

EUROPEAN HOSPITAL

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20-page ECR 2012 supplement

- The 3-in-1 fully digital R/F system
- EU's 1st positron emission mammography
- CT cardiac scanning ends blooming effects



1-4 News & management

- Hitting at EU hospital hygiene problems
- Czech-Austrian research link-up
- Shopping in a virtual medical equipment show



7-12 Intensive care

- STEMO: Stroke ambulance has on-board CT
- Maltese ICU cuts nosocomial cases and mortality
- ISICEM and intensive care medicine reports



5-6 IT & telemedicine

- Ambulance paramedics go electronic
- High sales predictions from diagnostics firms
- Remote blood gas data management



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Administrators struggle to find cost savings in hygiene and many other areas

Along with questions about raising hygiene standards to save costs, there are also issues of quality standards, transparency and certification procedures and the economic viability of processes on a high technological level. The average patient is also changing – she/he is getting heavier, older and multi-morbid and often suffers chronic pain. The patient takes up the services of different specialists, requires new treatment methods and a large number of drugs. These days, renal artery stenosis is no contra-indication 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

'Before each ward round my students and I wash our hands' – so said Ignaz Philip 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

Hospital Build Europe is the only event that brings together investors, planners, contractors and managers of major healthcare building projects with service-suppliers in planning, design, building, operations, management and refurbishment. The launch event, Hospital Build Europe 2011 in Nuremberg, attracted 58 exhibitors and 2,000 visitors from more than 50 different countries.

Key highlight of the Hospital Build Europe will be a series of conferences focusing on five of the most important issues the health industry currently faces, such as the design, build and upgrade of facilities, process optimisation and facility management. Furthermore, within the scope of the "Leaders in Healthcare" conference, experts of various backgrounds will provide an overview of the current challenges in the health industry and illustrate how companies and institutions can successfully overcome them.

The business-to-business platform is set to provide answers on how healthcare operators can expand and enhance their facilities by choosing the right expertise, products and services. Nearly 60 international exhibitors will offer insights into the latest developments, hold workshops and showcase their solutions in live presentations.

Hospital Build Europe

In Berlin, from 24-26 April visitors to this international congress and trade fair will hear of medical imaging, process optimisation and facility management, and the latest construction, operation and equipment trends. The event will run alongside Euro ID, a trade fair for automatic identification, and conhIT, an IT healthcare industry tradeshow

RADIOLOGY

On 24 April a special session will focus on radiology and medical imaging. The available offers for modern imaging equipment, apart from X-ray machines, are diverse and innovative but expensive. This session will showcase the latest products, new and improved fields of application and the optimised use of imaging equipment in healthcare services.

Professor Georgios Sakas, a doctor of engineering and head of Cognitive Computing and Medical Imaging Competence Centre at the Fraunhofer Institute for Visual Computing, will speak on the shift from imaging to navigation. His research team in Darmstadt, Germany, develops solutions for using existing data more effectively, especially

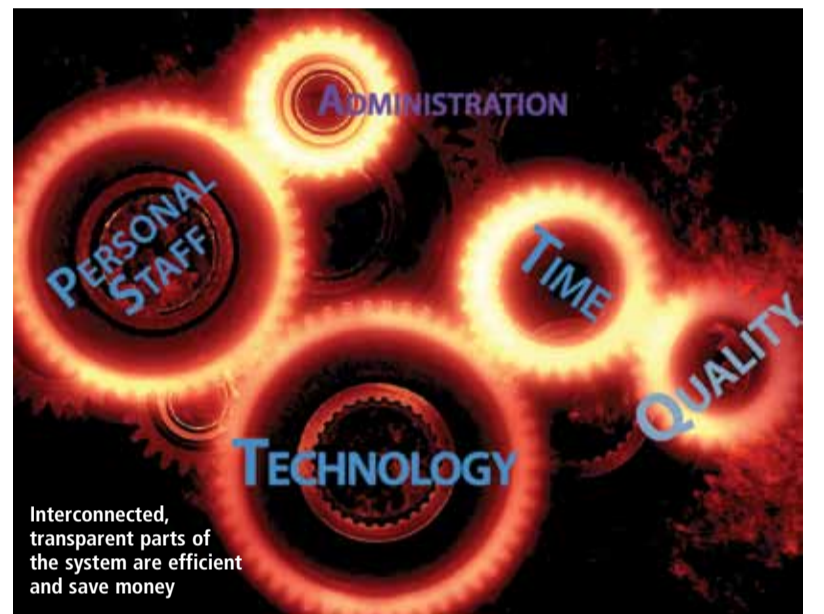
places. Sterile materials, laundry and catering services are being outsourced, lighting is switched to LED and the remaining technology is upgraded with the most up-to-date equipment. These devices obviously save energy, lower CO₂ emissions and are environmentally friendly. However, first they must be bought and nobody can guarantee the point of time when they will be amortised.

Many older hospitals in particular need considerable investment, the implementation of which – assuming that financing

has been successfully arranged – can severely affect day-to-day hospital operation. Patients ideally should not notice too much of any on going works, meaning the staff has to take the strain.

However, the empathy of nurses and doctors is a decisive factor that contributes to the patients' wellbeing and faster recuperation. If you ensure a motivating and satisfying working environment you automatically save a lot of money – both the number of sick days taken by staff and the

continued on page 3



contents



News & management	1-4
IT & telemed	5-6
Lab & pharma	6
Intensive care	7-12
ECR-Supplement	1-20



Berlin is the venue again

in diagnosis, treatment planning and intraoperative navigation. 'New software solutions have greatly changed medicine in the last few years,' the professor points out. 'Imaging procedures in particular facilitate the daily work of doctors and have earned a firm place in everyday hospital routines.'

However, the aim is to use as much information from images as possible in a great variety of application areas to



3-D image of the liver

minimise the effort required for interactions with image data during an operation. One of the latest developments is a 3-D hologram of the human liver, based on MRI scans. 'This will help physicians to find tumours and other diseases of the liver more easily,' he explains.

In addition, **Dr Arne Hengerer**, Director of Molecular MRI at Siemens, will provide an overview of developments in medical imaging.

New options provided by interventional radiology will be discussed by **Professor Siegfried A Thurnher**, Chairman of the Department of Radiology and Nuclear Medicine at the Barmherzige Brüder Hospital, in Vienna. He will demonstrate new fields of application and show the advantages for both hospitals and patients – and the expertise and equipment needed.

Details: www.hospitalbuildeurope.de.

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 37,000 people die of nosocomial infections in European hospitals; 4.1 million patients contract healthcare-associated infections – that is every tenth patient in Europe, as EU Health Commissioner **John Dalli** recently pointed out.

The causes are well known: first, antibiotic resistance; then the fact that more and more elderly and multi-morbid patients are admitted to hospitals and thirdly the shortage of professional medical staff. For example, Germany has 2,000 hospitals but only 70 hospital hygiene specialists. A hospital hygiene department is usually organised around out-patient, clinical and surgical tasks while clinical professions focus on either primary care, specialisation or management and are faced with an increasing need and demand for additional qualifications and even more specialised knowledge.

The German 'physician landscape', for example, clearly shows that geriatric care is seriously understaffed and that projects to link in- and out-patient care are urgently needed. As far as out-patient care is concerned some 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 out-patient care is expected to increase further and care manage-



ment will play a crucial role. The entire process needs to be optimised and its inherent problems need to be controlled. No doubt new skills and competencies will be required also – 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 a prognosis as to the results. The demands are not new; today the discussion is all about implementation. As long as handshakes are common in hospitals and as long as simple hygiene principles are neglected due to staff and time pressures, the prettiest framed certificate on the wall has little value. The German Hospital Society has quite a dry perspective on the issue: 'In the short term we cannot train the number of hygiene specialists that we need.'

At the University of Witten/Herdecke teaching hospital the hygiene manager founded a hygiene group to raise awareness of the dangers the invisible bacteria pose. A hygiene specialist monitors compliance with the guidelines, which

cover areas such as the use of disinfectants, a strict dress code particularly in the ICU and the operating theatre, isolation and antibacterial care of MRSA patients.

The new German Infection Protection Act 2011 tightens the rules. Thus, for example, MRSA incidences must be reported faster and hygiene plans have to be drafted. To date there are no comprehensive studies that assess additional hygiene measures using evidence-based criteria. The research results are ambiguous. Guidelines from the US-American Healthcare Infection Control Practices Advisory Committees (HICPAC) on the handling of multi-resistant micro-organisms in the context of medical care do not offer clear recommendations regarding active screening, whilst Dutch guidelines do recommend active screening for certain patient groups.

In Germany, recommendations for effective hygiene measures are urgently needed. Several hospital hygiene specialists in Baden-Württemberg suggested the development of hygiene standards taking into account the type of resistance and the type of in-patient care the patients are receiving. Such recommendations would distinguish between standard hygiene measures, extended measures including coat, gloves, patient-specific care utensils and single toilet (barrier isolation), single room isolation or cohort isolation. Hand hygiene compliance is of utmost importance as is the responsible use of antibiotics.

Patients can help to contain MRSA by, for example, having their GP test them for MRSA colonisation before hospital admission.

In any hospital hygiene plans and their accurate implementation are an absolute must – a mist that requires well-trained and sufficient staff.

Quality management

Quality management has been an integral part of the German healthcare sector for years. Doing without it is unimaginable, particularly in terms of increasing economical 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 Döbereiner* highlights quality management at the privately funded hospital group Schüchtermann-Klinik, the University Hospital of Tübingen and the perspective of the management consultancy Unity AG.

Does the investment in quality management (QM) pay off one-to-one? Not really, said Dr Michael Böckelmann, CEO of the regional hospital corporation Schüchtermann-Klinik, during his lecture at the National Quality Congress. To economise on the annual costs for full-time staff in charge of on-site QM, material expenses, costs for further education etcetera, will not be successful. '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 due to the QM, he quoted the restructuring of work at the integrated cardiac centre Schüchtermann-Klinik Bad Rothenfelde. Several years ago, the

ward-based medical team system had been replaced by a patient-oriented, team-based system. That is to say, patients are only tended by one team of physicians from their admission to discharge. Consequently, patient-centred care improved, the patients' satisfaction obviously increased and, as a pleasant side effect, the accuracy of documentation and therefore invoicing was enhanced, he pointed out.

Data consolidation

To clarify procedures and manage them is a major benefit of QM, emphasised Dr Jens Maschmann, who is responsible for business development (Medizinplanung und Strukturfragen) at the University Hospital Tübingen. Therefore, during his lecture he referred to the consolidation of all relevant data (for the first time!) from the multiple sources of the different applications at the University Hospital in 2009/2010 by the business platform QlikView, and the impact this had on QM with regard to the procedures in the operating theatre, wards and out-patient clinics.

In visualising ordinary procedures, problem-areas could be detected better and eliminated. Consequently, for example, the changeover time could be reduced, thus the occupancy rate of the operating theatre was improved. But as



Jens Maschmann



Michael Böckelmann

important is the possibility offered by data visualisation to involve employees in process-monitoring, to give them relatively prompt feedback, without upsetting them e.g. by finger-pointing, due to the objectification in graphs.

The digitally verified clinical concept

All the gathered expertise in process management as part of QM is to be applied in the new building and the renovation of the Elblandklinikum 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 givens 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 plans. For example, within only a few minutes the simulation helps to visualise the operating theatre procedures of an entire year. Now, one can easily see the effects, in terms of case numbers, of changing individual parameters, or of adding one operating theatre.

'In several projects so far, the changeover times could be reduced by 66%, while the number of surgical operations could be increased by 20% and the number of cancellations reduced by 70%', Meik Eusterholz explained. He believes these figures already make the digital simulation concept effective after a very short period of time and will prove successful in the long term.

Whether or not this optimistic view proves true will first be seen from 2015 onwards, when the renovation and rebuilding of Elblandklinikum Riesa are expected finish.

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Other institution (eg medical school) _____

2. YOUR JOB

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Chief of medical department/type _____
Medical practitioner/type _____
Other/department _____

3. HOW MANY BEDS DOES YOUR HOSPITAL PROVIDE

Up to 150 151-500 501-1000 more than 1000
 None, (not a hospital/clinic)

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- Surgical innovations/surgical equipment Radiology, imaging/high tech advances
 Clinical research/treatments/equipment Intensive Care Units/management/equipment
 Ambulance and rescue equipment Pharmaceutical news
 Physiotherapy updates/equipment Speech therapy/aids
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ESPECIALLY FOR DOCTORS:

Please complete the above questions and we would like you to answer the following additional questions by ticking yes or no or filling in the lines as appropriate.

What is your speciality? _____

In which department do you work? _____

Are you head of the department? Yes No

Are you in charge of your department's budget? Yes No

How much influence do you have on purchasing decisions?

I can only present an opinion Yes No

I tell the purchasing department what we need Yes No

I can purchase from manufacturers directly Yes No

Do you consider that your equipment is out-dated Yes No

relatively modern Yes No

state-of-the-art Yes No

Do you use/buy second-hand equipment? Yes No

If so, what do you use of this kind? _____

Is your department linked to an internal computer network? Yes No

Is your department linked to an external computer network? Yes No

Is your department involved with telemedicine in the community? Yes No

Do you consider your department is under-staffed? Yes No

Are you given ample opportunities to up-date knowledge? Yes No

Do you attend congresses or similar meetings for your speciality? Yes No

This information will be used only in an analysis for European Hospital, Theodor-Althoff-Str. 45, 45133 Essen, Germany, and for the mailing out of future issues and the EH electronic newsletter.

EH 1/12

TRANS-BORDER RESEARCH

The Czech Republic and Austria hold a joint seminar

'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 Pátek (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 Technopols in Tulln (agro-ecological biotechnologies), Krems (medi-

cal 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 institutes introduced selected sectors, products and services. Professor Friedrich Franek (Vienna University of Technology) presented the AC²T 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 Palacký 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

Administrators struggle to find cost savings

continued from page 1



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 16 million additional in-patient hospital days annually and the direct yearly costs run to around €5.5 billion – an average of €334 a day (Source: ECDC Annual Epidemiological Report 2008 and Monnet DL, 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.



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Shopping for bargains at a virtual trade show

‘The United States is really the trailblazer when it comes to how it deals with used equipment,’ says Philip Jacobus, President of DOTmed. ‘There are brokers and dealers selling equipment, independent service companies, spare parts companies and refurbishers. An interesting dynamic in the US is that many of the major OEMs have adopted their own programme for refurbishing and selling used equipment, whereas in the old days the manufacturers only sold new. In the US the market for used equipment is much more developed than anywhere in the world because the OEMs are now selling both new and used, and there are a number of people involved in buying and selling used equipment.’

Why should European hospitals care about what happens to their used equipment?

‘Because the economy is not booming, being able to remarket used equipment or sell used equipment for a profit – rather than trade it in for less of a profit – is a good thing. They should care about it because it generates additional revenue.’

‘The market for used equipment has grown. In addition, hospitals save when they sell equipment because not only do they generate a profit, they don’t have to spend money to get the equipment de-installed.’

Whilst there is a market in the US for used equipment, Europeans appear to sell their equipment beyond Europe – is that correct?

Stretchers, 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?



Phil Jacobus

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.’

Ambulance paramedics switch to on the spot electronic reporting

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 WebViewer, 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

to the hospital. 'This will greatly improve planning and preparedness at the hospital, assist the handover process and has significant clinical and patient benefits, particularly in terms of continuity of care,' said Mick Conibear, who has been working with Jason Pashley, the project manager, on the implementation.

The system also interfaces with the NHS Personal Demographics Service (PDS), which stores key

summary data about patients registered with England's NHS, including the patient's name, address, district of residence and GP Practice. It also has the ability to automatically generate an e-mail notification to the patient's GP.

The benefits of the Toughbook technology have been recognised across the trust and A&E departments, Mick Conibear confirmed.

Report: Mark Nicholls



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 a patients' arrival, or to pass on relevant information to other ambulance crews or GPs. Paramedics can also access resources such as treatment and


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Diagnostics manufacturers predict high sales increase

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.

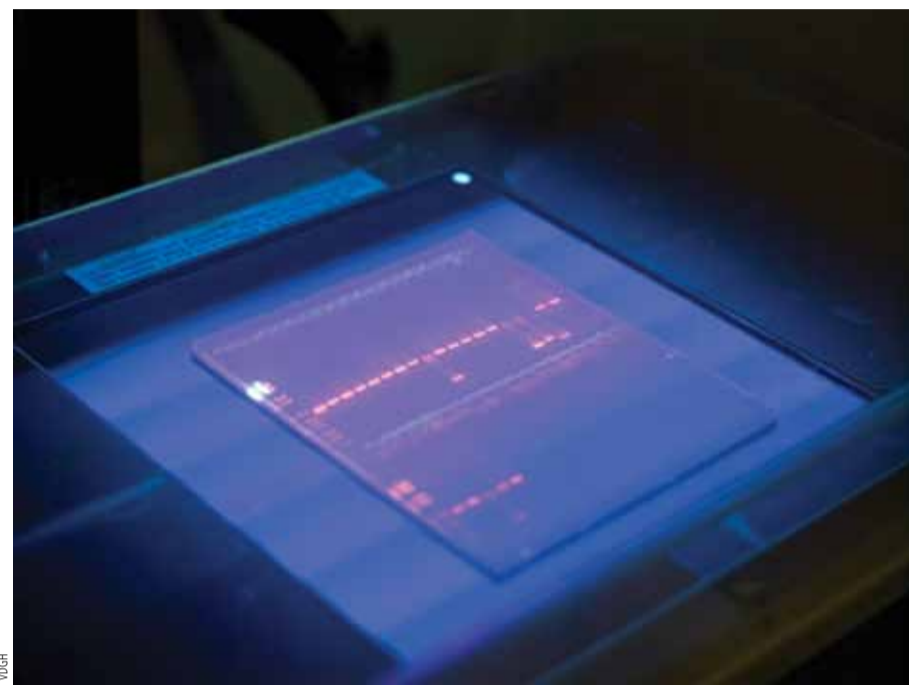
This optimistic growth prognosis, the result of a survey amongst its members announced in January by the German Diagnostics Industry Association (VDGH) is surprising, given that statistics previously presented a rather paradoxical picture.

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 0.1% 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.

However, with around 20,700 employees in the diagnostics sector, Germany intends to expand again in 2012 – primarily through investments. Two thirds of its companies plan to expand research activities (56%) or maintain them at the same level (36%). Innovations particularly help the sector to grow. 79% of the firms in the sector are already achieving up to 20% of their turnover through products marketed for less than three



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



The industry's mood is good, says VDGH Chairman Matthias Borst

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 – from 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 500-bed Warrington Hospital in the north-west of England has introduced rapid, accurate POCT to its wards.

The hospital was one of the first in the UK to install Siemens RAPIDLab 1200 Blood Gas Analyzers and the RAPIDComm v3.0 Data Management System. More recently, it has installed Clinitek Status Connect systems to further enhance its operations.

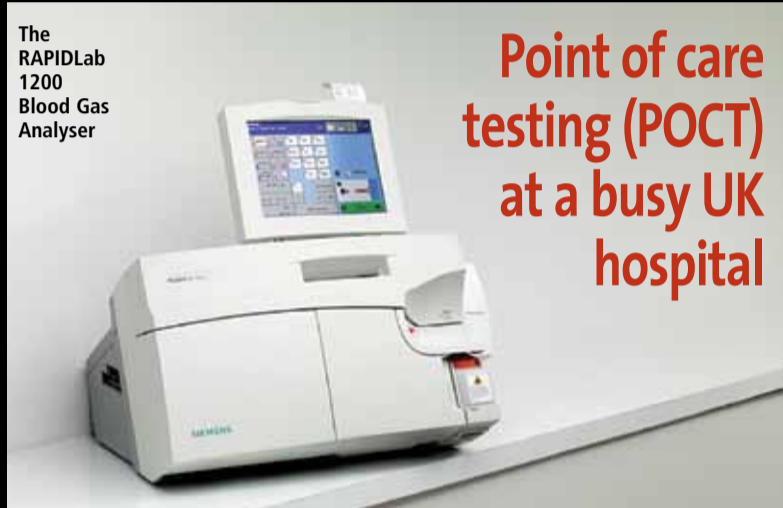
A key factor in the decision to upgrade its Blood Gas analysers was because existing equipment was experiencing problems and letting down staff.

nity 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, Neonatal Bilirubin; and full COoximetry).

The RAPIDComm v3.0 Blood Gas and Urinalysis Data Management and Connectivity Solution allows centralised management of multiple Siemens analysers and operators, while the Clinitek Status Connect System brings connectivity and testing oversight to POC urinalysis.

Remote blood gas data management



Point of care testing (POCT) at a busy UK hospital

The point of care (POC) team at the hospital - with a full-time POC coordinator and two part-time biomedical 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.

Previously, 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, 1,100 from the haematology and transplant unit, 1,200 from the intensive therapy unit, 400 from the neonatal ward and 250 from the mater-

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 Celia 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 can 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

IT & TELEMEDICINE

Med-e-Tel 2012

Med-e-Tel, the annual International eHealth, Telemedicine and Health ICT Forum, organised by the International Society for Telemedicine & eHealth (ISfTeH), an international federation of national associations that represent their countries' telemedicine and eHealth manufacturers. The Society was formed to help in the international dissemination of knowledge and experience in Telemedicine and eHealth and provide access to recognised IT experts worldwide. Med-e-Tel is their meeting place, providing education, networking and business for a global audience with diverse professional backgrounds.

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

Education – This year Med-e-Tel is running over 150 presentations and workshops, led by international experts covering experience, current applications, and predictions of future trends in Telemedicine and eHealth, and their effects on the healthcare

18-20 April 2012 Luxembourg



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.'

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.medetel.eu

THE 32ND INTERNATIONAL SYMPOSIUM ON INTENSIVE CARE AND EMERGENCY MEDICINE

ISICEM 2012
20-23 March
Belgium

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 are new study results comparing several types of intravenous (IV) solutions including albumin, hydroxyethyl starch or saline solutions will be presented. 'We still lack solid data approving the benefit or superiority of some agents for IV therapies,' Prof. Vincent explained. 'Other clinical research engages in the field of glucose monitoring. We know that blood sugar needs to be controlled more strictly, but this requires reliable principles of measurement. A number of companies are now working on the development of smarter glucose monitoring systems to decrease mortality as well as morbidity in intensive care patients. With exceeding attention, we also expect the first presentation of the full results of the PROWESS-SHOCK trial on the use of activated protein C in the treatment of severe sepsis. Prowess-Shock kicked off a controversial discussion not only in the treatment of sepsis but the design of sepsis studies in general.'

'It was a follow-up of the multi-centre PROWESS trial (Recombinant Human Activated Protein C Worldwide Evaluation in Severe Sepsis), which was cut short after a lower mortality rate showed up in the treated group. On the basis of this analysis, Eli Lilly launched the substance drotrecogin alfa under the drug name Xigris in the US (2001) and in Europe (2002).

'Xigris is an anticoagulant that influences the endothelial cell function in severe sepsis. However, after the market introduction, other randomised studies could

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.

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 launched 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 walls

not underline the Prowess results in patients with lower severity, or in children. Instead, some concerns about severe bleedings piled up, so the European Medicines Agency (EMA) demanded a repetition of Prowess in 2007. This follow-up study – Prowess-Shock – confirmed the negative experience with Xigris, which obliged the manufacturer to take the product off the market in 2011. So the question is: Do we need two trials

in the future before a new drug is marketed? If this is the case, the pharmaceutical industry will stop developing new drugs, because it will become too costly. Besides, the companies want to commercialise their products as soon as possible to make the most of their industrial property rights.'

Could this end sepsis studies?

'Hopefully not – in fact, we must prescribe what kind of studies we exactly need. Sepsis is a very heter-

ogeneous syndrome, so we need to be more specific in the selection of patients incorporated in these trials. If investigators enroll patients who may die or survive anyway in a trial that evaluates the drug effects on mortality, the collected data is worthless. Unfortunately, the criteria to select probands based on fever and tachycardia are too loose. We need more precise descriptions of patient selection, like biomarkers, for future investigations.'

What technical improvements will take centre stage at ISICEM?

'We cover innovations in all fields but very exciting are the new techniques in neuromonitoring. The brain was a kind of black box until recently. We could only gain some information about, for example, electrical activity of the brain by an electroencephalogram, or by monitoring intracranial pressure. There are now some new systems that allow the assessment of cerebral blood flow and oxygenation.'

'More and more institutions introduce the new concept of Medical Emergency Teams (MET) in their hospitals where intensive care is practiced without walls and cross-departmental. The focus of these inner-clinical teams lies on early interventions to avoid impending cardiopulmonary reanimation or evitable ICU admission. There



Jean-Louis Vincent

are also some new mobile systems gaining ground that allow better monitoring of patients on the hospital wards. These devices that can not only continuously monitor the heart rate, respiratory rate, blood pressure, blood oxygenation, temperature and other simple variables, but also integrate them to result in more complex intelligent alarm system.'

ICU teams often face life or death situations. Which areas currently provoke ethical debates?

'An abiding theme remains – organ donation, of course. Medical and technical advances have broadened the range of organ transplantation strategies. Thereby, new ethical-juristic questions emerged on how to implement these new strategies.'

'As a result, in the EU various terms and conditions circulate that apply to organ harvesting. Due to the fact that 90% of deaths are medical decisions to stop life support systems, in countries like Belgium or the Netherlands we do remove the organs not only in the case of brain death but also after cardiac arrest. There are many institutions like Erasme University Hospital where we also offer the possibility of non-heart beating organ donation, with the relatives' consent, of course.'

'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 physiopathology of catheter infection is now more 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, from the Surgical Intensive Care Unit at the Centre Hospitalier Universitaire, Poitiers, France.

The most common route of infection for short-term central venous catheters (CVCs) is the external route, the catheter tip being colonised at catheter insertion or subsequently by the migration of skin organisms from the insertion site. For long-term catheters the main cause of colonisation is manipulation of the venous line with migration of organisms along the internal lumen of the catheter.

The best criterion defining a catheter infection is the evidence of bacteraemia.

The question whether a catheter is infected, or not, can be answered after any other infectious complication has been ruled out. The most secure way to gain certainty is to remove the catheter and send it to the laboratory for cultivation. If the catheter cannot be removed, microbiological samples are performed, blood cultures, for example, or a culture from the insertion site. 'Many studies have shown that if the culture from the insertion site remains sterile the diagnosis of catheter infection can be ruled out.

Better safe than sorry Five recommendations to prevent central venous catheter-related infections

Catheter-related bloodstream infections are the third frequent infection in the intensive care unit (ICU) after pneumonia and peritonitis worldwide. The incidence of CVC infections lies between 1-4 for 1,000 catheter-days. This means for the USA, as an example, that more than five million patients annually need a central venous access, while 80,000 of them develop an infection. Catheter-related bloodstream infections have been reported to occur in 3 to 8% of inserted catheters and are the first cause of nosocomial bloodstream infection in ICUs. Attributable mortality rates ranges 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:

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/gown/gloves and large sterile drapes.

3. The preference for a chlorhexidine-based solution skin antiseptics and cleaning hands with an alcohol-based hand rub solution before any manipulation of the infusion line. In most of the studies, the superiority of chlorhexidines 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



Olivier Mimoz

Make a note:
ISICEM

20 March. 4.50 p.m.

**Session: Nosocomial bloodstream infections
Catheter-related infections**

Olivier Mimoz MD (CHU Poitiers)

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 or the enteral route can be used and CVCs that are no longer needed should be removed.

Catheter material is also an important determinant in the prevention of catheter-related infection. Catheters coated with antimicrobial or anti-septic agents decrease microorganism adhesion and biofilm production. 'Considering their costs and their good safety profile, the large use of CVCs coated with chlorhexidine and sulfadiazine should be considered, especially in ICUs where the incidence of catheter-related infection remains high despite adherence to guidelines and recommended measures,' accord-

ing to Dr Mimoz.

Dressing is also an important issue: 'Several studies have shown that the use of chlorhexidine-containing dressings reduce the risk of catheter-related infections and catheter-related bloodstream infections, and that non-adherent dressings increase these risks; therefore, the use of these new devices should be encouraged, as the rapid change of every non-adherent dressings.'

Last but not least, educating and training medical teams who insert and maintain CVCs is essential for prevention: 'In my opinion, all staff working around a patient should be concerned about avoiding catheter-related infections,' Dr Mimoz points out. 'The mentioned recommendations are valid as guidelines in all main countries, even if they have to be updated – like the French guidelines at the moment.'

Traumatic brain injury

'Traumatic brain injury is a clinical term that's often misunderstood – because it stands for a lot of underlying damages in brain tissue,' Dr Wright explains. 'In general, it stands for alterations in brain function due to external force, but what it also means is that these pathologies are not visible from the outside, so that they are difficult to study or to evaluate. That's part of the reason why it's on the one hand so little recognised by the public and, on the other, difficult to explore in science.'

Consequently, to this day there are no medical treatments to help the brain heal after trauma. TBI treatment is limited to preventive strategies that aim to avoid further damage after the primary injury. 'We divide TBI into primary and secondary injury,' Dr Wright explains. 'Primary injury occurs during the initial insult and results from displacement of the physical structures of the brain leading to contusion, concussion, etcetera. The 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, has devastating effects on the surrounding structures. If these processes are not controlled, the swelling herniates down through the brain stem and causes instant death.'

Therefore, clinicians today concen-

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 it once received the nickname 'silent epidemic' by the American Centres for Disease Control and Prevention (CDC). Why does this condition receive so little attention? EH reporter *Karoline Laarmann* asked **David W Wright MD**, Associate Professor of Emergency Medicine and Director of Emergency Neurosciences at Emory University School of Medicine, Atlanta, Georgia, USA, who will discuss severe brain injury in adults at ISICEM 2012

trate on decreasing intracranial pressure by giving infusions of hypotonic saline or mannitol, which have a substantial osmotic capacity to draw water out of the brain. In craniotomy, a surgical approach, part of the skull is removed to release pressure. Patient monitoring plays another important role, Dr Wright points out: 'The international guidelines for the management of severe brain injury show that one episode of low blood pressure doubles mortality for patients with severe brain injury. Therefore, if you keep the vital functions up, you achieve better patient outcome. Unfortunately, these evidence-based recommendations are inconsistently followed worldwide. For instance, in the US, where the guidelines were originally developed in 1995, only 60% of clinicians follow them. That is not acceptable.'

Beyond supportive care, 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

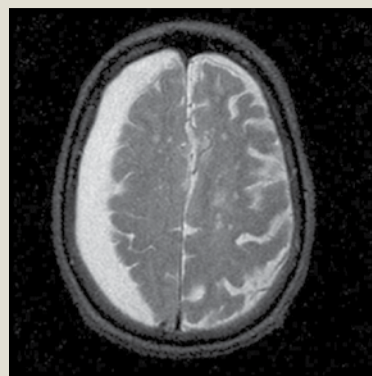
functions. Therefore, the goal is to design treatments that stop or slow down the damage caused by secondary injury.'

In TBI research, the greatest hope in many years is pinned on progesterone, a steroid 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 shockwaves that go through the brain and release neurotransmitters like breaking the flood gates of a dam', he explains. 'These neurotransmitters open calcium channels that then flood into the cells and cause cell death, which then brings environmental service cells to the scene to clean up the debris. That 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.'

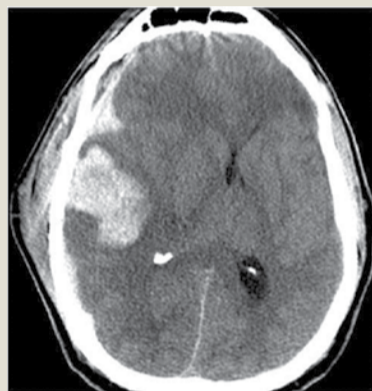
Currently underway are two Phase III clinical trials with progesterone: The ProTECT trial in the USA and the SynAPSe study in Europe, sponsored by BHR Pharma, LLC. As principal investigator of ProTECT, Dr Wright will present the latest promising results of the trial during the ISICEM in Brussels.



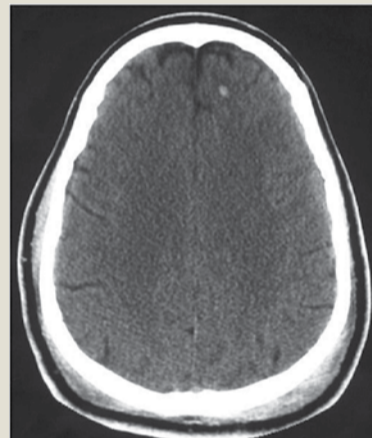
David W Wright



This slide represents an epidural hematoma, rapid bleeding under the skull but outside the brain's covering (dura mater), usually as a result of a torn artery. Notice that the brain is being pushed (shifted) due to the mass lesion



CT scan of the brain showing a large area of bleeding on the right side of the brain as a result of a traumatic contusion (bruise) to the brain. Notice the shift to the left in the brain from the blood and swelling pushing the brain tissue over



CT scan of the brain demonstrating diffuse axonal injury. This form of injury is difficult to visualise on CT scan, but the brain in general appears swollen with small bright spots representing bleeding throughout the brain tissue

Intensive care units (ICUs) are vital in healthcare. ICUs in US hospitals, for example, treat six million of the sickest and oldest patients annually, according to a document recently published for the Massachusetts Technology Park Corporation, which states that choices about how to manage them carry high stakes: 'ICUs have both the highest mortality and the highest costs in healthcare, accounting for 4.1% of the nation's US-\$2.6 trillion in annual healthcare spending, or nearly \$107 billion per year.' The increasing number of critical care patients and the severity of cases in an ageing population adds to this complexity, as does the decreasing supply of critical care physicians. In Europe, the situation is basically similar, even if focuses differ largely: Whereas Germany maintains approximately 24.6 beds per 100,000 people, the UK's NHS only has 3.5 ICU beds [2010]. Experts suggest that information technology (IT) can help improve the outlook.

'IT may improve the quality, safety, and efficiency of medicine,' states a recent article by Belgian author Kirsten Colpaert et al., 'and is especially useful in [ICUs] as these are extremely data-rich environments with around-the-clock changing parameters'. However, data regarding IT implementation rates in ICUs is scarce and restricted mostly to non-European countries. The authors provide insight about the implementation of IT in Flemish ICUs: Computerised display of laboratory and radiology results is almost omnipresent, but computerised physician order entry (CPOE) is rarely used; 65% of these ICUs use an electronic patient record (EPR), 41.3% use CPOE for medication prescriptions and 27% use computerised medication administration recording. The implementation rate of dedicated information systems, however, is 'surprisingly low', due to initial investment costs, integration problems with the hospital information system (HIS), concerns about user-friendliness, the need for dedicated staff, and a questionable cost-benefit ratio. 'Uptake has so far been slow in the UK and worldwide'

Findings by UL authors Nicholas Lees et al. are similar to the Flemish study; in *Information technology in anaesthesia and critical care*

DATE FOR THE DIARY

ISICEM 2012

20 March

11.35 a.m.

Guidelines for brain protection
Severe brain injury in adults

1.45 p.m.

New ideas in neuroprotection
Progesterone research results

Speaker: Dr David Wright, Emory University Hospital, Atlanta, USA

The Starled1 EVO single light examination lamp

Evolving from the first medical examination lamp in the Starled1 series created by the Italian manufacturer medical lighting manufacturer ACEM Medical Company (Division of ACEM S.p.A.), the firm reports that its new Starled1 EVO is based on LED technology (Light Emitting Diodes) and produces an 'unparalleled quality of light with a colour temperature of 4.900°K and a colour rendering index (CRI) of 95'.

'Starled1 EVO has great performances (60.000 Lux) with low consumption (12W) and an average life of more than 100 times that of normal bulbs,' ACEM reports. 'Thanks to its practical and functional design studied to ensure handiness and stability, this lamp is easy to use and clean. In addition, the light intensity can be perfectly adjusted through the simple use of its innovative I-SENSE control panel.'

According to needs, the lamp is available with an articulated or flexible arm, rail, wall, table or adjustable height trolley mount. An adjustable height ceiling mount is also available.

Details: ACEM Medical Company. Phone: +39 051 721844
www.acem.it



NEW

A new generation of video laryngoscope

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 Anil Patel, co-inventor of the system (A.P. = his initials), include more controlled access and better visibility to access complex airways more effectively and accurately, causing less trauma to patients and leading to better clinical outcomes.

Dr Patel, from the Royal National Throat, Nose and Ear Hospital and University College Hospital in London, explained that video laryngoscopes have a real benefit because they allow the anaesthetist to visualise the passage of a tracheal tube through the glottis. 'What we use for laryngoscopy at the moment is often adequate but sometimes, when things are difficult, being able to see around the corner with a video laryngoscope and being able to see the tube passing through the vocal cords is useful.'

Portability and flexibility are further assets, he points out. 'It allows you to go very quickly from a normal blade to a difficult blade, so it can pick up the whole population group from normal airways to difficult airways, whereas most video laryngoscopes have tended to concentrate on the difficult end of the spectrum. We have allowed our disposable blade to change shape on the same hardware.'

While most video laryngoscopy blades are bent around a corner to enable the anaesthetist to see more than they can with the naked eye, the real challenge, he explained, still remains in successfully passing the tube around the corner – but the A.P. Advance Video Laryngoscope can meet this challenge. 'We have created a guide plate which guides the tube to the exact point that you are looking at, which is something that is very new and very different.'

However, Dr Patel, who has had more than 20 years' experience and often in complex cases, stressed: 'It is still important to recognise that



The Venner A.P. Advance Video Laryngoscope enables a view of the glottis to aid tracheal intubation and may be used to facilitate endotracheal intubation as part of general anaesthesia or cardio-pulmonary resuscitation. The high image quality camera chip and high intensity white LED light source provide a clear image of the laryngeal structures

potential benefits cited are documentation accuracy, electronic prescribing reducing errors, facilitating audit and research, and clinical decision support. 'Cost is still the main barrier to implementation, but other factors are IT problems and uncertainty from clinicians.'

Systems integration, virtual simulation to guide study

How can barriers be overcome? 'A hospital ICU contains 50 to 100 pieces of electronic equipment

more efficient ICU model not just for Johns Hopkins but for patients around the world.'

A single system that could triage and prioritise patient alarms based on individual risk of cardiac or respiratory arrest, for example, could prevent alarm fatigue, when clinicians sometimes are inundated with a chorus of competing signals. This could promote an understanding of the risks at a personal level, based on each patient's age, diagnosis, and family history.

data to mimic possible outcomes of life-like scenarios. The software can also be used to train healthcare providers on newly engineered devices or processes, similar to the way pilots learn to respond to high-pressure scenarios.'

Hopkins researchers will test alternative approaches to ICU care in a learning laboratory with a virtual simulation theatre, engineering workshop, and a testing area with simulator mannequins that imitate patient conditions and responses.

between 4-17% of ward patients experience a critical situation that is not recognised in time in all the cases; subsequently, the average length of stay goes up from 18.4 to 38.5 days, according to a study presented by Philips. Costs for care increase accordingly. A third of all deaths occur after transfer from ICUs.

Those figures illustrate the need for technology to help monitor the health status of transferred ICU patients. A portable spot-check

critical events, which may considerably increase patient safety.'

The promise of the tele-ICU

In this context, tele-ICU is a further approach: telemedicine technology enables clinicians in a 'command centre' to remotely monitor, consult, and care for ICU patients in multiple and distant locations, explains the Massachusetts Technology Park Corporation report. By increasing the number of ICU patients that critical care teams can manage, 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 study results show that telemedicine technology leads to a significant decrease in patient mortality; patient ICU stays were shorter; tele-ICUs have a rapid amortisation for hospitals; and tele-ICUs produce a substantial financial benefit for payers. Authors summarise: 'Taken together, the clinical and financial benefits of a fully implemented tele-ICU system offer a win-win-win opportunity for patients, hospitals and payers.... Now that tele-ICUs have a strong reputation based on clear evidence, we must seize the chance to speed the adoption of this valuable technology.... We cannot afford to lose this opportunity to improve the quality and control the costs of critical care'.

The outlook

Availability of patient data to physicians 'anytime, anywhere' 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.

IT helps ensure patient safety in the ICU – and beyond

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

that may neither communicate nor work together effectively', says Peter Pronovost, MD PhD, director of The Armstrong Institute director and senior vice president for patient safety and quality for Johns Hopkins Medicine. He compares healthcare and aerospace industries: 'When an airline needs a new plane, they don't individually select the controls systems, seats, and other components, and then try to build it themselves.' The piecemeal approach by which hospitals currently assemble ICUs is inefficient and prone to error, adding risk to an already intricate environment.

The Armstrong Institute, which oversees all patient safety and quality efforts throughout Johns Hopkins Medicine, is designed to rigorously apply scientific principles to the study of patient safety, also beyond Johns Hopkins. The Institute is committed to eliminating preventable harm for patients, reducing health disparities, ensuring clinical excellence, and creating a culture that values patient-centred care. Armstrong recently entered into collaboration with a global security and technology company Lockheed Martin, which Dr Pronovost believes, 'has the expertise to integrate complex systems to help us build a safer and



'Flight simulators and systems integration revolutionised the aerospace industry, and similar concepts can be applied to increase effectiveness and efficiency of the healthcare industry,' says Dr Ray O Johnson, Lockheed Martin senior vice president and chief technology officer. '[Our] advanced computer-generated modelling and simulation will allow scientists to input ICU

Safer monitoring after transfer to ward

Today, ICU patients are transferred to general care wards at an ever earlier moment in their care process. Therapeutic aspects and cost pressures are key drivers of this trend. For this reason, nurses are increasingly confronted with, and challenged by, more critically ill patients. Statistics show that

DATE FOR THE DIARY

13-17 October 2012

The 4th Congress of the European Society of Intensive Care Medicine ESICM/LIVES

Lisbon, Portugal

Details: www.esicm.org

monitor from Philips includes a built-in Early Warning Scoring system designed to support nurses in the routine checking of vital signs. Values can be compared automatically with the patient profile, and sets off alarms when values become critical. There are also wireless sensors developed for ambulatory patients who need frequent monitoring.

'Current trends demand the frequent monitoring of many patients outside the ICU, and today's manual monitoring procedures are often no longer sufficient,' said Andreas Hvarfner, MD PhD, of Lund University Hospital, Sweden. 'Critical changes in the patient's health status are not always detected in time. Intelligent monitoring and early warning systems can help us to intervene at an early stage in order to avoid the occurrence of

no video laryngoscope will cover everything because patients are very diverse. Ultimately, it always comes back to individual clinical assessment by an anaesthetist and the skill set that they have and then deciding what the appropriate devices and tools are. This device is not the solution to every problem, but hopefully it is the solution to many, many problems.'

Explaining the reduction in patient trauma, he added: 'If you put a difficult blade on, making it into a difficult airway tool, you can pass a tube to the point you want it to be at without levering on teeth and use much less force because your blade and guide plate is taking the tube to where you want it to go. That means you may well get less dental trauma and less soft tissue trauma as a result.'

The device is also a useful tool for teaching standard laryngoscopy – with instructors also having a clear view of proceedings – and avoiding unnecessary trauma to patients.

Development of the device has been anaesthetist-driven, resulting in ergonomic comfort for practitioners, Dr Patel pointed out. The Red Dot Product Design Award 2011 'Best of the Best' is among its design awards. On the market for a year, the laryngoscope is in use internationally.

Dräger

COMFOR_T

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A Maltese success story

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

motor vehicle accidents to post-major surgical octogenarians needing intensive monitoring. Nor is race an issue, in fact Malta opened its ICU doors to Libyan

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 – uncontrolled severe systemic infections acquired either in the community or while in hospital. This associated with ever-increasing antibiotic resistance is the major cause of mortality in most European hospitals, taking more 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 reduce hospital acquired (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 they are admitting sicker and greater numbers of patients per annum, we have not observed a higher mortality rate – in fact this decreased slightly in 2010 to 18%.

Our experience in intensive care has shown that the small size of our nation (400,000) and the stringently tight resources, while making the challenge hurdles 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 EC campaign, *Europe for patients* is all about - better healthcare for all in Europe - and hopefully beyond.



Mater Dei Hospital's medical and surgical ICU

casualties 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

the ICU at Mater Dei Hospital, in Malta, has been at the forefront in resuscitating and rehabilitating people from all age groups, including teenagers involved in



Most people associate intensive care with life-threatening conditions or potential mortality, underestimating the other major challenges facing ICUs in today's hospital care areas such as sepsis control, quality of care and availability whatever the age, health status and nationality of the patient. These have been the major challenges encountered at the 20-bed combined medical and surgical ICU at the recently built Mater Dei Hospital in Malta.

In recent years, despite the constant challenge surrounding bed availability and staff shortage,

The 40th International Congress of Intensive Care Medicine

Held at La Defense in January, the 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) the publication of the English language publication *Annals of Intensive Care*, available in open access, and setting up a trials 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 role of telemedicine in the ICU. One fundamental problem faced by intensive care medicine is the increasing demand for its services and a decreasing number of doctors to provide these.

Critical care teams are expected to work not just within their specialised unit, but wherever intensive acute techniques are required e.g. in the emergency department, or at the scene of an accident. Figures from the USA show that, for the whole country, there are fewer than 6,000 intensivists in active practice and only 15% of ICUs have a dedicated intensivist, whilst in

another 30% there is an intensivist available. Professor Vincent said that, while the situation is not quite as bad in Europe, teams are short-staffed, work long hours and are therefore often tired. As we all know, tiredness is not conducive to good clinical decision-making. Therefore, telemedicine is an option widely embraced by ICU teams in the USA.

With electronic transfer of patient data, images and biochemical results, already in place between departments within the same hospital it is not too great a stretch of the imagination to see how these could be transferred to the intensivist's PC when at home, or to a smart phone when out and about. Alternatively, any other specialist consultation e.g. obstetrician, cardiologist etc. could take place at-a-distance via good video and telephone links.

In the USA, this system is in place in many ICUs. Telemedicine offers a means of sharing intensivist coverage over more ICU beds. A command centre based on a team of one physician and four nurses can oversee the care of up to 75 patients in at-distance ICUs, while the actual ICUs may be staffed with physicians and nurses providing direct care to patients, but not necessarily with intensivists. Another possibility from the use of telemedicine that the US is exploiting is the use of foreign specialists in countries in

a different time zone, for example in India, to ensure 24-hour cover, which is cost effective. Studies from the USA have been published showing cost-savings from using telemedicine in intensive care with no increased risk to patient morbidity and mortality. While Professor Vincent was enthusiastic about the advantages of telemedicine, he agreed with many delegates who had serious misgivings at the thought of critically ill patients not having the 'expert' presence where perhaps it is needed most, at the bedside.

Indeed this thought moved naturally on into the next presentation by Professor Yaniv Almog (Beer-Sheva, Israel) who discussed the ICU clinical decision process. Whilst acknowledging the utility of decision-making algorithms, the professor drew attention to the fact that humans, unlike computers, do not automatically follow such pathways. In any clinical decision, especially under stressful conditions like intensive care, emotions come into play and physicians have to make what is known as judgement under uncertainty.

Two major processes are in play, the intuitive snap judgement that is unconscious and based on emotional memory and rational decision making based on the evidence in front of the doctor. All probabilities need to be disregarded and rapid, knowledge-guid-

ed perception, based on the patient's condition, needs to form the basis of the decision process. Unfortunately, Professor Almog feels that this skill is difficult to acquire and is probably innate to the good physician and its lack may be one reason why mistakes are made. He also fears for a future where doctors see fewer patients in training – and the use of simulators perhaps leads to the loss of this important ability from the doctor's skill base.

The final presentation from Professor

Etienne Danse (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 patient's bedside. It would seem that the technology for the future is in place for ICUs – but are the future intensivists?

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There are times when the timely detection of a patient's weight change could save a life. Regular weight checks can reveal an unexplained loss of fluids due to diarrhoea, vomiting and third-degree burns in time to prevent complications. For illnesses associated with excessive fluid volume, such as heart failure, cirrhosis of the liver, pulmonary disorders and hypothyroidism, weight checks are indispensable.

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seca 985

What are the characteristics of quality in intensive care medicine? According to Prof. Suter it is not only about a patient's survival. 'Patients and their relatives cannot really judge what the chances of survival are in the case of a critical event. What they will remember is how well doctors and nurses looked after them. Therefore, attention and sympathy play a much more important role than conventionally assumed.' Although there is no empirical proof of a direct connection between the chance of survival and humanity, good contact with the patient and their relatives nevertheless appears to have an impact on the chance of survival.'

To find out to what extent one's

DATE FOR THE DIARY

ISICEM 2012

20 March

9.40 a.m. - Opening Session

The Max Harry Weil lecture: Quality of ICU care: Science and humanity

Peter M Suter

(Geneva, Switzerland)

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 revolutionised intensive care medicine and became known as its founding father. He died in 2011 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

own human competencies stretch, it is not good enough to hope for spontaneous responses. The expert recommends actively soliciting the patient's opinion: 'This should be done by way of a personal conversation at the end of the hospital stay, and then also later via completion of a written questionnaire.'

Human empathy is even more important in those cases where the prognosis is bad or hopeless, he emphasises: 'This means that you

need to talk to the patient and his/her relatives as early as possible about their ethical values and about which life-saving measures they no longer want.'

Further training can also help to discover one's own strengths and weaknesses in this field. Practical case study discussions using the examples of actual patients from day-to-day clinical life can be particularly helpful: What worked well when we looked after this patient



Peter Suter is an Honorary Professor at the University of Geneva, where he headed the Division for Surgical Intensive Care Medicine, was Director of the Department for Anaesthesiology, and in 1995 became Deacon of the Medical Faculty.

During his career he has also been President of many leading organisations, including the European Society of Intensive Care Medicine, Swiss Society of Intensive Care Medicine, World Federation of Societies of Intensive and Critical Care Medicine and the Swiss Academy of Medical Sciences (SAMW). Among his c. 200 scientific publications, his particular focus has been on respiratory insufficiency, lung mechanics, pathophysiology and mediators, as well as on acute respiratory failure, nosocomial infections and sepsis.

and what didn't?

Prof. Suter also pleads for more emphasis on the subjects of ethics and communication during scientific meetings: 'This is not necessarily something that has top priority for the participants of symposia or congresses, but I am sure you can make these contents more interesting to make them more attractive to participants.'

The problem that economic conditions often leave no time for interpersonal relationships still remains. However, he believes it is important to create some time and space for this. 'Obviously the hospital management has a primary interest in looking after as many patients as possible in the shortest possible time. This is why you have to fight for certain issues, such as ensuring that there are always enough doctors and nurses available. However, even on the intensive care ward it's possible to take the initiative and ensure that these matters are given priority.'

'Doctors are always very interested in progressive technologies and will often spend hours trying to fit special catheters or to understand a new device. This is important, but technology by the bedside should always contribute towards a situation where we create more time for the patient and should not lead to a situation where we lose contact with people.'



Berlin's Stroke Emergency Mobile Unit (STEMO)

Dr Gerhard Jan Jungehülsing believes the subject of strokes will become increasingly important because the number of stroke victims is increasing – with estimates predicting cases will more than double by 2040. Currently, about 250,000 people in Germany suffer a stroke every year. Thus, with an average survival rate of five years, the country could contain around a million stroke victims still suffering the effects. 'Whilst the majority of German patients obviously receive prompt treatment and will not suffer any problems, or at least no major problems, around a third of patients will be left with permanent limitations or even disabilities, whilst a quarter of patients die within the first three months after suffering a stroke,' Dr Jungehülsing pointed out.

Diagnosis and treatment

'Stroke is a dynamic disease because the area of dying cells spreads across the brain within the first few hours of the event,' he explained, adding therefore that the earlier its detection, the better the chances of successful treatment. 'Complications arise when the time of the event cannot be determined. This is the case with so-called 'wake-up strokes' where the patient has suffered a stroke at some stage during the night and wakes up the next morning hemiplegic. In around 25% of stroke patients the

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



Gerhard Jan Jungehülsing

exact time of the event is therefore unclear, making treatment much more difficult. Lytic treatment for instance can only be started within 4.5 hours after the first occurrence of symptoms and therefore has not been possible for the treatment of wake-up strokes so far. Various imaging procedures will therefore play an important part in the future.'

Apart from clinical stroke studies, MRI for acute stroke is one of Dr Jungehülsing's key scientific subjects. 'In the future, we expect MRI will improve the treatment of wake-up strokes. We are currently investigating how to assess MRI for strokes where the time of the event is unclear. In this case, MRI is diffusion-weighted and combined with the MRI sequence FLAIR, which makes it possible to differentiate between free fluids and tissue fluids. This protocol could make the tissue damage visible, which has already occurred, and could also help to narrow down the time of event.'

'Helped by this information, we can then decide which wake-up stroke patients can receive lytic therapy and which can't. Both CT and MRI are basically important in stroke diagnosis. Which procedure is chosen is a matter of availability. Head CT

remains the method of choice to rule out brain bleeds. New perfusion CT and CT-angio procedures work even more sensitively and deliver more information. However, with the help of MRI it's possible to determine more precisely the extent and localisation of tissue damage.'

Does MRI deliver additional information that expands the treatment spectrum?

'We assume this is at least the case for wake-up strokes, and we will start a multi-centre study on this topic this spring. Different stroke centres nationally are working together, with our University Hospital Hamburg colleagues managing the project. We want to find out if MRI can deliver additional information on the exact time of the event for wake-up stroke patients. This data could lead to a more targeted, individualised treatment plan. My prognosis is that MRI will be used more comprehensively to treat stroke patients in the future and that the treatment spectrum will therefore expand.'

CT and MRI deliver more details for the diagnosis. What part do they play when it comes to 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 recanalisation 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



STEMO interior showing CT

medical discipline can accomplish such an intervention on its own. Everybody has to work together well – emergency medics, neurologists, anaesthetists and interventionalists. In an ideal situation, the neurologist controls the catheter and guides it into the brain. However, given a choice, it is important that this task is carried out by the person in a team with the most experience in the matter and who has carried out the most procedures.'

STEMO

At ANIM 2012, Berlin's Stroke Emergency Mobile Unit (STEMO)

was introduced to attending interventionalists. 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 also be an emergency medic, and one of the emergency medical technicians must be either a trained radiographer or must have had training in radiation protection.'

Along with regionalising critical care into major centres, Timothy Evans, Professor of Intensive Care Medicine at Imperial College London and Medical Director and Consultant in Intensive Care and Thoracic Medicine at the Royal Brompton and Harefield NHS Trust, in London, also maintains such a restructure will offer patients greater access to excellent quality intensive care that will be consistently available 24/7.

He will lead the 'Should we regionalise intensive care?' debate at the International Symposium of Intensive Care and Emergency Medicine (ISICEM) in Brussels (20-23 March).

to continue providing acute respiratory services on a site.'

He said that it was no longer feasible to provide a comprehensive service in every town or city and to receive first class intensive care, patients will have to travel to better-equipped, larger regional centres. 'The advantage of bigger and better equipped regional centres at this time is that it offers more effective utilisation of resources.' As said, at these there will be – 24/7 – access to MRI



Timothy Evans

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 (NHS) seeks to make the best use of resources, Mark Nicholls reports

Speaking ahead of the conference, he said, 'In my view, we do need to regionalise critical care in the same way that there is an increasing focus on regionalising many specialist services; whether that is vascular surgery or cardiothoracic surgery or anything else. As the services that intensive care supports move into regional centres, then the need for advanced critical care support in community or district general hospitals will subside.'

He also pointed out that some of the advanced technologies that are now run by intensive care – such as extracorporeal membrane oxygenation (ECMO) – can only be offered in larger units with specific expertise and enough staff to operate them.

An important consideration in moving intensive care from smaller centres into fewer larger centres is the response from the public, who may be dismayed at losing a 'local' service.

Professor Evans also warned that once intensive care is taken out of a hospital, its future could be in jeopardy. 'We need to be aware of the consequences – we cannot just say we will regionalise because that has a knock-on effect for all sorts of services. Respiratory physicians might say, for example, that if there is no intensive care, they will not be able

scanners, surgeons, imaging and laboratory services and highly-trained consultants on hand in A&E departments.

However, Professor Evans said that if such changes are introduced, the benefits will have to be clearly communicated to patients. 'We can't just say "we'll close your hospital but you will get something better", we have to say what it is that's better and I think that is where the debate needs to come in.'

There are already examples of regionalisation in the UK; children's services are already centralised and parents are prepared to travel to get a first class service for their child.

'I regard regionalisation of intensive care as inevitable,' he added, 'and if you want excellence in care, that is what is going to have to happen. We are almost saying we need to redefine what constitutes a modern quality service.'

Professor Evans will use data from the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) reports to support his case that change is needed.

He also pointed out that medical leadership in the UK and organisations representing health professionals are starting to acknowledge this pattern of regionalised intensive care will be part of the future of the NHS.

Post-operative care

Classifying complications – from minor to major

The list of post-operative complications is long. Most common are fever, chest infection, pneumonia, wound infection, bleeding or deep vein thrombosis. As these post-surgical complications can range from minor, self-limiting problems to major life-threatening events, their definition and severity staging can be challenging. Therefore, new and reliable definitions and classification systems are needed that allow for systematic strategies to identify, prevent and manage post-operative problems.

The work of ISICEM-referent Dr Daryl J Kor, a physician in the Department of Anaesthesiology Department, 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 identification of intermediate biologic markers that accurately and reliably 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 "postoperative complication" is very generic and non-descript. When attempting to study risk profiles for postoperative 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.'

One more elaborated definition of the term was provided in 2008 by Daniel K. Sokol and James Wilson who described it as "an undesirable, unintended, and direct result of an operation affecting the patient which would not have occurred had the operation gone as well as could reasonably be hoped." (Sokol DK, Wilson J; World J Surg, Vol. 32, Nr. 6).

In the recent past, there have been some efforts to extend the general definition of major vs. minor complications. At the Mayo Clinic in

Rochester, Dr Kor and his colleagues typically go with what the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) defines for major postoperative events – primarily, because it has the greatest history of previous literature. ACS NSQIP collects data on approximately 130 variables, including pre-operative risk factors, intra-operative variables, and 30-day post-operative mortality and morbidity outcomes. 'In addition to providing specific definitions for a variety of adverse postoperative events, the NSQIP programme also classifies complications into categories of major and minor. Still, these categorisations are somewhat arbitrary and, in order to significantly improve the accurate identification of high-risk cohorts for potential therapeutically strategies, it is of vital importance to classify specific complications in an objective and reproducible manner,' Dr Kor says. To this end, in the US Center for Medicare & Medicaid Services is working to refine the classification of major versus minor postoperative complications.

A second method for classifying postoperative complications is based on the extent of therapies required to treat the complication. This system, termed the Clavien-Dindo Complications Classification, is named after its inventors Pierre A Clavien and Daniel Dindo from the Department of Surgery, University Hospital Zurich, Switzerland. Their



Daryl J Kor

classification system grades the variety of complications by invasiveness, extent of surgical procedure etc.

'One of the strengths of this new classification system is that it removes some of the subjectivity that exists in alternative complication staging systems. In addition, it tends to stage the severity of a post-operative complication in a manner that is most understandable from the patients' perspective. Patients may not understand or appreciate the importance of a diagnosis of "anastomotic leak", but they do understand its importance when they learn that it will require a return to the operating room', says Dr Kor.

'It's only when the definitions and classifications are well-defined that we can meaningfully start to evaluate and model risk for the development of specific post-operative complications', Dr Kor says, explaining that there are three key domains that need to be considered in the context. First comes the pre-operative setting: 'It has been replicated in multiple studies that the baseline health status and the specific surgical procedure the patient is undergoing are very strong predictors of who ultimately will develop a serious postoperative complication.'

The second domain is the intra-operative environment. Events

DATE FOR THE DIARY

ISICEM 2012

22 March. 8:00 a.m.

Postoperative complications – Who is at risk?

Daryl J Kor

(Mayo Clinic, Rochester)

occurring in the OR can either increase or decrease the pre-operative risk profile to develop a major postoperative problem. While for certain complications it is quite clear that there are specific intra-operative events that encourage risk, e.g. longer surgical procedures, extent of fluid resuscitation, or aggressive transfusion practice, this area is nevertheless lacking data determining what specific role the intra-operative course really plays in determining who will develop postoperative complications or not.

The third domain of risk modification is the postoperative period. 'Fortunately,' he says, 'we have identified some interventions in the postoperative period that indeed do reduce the risks for complications. For instance, we know that the early removal of urinary and central venous catheters will reduce the incidence of urinary tract and catheter-related blood stream infections.'

'However, significant knowledge gaps remain and to make further progress, two key steps will be required. First, we must continue to refine our understanding regarding what aspects of a patient's baseline health status and the care delivery process are associated with risk for complications of interest. Once this has been more precisely defined, we can then start to evaluate specific strategies to mitigate those risks. As an example, we have come to believe that aggressive transfusion and fluid resuscitation practices are associated with a complication known as acute lung injury. By attempting to modify provider's transfusion and fluid resuscitation practices, we can hope to mitigate the development of postoperative acute lung injury.'

Thus, Dr Kor's own clinical research is attempting to better understand the impact of transfusion practice on patient outcomes. One of his goals is to improve the understanding of the risks associated with blood product administration.



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MARCH 2012

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

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 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

space. 'They will benefit from the new subspecialty refresher courses entitled *How I report*, which focus on how 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 Trainees Forum and the ESR Session, and Invest in the Youth.

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, specialists from various disciplines will discuss their close cooperation at the hospitals where they work together as cancer teams.

Radiation protection

One Professional Challenges Session, being held jointly by the ESR and the International Commission on Radiological Protection (ICRP) is radiation protection, an extremely important area of focus for the whole discipline. The collaboration with the ICRP, the first of this kind at any ECR, will involve not only the organisation's own experts,

edge 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

One of the great attractions of the ECR is, of course, the enormous trade show that is showing the indispensable tools of the radiologist's trade. Some 300 international firms are here at ECR 2012, with innovations spread over 26,000m² of exhibition space.

Catch up with ECR online

For those unable to attend this



Lorenzo Bonomo

Meet our EH team at ECR 2012



Entrance Hall. Booth 701 (Entrance Level)

year's ECR, certain selected sessions – e.g. the opening ceremony, honorary lectures and the *ESR Meets* sessions – will be broadcast online 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 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.'



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 specialised physicians, and the importance of including ultrasound in diagnosis, along with other imaging techniques,' he emphasised.

Also enhancing education and training, the number of interactive sessions has been increased and one of last year's innovations, the extremely popular Categorical Course 'CLICK' (Clinical Lessons for Imaging Core Knowledge) is again being held.

'Interactivity enhances understanding and bridges the gap between theoretical lectures and practical application in daily routine,' the professor points out. 'Moreover, it allows attendees to make a direct contribution to the sessions and to communicate with the speakers.'

Young radiologists

As always, young radiologists will be paid particular attention and

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Many smokers continue to use tobacco despite high taxes and drastic health warnings.

Indeed, in industrialised countries, tobacco-related mortality rates or illnesses are increasing. These include chronic obstructive pulmonary disease (COPD), the fourth leading cause of death in adults – and rising. COPD has many faces, so treatment needs to be tailored to the patient's individual health status.

Today, multi-detector CT scanners that can acquire high-res 3-D data volumes offer new

in the upper lobes. Bronchitis is quite a different story – chronic inflammatory processes thicken the bronchial walls and consequently the lumen decreases. While damages caused by emphysema are mostly irreversible, the obstruction caused by chronic inflammation responds better to medication – that's at least what physicians hope. Phenotyping COPD describes the efforts of several research teams to differentiate and quantify the two components of COPD, as early as possible, where morphological-functional factors

bronchiolitis, the obstruction of small airways.'

This type of differential diagnosis requires special software programmes, some of which are commercially available, while others are prototypes still being developed. 'The problem is that these programmes, by either commercial providers or researchers, differ widely so that comparison is close to impossible', Schaefer-Prokop explains.

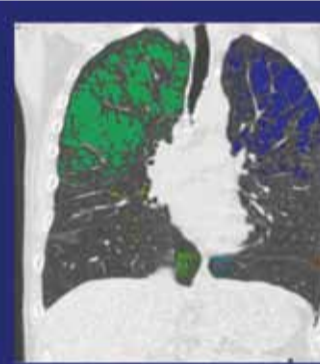
COPD phenotyping is still being evaluated and to some extent yields contradicting results.

CLASSIFYING COPD

Multi-detector CT scanners acquiring high-res 3-D data volumes offer new possibilities



a



b

a) Coronal MPR of a patient with advanced emphysema; b) voxel with density values below -950 HU are shown in colour

possibilities to differentiate, phenotype and quantify COPD.

Professor Cornelia Schaefer-Prokop, specialist physician at the Radiology Institute of Meander Medical Centre in Amersfoort, the Netherlands, is an expert on COPD classification. 'Typically it is a combination of emphysema and chronic bronchitis. The diagnostic workup includes clinical pulmonary function tests and the severity of airflow limitation is classified from one to four on the GOLD scale – the Global Initiative for Obstructive Lung Disease.

'However, spirometry assesses only the function of the overall respiratory system; it does not provide any information on either the severity or the dominance of the individual components of COPD, namely emphysema and bronchopathy. This is unfortunate, since recent research has shown that precisely this information is crucial for a more targeted therapy.'

Both pathologies have characteristic features: emphysema is the enlargement of certain air spaces that causes the destruction of the alveolar walls, particularly

as well as genetic factors are taken into account.

Computed tomography is excellently suited to differentiate emphysema and bronchopathy morphologically and, indirectly, also functionally, and to show the regional distribution of the pathologies. 'Efforts are under way to develop processes for the quantitative assessment of the pathophysiological components,' says Schaefer-Prokop, is in a research team of non-radiologists at the University of Nijmegen to draft quantification criteria.

Density, she explains, is a particularly important parameter. 'Where emphysema is concerned, the most frequently used threshold is -950 Hounsfield units. Everything below this value is emphysema. To gain more information on the bronchitis a CT scan is acquired of both inspiration and expiration and the density values are compared. Expiration imaging shows that oxygen reaches the lungs but is not exhaled properly. This phenomenon called air trapping can be correlated to bronchitis or

For this new approach to be introduced in clinical practice, uniform standards have to be developed and a number of basic issues need to be answered such as: *What exactly is being measured? How can the morphological values be correlated to the pulmonary function test results? Which factors can influence the measurements?* 'There are many patient and technology relevant details that must be taken into account', the professor points out. 'For example, the type of scanner, patient's age, the depth of inspiration, the threshold being applied to density measurement, or the way data are reconstructed.'

From a clinical aspect, further research is necessary. While it is very likely that COPD phenotyping will lead to more personalised, earlier and thus better therapies, clinical studies corroborating this assumption need to be conducted.



Cornelia Schaefer-Prokop

DRUG SMUGGLERS IN THE GANTRY

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 vessel to conceal and transport their goods. However, the police send suspected 'body packers' 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 for Clinical Radiology at Ludwig Maximilian University Munich. 'X-ray is a conventional projection procedure and often visualises the swallowed drugs only vaguely. Moreover, most radiologists are not experts in body pack detection. Therefore, we see quite a high rate of false findings. Drugs often have

a low density, very similar to soft tissue or stools. In addition, drug traffickers today know exactly 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 of 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 sphincter,'



Michael Scherr

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 doses 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, dose is not the only factor that influences body pack detection. Success strongly depends on the image settings used, the 'windowing'. 'The radiologist should use at least the same values as he would normally choose for a lung scan. This will detect packs much better. The so-called soft-tissue windowing used for abdominal scans makes detection much more difficult if not impossible,'

The end Anatomic and functional cardiac examination with CT scanning

diagnosed via CT, but the same modality also makes it possible to determine myocardial blood flow.

Dual energy CT is the preferred procedure in Prof. Schoepf's clinic, to assess coronary arteries or the patency of bypasses as well as of the heart muscle, particularly through the direct determination of the myocardial blood volume. The merely indirect determination of the myocardial perfusion via Nuclear Medicine (NUM), the resulting false positive findings and the insufficient categorisation may soon be outdated.

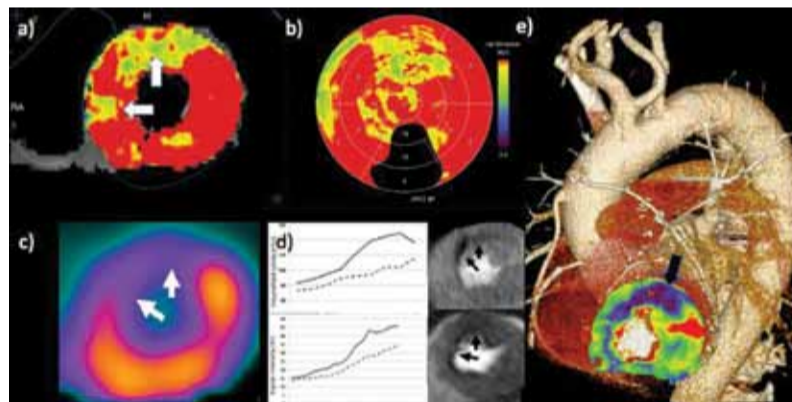
However, the necessity of two examinations to detect reversible ischemia – a stress-related lack of myocardial perfusion – remains, but these can be performed using only one modality! After the first rest CT, a second image is taken under pharmacologically induced hyperaemia. Although the associated higher cardiac frequency pushes the CT to its limits when examining

When, during the RSNA 2011, **Professor Uwe J Schoepf MD**, was asked what will be the chosen procedure of the future in cardiac imaging, he answered without hesitation: 'Definitely CT,' and, the Director of Cardiovascular Imaging at the Medical University Charleston, South Carolina added: 'We are trying to transfer as many examinations as possible that are currently carried out with MRI or NUM, to CT.'

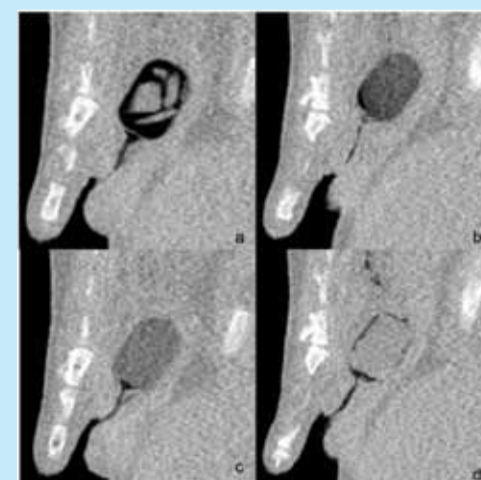
The professor is convinced that CT will soon meet all the requirements of a 'one stop shop' and it will be possible to answer structural, anatomic as well as functional questions with the help of just this one modality.

MRI diagnostics is considered the international gold standard for the functional imaging of cardiac perfusion – 'although,' he says, 'this procedure is not actually the most common examination used for this purpose in any particular country, worldwide.' In the US, nuclear-medical procedures such as SPECT are far more likely to be used for this purpose.

Beyond these procedures, Prof. Schoepf is convinced that it will be CT examination that will become established as the only non-invasive procedure for the examination of coronary arteries. The one stop shop CT modality will cover all aspects of coronary disease. Coronary narrowing or occlusion is already routinely



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 (arrows) in the anterior wall of the cardiac muscle in good correlation with the results of the nuclear-medical SPECT examination (c). The flow of blood in healthy and diseased tissue can be measured and compared with good precision (d). The examination also facilitates the assessment of the patency of the bypasses (e)



Low dose CT with 30 mA, sagittal, rectum of a 120 kg pig: a) solid heroin brick; b) loosely packed heroin; c) cocaine; d) hashish

Dr Scherr adds.

Despite the drug traffickers' cunning in packaging and sealing of their wares, bags do rupture from time to time inside the body and the substances cause

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

Uwe J Schoepf



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.

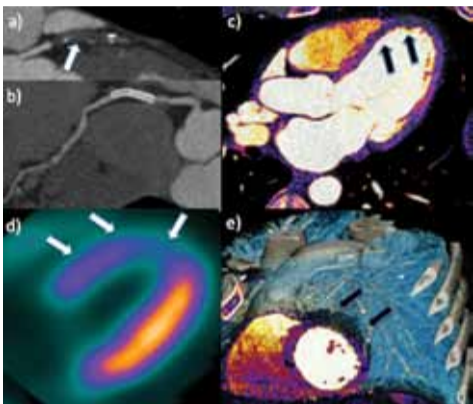
This, in turn, has great advantages, he emphasises, as for the detection of therapeutic effects. All doctors are permanently under pressure to prove the efficiency of their treatments. From this point of view CT is also

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. State 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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Inspire the Next

As 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 isocentre.'

Lower dose

'In Germany, the collective radiation dose across the population from medi-



Presently the prototypes are only used to scan mice. However, in only a few years the first Watch scanners may be available in hospitals and specialist radiological practices

Mathematical wizardry

A lot of maths and physics – and good ideas



As soon as the tube or detector move around an object, rotation stability also affects image quality, along with object movement

Parallel beams

Existing scanners – CTs up to and including the 3rd generation – use reconstruction algorithms that are optimised for fan beams and which also reconstruct data from tilted projection. For these geometries, the 'filtered back projection' as well as modern iterative procedures and the above-mentioned Oped procedure can be used. 'Watch' is a geometry that samples parallel beams rather than fan beams, which can then be reconstructed with Oped.

During the process, 'Watch' requires a lower number of projections that also can be reconstructed into images in a shorter period of time. 'The big advantage of the Watch geometry consists of the ability to generate parallel beam data sets that are optimally suited for reconstruction with Oped due to the distribution of the samples. With Watch geometry it's even possible to generate parallel beams with a conventional X-ray tube, and also to reconstruct faster,' explains engineer and medical physicist Thomas Förster.

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.

cal 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.



Prof. Hoeschen: 'CT scanners are responsible for a significant part of medical radiation exposure amongst the population. We are researching methods to lower the radiation exposure of CT'



Thomas Förster: 'A key question for the medical physicist is how to generate parallel beams and still be fast'



Watch is a symbiosis of tube, object and detector. The configuration has elements of the 1st and 4th generation of scanners, Thomas Förster explains

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Europe's 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 Müller introduced 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 conclude: '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 procedures 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 confirms with 90% probability whether 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 examinations.'

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 mammography 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 forefront of all things PET for more than a decade. The convenience of having to undergo just one examination to confirm the final diagnosis is complemented by the high level of comfort during the examination. 'The patient sits in front of the scanner, she doesn't need to be positioned in an examination tube, and the pressure on the breast during the examination 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.

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 confirms. The examination is particularly suitable for women with suspected 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 covered by all statutory medical insurers.



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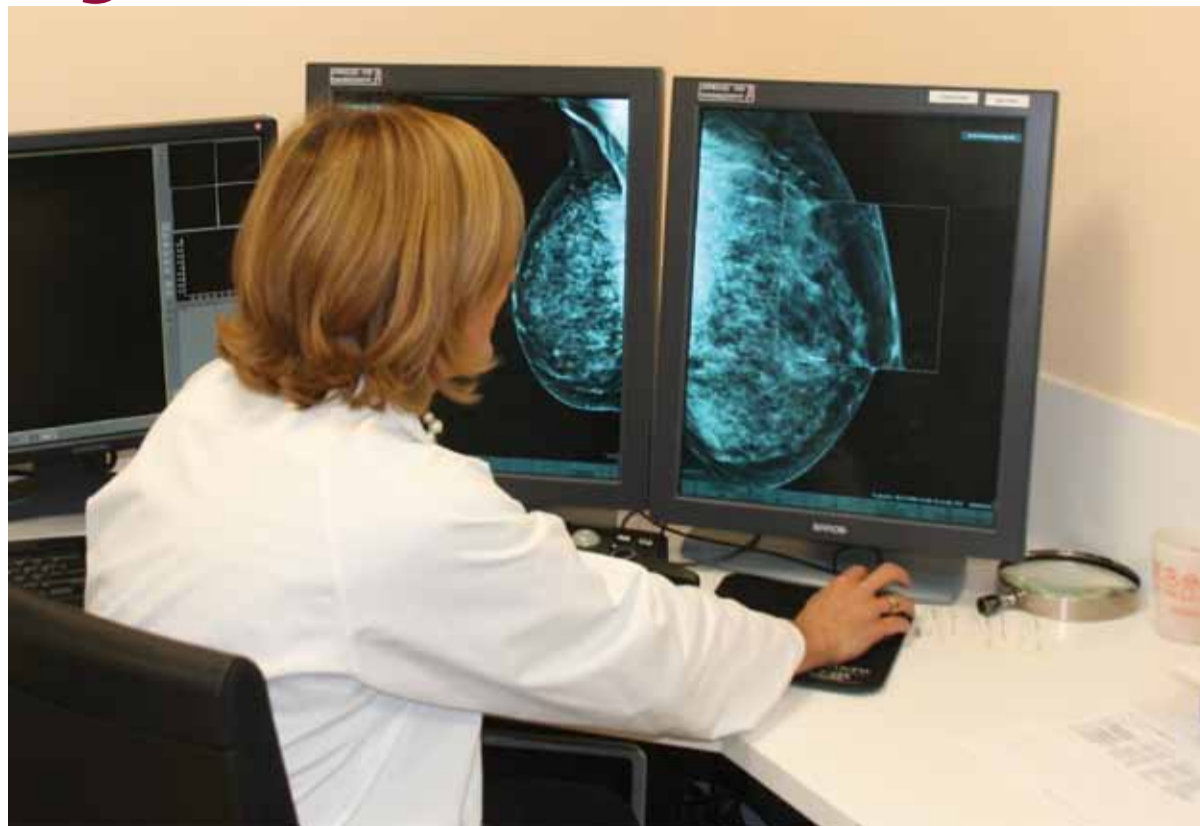
Breast tomosynthesis

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 been examined with a conventional digital mammogram and a tomosynthesis exam - all in one compression,

in just seconds. 'For a year and a half, we considered every over 45-year-old woman, and those at normal risk, for tomosynthesis diagnosis as well as individual screening. For younger women and patients with high-risk gene mutations, such as *BCRA1* or *BCRA2*, we don't use tomosynthesis because of radiation protection,' Dr Schillings explains.



Far better specificity and improved sensitivity

The most important advantage of tomosynthesis for Dr Schillings is the frequent reduction in false positive results. In a 2-D image, overlapping tissue can hide objects of interest, potentially resulting in missed cancers. Conversely, normal structures in the breast that overlap may give the appearance of lesions, leading to unnecessary recalls.

A breast tomosynthesis system produces three-dimensional images that are intended to reveal the inner architecture of the breast, free from the distortion typically caused by tissue shadowing or density. While keeping the breast stationary, the X-ray tube is moved in an arcuate motion and a series of

low-dose images, known as projections, are taken at different angular locations of the tube. Following the scan, the projections undergo a reconstruction process, which consists of computing high-resolution images with planes parallel to the breast support plate. The number of reconstructed slices will depend on the thickness of the compressed breast and the desired separation between slices - typically around 1 mm. 'With tomosynthesis it's quite easy to show if there is a problem in an image or not. New studies prove that the recall rate can be reduced up to 70%', Dr Schillings confirms.

The second advantage of tomosynthesis is to find more cancers. In the last year and a half Dr Schillings found 10-12 more small

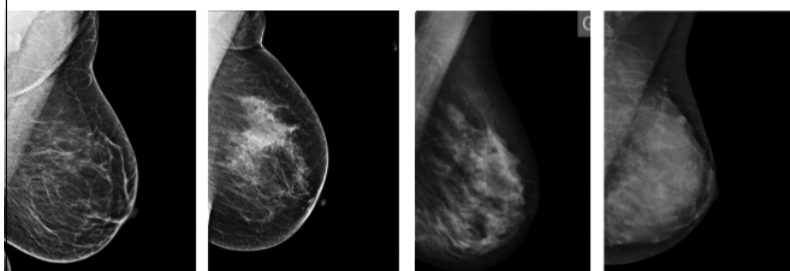
Working with tomosynthesis Belgian breast radiologist Anne Pascale Schillings reports an increase in the early detection of small tumours

tumours thanks to tomosynthesis. 'We found very small cancers at 3-4 mm that we wouldn't have found with common 2-D mammography. However, to detect cancers needs some experience, a little learning curve in reading the mammograms,' she says.

The only problem for the radiologists is the radiation dose. Even if it remains under dangerous limits the radiation dose from tomosynthesis is 20% higher than from normal mammography. Up to now, 2-D and tomosynthesis images were always made in combination, so tomosynthesis meant a higher radiation dose for patients. Hologic has developed an algorithm to make a synthesized 2-D image from the breast tomosynthesis slices. Hologic says the new algorithm will save on patient time under compression and give the patient lower dose by eliminating the need for a conventional 2-D image.

Limitation of screening mammography

Overall sensitivity 75% varies depending on the density of the breast



Specificity >90%: recall rate 5 to 10%

Benign Breast Lesion

Malignant Breast Lesion

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1 ShearWave Elastography Improves the Specificity of Breast Ultrasound: The BE1 Multicenter Study of 159 Women. Song WK et al. Radiology 2012, in press.
2 ShearWave Elastography for Breast Lesions in Righty-Semibipolar. Coppone DD et al. Eur Radiol. 2011 Dec 31; DOI: 10.1007/s11604-011-2040-7

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Less patient fears and higher screening rates

For patients there is another important achievement. In normal mammography the breast is compressed very hard to avoid superimposition. During tomosynthesis the breast is about 50% less compressed. 'Hard compression is one major reason not to come to mammography sessions because women fear the pain,' she points out. 'With tomosynthesis the breast is compressed only a little. So they are happy, they don't feel pain and they will come back for the next screening.'

Are tomosynthesis mammograms complex to read?

Whereas initially Dr Schillings perceived tomosynthesis as a 'gadget', she is now very satisfied with results. Although her experience with it has been brief, she feels very secure in reading the images. It takes her only 20-30 seconds if there are no abnormalities. In fact, she is gaining time: If she finds no lesion she doesn't have to ask for other views.

Dr Schillings is now convinced that tomosynthesis really means a revolution for breast imaging and that it will change mammographic screening with better sensitivity and specificity and more comfort for patients.

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 possibilities of this procedure have not yet been exhausted.

What then is the current state of play in iterative reconstruction, and where are developments in this field heading? Seeking and update, *Karoline Laarmann* spoke with *Dr Stefan Wirth*, computer scientist and radiologist at the Institute for Clinical Radiology at Munich University Hospital

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 reconstruction (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-

ative reconstruction (MBIR) will shape the future of CT to such an extent that it is likely, at one stage, to be perceived as such a great advance in technology as 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/detec-



Stefan Wirth

tor 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.

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To upgrade hospital communications in line with building upgrades and new operating theatres, the diako hospital in Augsburg needed special software solutions because, as the hospital's quality assurance manager Rainer Lederhofer pointed out, nowadays operating theatre videos and still images are not only relevant for research, teaching and training, but also important in

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-

users as well as the IT staff could work with just the one system. 'The medical product synedra AIM was best able to pick up on our concept of a universal medical archive,' Peter Lederhofer said. 'We also felt that synedra conveyed competence and came up with innovative solutions, based both on recommendations and our own personal contact with the company.'

to the hospital, etc.) the focus of the project team was clear: 'We are convinced that the objective of optimised patient care goes hand in hand with optimised work flows for our users,' Bianca Brinkmann said.

Therefore, from the technical aspect, synedra's universal archive had to be closely networked with the Orbis HIS from Agfa – something that Peter Lederhofer believes has been achieved very well by all.

From a user's point of view the HIS is the central point of entry into the data available in the universal archive. From the HIS, data can be easily accessed and then displayed in the synedra DICOM multimedia viewer.' The HIS and the uni-



Rainer Lederhofer and Bianca Brinkmann: 'With the introduction of a universal medical archive we are achieving significant added value. Even multimedia documents are now accessible across the hospital at all times.'

The diako's universal medical archive

Embarking 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

documentation, treatments, communication between doctors and patients, and finance.

The diako's IT team needed to link the operating theatre, archiving and HIS and safely store all documentation with legal compliance in an innovative, medical universal archive. The IT team decided to implement its ideas with the help of special HD cameras supplied by Storz.

Picking up the tale, Bianca Brinkmann, head of IT at the hospital, added: 'We didn't have the

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 context of this project, 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



Multimedia recording is no longer only relevant in research, teaching and training; it is important in communication between doctors and patients



HIS integration

In summer last year, the team and synedra began to implement the IT project. Next to the installation of the backend infrastructure based on VMware ESX and of the connection of the existing image, video and multimedia sources (Storz HD cameras, various C-arms, ultrasound scanners, patients' CDs brought

versal archive also work together closely with the data acquisition. Interfaces were designed ranging from the simple handover of patient data right down to the creation and transfer of work lists.

Objective achieved

Even the first experience with operating the universal archive proved

that considering users' needs during each phase of the project has paid off, is confirmed by internist Dr Nagel: 'The promise to optimise workflows was kept to our full satisfaction during the implementation of the project. We now have immediate access to the entire multimedia patient file everywhere in the hospital, and with synedra View, the viewer accessible via the HIS, we have the necessary tools to display and process all kinds of data. This ranges from standard image processing functions via MPR functionality and the display of PDF files right down to video streaming from the archive and playing videos in HD quality.'

Expansion plans

'With synedra AIM we now have many opportunities that we will want to utilise in the future,' Rainer Lederhofer said.

One of these expansion plans is the ability to send the hospital's partners relevant examination results via DICOM e-mail, or also the introduction of a basic diagnostic procedure for ultrasound scan examinations, where relevant image data and indexing information are integrated into a PDF document and then stored.

'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 AIM system with the resident management system so that the files of all residents can then be stored in the universal archive with legal compliance.'

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 their patients within its walls. Thus around 7,500 in-patients and 2,500 out-patients annually see their own 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



Miodrag Todorovic

of the early development of the hospital. Among those decisions was selecting the best PACS (picture archiving and communication system). When 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

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

and is an emerging company offering technological breakthroughs. 'So far,' he said, 'over the two years, we've had only good experiences with Visus products.'

ABH is a 200-bed special care institution offering top-level diagnostic and treatment procedures providing care in cardiothoracic, orthopaedic, neurosurgery, nephrology and transplant surgery along with paediatrics, maternity, and therapies including stem cells and in-vitro-fertilisation. 'Mauritius also has an orientation to develop the highest standard of medical services, and become a hub for medical excellence,' Dr Todorovic pointed out, adding that the country is attracting professionals, investors and international clients.

The Diagnostics Department offers computerised tomography (CT), magnetic resonance imaging (MRI) including whole body MRI, angiography, ultrasound investiga-



tions, X-ray and fluoroscopy, OPG dental X-ray, 64-slice dual head CT scan, 1.5 Tesla MRI, and mammography. Additionally, the hospital has an advanced EMR (Electronic Medical Records) system.

ABH conducts 17,000 digital X-rays annually, including 2,800 CT scans, 1,700 MRIs, and 7,000 ultrasound scans, all handled through PACS, which covers the whole hospital.

In particular, the PACS system offers the radiology department a number of high definition diagnostic screens, along with separate

diagnostic centres for the cardiovascular department and catheterisation lab, with each consultation room connected to the system and clinicians able to access the PACS via the internet.

Linked into the Hospital Information System (HIS) and the telemedicine system (both from other providers) the PACS enables doctors to access images within the patient, consultation and diagnostic areas as well as from their homes. The physicians can also seek second opinions or specific advice through teleconferencing, trans-

ferring images to colleagues in places such as America, Europe or India.

Visiting consultants from other hospitals can also be accredited to access the PACS.

Clinicians at ABH are reported to be pleased with the PACS integration across the entire hospital. As Dr Todorovic said, 'It is fast, reliable and easily connectable with other systems. We have good pictures, good storage recall from the system, and fast availability on the diagnostic screens. We're very, very satisfied.'



Dr Todorovic (right) in the operating theatre when the PACS was integrated with the telemedicine system

The CT workstation with onscreen PACS image

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.’

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 con-

ventional 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.



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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, intra-operative 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 intra-hepatic 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 pre-operative 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



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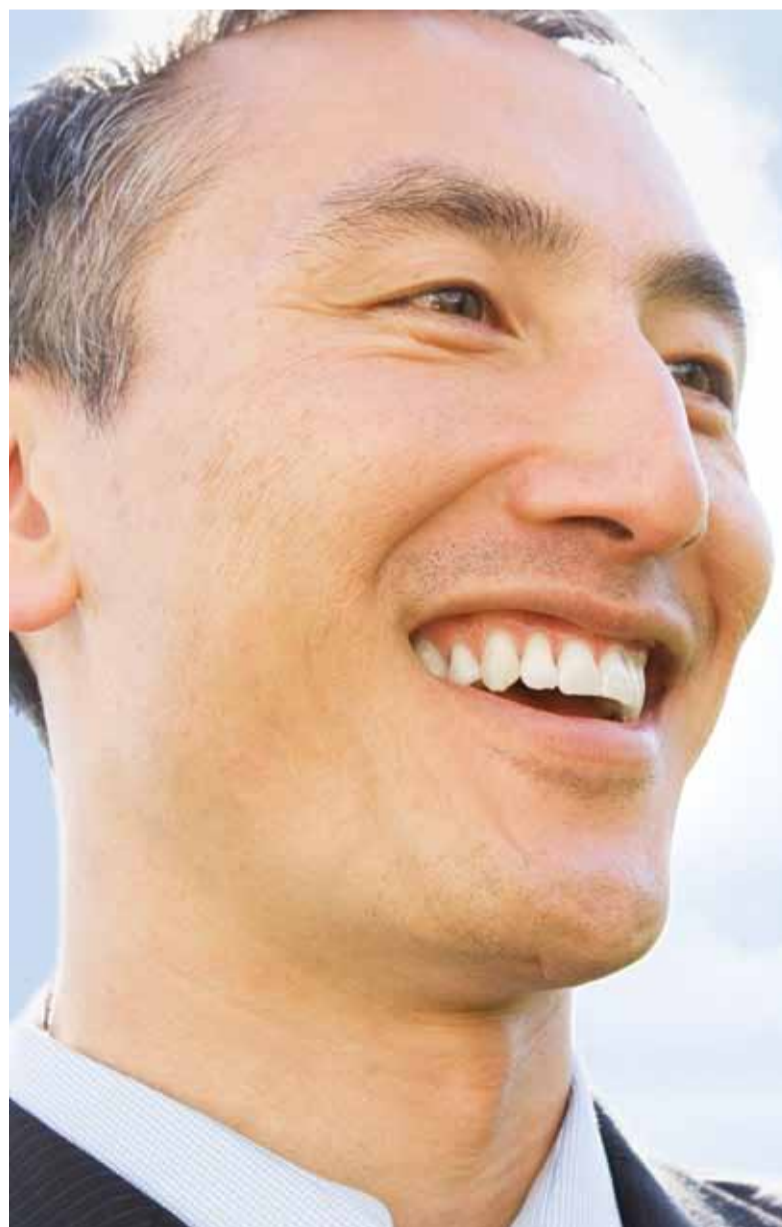
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Helping to create the 'medical home' EPR

Siemens' acquisition of MobileMD relates to a "medical home" concept. Currently most people begin their treatment journey with a primary care doctor, Dr Gregory Sorensen explained. 'That physician is expected to be a medical diseases specialist as well as coordinating specialist. So, say the patient sees a cardiologist and is prescribed blood thinners, and next sees an orthopaedic surgeon, the primary care physician has to warn the surgeon about the blood thinner. Then the orthopaedic surgeon puts the patient on an anabolism – the primary care physician should pick up on a conflict between that prescription and the blood thinner, and change to a different anabolic.'

Just one person is coordinating the patient's care but... 'It's too much for a care physician to monitor everything – so instead you have an organisation with many sections to take responsibility and be accountable for all the care a patient might need.' For this fully accountable organisation (the medical home) to succeed a dependable EPR is thus 'critical'.

Thus, in 2011, the US Government's new healthcare legislation began to provide large financial incentives for its development. To this end, government auditors check whether firms are producing meaningful software, and if so, 'they write a big cheque', said Dr Sorensen, adding: 'Some of our customers [hospitals] have received \$2-6 million cheques for implementing EPRs and demonstrating their medical use. Therefore, we're building some

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 Sorensen in a talk with **Daniela Zimmermann**

software to facilitate this, and sometimes it's less expensive for us to buy an existing software company than spend years and money to build it. So, we bought MobileMD.'

Does medical home refer to a physical or virtual place? 'The accountable organisation could be a single hospital that has clinics in it, or is a distributed network, where there are small community clinics, big community hospitals, independent physicians buildings, imaging centres, blood test centres, all woven together and this organisation is the patient's "medical home". So, when she needs an imaging test she goes to one part but, for a flu shot, she goes someplace else, but it is still the medical home – the organisation that provides the care, and is accountable for all of a patient's care. It might be paid for by an insurer, or an insurance company might be owned by the accountable care organisation. That's not relevant. The relevant question is: Who is

the accountable care organisation. Some we already see are hybrids between providers and insurance companies, as is already happening with Kaiser Permanente, a healthcare system in California that is both an insurance company and a provider for millions of citizens in that state. You pay Kaiser your insurance premium, and then they also take care of you. They don't send you somewhere else.'

Such a dual provider is regulated, not controlled, he pointed out. 'They've got rules, they must follow and the insurance companies have rules they must follow and Kaiser must follow both sides of the rules, acting like a good hospital and like a good insurance company. Both aspects are regulated, but they happen to be combined. They see more efficiency in this, and many people think it is the future to combine them. Maybe that will be safe, maybe not.'

Inevitably, for all this to work so must the EPR.

The concept of cloud computing is becoming attractive to hospitals – effectively letting an external organisation take care of the storage of images and ensuring they are available to whoever requires them, whenever needed. Carestream, for example, is now a recognised provider of cloud computing services with a number of hospitals already making the switch to off-site, third party storage.

issue when data is stored in this way, Saskia Groeneveld points out that Carestream has secure access controls, robust audit tracking and security teams that 'ensure the integral 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,

Cloud computing



The storage and retrieval of an ever increasing volume of imaging data is raising hospital IT managers' interest in sharing computing resources via the Internet, thus saving on storage space, hardware and software costs and

concerns over data security. **Mark Nicholls** spoke with **Saskia Groeneveld**, Carestream's Regional Marketing Manager (Healthcare Information Solutions), about the company's expanding service in this area

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 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 systems go down, imaging data will still be available to clinicians via a 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

or non-DICOM, images to the service access point, which then transfers them to the data centre for storage.'

An early adopter of Carestream Vue is the National Health Service (NHS) in Scotland. Carestream provides the national archive with all images stored in a data centre. Hospitals in The Netherlands, France and Germany are also using the system.

'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 in up or down staging volumes and cloud offers strong collaboration possibilities, more so than when data is kept within the hospital, facilitating image sharing with referring physicians who have the authorisation to access data.'

A new aspect of Carestream Vue Cloud Services, to be showcased at ECR (Work in Progress), will empower patients to view and share their own medical data with referring physicians through the My Vue patient portal - thus eliminating the need for patients to carry medical imaging exams to physicians on CDs, DVDs or X-ray film. 'The patient can only give access to one person at a time and determine how long they are going to give access to data for in the cloud, and be selective about what they want to share,' Saskia Groeneveld points out.

Carestream Vue is patient centric and agile in the way it can deal with data coming from different software by different manufacturers and eliminates 'silos' in hospitals. They can have different storage platforms for different modalities, but she adds, 'we can centralise that in one clinical data archive'.

Data protection

Carestream has addressed the varying legal issues and protocols that exist in different countries for data storage, patient ID and consent regarding cloud computing. 'Some countries require data residing in their own country but in other countries there is no problem storing data across borders. We have 10 data centres around the world and now manage over 40 million studies – and that's one petabyte.'

Early indications from Carestream's internal data and informal responses from early adopters suggest the cloud option is 30% cheaper than traditional on-site storage.

Feedback from users shows satisfaction with predictable costs and security arrangements, she points out. 'With cloud computing they can now focus on their core business, which is healthcare, rather than on managing large IT systems.'

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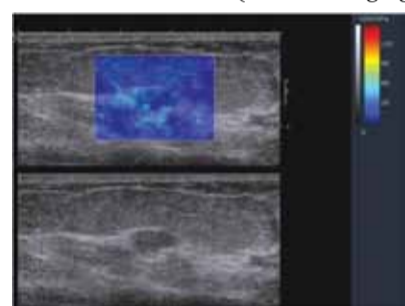
Improved specificity in breast ultrasound

Sonography is the most important non-invasive supplementary procedure to mammography, the current gold standard in breast cancer diagnostics. High-resolution ultrasound 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 malignancy or non-malignancy of masses.

The BE1 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



Top: ShearWave Elastography: E max 180 kPa. Colour scale from blue to red shows increasing kPa (Kilo Pascal), i.e. very soft tissue is blue. The lesion shows an E Max reading of 30 kPa and is very homogenous (E Homogenous). ShearWave Elastography features indicate a non-malignancy, which allows downgrading of the mass to BI-RADS 3 and follow-up after six months.

Bottom: B-mode sonography, hypoechoic, oval, smoothly delineated mass, BI-RADS 4a, fibroadenoma was histologically confirmed.

Reporting and Data System) 4a masses and allows certain masses to be downgraded to BI-RADS 3, a category in which the malignancy rate is below 2%. Under certain circumstances ShearWave Elastography may also corroborate tumour suspicion in BI-RADS 3 masses (and involve a reclassification of the lesion to BI-RADS 4a to catch a cancer that would otherwise have been missed.)

- Certain BI-RADS 3 masses that require follow-up can, in combination with shear wave elastography be downgraded to BI-RADS 2 and can thus be followed up in the usual intervals.

- ShearWave Elastography is a valuable supplementary procedure to conventional ultrasound in breast cancer diagnostics.

During this international study at 17 renowned US and European breast cancer centres, more than 1,800 tumours with histopathological findings were examined with ShearWave Elastography. While elastography is a very exciting development in ultrasound, ShearWave Elastography, which measures tissue elasticity with the help of shear waves, is the most recent innovation in this area.

The technology, which is based on ultra-fast imaging, is user-independent since it does not require manual pressure. In ShearWave Elastography, shear waves are generated in the tissue and their speed of wave propagation is measured. Thus the radiologist can assess tissue elasticity and stiffness. In 2009, University Hospital Schleswig-Holstein (UKSH) Campus Kiel was the first hospital in Germany to introduce ShearWave Elastography. Out of the approx. 5,000 patients examined with ShearWave Elastography so far in Kiel, 250 underwent the procedure for this study.

Associate Professor Fritz Schäfer, Head of Mamma Diagnostics and Interventions at UKSH Campus Kiel,



Fritz Schäfer

tor for a reliable diagnosis. The study indicated that particularly masses of BI-RADS categories 3 and 4a could be better assessed with ShearWave Elastography.

Masses in BI-RADS category 3 have a 98% probability of non-malignancy. Further follow-up at six months is recommended in this category. 'An important result of the study says that with maximum elasticity (E_{max}) of 160 kPa and higher, or non-homogenous findings (E_{homo}) in ShearWave Elastography, the lesion should be upgraded from BI-RADS category 3 to 4 since these

parameters indicate a high probability of malignancy,' radiologist Dr Schäfer explains.

Masses in BI-RADS category 4 have a probability of malignancy between 3 and 94%. In this category the pertinent question is which lesions might be malignant and how these lesions could be described more precisely. Researchers looked at ShearWave Elastography for reliable indicators to downgrade masses from category 4a into category 3. 'If E_{max} is 80 kPa, or less, and if the findings are rather homogenous 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 E_{max} and E_{homo} increase specificity by 29-34% com-

ECR Satellite Symposium
ShearWave Elastography
Classifying lesions –
avoiding breast biopsies
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pared 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 tissues stiffness is 20 kPa or less, the mass might even be downgraded from BI-RADS category 3 to 2.

Source: *Radiology: Volume 262: Number 2 – February 2012 pp.435-449, www.radiology.rsna.org*

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

The Breast Pathology Center at Tejerina Foundation, Madrid, Spain

"We have identified cancers using the Dimensions 3D that we wouldn't have found using 2D mammography."

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, becoming the pioneer among several others in Spain to use the innovative technology to improve the early detection of breast cancer. "We added tomosynthesis because we always want to be at the leading edge of technology," declares Alejandro Tejerina, M.D., breast radiology coordinator.

"Tomosynthesis is very useful in characterizing nodules and mammographic distortions. It is also useful in patients with suspicious lesions, symptomatic patients, patients with family history, and high risk patients."

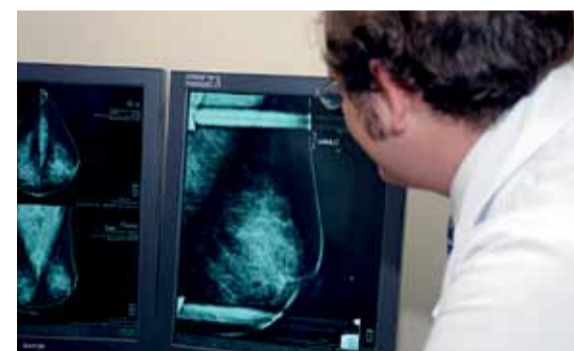
The Center's multidisciplinary staff includes radiologists, surgeons, oncologists, gynecologists, and psycho-oncologists. A team of eleven radiologists and fourteen radiology technicians performs approximately 50,000 breast mammograms annually. In a little over a year, the center has performed approximately 3,000 mammograms using tomosynthesis.

A New Tool for the Early Detection of Cancer

"Each imaging test has its own indication, and, when used properly and in concert with other modalities, the multiple systems considerably improve the accuracy of diagnoses," explains Dr. Tejerina. "When we decided to add tomosynthesis, we chose Hologic's Dimensions system because of our previous positive experience with Hologic. We studied different options and decided Hologic was the best."

"Tomosynthesis provides very important diagnostic information as well as different information from that acquired with 2D mammography," explains Dr. Tejerina.

"We have been able to diagnose cancers with this new technique, and it has provided us much more confidence when confirming or ruling out malignant processes. Using tomosynthesis, we have also been



Dr. Tejerina says that with tomosynthesis they have been able to confirm that suspicious lesions have benign features and avoid unnecessary biopsies.

able to confirm that suspicious lesions have benign features, avoiding unnecessary biopsies."

Radiologists at the Breast Pathology Center always perform both a 2D and 3D exam with the Dimensions system. "We either perform 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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3-in-1 and multi-functional

The Flexavision F3 is a fully digital R/F system with portable FPD

Shimadzu has launched a new fully digital R/F system, the *Flexavision F3*, which has a portable dynamic flat panel detector (FPD) – making this a system suitable for fluoroscopic as well as radiographic applications.

The FPD has a large field of view – 35 x 43 cm – and offers a multitude of examinations, from barium enema to gastrointestinal, non-vascular radiological interventions, urograms and other urinary tract contrast media acquisitions. General radiographic examinations of the thorax, pelvic region, extremities as well as for orthopaedic surgery purposes also can be performed easily, the manufacturer Shimadzu confirms.

The FPD is removable

The portable dynamic flat panel detector allows a wide range of R/F table examination, the

manufacturer reports. 'Depending on the examination, it can be rotated from portrait to landscape format. Due to a built-in hand-grip and detachable cable, the FPD can be removed easily from the bucky tray to perform direct projections on and beside the table and at the bucky wall stand.' Wheelchair or bed-bound patients can also be examined safely and comfortably, the firm adds.

Versatility due to high flexibility

The device is compact, suits a multitude of R/F applications, and is reported to be patient and user-friendly. For example, Shimadzu says that angles required for cranial and caudal projections can easily be achieved using the oblique projection feature. 'To support thorax radiography, the X-ray tube can be extended up to 150 cm for video fluoroscopy

(VF) and other R/F studies. Alternatively, it can be rotated by 180° for a projection onto a bucky wall stand. The high-quality table allows jerk-free 1°-positioning and helps to perform acquisitions even under difficult patient conditions.'

Due to flexible configuration options, the system also meets various clinical needs, for example by being converted from a basic R/F table to a multi-functional R/F examination room, Shimadzu explains. 'Valuable options of configurations are an elevating table function, oblique projection unit, X-ray tube swing-out unit or X-ray tube rotation unit combined with bucky wall stand and a ceiling mounted 2nd tube arm.

Patient care

An additional table elevation function and other features can

also ensure the ease, comfort and safety of patients and operators.

High-res/low dose

'Digital imaging improves the representation of small, low-contrast structures and thus delivers brilliant X-ray images to the monitor, virtually in real-time. Shimadzu's high-speed digital



Flexavision F3



In use for a paediatric examination

image processing technology effectively controls halation and the loss of shadow details, thereby instantly providing easy-to-view high-quality images on the monitor display,' the firm explains. 'These images contribute to keeping exposure low for patients – due to a removable grid, selectable filters for X-ray hardening and various modes for pulsed fluoroscopy, e.g. in paediatric and gynaecological examinations.'

Details: www.shimadzu.eu/medical
medical@shimadzu.eu

Meet Shimadzu at ECR 2012
Booth: 323. Expo C.

NEW

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

Education and science are not the only exciting aspects of the European Congress of Radiology; the Vienna venue is also a stage on which companies can introduce novel concepts in medical imaging. Following one product's world premiere during the RSNA 2011 in Chicago, the Echelon Oval 1.5-T MR system is now debuting before a European audience at the ECR 2012. Along with this new product, Hitachi Medical Systems, a full-line supplier of diagnostic imaging equipment, has more than one ace up its sleeve this year to convince the expert ECR audience of its continuing innovative drive.

At ECR 2012 Hitachi is showing The Echelon Oval 1.5T MR system, an MR 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 ranging 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, MR imaging is taking a new form. 'The Echelon 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 vertically 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 manufac-

urer's innovative product line on show at the ECR is the Hitachi Real-time Virtual Sonography (HI-RVS), a feature installed on Hitachi's premium ultrasound platforms, Hi Vision Preirus and Hi Vision Ascendus. This navigation tool enables image fusion of a real-time ultrasound examination with CT or MR images or contrast enhanced ultrasound volume data. Thus the maximum amount of information from all image modalities comes together on one single ultrasound platform and facilitates reliable diagnosis as well as accurate image guided interventions, Hitachi points out. 'To perform the image fusion, HI-RVS holds some technical refinements, such as flexible target and navigation markers, loading of multiple sequences, or 3-D navigation of the imaging scan plane. A versatile range of transducers means that the modality can be used to guide a wide range of clinical procedures, e.g. tumour ablation, 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.

Scenaria also includes other dose reduction features such as the combination of a lateral-shifting table-top with a smaller X-ray bow-tie filter, Intelli EC-Exposure Control and Intelli IP-Iterative Processing. 'Scenaria also excels in 3-D visualisation and analysis capabilities critical to physicians, by offering an integrated TeraRecon iNtuition server with a full range of advanced clinical applications that are simultaneously available to multiple users,' Hitachi adds.

Further details:

www.hitachi-medical-systems.eu

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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 on-going 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.



Orthopaedic surgeon Angus MacLean



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SAMSUNG MEDISON

Korea's advanced ultrasound and digital X-ray equipment

Samsung Medison and Samsung Electronics are in the Austria Centre introducing visitors to new products, including an advanced ultrasound system and a digital X-ray series

Samsung Medison reports that its latest ultrasound system, the Accuvix A30 is 'leading the new standard' in supporting more accurate, easier and effortless diagnosis. 'It has a world-first 21.5-inch full HD LED monitor with touch controls, perfectly offering state of the art imaging. Additionally, the powerful hybrid beamforming engine helps to enhance 2-D ultrasound imaging while greater power further improves colour performance. Uncompromising image quality supports clinical decision-making and helps users to save time and effort,' the company adds.

The system also provides a new function to 'dramatically' improve operational consistency and convenience for users. 'EZ Exam stores the workflow protocol, which can be operated by single touch of a button. ADVR makes real-time DVD and USB recording, creating an environment that allows users to choose desired recording areas,' and the company adds, 'its ergonomic design empowers users to provide higher-level care.'

The company first launched the Accuvix A30 last February at the Korea International Medical and Hospital Equipment Show (KIMES).

The XGEO CG80

Samsung Electronics reports a high-quality digital radiography performance, simplified workflow, increased throughput and workplace efficiency for those using the XGEO GC80.

'With Samsung's advanced technology and expertise in TFT (thin film transistor) design, Samsung is committed to developing TFT-

based flat panel detectors with built-in ALDAS (Advanced Low Dose Amorphous Silicon Sensor), delivering maximised image quality, immediate results and diverse applications,' the company reports. 'Even with dose reduction, the XGEO GC80 still guarantees accurate images and provides diagnostic confidence. Users can easily operate the THU (Tube Head Unit) with its soft handling technology, even without a side-handle. Low-level noise and easy handling technology enable users to operate the THU with low physical pressure. The THU integrates a 12-inch wide touch screen to optimise user convenience and check-up procedures.'

The firm is also showing the XGEO GU60 (U-Arm type) and XGEO GR40 (Retrofit type) aimed at meeting specific needs of customers.



The Accuvix A30

The XGEO series was launched in Korea in February, and the firm plans to expand its sales reach to countries in Europe and the Middle East from the second quarter of 2012.

Details: www.samsungmedison.com

XGEO CG80 – a new era for digital X-ray



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

exist although we are not quite sure yet what – from a biomedical point of view – creates the soft tissues 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



Franz Pfeiffer

Phase-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.

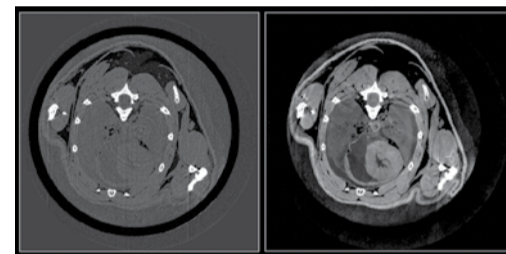
Named phase-contrast imaging, the method is an invention of Professor Franz Pfeiffer, Chair of Biomedical Physics at Munich Technical University, Germany. We asked him to explain the implications this development has for radiology

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 grate-like structures 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



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 the 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!



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RESEARCH

Protecting the future of incidental discoveries in imaging

Radiologists in the United Kingdom have taken steps to help ensure unexpected findings discovered during the course of imaging research are being recorded and effectively disseminated, **Mark Nicholls reports**

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 understand-

ing 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 ground-work, 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.

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One of the most controversial discussions, during the IROS 2012 meeting in Salzburg this year, developed around chronic cerebrospinal venous insufficiency (CCSVI).

The Italian vascular surgeon Professor Paolo Zamboni believes that multiple sclerosis (MS) is the result of a problem with blood flow from the brain, which could therefore be treated by opening up the affected blood vessels. The professor has developed a dilation procedure that he believes improves the symptoms in MS patients.

To this controversial hypothesis, Professor Thomas J Vogl, Director of the Institute for Diagnostic and Interventional Radiology at the Johann Wolfgang Goethe University Hospital in Frankfurt, offered a 'cautious yes' although he also characterised the procedure as 'experimental'. However, Dr Jim Reekers, Professor of Interventional Radiology, at the Department of Radiology Academic Medical Centre, University of Amsterdam, dismissed the alleged connection between MS and CCSVI: Prof. Zamboni's hypothesis has already been scientifically disproved; it is merely the patient forums on the internet that keep this 'message of hope' alive.

Professor Dierk Vorwerk, Consultant at the Institute for Diagnostic and Interventional Radiology at Ingolstadt Hospital and German Congress President of IROS 2012, also doubts Prof. Zamboni's studies: 'The data all come from non-independent sources, i.e. mostly from Zamboni himself, or from his followers. All others who have tried to get to the bottom of this syndrome have not been able to find any proof.' It could therefore be the case of a chimera being chased, he suggested. 'The problem is that the procedure is already being offered as treatment – for payment. It is therefore, in the first instance, a business model that plays on the desperation and hope of patients,' he added.

Definite answers will probably only result from a large study, which was initiated by the Canadian Ministry of Health.

'Hot topics can be found wherever there are turf battles, i.e. where several different medical disciplines fight over who treats the patients, explained the Austrian Congress President Professor Siegfried Thurnher, Head of the Department of Radiology and

IROS 2012

Controversies were certainly aired when 800 radiologists gathered in Salzburg for The Interventional Radiological Olbert 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*



Siegfried Thurnher

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.'

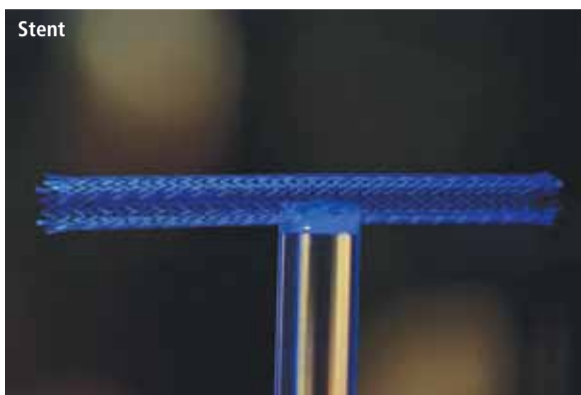
From other disciplines come grumblings that interventional radiologists have developed new, gentler therapy concepts that lead to the same results as those achieved with previously established treatments – typically, the uterine artery embolisation for fibroids. Whilst gynaecologists often tend to remove 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 procedure is also 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



Fine instruments for interventional radiology



Stent

IROS 2012 (supported by CIRSE – the Cardiovascular and Interventional Radiological Society of Europe), did justice to its image as a showcase for interventional radiology.

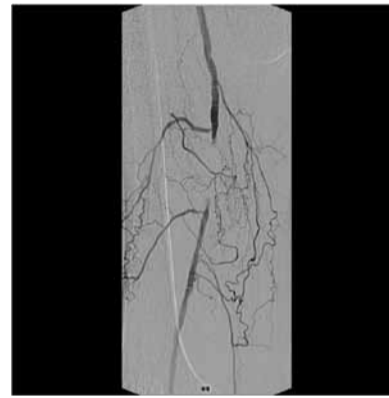
Renal denervation

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.

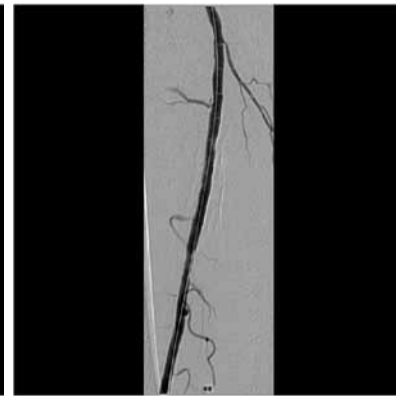
Interventional oncology

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; nanopores develop in the cell walls, the integrity of the cells is destroyed and they subsequently die.

Dr Ortrud Kosiek, senior house officer at the Clinic for Radiology and Nuclear Medicine at Otto-von-Guericke University Magdeburg, described the special characteristic of this procedure: 'Collagen and elastic fibres do not respond to this procedure. Key structures and vessels therefore remain, tumour cells are destroyed.' His regret is that there is not much data available on this procedure, as yet.



Recanalisation before stent implantation



Recanalisation after stent implantation

As in many other medical fields, surgical and radiological interventions are in competition here: The dangerous occlusion of the leg arteries can either be treated via bypass or through dilation of the occluded vessel. 'With the treatment of critical ischemia in the lower thigh, dilation with a large balloon has developed into the gold standard,' Professor Plank reported during the Interventional Radiological Olbert Symposium (IROS 2012) held in January in Salzburg, Austria. Compared to surgery, percutaneous transluminal angioplasty fares equally well, although the general state of health of many patients means that surgery cannot be carried out with a general anaesthetic. Moreover, fitting a bypass is expensive and also has more risks for the patients, she added. 'When it comes to PAOD, it's a case of giving priority to any treatment that can be carried out endovascularly.'

PAOD develops through a constriction or occlusion of the arteries that supply the extremities. Diabetes, generalised arteriosclerosis, high blood pressure, high cholesterol levels and obesity are the triggers of the disease, which is commonly divided into four stages: In the first stage the affected patient does not notice any symptoms resulting from the constriction or occlusion; during the second stage the person will have increasing difficulties walking; in the third stage critical ischemia develops and the lower thigh turns white and

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 Radiagnostics, Medical University of Vienna, points out: 'This is a very bad prognosis. Therefore, preserving the extremities is the primary objective in the treatment of peripheral arterial occlusive disease'

immobile, and during the fourth stage chronic wounds develop on the feet. In the pelvic area and in the upper thighs peripheral arterial occlusive disease is treated in stages 2 and 3; the lower thighs are only treated once the chronic lesions develop.

To heal these ulcers, which often necessitate amputation, the occluded blood vessels in the lower thigh are opened from the inside. Up to 22cm long, very thin, balloon catheters, which are inserted into the occluded area through the groin under local anaesthetic and then inflated with pressure, have proved

very effective. 'The occlusions in the lower thigh are mostly of long length and multi-segmental and can be dilated with long balloons in one go. This saves a lot of time,' Prof. Plank explained, referring to the advantage of long balloons compared to conventional ones.

It takes two to five minutes to dilate a blood vessel. Any possible remaining short-length stenoses can be dilated straight afterwards with short, high-pressure balloons. Although this does not guarantee permanent revascularisation, the partial restoration of blood flow suffices to heal the chronic

wounds. 'Healing the ulcers is the primary treatment objective' she stressed.

'The use of long balloons to dilate vessels in the lower thigh is indicated when critical ischemia is present, i.e. when it is a case of preserving the extremities,' confirmed Dr Florian Wolf, Consultant at the Department of Cardiovascular and Interventional Radiology, University Clinic for Radiagnostics, Medical

University of Vienna, stressing: 'The important issue is to bear in mind the principle of angiosomes.'

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



* A satellite symposium held during IROS 2012, sponsored by medical devices manufacturer Cordis

Left: Before balloon extension: The lower leg vessel of a patient with an open wound in the big toe area

Centre: Balloon in the vessel

Right: After ballooning the constrictions are gone

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 telemedicine that take radiologists' work into a different sphere.

The evolution of hybrid machines, particularly the combination of positron emission tomography (PET) and magnetic reso-



Philips PET-MRI

nance 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.



Representative low-dose CT image with adaptive statistical iterative reconstruction

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.

Molecular imaging

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

continued on page 18

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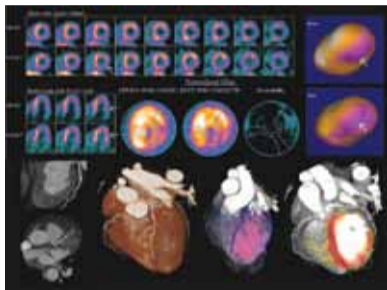


continued from page 17

Kettering Cancer Centre, New York, believes molecular imaging is where advances in cancer will occur, with a number of approaches already taken into clinical practice, although a need for new cellular and metabolic tracers for PET and markers and contrast media for MRI remains before wider clinical use.

Research is also ongoing into the potential use of MRI and MR spectroscopy for risk assessment in prostate cancer.

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



Molecular Imaging: Myocardial Perfusion study performed on Biograph 64 by Siemens Healthcare

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 anatomic 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 image resolution is not as good as MRI, so you might get a half cen-

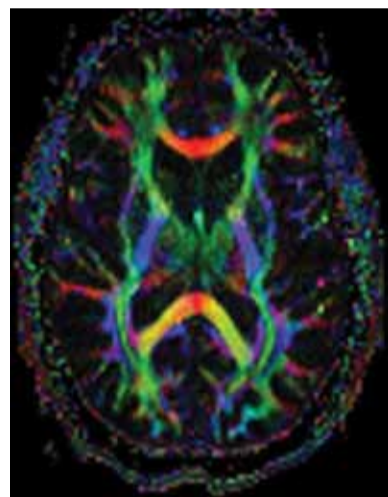
timetre resolution with PET but a half a millimetre resolution with MRI.'

Many larger centres were moving towards this approach, he said, as well as using magneto-encephalography (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 to scan seizures. While the increased magnetic signal strength offers better images patients might have biological side effects.

Significant improvements in image resolution from 7-T ultra-high-field magnetic resonance (UHF MR) 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.



Neuroradiology

Also progressing is diffusion MRI, which explores the micro-movements of water molecules, and can produce in vivo images of biological tissues weighted with the local microstructural characteristics of water diffusion, which can show connections between brain regions.

Interventional radiology

Within this, techniques demonstrating clear benefits include molecu-

lar MR imaging on a cellular and even sub-cellular scale; combined imaging with radiotherapy treatment delivery, e.g. MRI-Linac combinations (under development), and MRI perfusion imaging of the myocardium or MR angiography of cardiac blood flow.

An interesting development has been the evolution of training simulators, such as a computer-based virtual reality environment for training interventional neuroradiology procedures.

The NeuroCath (Neuroradiology Catheterisation Simulator) system includes extraction and construction of a vascular model from different imaging modalities, to efficiently represent a patient's anatomy.

Personalised molecular medicine

In breast imaging, advances are constant. Dr Peter Brader, at the Department of Radiology, Division for Molecular and Gender Imaging, Medical University Vienna, believes a paradigm shift will take place in this and by 2025 diagnosis and treatment will move from a 'one size fits all' approach to personalised, molecular medicine with greater use of theranostics with combinations of targeted diagnostic and therapeutic agents that work sequentially or in tandem. 'The use of more specific molecular imaging probes, along with high-throughput serum screening and biologically-targeted biopsies, will make it possible to apply a growing array of imaging, serum and tissue biomarkers to detect and characterise breast cancer. These will include predictive biomarkers for identifying the relative sensitivity or resistance of a disease to a specific therapy, or to identify disease not in need of treatment; biomarkers for assessing treatment response earlier than is possible with conventional means; and prognostic biomarkers that provide information about the likely outcome regardless of the specific treatment applied.'

Biomarkers

These are increasingly important in the early assessment of patient response to treatment. Consultant physicist Dr Stephen Keevil, Head of Magnetic Resonance Physics and R&D Lead for Imaging at Guy's and St Thomas' 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 functional/molecular imaging will give a much earlier indication of response, which will be important as increasingly treatments will only work with specific patients, for example, for genetic reasons.' (Dr Keevil is also 2012-13 President of the United Kingdom Radiological Congress (UKRC).

Breast MRI

Although an area of constant debate, this is becoming a widely accepted clinical modality in Europe. However, researchers in The Netherlands have shown that performing pre-operative breast MRI in all women with invasive lobular carcinoma (ILC) can reduce the need for re-excision.

Tomosynthesis

Now gaining greater prominence, radiologists believe this technique has a bright future.

Digital tomosynthesis, produc-

ing slice images using conventional X-ray systems, is a refinement of conventional geometric tomography in that it allows an arbitrary number of in-focus planes to be generated retrospectively from a sequence of projection radiographs acquired during a single motion of the X-ray tube.

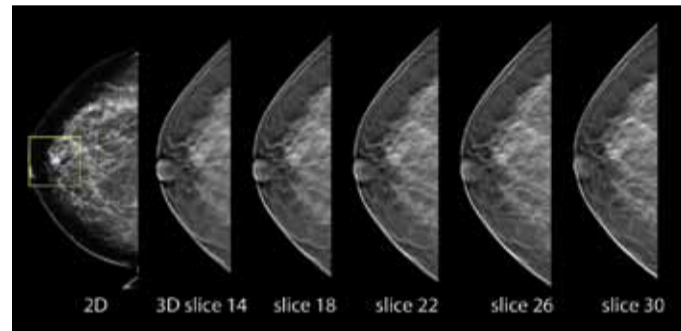
Studies have also highlighted potential advantages from tomosynthesis in diagnostic accuracy for breast cancer that could also help cut the number of recalls for further examination.



The multi-use ultrasound breast system Acuson S2000 Automated Breast Volume Scanner (ABVS) from Siemens Healthcare



The Hologic Breast Tomosynthesis System Selenia



3-D Mammography (Breast Tomosynthesis)

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 specialist uses have been discussed at numerous radiology conferences globally.

Dr Mitch Goodsitt, 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 relative to CT is poorer spatial resolution in the depth plane.'

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.

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

'The future is bright for tomosynthesis technology,' added Dr Goodsitt.

Elastography

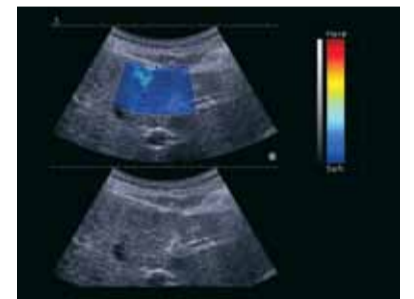
Here is another modality destined for an important future role, particularly in breast imaging with experts suggesting its potential to improve breast cancer diagnosis, reduction of false positives and fewer biopsies performed as accuracy of imaging improves further.

Elastography ultrasound measures stiffness or strain images of soft tissue to detect or classify tumours. Cancerous growth is between five and 28 times stiffer than the background of normal soft tissue so, with compression, the tumour deforms less than surrounding tissue indicating a possible cancerous 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.



ShearWave Elastography from SuperSonic Imagine

From basic strain imaging, elastography has evolved to utilise ShearWave and ARFI (acoustic radiation force impulse) imaging - a form of high-energy ultrasound - to provide more accuracy in estimating tissue stiffness being examined.

High-resolution radionuclide imaging

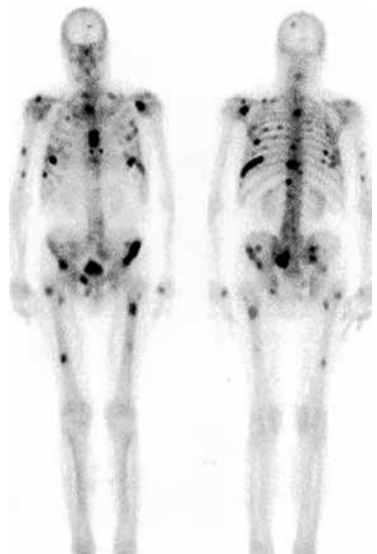
This technique is increasingly used to detect breast cancer and has been shown to improve diagnosis in many clinical situations. It is also allowing clinicians to detect previously unknown areas of breast cancer in women with newly diagnosed disease.

Involved in the technique's development, Professor Rachel Brem, Director of the Breast Imaging and Interventional Centre and Professor of Radiology at George Washington University, Washington DC, explained: 'High resolution nuclear medicine imaging of the breast is a functional approach to breast cancer diagnosis. This

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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 (BSGI) is that, unlike mammography and ultrasound – based on anatomy and asking what breast cancer looks like - BSGI asks how breast cancer functions differently to the normal surrounding breast tissue.



Radiionuclide Bone Imaging

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 lung 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 lung 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 managing 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.

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.

ology 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

Teleradiology

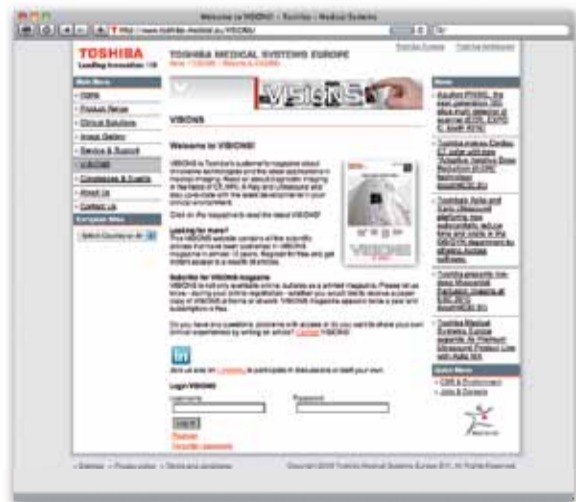


European healthcare systems and hospitals, but research, clinical skill and dedication continue to push forward these radiological breakthroughs that will give radiologists even more options and thus greatly benefit their patients.

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ULTRASOUND CT MRI X-RAY SERVICES

Currently there is a truly enormous hole in the ground in the city of Wiener Neustadt, Austria, but by summer 2012 MedAustron, one of the most modern centres for ion therapy and research in Europe, is to be built here. After two treatment centres in Germany failed, gaining from the experience and failure in others, this €200 million MedAustron project will be one of four ion therapy centres worldwide to offer treatment with protons as well as carbon ions

Ion therapy is considered a great beacon of 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 treatment with protons as well as carbon ions. 'This therapy is physically very different from conventional photon radiotherapy and is characterised by increased, relative biological effectiveness,' explained 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, radiation-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.

Financed 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 implementation of its own acceleration technology. 'The accelerator at MedAustron will basically work just like the world's largest particle accelerator, the LHC, used for the recent big bang experiment at CERN,' explained Dr Bernd Mösslacher, Managing Director of MedAustron. 'The design which originated from the so-called Proton-Ion Medical Machine Study (PIMMS) is based on a synchrotron, a circular accelerator with a circumference of around 80m, which accelerates 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

have experienced delays.'

Dr Mösslacher: 'We've definitely not experienced the technical problems that created so many difficulties in those centres. In hindsight it was the right decision that we didn't bank on cooperation with industry but with a scientific research centre like CERN. The economic pressure associated with a purely com-

mercially driven facility is obviously a lot more intensive than with our infrastructure project, which is to serve medicine and research.'

MedAustron is becoming a reality in Wiener Neustadt

unit, as well as its own research area where the knowledge of radiation biology and medical radiation physics is to be broadened.

Once the building works have finished the installation of the indi-



The Low Energy Ring (LEIR) at CERN

The MedAustron construction site

vidual accelerator components will commence. 'We expect to be operational in 2013, with the first patients to be treated in 2015,' Prof. Mayer hopes. 'This will be an exciting moment as the complex interaction between the accelerator, medical technology and control software can only succeed if all components work together harmoniously. Any problems likely to occur will be in this area. This is the point where most other ion therapy centres

research.'

Apart from the combined ion therapy centre in Wiener Neustadt there is a further Italian facility under development at the National Centre of Oncological Hadron Therapy (CNAO) in Pavia, the MedAustron Managing Director reports. 'The MedAustron and the CNAO Centre are technologically similar and are both based on the PIMMS design of CERN. However, our colleagues at the CNAO have

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 liver, pancreas or prostate tumours. The radiation exposure in the healthy tissue surrounding the tumour drops rapidly and the tissue behind the tumour is almost completely spared.'

'Especially in the treatment of children and adolescents, for whom even a small dose can lead to long-term consequences and side effects, proton therapy will certainly have a bright future. Moreover, there are already first concepts, such as at the Barnes-Jewish Hospital in St. Louis/Missouri, to scale down the particle accelerator to such a size that it will be possible to install it in a hospital. In this way, ion therapy could become much more widely established. We are therefore only at the beginning of what will be possible with this novel technology.'

Belgium's IBA

Ever growing – as well as shrinking cancer therapy systems

In January 2012, the world's leading cancer diagnosis and therapy technologies firm Ion Beam Applications S.A. (IBA) in Belgium, announced that Olivier Legrain, its then Chief Strategic Officer, became Chief Operating Officer (CEO) pre-dating his succession to Chief Executive Officer when current CEO Pierre Mottet becomes Vice-chairman of the Board – prior to becoming its Chairman in 2013. Such neat planning and organisation appears to typify the international IBA group, which employs 2,100 professionals and is a leader in cancer diagnostics and therapy. Innovation also keeps this specialist firm in the lead, **Brenda Marsh** reports

Around half a dozen notable companies manufacture the gigantic cyclotrons and synchrotrons that power proton therapy, yet over 60% of all proton centres have installed IBA technology. The firm has, for example, equipped all but two of the working proton therapy sites in the USA. In Europe, IBA has also installed centres in Uppsala, Krakow, Essen, Dresden, Prague, Paris (Orsay) and Russia: Dimitrovgrad and, in the Far East, three of its installations are at work – one in China, one Korea and one in Japan.

In late November 2011, when the group reported revenues showing a significant growth of 25.9%, compared to the same period in 2010, this result was attributed to the good performance in its proton therapy sales. On top of three systems sold in the USA, Sweden and Germany, in the third financial quarter, IBA booked the first sale of its *ProteusOne*, an ultra-compact (one-room) proton therapy system,

This first installation in the USA of this innovative compact solution will be at the Willis-Knighton cancer treatment centre in Shreveport.



The proton therapy size reduction is expected to stimulate a rise in purchasing interest from local communities – not only because it has a short beam line and smaller gantry, making the accelerator about a third smaller than other systems, but also because the single treatment room is not so overwhelming for patients. Bill Hansen, IBA Director of Marketing, who believes 'the future is going to be single room systems, though not necessarily in all cases', said the 'ProteusOne certainly offers a great deal'.

Providing attractive colour tones, a fresh mural and ambient lighting, the room looks more inviting than most medical rooms. Technically it also packs advanced imaging that includes stereoscopic X-rays, 3-D positioning, integrated CT and much else. 'It's been designed from the ground up' he said, with tangible pride.

The ProteusOne's other great significant factor is cost.

When, in 2007, IBA released the single room system with the reduced accelerator, Yves Jongen, IBA's founder, Managing Director and Chief Research Officer for particle therapy estimated the equipment would cost around €23 or 24 million, including building costs. By contrast, a typical multi-room proton therapy system, with an average configuration, would cost well over €100 million. However, it could, he suggested, treat 2,000 patients, at around €20,000 each, thus generating good revenues for treatment centres. Although the one treatment room could treat only about 500 patients annually, he pointed out that it's 'still a very acceptable rate for a number of hospitals'.

As said, the smaller system should also attract community hospitals... patients are certainly asking for this.

* Listed on the pan-European stock exchange Euronext since 1998, IBA sales exceed €380 million.

The UK's National Proton Beam Therapy Service

PBT uses a high-energy beam of particles to destroy cancer cells by more accurately targeting the affected areas and is particularly suitable for complex childhood cancers. It also increases success rates and reduces side effects, such as deafness, loss of IQ and secondary cancers.

For patients with highly specific types of cancer that occur in the brain and near the spine, PBT can be better than conventional radiotherapy as it precisely targets the tumour, giving better dose distribution and not harming critical tissues.

With no proton beam therapy (PBT) service available in the UK, in 2008 a scheme was set up to send selected NHS patients abroad for the treatment in Switzerland, Florida and Oklahoma. So far this has meant that 80 patients have been treated abroad, with payment made the NHS. The government has pledged to increase this to 400 patients a year by 2013-14.

However, it is acknowledged that for many patients with cancer, travelling abroad is inappropriate due to the additional worry and many require other treatments alongside PBT.

Now, from 2016, England will have its own purpose-built National Health Service (NHS) facilities in a Government plan to invest up to £150 million (€180 million) in procuring a PBT radiotherapy cancer service

The Department of Health has been working with three sites – in Manchester, London and Birmingham – as potential providers of the service, but a final decision has yet to be made on whether these are the best locations for the therapy.

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