disease diagnosis but also for surgical procedure planning. Some 30 years ago, intraoperative imaging became popular with the advent of ultrasound, which is now routinely used during procedures, e.g., to identify the size and position of liver tumours, as well as to detect the main intrahepatic vessels. Laparoscopic ultrasound helps to stage GI cancer and detect occult pancreatic and liver tumours.

Hybrid OTs

Increasingly OTs will become hybrids, i.e. integrating a radiological suite and a conventional surgical room … a shift seen in vascular surgery, Dr Pietrabissa pointed out. As for today, intra-operative imaging is still largely limited to C-arm X-ray and ultrasound; CT and NMR are limited due to environmental constraints and incompatibility with metal instruments. A deeper integration between preoperative studies and intra-operative images can already be realised and image fusion should be considered when new OTs are designed, he advised.

The major IT-based development in general surgery OTs has been robotic surgery.

The advent of 3-D

Dr Pietrabissa believes that image fusion will take place inside the 3-D display of new robotic systems, adding that visualising the biliary tree is among today’s success stories. New dyes and new camera detectors are under development, and intra-operative guidance with markers will soon be available for cancer detection and lymphatic sampling.

Challenging barriers

Existing systems within the OT are closed environments today. Proprietary solutions that do not connect with HIS or PACS do not allow for the integrated, seamless flow of information that promises to deliver the envisaged benefits. Now on the market are solutions to integrate video and audio within a network, to set up, manage and monitor data.

Decision makers should understand costly investments

Digital image acquisition and reading has gradually replaced conventional technology in radiology. Recently, digital image management has started to expand to further departments and disciplines. Interdisciplinary image sharing is now taking place alongside intensified collaboration of radiologists with other clinicians in order to plan for and guide interventions.

In the OT, image and information management can significantly support outcomes; however, it requires large investments. In order to ensure that investments will indeed result in the expected improvements, an understanding of workflow and complex image management infrastructures is required on the part of hospital decision makers.
Neuroradiologist and researcher Gregory Sorensen MD, changed roles in June 2011 when, as the new President & CEO of Siemens Medical Solutions USA, Inc., he became responsible for the entire Siemens Healthcare portfolio, including therapy, laboratory diagnostics medical imaging and – healthcare information technology. Affecting the latter are the aims of the USA’s healthcare reforms to drive towards more coordinated healthcare with a specific focus on electronic patient record (EPR) development and use. Thus, in late 2011 Siemens acquired MobileMD, Inc., the health information exchange (HIE) solutions provider, for reasons explained by Dr Daniela Zimmermann in a talk with Gregory Sorensen.

Saskia Groeneveld, Carestream’s Regional Marketing Manager (Healthcare Information Solutions), explains that, with Carestream Vue for Cloud Services, a hospital has a service access point which includes a small storage area on-site for the most recent images, with all images stored in a secure off-site data centre. Therefore, if a hospital’s own information system goes down, imaging data will still be available to clinicians via an secured Internet link, ensuring continuity of care and constant and consistent access to data.

Carestream Vue Cloud Services consists of three elements:
• Vue Cloud Archive – offering vendor-neutral, virtualised remote-long-term storage
• Vue Cloud PACS – providing radiologists and clinicians with a complete diagnostic workflow delivered by a cloud-based infrastructure on a pay-as-you-go basis
• Vue Cloud Community – enabling healthcare facilities to share images and information via a global work list, to consult on diagnoses and treatments, obtain second opinions and enable sub-specialty reading.

Although security is an obvious issue when data is stored in this way, Saskia Groeneveld points out that Carestream has secure access controls, and mobile tracking and security teams that ‘ensure the integrity and security of each data centre.’ The big advantage to a hospital of cloud computing is that it no longer has to invest in servers, hardware or software, she adds. ‘We take care of all of that. All hospitals have to worry about is sending out DICOM, or non-DICOM, images to the service access point, which then transfers them to the data centre for storage.’

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‘For these hospitals, the benefit of moving to cloud is that there is no infrastructure on site and no up-front investment,’ she explains. ‘By going to cloud, the customer has high flexibility, can scale up or down, saving on storage space, hardware and software costs and concerns over data security. Mark Nichols spoke with Saskia Groeneveld, Carestream’s Regional Marketing Manager (Healthcare Information Solutions), about the company’s expanding service in this area.’
Improved specificity in breast ultrasound

Sonography is the most important non-invasive supplementary procedure to mammography, the current gold standard in breast cancer diagnosis. ShearWave Elastography can reliably distinguish cysts and solid lesions. However, efforts are being made, in clinical practice and in research alike, to develop sonographic procedures that help determine the tissue elasticity and stiffness of masses.

The SRI Multinational Study of 939 Masses, whose results will be presented at the Satellite Symposium of this year’s European Congress of Radiology (ECR), offers first validated data. The authors of the study arrived at three key conclusions:

The supplementary use of ShearWave Elastography reduces the number of superfluous biopsies in certain BI-RADS (Breast Imaging Reporting and Data System) categories 3 and follow-up after six months is recommended in this category. 'If Emax is 80 kPa, or less, and if the findings are rather homogeneous and if high-resolution ultrasound shows solid findings with benign criteria, the mass can be downgraded from BI-RADS 4a to 3.' The two criteria Emax and E homo increase specificity by 29-14% compared to high-resolution B-mode ultrasound, he points out. Patients with a downgraded mass must be monitored, but a biopsy is no longer required. If the maximum tissue stiffness is 20 kPa or less, the mass might even be downgraded from BI-RADS category 3 to 2.


Using Tomosynthesis Technology to Find and Diagnose Breast Cancer in Its Earliest Stages

The Breast Pathology Center at Tejerina Foundation, Madrid, Spain

The Breast Pathology Center at the Tejerina Foundation in Madrid, Spain, has been leading the way in women’s breast health for over 40 years. It is the only facility in Madrid dedicated exclusively to women’s breast health, offering diagnostic services, medical and surgical treatment, and follow-up services. In 2000, the Center pioneered the use of digital mammography in Spain. In 2010, it led the way again, installing a Hologic Selenia ® Dimensions® breast tomosynthesis system. “We added tomosynthesis because we have identified cancers using the Dimensions 3D that we wouldn’t have found using 2D mammography.”

Tomosynthesis is helping the staff at the Center find small cancers earlier and changing outcomes for patients. “We have identified cancers using the Dimensions 3D that we wouldn’t have found using 2D mammography. And tomosynthesis helps us distinguish normal structures from pathological ones in dense breasts, identify subtle findings, and confirm that suspicious lesions have benign features and avoid unnecessary biopsies.”

Dr. Tejerina adds that tomosynthesis provides capabilities not available with other modalities. “Using tomosynthesis, we can carry out millimetric breast incisions and detect small diameter lesions enabling the Interventional Radiologist to reach the lesions from the back,” states Dr. Tejerina.

Tomosynthesis is helping the staff at the Center find small cancers earlier and changing outcomes for patients. “We either perform a 2D and then 3D exam with the Dimensions system. ‘We perform both a 2D and then 3D exam at two different times, or we combine 2D and 3D at the same time in a combo-mode study’”

Dr. Tejerina adds that tomosynthesis provides capabilities not available with other modalities. “Using tomosynthesis, we can carry out millimetric breast incisions and detect small diameter lesions enabling the Interventional Radiologist to reach the lesions from the back,” states Dr. Tejerina.

Tomosynthesis is helping the staff at the Center find small cancers earlier and changing outcomes for patients. “We have identified cancers using the Dimensions 3D that we wouldn’t have found using 2D mammography. And tomosynthesis helps us distinguish normal structures from pathological ones in dense breasts, identify subtle findings, and in many situations, enable us to make very early diagnoses,” concludes Dr. Tejerina.

The comments included in the articles in this publication are the opinions and personal stories of the individuals quoted and not necessarily those of Hologic.

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Hitachi presents... The world’s first oval bore 1.5-T MR system

At ECR 2012 Hitachi is showing The Elcheon Oval 1.5T MR system, an MRI scanner unseen in the world before. Known as one of the largest open MRI manufacturers on the international market, with more than 5,000 installed systems and a wide range of open MRI units rang- ing from 0.2-Tesla up to 1.2-T, the Japanese company is the first ever to present an ultra wide oval bore 1.5-T system.

With this system, Hitachi points out, MRI imaging is taking a new form. The Elcheon Oval is the first scanner ever to have an elliptic bore magnet that horizontally extends to 74 cm. The advantages are as simple as subtle. Because the human body is wider horizontally across the shoulders than it is ver- tically through the chest, the newly developed oval bore system gives a feeling of openness and is perfect for people of any size, even for very heavy patients.

‘The mobile table can handle people up to 660 pounds and is the widest – 65 cm – table available today. Additionally, integrated coils built into the table enable the fastest scanning with the highest imaging quality.

‘The high-end 16 channel coils with optical technology and fibre-optic coil technology give us the ability to take coil data and transfer it back to the system without any loss of signal to noise.’

Real-time Virtual Sonography (HI-RVS) – a perfect match

Another highlight of the manufacturer’s inno- vative product line on show at the ECR is the Hitachi Real-time Virtual Sonography (HI-RVS), a feature installed on Hitachi’s premium ultrasound platform, Hi Vision Preirus and Hi Vision Advance. It enables image fusion of a real-time ultra- sound examination with CT or MR images or contrast enhanced ultra- sound volume data. Thus the maxim- um amount of information from all image modalities comes together on one single ultrasound platform and facilitates diagnosis as well as accurate image guided interven- tions, Hitachi points out. ‘To perform the image fusion with HI-RVS holds some technical refinements, such as flex- ible target and navigation markers, loading of multiple sequences, or 3-D navigation of the imaging scan plane. A versatile range of trans- ducers means that the modality can be used to guide a wide range of clinical procedures, e.g. tumour abla- tion, complex biopsies, drainage and therapeutic injections.

The Scenaria multi-slice CT system – less is more

In combination with HI-RVS, Hitachi is also showing its multi-slice CT system Scenaria. During this scanner’s development the firm’s clear focus was on dose reduction. With its 0.35-second rotation speed the whole body system not only speeds up workflow in both, routine and advanced applications - e.g. cardiac examinations – but also strongly reduces dosage.

Scenario also includes other dose reduction features such as the combination of a lateral-shifting table- top with a smaller X-ray bow-tie filter, Inteli EC, Exposure Control and Inteli IP Iterative Processing. Scenario also excels in 3-D visualisation and analysis capable of critical to physicians, by offering an inte- grated TeraRecon iNtuition server and analysis capabilities critical to physicians, by offering an integrated TeraRecon iNtuition server and analysis functions, can be used to guide a wide range of clinical procedures, e.g. tumour ablation, complex biopsies, drainage and therapeutic interventions.

‘The Scenario multi-slice CT system demonstrates less is more. In combination with HI-RVS, Hitachi is also showing its multi-slice CT system Scenaria. During this scanner’s development the firm’s clear focus was on dose reduction. With its 0.35-second rotation speed the whole body system not only speeds up workflow in both, routine and advanced applications - e.g. cardia- ce examinations - but also strongly reduces dosage. Scenario also includes other dose reduction features such as the combination of a lateral-shifting table-top with a smaller X-ray bow-tie filter, Inteli EC, Exposure Control and Inteli IP Iterative Processing. Scenario also excels in 3-D visualisation and analysis capable of critical to physicians, by offering an integrated TeraRecon iNtuition server and analysis functions, can be used to guide a wide range of clinical procedures, e.g. tumour ablation, complex biopsies, drainage and therapeutic interventions.

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Orthopaedics and pulsed ultrasound

Ultrasound shows significant success in helping to heal badly damaged bones, Mark Nicholls reports

Doctors in Glasgow, Scotland – where ultrasound was pioneered some 50 years ago – have found that low intensity pulsed ultrasound (LIPUS) can speed up recovery in patients with serious fractures by more than a third.

The technique is being used in the fracture clinic at Glasgow Royal Infirmary by orthopaedic surgeon Angus MacLean. However, this painless ultrasound treatment, currently costing about £1,000 (£1,200) per patient, is only used on complex fractures where there may be problems healing.

Over time, however, hopefully the cost will fall and ultrasound will prove an efficient, cost effective method to help heal common fractures along with more complex ones such as non-union fractures – defined as the point when bone healing has stopped and will not proceed without some type of intervention.

The ultrasound is delivered through a probe and vibrates the cells, which then stimulates production of new bone cells and helps speed up bone healing and regeneration, Mr MacLean explained.

One patient he treated using low intensity pulsed ultrasound (LIPUS) had severely broken his ankle after falling six metres, causing concerns that the degree of injury would result in amputation. Following the ultrasound treatment the patient made a good recovery within a few months. ‘Before we used ultrasound I would expect to see this kind of injury healing with some difficulty – some of them don’t heal at all,’ the surgeon pointed out. ‘Even if they do heal, it can take between six and 12 months and, during that time, patients have ongoing pain.’

Evidence suggests a 40% speed increase in healing, he added, ‘But the main interest for me is to use it to ensure the bone heals rather than the bone not ‘knitting’ together, which then leads to serious problems.’

The technique has been approved by the UK regulatory body, the National Institute for Health and Clinical Excellence (NICE), which said the use of LIPUS technology represents a safe and effective treatment option to reduce the healing time in patients with bone fractures, and concluded that the technology provides clear clinical benefit, particularly in patients experiencing delayed healing and non-union fractures.

The recommendation was made following analysis of clinical data from over 1,900 patients via a meta-analysis of 13 individual randomised controlled trials (RCTs), information from additional RCTs and registry data, plus specialist guidance from the British Orthopaedic Association (BOA) and British Limb Reconstruction Society (BLRS).

Commenting on the NICE ruling, made a few months ago, Mr MacLean said, ‘By preventing complications before they occur and by accelerating healing there is significant potential for this technology to actually save money for the National Health Service and the public purse by reducing the need for surgery and returning patients to work more quickly than before.’

It was work in the 1950s by obstetrician Professor Ian Donald and colleagues at the Glasgow Royal Maternity Hospital (GRMH) that led to the first diagnostic applications of the technique.

He had first explored the use of ultrasound after seeing it used in Glasgow shipyards to look for flaws in metallurgy and he used industrial ultrasound equipment to conduct experiments on various anatomical specimens and assess their ultrasonic characteristics.

With medical physicist Tom Brown and fellow obstetrician Dr John MacVicar, he refined the equipment to enable differentiation of pathology in volunteer patients, reporting his findings in The Lancet in June 1958 as, Investigation of Abdominal Masses by Pulsed Ultrasound.

They later refined the technique for obstetric applications and, in the years since, ultrasound has become one of the most common medical technologies in the world.
Phased contrast imaging will revolutionise X-rays

This may sound like science fiction, but computed tomography with reduced radiation exposure and the highest soft tissue contrast is likely to be a reality – very soon. Named phase-contrast imaging, the method is an invention of Professor Franz Pfeiffer, Chair of Biomedical Physics at Munich Technical University, Germany. We asked him to explain the implications this development has for radiology.

The X-ray physics behind phase-contrast imaging has long been known: X-rays are nothing more than high-energy light and can thus be described as quanta and waves. Waves not only get stuck in matter, they also interfere. ‘Just like light that is refracted by a lens, X-ray waves can be refracted by structures,’ Professor Pfeiffer explains. ‘As far as clinical applications are concerned this means that refraction in tissues differs depending on tissue density. Since the angles of refraction are so minute they were invisible in conventional X-ray imaging, but recently we learned to make these tiny refractions visible.’

This visualisation is made possible by small grates-like structures which are placed one behind the other, which allow identification of the part of the beam that is being refracted. Since physicists speak of refraction in a phase, the term phase-contrast imaging was coined. This imaging method is based on the modification rather than absorption of X-rays in tissue in order to create contrast – thus the quality of the contrast is not necessarily linked to a dose that ‘gets stuck’ in the body.

This is not Prof. Pfeiffer’s only crucial insight. He and his team also discovered that phase interaction generates significantly more contrast in soft tissue. ‘Conventional absorption provides only weak signals in the soft tissue since tissue does not absorb the radiation very well. However, in phase-contrast imaging this limitation does not exist although we are not quite sure yet what – from a biomedical point of view – creates the soft tissue contrast. Nevertheless, the result is amazing.’ To explore the basics and potential of this novel imaging method, Professor Pfeiffer and team are working on tissue samples received from the radiology departments of Munich’s Ludwig Maximilian University and the Technical University, which have closely cooperated with the researchers for about 18 months. ‘Without the help of radiologists who, after all, will be the end users of the new method, we would not get anywhere,’ the professor said. ‘They tell us what they need and where they see problems – things of which we physicists are not necessarily aware. On the other hand, our clinical colleagues have recognised the enormous potential of phase-contrast imaging, for example in early detection of tumours, and thus their interest in having biomedical basic research translated as quickly as possible into clinical practice is growing.’

This increasing interest is already visible at an international level. For a long time there were only two research groups – one in Japan, one in Switzerland, headed by Prof. Pfeiffer – but now there are 19 teams worldwide dealing with phase-contrast imaging.

However, the practical implementation of the new X-ray method is no easy task. Presently, one of the physicists’ biggest challenges is visualisation of the refraction of the X-ray beams to an extent where they can be turned into reliable signals. ‘That’s because of the gratings,’ Prof. Pfeiffer explains. They don’t work very well yet for the high X-ray energies in a modern CT scanner.

It will thus be a while before the current experimental systems are transformed to commercially available products – but Professor Pfeiffer is ploughing ahead. He is in the process of setting up a CT scanner for small animals, first to perform in vivo studies. Results from this mouse model will be important to convince potential industry partners to team up with the researchers for the next stage of development – building a CT system for humans. This can only be realised in cooperation with a large company.

Prof. Pfeiffer has no doubt that the interest is there. ‘It’s a bit like building an entirely new engine for a car. At first no one really dares to do it. But, as pressure is mounting so the willingness to invest in innovative top technology grows.’

Who will go for it? ‘We’ll keep you posted!’
Concern among experts about how incidental and unexpected imaging discoveries should be managed has resulted in a call for improved guidance that could lead to greater awareness, clarity and uniformity of approach among research imaging centres.

Imaging with magnetic resonance, computed tomography, ultrasound and molecular imaging is used increasingly in research and unexpected or incidental abnormal findings arising in the course of imaging research are common – around 3-12% in brain imaging and up to 30% in body imaging.

Experts acknowledge that such unexpected findings have long-range implications for treatments, yet there are no agreed protocols for such findings and therefore they could go unrecognised or unreported.

To address this issue, the Royal College of Radiologists (RCR) and the Scottish Imaging Network: A Platform for Scientific Excellence (SINAPSE) led a UK-wide initiative, supported by the Wellcome Trust. This has resulted in the publication of a report, *Management of Incidental Findings Detected During Research Imaging*, which summarises current opinions and concerns regarding the practical aspects of managing incidental findings among those involved in research using imaging.

The meeting participants, representing many UK researchers, ethicists, patient groups, professional, regulatory and funding bodies, and interested parties from other European countries, found the present situation unsatisfactory on many counts. In particular, practice varied across the UK, meaning there is little evidence on which to base ethical practice.

The resulting document from the *Management of Incidental Findings Detected During Research Imaging* symposium recommends:

- raising awareness of the issues among imaging researchers
- disseminating information on incidence and common types of incidental findings
- assisting prospective researchers seeking guidance from ethics committees and central ethics agencies, on how to handle research studies using imaging
- issuing guidance for funders of research imaging studies, to ensure measures are in place to manage incidental findings
- training imaging researchers to recognise common abnormalities and artefacts
- transparency of study information sheets and consent procedures, to increase understanding of the risk of, and procedures for, managing incidental finding
- that information be made available on aspects of incidental findings for which there is currently no evidence base.

The report concludes that there is now a common purpose to create a framework of good practice for imaging research in the UK to safeguard both research participants and research imaging centres through better knowledge of the problem and to avoid research imaging falling into disrepute through practices that could disadvantage research participants.

Professor Mary Evans, Chair of the RCR’s Clinical Radiology Patients’ Liaison Group, said: ‘In recent years, imaging research has resulted in great benefits for patients in the treatment of a wide range of diseases. The difficulties of deciding what to do about incidental findings during that research have, for some researchers, created a dilemma in how to act in the best interests of research volunteers without detriment to all. This report has done the groundwork, enabling both non imaging trained researchers and research radiologists to work with the lay public towards a more ethical and consistent position which does not compromise the results of their research.’

The RCR worked on the project with SINAPSE, a consortium of six Scottish universities where the main research focus is on brain imaging, with additional interests in oncology and cardiovascular imaging.
Controversies were certainly aired when 800 radiologists gathered in Salzburg for The Interventional Radiological Obstert Symposium – a meeting of the German, Austrian and Swiss Societies for Interventional Radiology (DEGIR ÖGIR and SGCVIR) – and certainly some striking new interventions were presented. Michael Krassnitzer reports

Nuclear Medicine at the Hospital of the Order of Saint John of God in Vienna. His own irritation is that cardiologists increasingly act like vascular specialists and carry out minimally invasive interventions in the renal, carotid and leg arteries. ‘Numerous vascular surgeons are also getting a taste for this, now calling themselves ‘endovascular surgeons’ and taking over our procedures.’

From other disciplines come gun-blows: that interventional radiologists have developed new, gentler therapy concepts that lead to the same results as those achieved with previously established treatments, notably, the uterine artery embolisation for fibroids. Whilst gynaecologists often tend to remove the uterus in patients suffering fibroids, radiologists guide a catheter into the uterine artery, cut off the blood supply to the fibroids and thus starve them. ‘Preserving the womb, apart from the fact that the utero-invasive fibroids are minimally invasive, is the significant advantage of this procedure,’ Prof. Thurnher explained. ‘However, gynaecologists want to claim the womb for themselves and are worried that this more gentle treatment is being offered by radiologists.’

A further field of deployment for interventional radiologists is the treatment of acute strokes. In some centres, around 20% of severe strokes are already being treated with microcatheters, the professor pointed out. Along with controversies, all in all IROS 2012 (supported by CRISRE – the Cardiovascular and Interventional Radiology Society of Europe), did justice to its image as a showcase for interventional radiology.

Venous intervention

Among innovative procedures presented was renal denervation, based on the following concept: Research results have shown that high blood pressure (BP) is partially caused by the kidneys. BP can be lowered by the destruction of those nerves that connect the kidneys with the sympathetic nervous system. To interrupt the abnormal regulation of BP, the nerves are cauterised with the help of high-frequency radio waves from a tiny high frequency probe inserted via an artery in the groin under local anaesthetic and guided towards the renal artery. ‘In around 85% of patients we observe a significant effect and BP falls by between 15 and 60 mm Hg,’ said Professor Michael Uder, Director of the Institute of Radiology at the University Hospital Erlangen.

Interventional oncology

Procedures such as percutaneous alcohol ablation, radio frequency ablation, microwave ablation and cryoablation will soon face competition from Irreversible Electroporation (IRE), a procedure that originated in the field of food and bio process engineering. An electric field acts on the tumour cells; nanosecond pulses in the cell walls, the integrity of the cells is destroyed and they subsequently die.

Peripheral arterial occlusive disease

Long balloons are the gold standard

Every year, around 80,000 lower extremities in Europe have to be (partially) amputated as a result of peripheral arterial occlusive disease (PAOD). Half of the affected patients die within five years of the amputation. As Dr Christina Plank, Consultant at the Department of Cardiovascular and Interventional Radiology, University Clinic for Radiodiagnostics, Medical University of Vienna, stressed: 'The important issue is to bear in mind the principle of angionsomes.'

An angionsome is a block of tissue, all of which is entirely supplied by just one source artery. A foot consists of six angionsomes. Healing an ulcer therefore requires the opening of the exact ves- sel that supplies the affected area with blood, Dr Wolf explained.

But there are also supervascular interventions. Dr Wolf reported during the Interventional Radiology Symposium held during IROS 2012, sponsored by medical device manufacturer Cooks.

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IRE@E CRISRE
What’s new in the world of radiology?

Radiology constantly evolves. There are technical advances in terms of the capabilities of various modalities, greater clarity from contrast agents that are also safer for patients, and innovation in techniques that gains even greater performance from existing equipment, or enables further development. Ultimately, the patient benefits with more accurate and quicker diagnosis leading to more precise treatments that deliver better clinical outcomes.

Mark Nicholls sums up

Advances in technology for radiology – from ultrasound, CT and MRI through to exciting hybrid modalities such as PET-MRI and PET CT – are constantly impressive along with the uses of tomosynthesis, elastography, biomarkers, and IT and telediagnos which take radiologists’ work into a different sphere.

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The evolution of hybrid machines, particularly the combination of positron emission tomography (PET) and magnetic resonance imaging (MRI) as PET-MRI, is also exciting. First developed in 2008, the single scanner’s potential becomes increasingly clearer as the exquisite structural details of PET-MRI scans follow a radioactive tracer in the body. Although waiting to see where PET-MRI fits in to clinical care radiologists are optimistic about its value.

With tumours, MRI enables radiologists to correlate structure with the functional information of the PET, though bringing the two scans together in a single machine has been a challenge as the strong and smooth magnetic fields MRI relies upon can affect the detectors and electronics needed for PET scanning.

PET-CT, which preceded PET-MRI, provides less structural detail and patients receive radiation from CT.

Emerging whole-body hybrid PET-MRI scanners – being developed by Philips, Siemens and GE – are expected to impact strongly on diagnostic imaging, particularly for oncology but also in cardiology, inflammatory and infectious disease, and neurology, for example.

In Europe, Philips clinical whole body system was first installed in Geneva University Hospital, there’s also one in the Mount Sinai Medical Centre in New York, and so on.

In other areas, Professor Hedvig Hricak, chair of the Department of Radiology at the Memorial Sloan-

Continued on page 18
PET-MRI fusion has been used to manage treatment of some types of brain tumours and has improved detection of epileptogenic regions in children.

**Neuroradiology**

When scanning seizures, Dr Walter Kucharczyk, director of MRI at Toronto General Hospital, believes that MRI still remains the best imaging test to discover if there is an anatomical or structural abnormality that might account for a seizure. However, some centres are now combining this approach with other imaging technologies as well to improve results even further.

Better imaging of lesions, combined with other diagnostic tests, has improved decision-making over whether surgery would be safe or not, taking into account the chances of success and risk of complications. Some patients also have a PET scan, which can clarify the MRI or EEG and reduce ambiguities in test results.

PET is used more often for this and our finding is that PET results are fused to the MRI results, he said. ‘PET is very sensitive to brain biochemistry abnormalities but the imaging resolution is not as good as MRI, so you might get a half centimetre resolution with PET but a half a millimetre resolution with MRI.’

Many larger centres were moving towards this approach, he said, as well as using magneto-encephalogruph (MEG) for brain mapping.

Globally, most MRI machines are 1.5-Tesla and are good for scanning seizures, along with the 3-T machines, but one of the current areas of discussion is over the use of 7-T scan seizure. While the increased magnetic signal offers better images patients might have biological side effects.

Significant improvements in image resolution from 7-T ultra-high-field magnetic resonance (UHF MRI) scanners have been achieved in recent months by replacing the multichannel radio frequency (RF) system of four coils with 16 coils. Greater availability of MRI, and its array of applications, is high on radiologists’ wish lists due to its potential and ability to deliver excellent images without dose issues.

**Interventional radiology**

Within this, techniques demonstrating clear benefits include molecular MRI imaging on a cellular and even sub-cellular scale; combined imaging with radiotherapy treatments; and ultrasound combined imaging (under development), and MIBI perfusion imaging of the myocardium in functional cardiology blood flow.

An interesting development has been the use of SBUS diagnostic simulators, such as a computer-based virtual reality environment for MRI and cranial and spinal neuroradiology procedures.

The NeuroCath (Neuroradiology Catheterisation Simulator) system includes extraction and construction of a vascular model from different patient images, followed by computer-based virtual reality planning. Figures can be rotated and manipulated. The system is a platform for training, teaching, and research.

**Biomarkers**

These are increasingly important in the early assessment of patient response to treatment. Consultant radiologist Dr Stephen Keevil, Head of Magnetic Resonance Physics and R&D Lead for Imaging at Guy’s and St Thomas’s NHS Foundation Trust as well as Reader in Medical Physics at King’s College London, said the use of functional imaging biomarkers to assess early response to ‘personalised’ treatments e.g. for cancer, has increased. At the moment, he said, ‘the criterion is whether the tumour gets smaller on structural imaging, but this is insensitive and inaccurate. Imaging biomarkers will give a much earlier indication of response, which will be proportional to the activity of treatment and will work only with specific cancer patients, for example, for genetically targeted treatments. (Dr Keevil is also 2012-13 R&D Lead for Imaging at Guy’s and St Thomas’s, NHS Foundation Trust.)

Promising new developments in tomosynthesis include contrast enhanced (DPA) applications and multi-modality applications such as combined tomosynthesis and automated ultrasound, combined tomosynthesis and optical imaging.

‘The future is bright for tomosynthesis technology,’ said Dr Goodlett.

**Elastography**

Elastography ultrasound measures stiffness or strain images of soft tissue to detect or classify cancers. It is the only imaging technique between five and 25 times stiffer than the background of normal soft tissue so, with compression, the tumour deform less than surrounding tissue indicating a possible tumourous growth.

Dr Bill Svensson, Reader in Breast Imaging at Imperial College London and Consultant Radiologist and Nuclear Medicine Consultant at Charing Cross Hospital, believes elastography is enabling radiologists to detect stiffer, harder areas and is a more sensitive imaging method. It provides more certainty in the image viewed and indicates what you should be getting from a biopsy result, he said.

However, he remains concerned about the variability among manufacturers in the methods available for the technique and variations in readings and colour scales, which radiologists must be aware of and for which they must compensate.

**3-D Tomography**

A team at King’s College Hospital, London, has been exploring the benefits of tomosynthesis over conventional 2-D breast screening using a machine provided by Hologic. They found an apparent advantage in diagnostic accuracy from tomosynthesis compared to 2-D imaging, both in the radiologist’s ability to diagnose cancer and either benign or normal findings. In the last few months, tomosynthesis progress, future developments and special uses have been discussed at numerous radiology conferences globally.

Dr Mitch Goodsitt, Consultant in Radiology at the University of Michigan, said: ‘Advantages of tomosynthesis over CT are better spatial resolution in the imaging plane and lower radiation dose. A disadvantage of tomosynthesis is that it is more sensitive to patient movement and requires more imaging time.’

Tomosynthesis to image the body (chest, knee and legs) received FDA approval in 2006 and as recently as September 2010, the FDA’s Radiation Device Panel voted in support of Hologic’s pre-market approval (PMA) application for their tomosynthesis breast imaging system.

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**High-resolution radionuclide imaging**

This technique is increasingly used to detect breast cancer and has been shown to improve diagnosis in many clinical situations. It is also allowing clinicians to detect previously unknown areas of breast cancer in women with newly diagnosed cancer.

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uses a high resolution, breast specific gamma imaging that allows for the detection of both invasive and non-invasive breast cancer that are as small as 1mm. We can reliably detect 2mm cancers with this approach.

The approach of breast specific gamma imaging (RSGI) is that, unlike mammography and ultrasound — based on anatomy and asking what breast cancer looks like, RSGI asks how breast cancer functions differently to the normal surrounding breast tissue.

Radiologists are also exploring how to develop ultrasound contrast agents further and the possibilities of using that in liver disease and monitoring chemotherapy effects.

**Information technology**

This remains critical in radiology and demand grows for even more rapid report turnaround and quicker access to imaging, especially for cancer. Voice recognition software is gaining popularity with many radiology departments adopting it as an alternative to conventional transcription services.

Totally integrated RIS/PACS solutions is also desired to optimise a distributed workflow, in which radiologists can be in several locations, taking advantage of teleradiology and remote reporting.

Whilst the benefits of teleradiology as a diagnostic tool continue to grow, concerns have been raised about the lack of uniformity in reporting protocols across Europe.

Manufacturers, supported by clinical expertise, are continuing to develop technological breakthroughs that can give even greater diagnostic accuracy and help improve treatments.

Cost remains an issue within European healthcare systems and hospitals, but research, clinical skill and dedication continue to push forward these radiological breakthroughs that will give radiologists even more options and thus greatly benefit their patients.

**TOSHIBA**

Leading Innovation

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**Ultrasound**

Coming full circle in the Scottish city where it was first pioneered some five decades ago, at Glasgow’s Royal Infirmary’s fracture clinic orthopaedic surgeon Angus MacLean is using ultrasound to heal broken bones, thus speeding up recovery times of severe fractures by more than a third (Report on Page 13).

**Critical, emergency POC and ultrasound**

Critical ultrasound, as a tool for immediate therapeutic decisions, and emergency POC ultrasound – an extension of the clinical examination at the bedside or on the accident scene – have shown clear benefits along with busy ultrasound - a technique with widespread uses and advantages, particularly in helping with rapid diagnosis in patients with acute respiratory failure, as well as less critical areas.

**Contrast agents**

Dose levels and contrast agents, frequently debated at radiology conferences, due to concern over patient and staff safety, aim to provide quality images and therefore the best clinical outcome. Dr Manthos Koutalonis, Medical Physicist at the Barts and The London NHS Trust – Radiation Safety Group, said that monitoring dose remains a highly important task for a clinical radiation safety team, but, added ‘In terms of dosimetry during interventional radiology and fluoroscopy procedures, something really clever and useful, released this year, was the DoseAware personal real-time dose meter system by Philips Healthcare.

In his hospital’s angio and fluoroscopy rooms, each radiologist has his personal dose meter with a screen in the room. This shows in real-time how much dose each staff member has acquired. “In this way, staff can immediately adjust their working habits to minimise radiation exposure,” he said. “We’ve installed this in one of our angio rooms and noticed a significant reduction in staff dose. It really makes life easier for physicists who monitor staff and for radiologists and radiographers, who feel safer.”

Improved contrast agents and technology are factors in helping reduce the dose, though allergic reactions, contrast induced nephrotoxicity, nephrogenic systemic fibrosis (NSF), and extravasations etc. remain a concern with contrast agents. Nonetheless, there have been a number of new developments in contrast agents. Ultrasmall Superparamagnetic Iron Oxide contrast agents, designed to help improve the assessment of cancer spread to the lymph nodes are still at the experimental stage, although already used to some effect on patients.

Radiologists are also exploring how to develop ultrasound contrast agents further and the possibilities of using that in liver disease and monitoring chemotherapy effects.
Ion therapy is considered a great hope in cancer care – especially for tumours with no hope for a long time. So far around 70,000 patients worldwide have received radiotherapy with ions. This includes 1,300 proton treatments as well as carbon ions. This therapy is physically very different from conventional photon radiotherapy and is characterized by increased, relative biological effectiveness (RBE). According to Professor Ramona Mayer, project head at MedAustron, ‘The specific physics of the ray allows an even more targeted application of the dose to a certain tumour area. Patients with slow-growing or very resistant tumours, or tumours in close proximity to radiation-sensitive organs, will particularly benefit from this procedure which is the ideal complement to chemotherapy and surgery in these cases.’

The ions have to be accelerated to up to 70% of the speed of light with the help of a particle accelerator.

Founded by the Republic of Austria, the state of Lower Austria and the City of Wiener Neustadt, the MedAustron Centre is banking on 50 years of experience gained by the European Organisation for Nuclear Research (CERN) in Geneva, Switzerland, the largest Institute for Particle Physics worldwide, for the successful introduction of its own acceleration technology. ‘The accelerator at MedAustron will basically come as a miniature to what large particle accelerator, the LHC, used for the recent big experimental programme at CERN,’ explained Dr Bernd Minar, Managing Director of MedAustron. ‘The design which originated from the so-called ‘Proton-Ion Medical Machine’ (PIMMS) is based on a synchrotron, a circular accelerator with a circumference of around 250 metres. This will accelerate the particles to high speeds.’

40 MedAustron staff members spent several years working at CERN on the conception of the particle accelerator facility. With the product development completed, the building phase is in full swing. The new facility will consist of an accelerator area, treatment area which, next to three treatment rooms with two horizontal and one vertical fixed beam, will also have a treatment room with a proton gantry, i.e. a mobile radiation treatment unit, as well as its own research area where scientists have knowledge of radiation biology and medical radiation physics is to be broadened. Once the building works have finished the installation of the individual accelerator components will commence. ‘We expect to be operational in 2013, with the first patients to receive treatment,’ Dr Mayer hopes. ‘This will be an exciting match, a collaboration between the accelerator, medical technology and treatment software and control technology that will work together harmoniously. Any problems likely to occur will be in this area. This is the point where most other ion therapy centres hope to achieve their breakthrough.’

Around half a dozen notable companies manufacture the particle accelerator technology and control software between the accelerator, medical technology and control software as well as the medical rooms. Technically it also packs advanced imaging and dosimetry systems, though not necessarily in all cases’, said the MedAustron Managing Director. ‘The ProteusOne’s other great significant factor is cost. However, it is acknowledged that the smaller system should also attract community hospitals as providers of the service, but a final decision is yet to be made on whether this will be possible with this novel technology.’

So far only 10% of patients who have undergone ion therapy have also received treatment with carbon ions. The procedure initially underwent a long study period in Japan, under strict monitoring of the dose escalation steps, before it was licensed. However, the local treatment results are tremendous, Prof. Mayer reports. ‘The procedure is basically indicated for all oxygen poor tumours situated in the vicinity of high risk organs, such as the heart, lungs or kidneys or any tumours. The radiation exposure in the healthy tissue surrounding the tumour area is only around 1% of that behind the tumour is almost completely spared.’

In addition, in the treatment of children and adolescents, for whom even a small dose can lead to long-term complications and effects, proton therapy will certainly have a bright future. Moreover, there are many more areas of potential application at the Barretos Cancer Hospital in Brazil and the Barretos Hospital in Brazil: DimitrovGrad and, in the Far East, three of its installations are at work – one in China, one in Japan and one in Korea. ‘This is the point where it is possible to install it in the future. It could become much more widely established. We are therefore only at the beginning of what will be possible with this novel technology.’