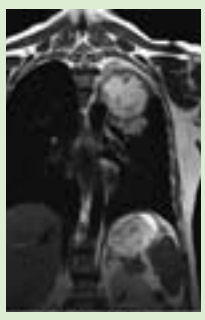
EUROPEAN HOSPITAL

THE EUROPEAN FORUM FOR THOSE IN THE BUSINESS OF MAKING HEALTHCARE WORK



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Drug patents expiry will save healthcare billions

European healthcare providers could benefit from savings of over €3.8 billion a year by 2014 as patents expire on leading pharmaceutical products and the market opens up to generics competition, according to latest research from independent market analyst Datamonitor (*www.datamonitor.com*).

Over the next few years, patent protection ends for many top-selling drugs, with lower priced generic versions anticipated to flood the market. Although therapeutically equivalent, the lower price of these drugs is achievable because generic companies do not have to invest in the expensive process of research, development and testing and can therefore sell these drugs at a significant discount to the branded products, Datamonitor points out.

In the EU, the average discount for generic drugs is 34%. In the US, which recently passed a major reform to its healthcare system, savings are even greater – average 80% – helping healthcare providers to save nearly £30 billion a year by 2014.

Whilst generics companies and healthcare providers are set to benefit, globally speaking, leading pharmaceutical companies are set to lose £52 billion from drugs facing patent expiry over the 2010 – 2014 period, on top of the £21 billion of continued losses from already expired drugs.

NHS Global NEW

UK to share healthcare expertise internationally

The United Kingdom's National Health Service (NHS) has launched NHS Global, a new branch of the organisation that aims to generate additional funding from other countries and organisations, and to explore new international opportunities to export its knowledge, skills, products, ground-breaking treatments, cutting edge research and other services.

Unveiled in March by Health Secretary Andy Burnham, the initiative comes against a backdrop of growing financial constraints within the NHS.

Report: Mark Nicholls

The Department of Health (DoH) has begun preliminary work with NHS organisations to bring products to the world market and is now seeking further ideas to be submitted for consideration by NHS Global, with NHS staff invited to come forward with their own suggestions.

NHS Chief Executive Sir David Nicholson said with growing international demand for knowledge, skills and services developed in the NHS, a more systematic approach to supporting NHS organisations in making the most of such opportunities was needed and NHS Global would help facilitate that.

Last October's success of the NHS Innovation Expo – which brought together healthcare providers to showcase innovation, spread best practice and generate business on a domestic and international level – helped illustrate the global demand for NHS services from governments and organisations abroad and generated transactions of more than £27 million (€30m).

NHS Global, to be launched in the summer, will help NHS organisations replicate this success more widely in an international healthcare marketplace, worth around $4 trillion (€3 trillion).

While it will be up to the individual organisations to decide how NHS staff become involved in NHS Global, the DoH hopes that organisations undertaking international activity will be able to offer their staff opportunities for development and insights into how other healthcare systems operate.

Given the lack of management skills in many developing countries, opportunities may arise for more NHS managers to become involved in overseas work. Some NHS organisations are already sharing their expertise internationally, such as the NHS Institute and Moorfields Eye Hospital.

Professor Lord Darzi, UK Global Health and Life Sciences Ambassador

'There is significant international demand for NHS products and knowledge and it is important that NHS organisations are supported in making the most of this opportunity,' said Professor Lord Darzi, UK Global Health and Life Sciences Ambassador. 'Proper management of our knowledge and skills will create additional income to invest back into frontline services. At the same time, greater participation in the Global Health agenda will provide greater security to the UK and the rest of the world in confronting international health security challenges, such as pandemic flu.'

The NHS has gained a reputation for technologies and innovations to combat healthcare associated infections (HCAIs) and this is an area where there is demand from other health systems.

The NHS Institute for Innovation and Improvement's *Productive Series* – which sets out steps to improve quality of care and deliver more productive services by focusing on supporting NHS staff to drive change - and *NHS Direct Software* are also seen as opportunities to generate international business.

The UK government says NHS Global will be able to remove barriers, provide technical and commercial support and help the NHS to get best value for the knowledge and skills it holds in a way that does not affect frontline services at home, by acting as a central contact point for countries interested in doing business with the NHS. It will support the NHS in a range of business functions, including: identifying commercial opportunities; generating demand in international markets; brokering partnerships between NHS organisations and overseas customers; identifying potential legal issues and risks; providing advice on Intellectual Property management; and marketing and communications.

E-health advances in Austria

Like many others, the country is in the process of introducing electronic patients' records (EPRs) for use in and by all healthcare facilities. After a drawn out preparation phase, a company was founded to implement the project and ELGA (Elektronische Gesundheitsakte) is underway.

With the launch of the public health portal *www.gesundheit.gv.at*, the first ELGA milestone has now been reached. 'E-health will come, step by step, but inexorably', said Austrian Health Minister Alois Stöger. *Michael Krassnitzer* reports

ELGA is a searchable database that contains all health data about a patient, no matter when and where they were collected – i.e. in healthcare institution. The data can be accessed anytime by everybody who has the necessary access privileges. 'A reliable system of strict access privileges is a crucial issue,' said Dr Susanne Herbek, managing director of ELGA-GmbH. 'Privacy and patient autonomy have to be guarded under all circumstances.'

Citizens can opt out, i.e. deny ELGA access to either their complete set of health data or to selected information, for example sensitive data on in-patient treatment in psychiatric institutions. They can also call up the logs where every access - when, where, by whom – is recorded. These logs in particular are designed to prevent abuse, and, as Dr Clemens Martin Auer, senior official in charge of ELGA at the Ministry of Health, assured, any abuse of the data in the EPRs will be subject to criminal prosecution.

'In its final form, the health portal will be every Austrian's door to his or her personal EPR', Susanne Herbek added. For the time being, the online portal focuses on the provision of quality-assured and independent health information, such as a medical encyclopaedia, or information on patient rights and laboratory procedures.

The first ELGA application to be implemented is *eMedikation*, i.e. electronic prescriptions. Data on prescribed and dispensed medication will be stored and can be accessed from hospitals and doctor's offices. eMedikation will cover both prescription and over-the-counter drugs if they contain active ingredients that might interact with other pharmaceuticals. Automatic

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EUROPEAN HOSPITAL
Reader Survey

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For new EH registrations, tell us more about your work, so that we can plan future publications with your needs in mind. Please put a cross ☒ in the relevant boxes.

1. SPECIFY THE TYPE OF INSTITUTION IN WHICH YOU WORK

☐ General hospital ☐ Outpatient clinic ☐ University hospital

Specialised hospital/type

Other institution (eg medical school)

2.YOUR JOB

☐ Director of administration ☐ Chief medical director ☐ Technical director

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)

4 . WHAT SUBJECTS INTEREST YOU IN YOUR WORK?

☐ Surgical innovations/surgical equipment
☐ Clinical research/treatments/equipment
☐ Ambulance and rescue equipment
☐ Physiotherapy updates/equipment
☐ Nursing: new aids/techniques
☐ Hospital furnishings: beds, lights, etc.
☐ Hygiene & sterilisation
☐ Linens & laundry
☐ Information technology & digital communications
☐ Personnel/hospital administration/management
☐ Material Management
☐ EU political updates
☐ Radiology, imaging/high tech advances
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☐ Pharmaceutical news
☐ Speech therapy/aids
☐ Laboratory equipment, refrigeration, etc.
☐ Hospital clothing and protective wear
☐ Nutrition and kitchen supplies
☐ Waste management
☐ Hospital planning/logistics
☐ Hospital Purchasing
☐ Medical conferences/seminars

Other information requirements - please list

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. 39, 45133 Essen, Germany, and for the mailing out of future issues and the EH electronic newsletter.

EH 2/10

COMPETITION

Your chance to win a Beurer PM 70 watch

The unisex Beurer PM70 watch, which comes with PC software, monitors heart rate – red blinks signal when the wearer has gone above or below personal limits during exercise

A healthy diet and regular exercise improve health. However, ensuring that the exercise we take is sufficient enough to help our bodies to stay fit – as well as not harming us – is not so easy. The pulse should be monitored during exercise not only to achieve optimal training results but also to prevent excessive strain on the heart.

Our competition prize this month comes from the German company Beurer*, which produces an extensive range of pulse watches for optimal training control as well as protection.

To be worn with the accompanying chest belt, when jogging or working out at the gym, the unisex *Beurer PM 70* heart rate monitor watch can be set to support your individual training programme.

By measuring your pulse rate, the watch can then help you to monitor and maximise exercise routines.

Using the PC software *EasyFit* the user acquires the results from the watch and these can be analysed in various ways.

Additionally, the software provides useful calendar and functions that support optimal training over longer periods of time.

Using the software, you can also control and monitor your weight.

Along with an alarm, time in zone, plus date and weekday display, the watch enables or provides

- A function to set your individual training range
- ECG - precise heart rate measurement, with average and maximum heart rate display
- A coloured LED that blinks green for hearbeats within your limit and red as soon as you go over or under it
- Display of calorie consumption in kcal + fat consumption in g/oz
- Lap times (50)
- Digital data transmission (PC link, including interface and software)

The watch is speedbox-compatible; has a bicycle mounting bracket and is waterproof to 30 metres.

** Headquartered in Ulm, Germany, Beurer GmbH specialises in R&D and production of health and well-being products – currently offering over 120. As well as pulse watches the firm's range includes blood sugar measuring units, blood pressure instruments, fever thermometers, electric blankets, bathroom and kitchen scales, footbaths and nebulizers.*

HOW TO ENTER

Simply fill in the Readers Survey form (left) or go to our website: www.european-hospital.com

PLEASE NOTE:

- **The closing date for entries to the EH 2/10 competition: 24 May 2010.**
- **Entries received after that date cannot be entered in the draw.**
- **The winning entry will be drawn from the correct answers.**
- **Only the winner will be contacted directly.**
- **The winner's name and location will be published in a future issue of European Hospital.**
- **NB: The prize is not exchangeable for cash.**
- **The usual competition rules apply.**

Why enter?

It's so easy – and, since we launched our competitions some years ago, winning medical and healthcare workers throughout Europe have been delighted to receive the fine prizes featured in *European Hospital*.

So, don't delay, enter our competition today (why not right now!). Simply go to the EH website.

Good luck!

The winner of the iPod Touch, featured in our competition in EH issue 1/10 and on our website, is:
Tina Vigan Johansen
Radiographer
Odense University Hospital, Denmark

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checks of prescriptions and fillings in the pharmacies are designed to detect and prevent interactions and multiple prescriptions. However, there is no time frame yet for the introduction of eMedikation and nobody knows when the negotiations between all stake holders will be concluded. In Austria, the professional associations of physicians and pharmacists are traditionally not on particularly friendly terms.

Much easier was the definition of harmonised technical standards – a precondition for any ELGA application. All information systems have to be IHE-compatible, which means they must comply with the interoperability guidelines of the Integrating the Healthcare Enterprise (IHE) initiative. CDA (Clinical Document Architecture) was selected as the document standard.

While some Austrian hospitals and hospital associations still struggle with the introduction of ELGA, others are well prepared. The federal state of Tyrol, for example, is a trail blazer in terms of e-health. 'Gesundheitsnetz Tirol', a 'mini-ELGA' in Tyrol, has been established over the past few years. Seven hospitals run by different operators can access physicians', labs' and radiology departments' data in a database that began to be filled in 2001. Since the operators of the 'Gesundheitsnetz Tirol' recognised the importance of IHE and CDA years ago, the network can easily be integrated into the country-wide ELGA system.

In Austria's capital, Vienna, the situation is more problematic. The Wiener Krankenanstaltenverbund (KAV), a network of twelve hospitals and eleven geriatric institutions, is one of Europe's largest hospital associations. Long before ELGA, KAV developed its own EPR system – which, however, is incompatible with ELGA's technical standards. Consequently, KAV has to introduce CDA as an additional format, build an IHE-based archive and replace proprietary interfaces with IHE interfaces. All in all, quite a daunting task.

A project such as ELGA is not universally loved. Privacy is a major concern and consumer-protection organisations and office-based physicians have voiced their protests clearly. They fear repercussions for patients on the labour market when prospective employers can access a candidate's ELGA data, or for patients whose record shows poor compliance. 'As soon as such data are available, there are immediately many parties who want to access them – for whatever reason. In view of a whole slew of scandals involving the unauthorised use of data and privacy infringements throughout Europe, we strongly advise against such data pools', Dr Christian Euler, president of the Austrian association of GPs, has warned. Moreover, general practitioners fear that the wealth of data cannot be analysed in a timely manner and that they will be held responsible if they overlook a piece of information hidden somewhere in the depth of the data pool.

'We do take the fears and concerns seriously and try to find a solution,' Susanne Herbek emphasised. 'But personally I consider the concern that ELGA will be turned into a system of control entirely unfounded.'

Problems piling up

Rostislav Kuklik reports from the Czech Republic

Everyone (even if only marginally interested in public affairs) must have noted the current astronomic, worldwide public debts – including the USA's astounding $12 trillion. Additionally, everyone probably noted that, in many cases, this had something to do with the healthcare sectors. President Obama, for example, has been fighting to reform the US system because health expenditures represent 16 % of American gross domestic product (GDP) – the highest among OECD countries. Ranking second, France spends 11% of GDP on healthcare (both figures from 2007). This situation clearly cannot continue.

Smaller country, smaller problems? No. In the Czech Republic (CR) public debt reached ~€48 billion); the state budget deficit equals ~€0.92 billion, and 6.8 % of the GDP (same as Korea) was spent on healthcare in 2007 – also extreme. Only two other OECD countries spent less: Mexico 5.9 % of GDP, and Poland 6.4 % of GDP. No matter whether spending too much, or too little, the economy must be well balanced, which is neither the case in the USA nor CR.

So far, these are just economic figures, but how do all these affect the Czech healthcare system? Deeply enough.

Apart from various 'lesser pains' in the Czech healthcare system, two problems dominate – the lack of money and lack of qualified professionals.

Let's examine more figures: The Czech health insurance system is based on the Bismarck model of compulsory insurance, in which every citizen must contribute regular payments, based on actual income, to the respective health insurer (currently 11 of these in CR). As things stand, this system is disproportionate (the majority of funds are consumed by a minority of patients), rigid, and ineffective (no direct patient payments for any, even very expensive state-of-the-art, treatment are required).

The wrong financing translates into poor salary conditions – on average, in the second half of 2009, physicians earned less than ~€20,000 and nurses went home with less than ~€920 gross. Taking this into account, no wonder interest in medical study declines year after year: 874 general medical students graduated in 2003, but only 784 of them graduated in 2009. No wonder experienced doctors, or those freshly graduated, are leaving CR en masse for a better life abroad – hundreds are lost annually, particularly to Germany, the United Kingdom, USA or Arabian countries, and Czech healthcare is becoming increasingly dependent on foreign professionals (only 829 in 2003, but over 2,000 foreign doctors worked here in 2008).

One last, but truly unbelievable example of a grim misconception that epitomises Czech 'modern healthcare management': 13 years have passed since the first lung transplantation and, up to now, 145 patients have been successfully operated on, yet responsible officials and health insurers have not been able (or did not want?) to agree on the insurance code used for billing purposes for this extremely demanding and difficult procedure. Lung transplantation costs about €30,000 (surgery plus ICU care) and only one surgical team (3rd Surgery Clinic at Motol Teaching Hospital) in the entire country can perform this. It is pathetic…

Sources: http://stats.oecd.org/; http://www.motol.cz/; http://www.mfcr.cz/; http://www.mzcr.cz/

The Health Executive Summit

Although focused mainly on European challenges, the Health Executive Summit aims to share 'visionary strategies and latest best practices', as well as to provide solutions for current health challenges facing European health systems. As such, the event draws in leaders and decision-makers from around the world.

19-21 May 2010

Paris, France

This year's conference themes:

- Chronic Disease Management: Chronic or long-term conditions can represent up to 70% of a country's total health expenditure. For European healthcare systems, chronic care is increasingly seen as a promising opportunity to improve clinical and financial outcomes.
  Roselyne Bachelot-Narquin, Minister of Health and Sports in France, will preside over a Ministerial Roundtable: *Preparing health systems for the future: Integrating chronic disease management in national reforms.*
- eHealth: focusing on usage of the internet and mobile technologies to integrate care and augment collaboration between healthcare professionals and patients.
- Sustainable development: Healthcare establishments are big consumers of resources and major producers of waste. The Summit will present and utilise successful initiatives in sustainable development.

The event is collocated with *Hopital Expo* and *HIT Paris*, which attract around 26,000 visitors and 750 exhibitors.

Details: www.health-es.com

E-mail: camille.delboccio@fr.cmpmedica.com

HEALTH EXECUTIVE SUMMIT

SWITZERLAND

The end in sight for hospital subsidies

The financing of hospital treatments in Switzerland is particularly complex. The current health insurance law (KVG) has no easy answers. Who covers the cost of treatment differs from district to district, depending on whether a treatment is carried out in a public or private hospital, whether carried out within a resident's own district, whether out- or in-patient care or whether, or not, the hospital is listed on a district's official list of providers.

In the case of public (= district) hospitals or those that receive public subsidies, the state and insurers share costs – but the ratio differs from district to district. Mostly, private hospitals do not receive subsidies, but even here there are exceptions. This situation all too often leads to problems and ambiguities when it comes to who has to pay how much for which type of hospital treatment.

KVG revision

During the last revision of the health insurance law an overhaul of the regulations on in-patient treatment was finally decided. From 1st January 2012 these changes will apply all over Switzerland. The most important alteration is that there are now standardised guidelines as to the extent the state (i.e. the districts) has to pay for treatment. Normally, the district will pay 55% of costs and the insurers bear 45%, which will be calculated based on DRGs (diagnosis related groups). Therefore, all Swiss hospitals will charge the same price for any specific type of treatment. Patients will also be given the right to choose a hospital freely, right across Switzerland.

At the same time, the differentiation between public and private hospitals will be abolished. There will be a free market with standardised conditions for all hospitals. This entails significant changes for the public hospitals. The subsidies received so far will cease to exist; public hospitals will literally be thrown onto the open market. From then on, they will be responsible not only for their operating costs but also for infrastructure, investments and reserves, because the state will no longer be permitted to help.

DRGs with investment percentage

This change of system will be made easier because the calculation of the DRGs in Switzerland (Swiss DRF) is to include an additional, percentaged amount for investments for each diagnosis. The incentive for hospitals to optimise their business and plan future investments wisely is therefore increased significantly.

Now, a year and half before it begins, private hospitals still have a head start, as they have always had long-term investment strategies. On the other hand, the public hospitals had to make any impending investments through the (often protracted) public purchasing process. Often, financing for new equipment was approved too late, sometimes the acquisition of new equipment was rejected for political reasons.

From 2012, the new 'freedom' for public hospitals will only succeed if they are allowed to be on a par with private hospitals right from the start when it comes to planning. The districts will then be obliged to ensure that the infrastructure of their hospitals is up to date and to equip them with start-up capital for investments during the transition period. Although the hospitals will receive an added, percentaged amount for investments for each diagnosis from 1st January 2012, it will obviously take some time to accumulate enough money in this way to finance the acquisition of, for instance, a new MRI scanner.

The objective

The objective of these changes is clear – to achieve simplification, comparableness, benchmarking, quality improvements and control, free competition etc. Whether or not these ambitious targets will be achieved is still written in the stars. However, it would be good to think that the Swiss will soon be able to benefit from the same quality of medical care without having to continue to pay the extremely high insurance premiums.

Report: André Weissen

SCOTLAND

Boldly tackling catering and hygiene issues

Although food for in-patients can be integral to healing, the standard of catering can be disappointingly low in some hospitals. In addition, sometimes even the help needed by those patients unable to eat or drink unaided can be overlooked. In addition, the problems of poor hospital hygiene can, at worst, result in deaths as well as legal issues for management. These two difficult areas are now being firmly addressed in Scotland.

Catering - A recently published review of the food supplied to patients in Scottish hospitals has highlighted good performances by various healthcare boards and also identified improvements to be made.

The next step of the plan will be the launch of the new Nutrition Database, which will enable the country's NHS Boards to analyse recipes to ensure meals are nutritionally balanced and match individual patient's needs. Using the database, the Boards will be able to record data and information and produce reports on their patients' catering recipes, so that what they provide is nutritionally balanced and healthy. Additionally, recipes can be shared across Scotland and special requirements, e.g. textured food, supplied.

The Nutrition Database and compliance reports are two elements of a comprehensive programme for improving nutritional care in hospitals. Established in 2008, and backed by £1.5 million to support the implementation of the NHS Quality Improvement Scotland Clinical Standards for Food, Fluid and Nutrition in Hospitals, the programme includes:

- The publication of Food in Hospitals - A National Catering and Nutrition Specification for Food and Fluid in Scottish Hospitals (2008)
- The publication of a Practice Development Programme and Toolkit (2008)
- Development of a web-based Educational Framework
- Funding of Nutrition Champions in each NHS Board
- Increased emphasis on the key role played by nurses in ensuring vulnerable patients who may need assistance with eating and drinking are given the care and support to improve and maintain their nutrition where appropriate.

For the last six months in 2009, the National Catering and Nutritional Services Specification: Half Yearly Compliance Report was used to assess the NHS Boards' performances against required standards. These include the planning of healthy and nutritionally balanced menus and specifying the number of portions, and provision of a good range of food types; providing modified diets to assist with particular conditions; listening to patients, carers and staff and, particularly important in our increasingly mixed society, flexibility regarding people's cultural, religious or personal preferences.

Nicola Sturgeon, Cabinet Secretary for Health and Wellbeing, said that this report has not only shown, for the first time, what nutritional ratings have been achieved by the NHS, but also has provided a standard against which to measure progress in this sector across Scotland. 'By this time next year I expect all health boards to achieve over 90% for every one of the food standards. The new database is a fantastic start to improve hospital food and will allow boards to nutritionally analyse their menus and provide patients with healthy meals tailored to their individual recovery needs.'

Hygiene: Tough measures for a tough task

The Healthcare Environment Inspectorate (HEI) set up in spring 2009 to undertake visits to each acute hospital in country's National Health Service (NHSS) at least once every three years, aims to reduce the healthcare associated infection (HAI) risk to patients through rigorous announced as well as unannounced inspections.

Susan Brimelow, Chief Inspector of Scotland's Healthcare Environment Inspectorate

Each visit is led by an experienced inspector and supported by a small team, which also includes a volunteer inspector to ensure members of the public are involved in the Inspectorate's work.

Former nurse, Susan Brimelow, became chief inspector of the organisation just over six months ago. Since her appointment, 16 hospitals have received visits. She recently expressed surprise at the state of some of the hospitals. In some cases, standards of cleanliness were found to be particularly poor in the cleaning of equipment, commodes, underneath beds and in dusting. In terms of hospital maintenance, ventilators were found to be clogged with dust, and items not repaired. Regular infection control training was absent, and manuals missing from wards; additionally, in some cases staff only had out-of-date versions.

The inspectors also found some NHSS managers were very resistant to the strong measures recommended to tackle problems, in this 'unprecedented scrutiny of the health service'. Some managers even attempted to influence the content of the inspection reports on their hospitals.

The hospitals involved are already raising hygiene standards, the NHSS pointed out.

Patients have also been urged to contact the HEI to report any observed problems in any hospital or department.

Report: Brenda Marsh

GOOD GRADES = GOOD PHYSICIAN?

German Health Minister calls for abolition of *numerus clausus* in medical study selection

Above average grades or lots of patience – whoever wants to study medicine in Germany needs at least one of the two. That's because some 40,000 school graduates apply for just 9,000 places to study medicine every semester. The coveted places are assigned by the central office for university admissions (ZVS): 20% go to the top graduates, 20% are granted on the basis of a waiting list, and 60% are granted by the universities themselves.

The current *numerus clausus* (NC), the average 1.4 grade needed to be considered for a place in medical school, is very high. Federal Health Minister and physician Philipp Rösler (Free Democratic Party - FDP) argues that the NC should be abolished and selection interviews given more credit in the application process. 'The grade average alone does not say much of anything about whether someone will make a good physician,' he said in an interview with the daily *Frankfurter Allgemeine Zeitung*. 'Actually quite different factors are more important. For example, the capacity to listen to people plays an enormous role. If you choose a profession to help people and then find you spend more time with quality assurance sheets and forms than with patients, then one is justifiably angered.'

Philipp Rösler

The President of the German Physicians' Association (*Bundesärztekammer*), Professor Jörg-Dietrich Hoppe, supports Dr Rösler's reform plans. 'Other criteria have to be added to the Abitur (see box) grade for admission to the study of medicine,' he told *Die Welt*. 'Thus, commitment to healthcare as a nurse or paramedic and a related course of study compatible with medicine ought to be given more consideration.' In his opinion the establishment of selection interviews by the universities is essential.

Universities can already admit some students through selection interviews, but they rarely do because of the additional effort required. Therefore most universities use average grades as the decisive selection criterion and assign selection to the ZVS. Thus, in the German healthcare system, personal suitability and inclination for the medical profession are inadequately assessed. Prof. Hoppe thinks that a fair number of first class Abitur graduates only find out once they have entered practice that they do not like the medical profession or are unsuited to it.

Dr Rösler also raises the spectre of an impending physician shortage as a principal argument for his proposal to abolish the NC. 'In coming years, a large number of physicians will reach retirement age. Action has to be taken to counteract this effect.' According to 2008 Federal Statistical Agency data, 390 physicians per 100,000 inhabitants was well above the international average. Dr Rösler admits that the desperate physician shortage is mainly local in nature, with a surplus in urban areas and a noticeable shortage in rural areas. He wants to introduce a rural physician quota in which a certain portion of university places would be granted to those who make a commitment to practice in rural areas upon graduation.

Opponents argue that abolition of the NC might create equality of opportunity among Abitur graduates – but it will not change the actual physician shortage. The reasons lie above all in the poor remuneration and amount of overtime, according to the federal association of health insurer-licensed physicians.

Many German-trained physicians emigrate. Professor Wilhelm Schmitz, dean of the medical faculty at Münster University, expresses concern that the new Working Hours Protection Acts also reduce the physician's potential: 'Whereas in the past it was not unusual for physicians to work 24 to 36 hours straight, today more posts are needed to care for the same number of patients. The healthcare system has yet to respond adequately to these developments. In addition, the increasing feminisation of the profession also leads to a shortage of practising physicians. Nearly 70% of incoming students are women, yet only about two thirds actually end up working with patients after completing their studies.'

Simplified access to medical studies solely by abolition of the NC probably cannot significantly create more physicians: the NC is merely an indication of how desirable a place to study medicine is and that there is little capacity for medical training. Therefore the discrepancy between supply and demand appears to be a far greater problem – however hard to solve financially. But there are already some signs of initial success: the largest federal state, North Rhine Westphalia, for example, intends to create 100 new places – a five percent increase – for medical students by 2011.

Dr Rösler's NC reform is still supposed to become policy within this legislative period. The Christian-Democratic Union (CDU), senior partner in the German government coalition, intends to support the Federal Health Minister's planned measures. 'We welcome the proposals and we, in the coalition, should be able to agree on the key points before the summer recess,' said CDU health policy expert Jens Spahn.

Report: Karoline Laarmann

Definitions

Numerus clausus (NC) – *The numerus* (Lat. number) *clausus* (Lat. closed, blocked) designates a limit to admissions in certain academic subjects for access to study at universities or polytechnics. These limits are usually based on capacity. In Germany there is a nationwide limit to the number who can be admitted for medical study due to far more applicants per semester than universities can accept. The NC is measured anew each semester. All applicants are sorted by *Abitur* (school leaving certificate) average grade; those with the highest average are admitted. The grade of the worst candidate admitted constitutes the so-called NC.

The UK's Vanguard is going global


Maurizio Pupi

Last January Dr Maurizio Pupi became the International Business Manager of Vanguard Healthcare – the UK supplier of mobile healthcare facilities – which intends to spread its already very established and necessary services beyond the United Kingdom. Vanguard's choice for the role augurs well. 47-year-old Dr Pupi, an Italian and graduate in economics and business, not only speaks Italian but also English, German and Spanish. In addition, he is a seasoned international leader in the European healthcare market. Before joining Vanguard he was for eight years European Business Director and a shareholder in Alliance Medical Ltd, where he was responsible for several acquisitions and, among other responsibilities, created AMIS, the pan-European arm of AML, with a €6 million turnover. He was also Managing Director of the Spanish JV after its acquisition in 2007, with a €9 million turnover.

There is much else one could add about his accomplishments, but this should suffice to demonstrate that Vanguard has a 'lion' roving to present its unique mobile services to healthcare providers internationally. Interview: *Brenda Marsh*

What are the benefits of your experience with Alliance Medical for Vanguard?

The European healthcare market is a complex environment with many different requirements, focuses and aspirations. Mobile services can answer many of the modern challenges faced by healthcare professionals across Europe and, in most cases, do so at a considerably lower cost than alternative solutions. My experience with Alliance has made me familiar with the intricacies of incorporating a mobile solution into a country's healthcare system seamlessly, effectively, with the least inconvenience for the healthcare providers and the most benefits for the patients.

Is there is a natural symbiosis between the offerings of Vanguard and Alliance?

There is always a natural symbiosis between diagnostic services and surgery services, so it is true that there is a potential synergy between the services of Alliance and Vanguard. However, the opportunities present for Vanguard Healthcare extend well beyond Alliance Medical's presence in Europe. Potentially every single hospital in Europe is a prospective client for us, and this is the approach that we are taking with our international goals.

Will you approach hospitals that have already utilised Alliance Medical services?

Our approach is more focused on spreading the information about our services in Europe and generating high level contacts at government level. But there is nothing to say that we would not work with hospitals that have already utilised Alliance's services – far from it.


Vanguard units at Moorfields Hospital, London

How will you approach entry into Europe?

We have selected seven countries that, in our opinion, present the best opportunities for a swift entry to market. In no particular order, they are: Holland, Sweden, Poland, Italy, Spain, France and Germany. We have identified dedicated agents in the majority of these target countries and are dealing with a number of serious enquiries already under offer.

Our approach is based on disseminating the information that we have about an area, its healthcare industry and about how they might respond to the provision of mobile services. Mobile units are a new idea for most countries and we will, of course, need to make special efforts to ensure that decision makers and users are familiar with the concept. To this end, we now have a multi-lingual website, we are attending a number of conferences (i.e. Surgeon's Day in Holland) and are participating in a number of European healthcare forums were our contribution as a new and innovative service provider is already highly valued.

Can you assess which hospitals have an immediate need to use the units?

Typically our partners hire a mobile unit for one of two main reasons.

The first is **to protect revenue**. All hospitals have to refurbish their facilities; maintaining their revenues and keeping referral paths whilst ensuring that their surgeons keep working are important parts of the management of the refurbishment project. Vanguard helps them to do this by providing one or more of our mobile facilities. They can be hired on a short or long term basis, and can be supplied with equipment and staff to suit individual needs.

The second reason hospitals hire a Vanguard unit is **to create additional revenue streams**. Vanguard can help health operators to do this by supplying additional capacity to them at the time when they need it. With units immediately available, we can help them to take advantage of new opportunities and test markets without them taking the risk of capital investment.

Through our agents and via direct contact with hospital decision makers, we discern whether healthcare providers fall into either of these categories.

Are the EU's poorer countries more likely to need Vanguard units?

The requirements are there, but funding can be difficult to arrange. I strongly believe that the eastern part of Europe will be a key market for us in the future, and will form a major part of the second phase of our international strategy.

Will you also introduce the services to Arab countries?

It's a coincidence that you ask, as we made our inaugural visit to Arab Health in January! We exhibited one of our mobile operating theatres there and attracted a great deal of attention from visiting dignitaries.

From our success at Medica last year and Arab Health this year, we have identified a key potential market for the sale of second hand units beyond Europe, mainly focusing on the Middle Eastern region. There was a great interest in purchasing the units exhibited at Medica and Arab Health and, in response to this clear demand we are establishing an arm of the business that will sell units second hand in these countries. We are in the process of creating a mobile unit 'showroom' in the UK, where potential buyers can inspect and explore fully operational units with the view of buying one to incorporate into the healthcare system back in their own country. We have also set up an international website to support this new endeavour.

What swallows up your time in presenting Vanguard?

As I said, Vanguard solutions are a completely new idea to many European countries, but the potential that they have to solve the challenges posed by modern healthcare has got healthcare providers across the Continent to sit up and listen. My time is spent explaining the advantages and flexibility of our solutions to these healthcare providers, helping to establish our growing network of agents, and in making sure that the Government of the target European countries also understand the benefits of a mobile surgery solution.

How would you briefly present the value of using Vanguard units?

The value in Vanguard's solutions has been proven time and again in the UK – over 120,000 procedures have been performed on our units, and many NHS Trusts now consider us to be the 'national fleet' of the National Health Service.

Vanguard's success has been because our mobile services allow healthcare providers, both private and public, to revolutionise the way that they treat patients, providing a flexible, state-of-the-art solution to any challenge that may arise. This flexibility allows healthcare providers to treat more and more patients without experiencing a loss of standards to requiring significant capital expenditure – something that few can afford in these frugal financial times.

In the best scenario, how far could Vanguard reach, globally?

Whether you are talking about healthcare in the UK, or France, or Holland, or any country in Europe, or across the world, you are talking about very similar problems and challenges. The healthcare industry needs to be able to cope with stringent budgets and an ageing population – both of which put a major strain on capacity and standards of healthcare facilities. Because of this, there is a prevalent need for healthcare providers to establish a framework that has the flexibility to cope with these challenges as they change and grow.

In essence, flexibility will be the core directive of healthcare providers across the world. Whether it is in providing long term unit rentals, or in the sale of second hand units, our mobile services offer this flexibility, and as long as our services can solve modern healthcare challenges, I feel that there is no limit to how far this company can reach.

International link: http://www.vanguardhealthcare.eu/

Serving and improving Middle East healthcare
The Dubai congress

The 2nd Hospital Build Middle East Exhibition & Congress (1-3 June. Dubai) aims to draw together the investors, commissioners, backers and managers of major healthcare building projects, as well as suppliers of services in planning, design, building, operations, management and refurbishment.

Middle East experts at ICME Healthcare, a specialised management consultancy firm acting as a consultant for the Abu Dhabi Government Health Services, have already supported authorities in the region with strategic initiatives, such as capacity and medical planning, public private partnerships, feasibility studies and the design management of new healthcare facilities. Despite the global financial crisis healthcare appears to fare better than other industries, said Holger M Sprenger, MD of ICME Healthcare, adding that the region is characterised by a high prevalence of diabetes, obesity cardiovascular diseases, and increasing cancer diseases. 'These factors, along with a high prevalence of smoking coupled with changes in health insurance regulations have lead to an increase in the demand for health services in the region.'

Healthcare demand and spending are on the rise in the GCC Countries. Healthcare spending stands at around US$16-18 billion – a figure expected to rise to around US$22-24 billion by 2018. 'No other global region faces such rapid growth in demand with the simultaneous need to realign its healthcare systems to be able to treat the disorders of affluence,' he said. 'In the GCC, estimates from various sources indicate around 75 to 132 hospitals are planned for construction with a total bed capacity of around 20,000 to 25,000 beds. As per a high-level analysis done by us, we anticipate a bed requirement of around 400,000 to 450,000 beds in the MENA Region by the year 2018.'

Details: www.hospitalbuild-me.com

conhIT 2010
Success despite volcanic ash

The volcanic ash creating widespread no-fly zones had no significant impact on the success of conhIT, Germany's largest healthcare IT event; for three days in April some 3,500 experts were there to discuss current trends in their field and visit the IT trade fair to assess new solutions and products.

One topic central to this year's event was the convergence of IT and medical technology, which, based on the experts' assessment, has already become reality.

From 21 March 2010, software has been defined as an independent medical product. This confirms a paradigm shift, the consequences of which will keep hospitals on their toes for some time: The classic division between IT and medical technology no longer exists; experts have meanwhile started to refer to MIT, i.e. Medical IT. What does this mean for previous structures and the safeguarding of medical networks? An expert session at this year's conhIT delivered the background and answers.

A two-part lecture, *Medical networks and software as a medical product, using the example of telemedical solutions*, was given by Armin Gärtner, an appointed sworn expert and responsible for telemedicine at the Sana Kliniken GmbH, and Gerhard Härdter, head of the Service Centre IT at the Klinikum Stuttgart. Both see medical networks as an essential part of success management in a hospital – hardly any decisions are made without the use of software. Classic IT with its applications and the requirements for availability and safety is becoming increasingly integrated with direct patient care. Now that software is also classified as a medical product, as long as it has a medical purpose, there are also new communication structures: Individual disciplines must work closer together, as do users and the industry. After all, the users define whether there is a medical purpose.

In terms of coordination between individual departments, Gerhard Härdter sees the potential for an impending vicious circle with the increased networking, unless all those involved in the process join together to seek solutions. Whilst some areas, e.g. radiology, are already well integrated, others, such as pathology, cause this expert some concerns. He named modern operating theatres, where information converges from imaging systems, navigation systems and microscopy, along with patient data, as a good example for highly complex networking. To ensure that this complex is faultlessly networked the creation of a new 'MIT' sector is vital. How this is achieved in practice, and what type of training will be necessary, are questions that must be answered in the very near future.


Armin Gärtner

In his lecture, Reinhard Harweg, Head of Computing at the Asklepios Klinik Weissenfels asked *How can images and data from medical equipment be made available to other systems within the hospital IT setup? Which tools support structured documentation? How can a PACS be integrated as a central image archive?* His hospital was faced with the problem of having a RIS and diagnosis system, as well as a PACS, i.e. three different data sources. The objective was to make that data quickly and easily accessible from just one source.

With the help of a solution from Visus and MEDNOVO Medical Software Solutions GmbH, the PACS system was integrated into the hospital information system (HIS) as a central image archive, and its use as an archive for some sub areas was realised. An interface to all other existing information systems was created via MediColor, a communication software that receives data and results from medical equipment and then makes these available in edited form to users/clinicians and software systems.

MediColor makes it possible to utilise radiological images (e.g. breast ultrasound) parallel with data from medical devices, such as endoscopes, ultrasound scanners and ECG equipment to facilitate a joint, interdisciplinary diagnosis.

Using DICOM, images and data can also be saved and accessed in uncompressed form. The viewer allows access to the images from different departments at all work stations, also independent of MediColor. During an exam, older image data saved in the PACS can also be accessed, displayed and assigned to the exam. This also applies to images that a patient may have brought along from his doctor in digital form. Moreover, the system serves as an instrument for structured diagnosis documentation. The consolidation of image and diagnosis and the interface to the HIS guarantee fast availability of all relevant information. MediColor simply and conveniently controls where which data is archived, made available and transferred.

Result: The PACS and the diagnosis system can access and retrieve all patient-relevant data.

Convergence of IT and med-tech via IHE backbone integration

Dr Kurt Becker, Strategic CIO at the Salzlandkliniken GmbH, on the board of promedtheus AG and head of Health Technology Management at the Apollon Academy of Healthcare Management, was also faced with a particular challenge. Following a merger, the newly founded Salzlandkliniken comprised three limited liability companies, five hospitals, three IT departments, 90 servers and 1,200 clients.

The objective of the new IT infrastructure was to address comprehensive business processes clearly and to install effective fault management. A not to be underestimated prerequisite for the successful operation of this management holding company is the availability of decision-relevant information regardless of location, as well as the networking of the three district hospitals under economic, administrative and clinical considerations to achieve a comprehensive potential for synergy.

In this context, the convergence of medical technology and IT is significant in order to meet the challenges of healthcare technology management in the future – from an organisational as well as economic aspect. One of the projects at the Salzlandkliniken, identified during this process, deals with the design and testing of a sustainable telematics platform for the holding company via IHE backbone integration, based on IHE standards. Dr Becker's bottom line is: Making use of standards. It is vital that the users clearly state what they expect from the network when a contract is entered into, to avoid unpleasant surprises during the implementation.

Report: Meike Lerner

iPhones and healthcare

An application to help patients calculate and log radiation doses and another to estimate emergency waiting times

January saw the release of a German language version of *Radiation Passport*, an iPhone application that enables patients to calculate estimated radiation exposure from diagnostic imaging procedures and keep a personal record of their examinations. Radiation Passport costs US$3.99; by the end of 2009 over 1,000 English language versions were sold.

The brainchild of Dr Mark Baerlocher (when a radiology resident at the University of Toronto) the application has radiation dose exposure calculations for about 140 of the most common radiological procedures for the adult body and gender. Dr Baerlocher used radiation dose statistics from peer-review journals as a basis for his calculations.

Radiation dose estimates for children are not yet available. The software developers are aware of the Image Gently campaign to child-sise radiation dose, especially that of CT and fluoroscopy, and recognise that, when they can offer this, the application would become useful for parents.

In addition to providing a record of imaging exams, the application provides an easy way for doctors to evaluate the risk-benefit equation of a diagnostic imaging procedure they may be thinking of ordering.

Hospital A&E waiting times

Residents of central Connecticut can download a free iPhone application that tells how long the waiting times are in the accident and emergency (A&E) departments in five local hospitals. In addition to showing the delay before patients without life-threatening medical conditions can be seen, it provides easy to understand directions to the hospitals.

Emergency teams at the Hospital of Central Connecticut and Middlesex Hospitals are pleased with the application because it gives patients an idea of what to expect in terms of waiting for treatment before they arrive. It is also seen as a useful tool to provide better emergency patient distribution among the hospitals. Importantly, patients who do need urgent treatment may also be in a better situation if they know which hospitals to avoid. In an interview in February with the *Hartford Courant* newspaper, the head of emergency medicine at the Hospital of Central Connecticut said that this was also particularly useful for physicians if an emergency unit was backed up with multiple trauma cases or patients who had heart attacks.

The system was designed for the 75% of patients who arrive at an A&E unit of their own accord, but without life-threatening injuries or symptoms. So far, Middlesex Hospital's site alone has been viewed more than 23,000 times since first offered in September 2009. The information also can be accessed via www.middlesexexamtime.com.

Report: Dot M. McSherry, i.t. Communications

Advisa: A safe pacemaker for MRI scans

NEW

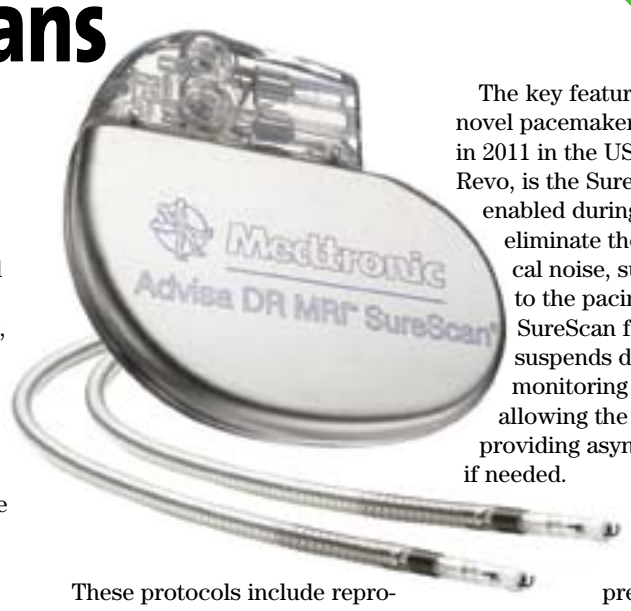
'There are few reasons to deny a patient an MRI scan, and nearly all of them are having a pacemaker,' said Pierre Bordachar MD at the Centre Hopitalière Universitaire (CHU), Bordeaux, France. Yet one-in-five pacemaker patients will require an MRI scan within the first year of receiving a pacemaker, while more than half of all pacemaker patients will need such a scan at some later point in life after receiving the device, according to Jean-Nicolas Dacher MD at the celebrated cardiac centre in the CHU in Rouen.

Around two million Europeans have implanted pacemakers. Risks for patients with an implantable cardioverter-defibrillator (ICD) are slightly lower for MRI scans.

The MRI scan is 'unmatched, irreplaceable and the indispensable reference for the diagnosis of cancers, neurological disorders, and increasingly, cardiac conditions,' Dr Dacher said, adding that computed tomography (CT) scans or ultrasound are often 'not a suitable alternative to MRI for many conditions.'

Exceptions are made, the two experts acknowledged during a presentation at this year's annual congress of the French Cardiology Society, citing an especially strong pressure by neurologists for the MRI scans.

Dr Bordachar admits that, despite the discouragement in practice guidelines, MRI scans are conducted on as many as 12 patients per year at CHU-Bordeaux under careful protocols.



These protocols include reprogramming the MRI scanner, careful patient monitoring by a cardiologist during the scan and a thorough follow-up over several months because the three magnetic fields of the MRI can provoke diverse effects including arrhythmia, device damage, interference with the pacing function and an electronic reset of the device.

The immediate concern is the super-heating of lead wires on the device, and the follow up is required because force and torque exerted by the whipsaw effects of magnetic cross currents can shake or dislodge an implanted device.

Dr Bordachar said even after following careful and time-consuming protocols, 'there are always going to be unpredictable complications.'

The only study of deaths from MRI have been by Werner Irnich MD, at the University Hospital Giessen, Germany, who compiled reports from 30 German medical centres and found that, from 1992 through 2001, six deaths resulted when pacemaker patients underwent an MRI scan.

In this clinical context, the announcement at the French congress that the innovative *Advisa* pacemaker from Medtronic will be introduced in 2010 in Europe was welcomed by cardiologists.

The world's first MRI-compatible pacemaker, the Advisa is re-engineered with reduced ferrous components to minimise the level of energy transmitted through the lead wire to the device connection point, a potential source for overheating under magnetic forces.

The key feature for Medtronic's novel pacemaker, to be introduced in 2011 in the USA under the name Revo, is the SureScan programming enabled during an MRI scan to eliminate the impact of electrical noise, such as disruptions to the pacing therapy. The SureScan feature temporarily suspends data collection and monitoring functions while allowing the device to continue providing asynchronous pacing, if needed.

Frédéric Anselme MD, from CHU-Rouen presented the preliminary findings from a Medtronic-sponsored EnRhythm MRI SureScan clinical trial to assess safety and effectiveness of the new device with 470 patients from 53 centres in Europe and the USA.

To date, 211 patients with the new pacemaker underwent head and lumbar scans with 1.5 tesla scanner while the remaining patients served as a control group.

'The big news is that patients have been 100% complication-free,' Dr Anselme reported, saying there were incidents of ventricular arrhythmias or asystole, no differences in pacing and sensing, nor evidence of either clinical or device complications.

'This data is promising as we have observed no lead-performance issues or unexpected MRI effects in this patient group to date,' said Professor Torsten Sommer, chief of the cardiovascular section of the radiology department, University of Bonn, Germany, and European lead radiology investigator for the clinical trial. 'MRI is unmatched and irreplaceable in the diagnosis of cancer and neurological disorders. As the necessity for MRI grows, it is critical to introduce a solution that allows pacemaker patients safe access to MRI.'

The Advisa pacemaker will be available for implantation in patients as early as June this year, according to Christèle Pelade, Manager for Implanted Diagnostic & Monitoring Devices with Medtronic France.

Report: John Brosky

Siemens Definition Flash CT

Stroke

Kneale Metcalf

Changing radiology assistants' role speeds diagnoses

A key development at the Norfolk and Norwich University Hospital (NNUH), east of England, has seen a change in the role of radiology assistants: They now help to prepare patients for radiology scans and look after them – work previously undertaken by radiographers. The change now allows radiographers more time to concentrate on scanning patients, resulting in faster scanning with quicker diagnosis and the commencement of therapy for stroke patients within the crucial three-hour time window.

The simple changes to how acute stroke services have been redesigned and improved to achieve faster access to CT brain scans at NNUH have been highlighted by the Department of Health as an example of best practice in brain scanning care for stroke patients in the UK.

The initiative was coordinated by radiographer Chris West, lead NNUH radiographer for CT scanning, and consultant stroke physician Dr Kneale Metcalf, who said that the stroke services were developed and redesigned around hyper-acute care, which has permitted earlier CT scanning and thrombolysis for ischaemic stroke patients. The unit is now obtaining twice as many scans within the first 24 hours, up from 40% to 80%. 'In patients needing very urgent scans, within the first half an hour of coming through the door, we have put in place processes to do that and we are doing it robustly, 24 hours a day. Interacting with people on the ground within the CT scanning room allows us to arrange urgent scans; consequently, patient care is definitely better.'

The Radiology and Improving Stroke Services video forms part of the NHS Quality, Innovation, Productivity and Prevention (QIPP) programme and is being used to help other NHS hospitals understand more about improving the quality and productivity of such services.

NNUH serves a rural area of the UK, where fast access to CT scans is essential for patients with stroke caused by a blood clot. This allows stroke consultants to diagnose the type of stroke and authorise the administration of thrombolytic drugs within the critical period, significantly improving a patient's chance of a better recovery, or beginning other treatments.

Chris West pointed out that radiology now has a central role in the treatment of stroke patients. ''It sits centrally to the delivery of those services right from the point the paramedic identifies the patient and calls that case into hospital,' he said. 'A stroke assessment nurse is waiting to assess the patient and then refer them straight to us. Previously this would have taken hours to achieve. Now, once the decision to image has been made, we can image them within 10 minutes. As allied health professionals we are in a really good position to influence the way patients are treated because we are right at the centre of a patient's care pathway.

'We know what works well, and what doesn't,' he added. 'We can identify where the constraints are and then unlock them to deliver a better service.'

NNUH first introduced a stroke thrombolysis service in December 2008; from June 2009 this became a 24/7 service.

The hospital is also currently investing in four new CT scanners - including a Siemens *Definition Flash* - to provide a cutting-edge diagnostic service for patients.

Report: Mark Nicholls

The 91st German Radiology Congress

Walter Gross-Fengels

12-15 May 2010

The congress organiser Deutsche Röntgengesellschaft again expects about 7,000 participants at the largest German language congress on medical imaging. The programme, organised by Hamburg radiologist Professor Walter Gross-Fengels, will focus on the potential of radiology in diagnoses and therapies for vascular diseases. 'Illnesses affecting blood vessels are one of the great challenges of medicine in the 21st century,' the professor pointed out, adding: 'The incidence of illnesses such as stroke or peripheral occlusive arterial disease is increasing dramatically. We expect treatment to double in the next 20 years.'

The role of radiology is not restricted to diagnosis: 'Interventional, i.e. minimally invasive methods, enable us to open occluded vessels using real-time image control, or to treat aneurysms with stents or coils,' he added.

Along with the focus on vascular diseases, medical imaging experts will concentrate on the entire spectrum of radiology, e.g. cardiac and thorax diagnostics, molecular imaging, new CT and MRI procedures, etc.

With some 425 scholarly papers, 450 continuing education events, plus 80 poster contributions, the congress is an important further and continuing education forum for radiologists and others in this field. Additionally, over 120 exhibitors will present imaging innovations and new interventional treatments.

Congress partners: Deutsche Gesellschaft für Angiologie (DGA) and Deutsche Gesellschaft für Gefäßchirurgie und Gefässmedisin (DGG).

ESR: 'Teleradiology is a medical act'

Campaigners aim to restore a medical view of telemedicine

After years of promise, with no progress, e-health is gaining ground in Europe, where governments see the potential for cost reductions and productivity gains in telemedicine, regarding it as a magic formula to fix overstretched healthcare systems, and the European Commission (EC) is aggressively pushing tele-anything in healthcare to drive what it sees as a potential for job creation and economic growth.

Among the cheering for the growth of e-health, the European Society of Radiology (ESR) recently raised its voice to reassert the role of the clinician in the brave new world of click-and-send medicine. 'Teleradiology is a reality; it is here to stay and it is going to expand,' ESR president Christian Herold MD told *European Hospital* correspondent *John Brosky*. 'Yet this action should not be seen as the provision of a healthcare service, but as the delivery of medicine through the use of ICT. Teleradiology was first embraced for economic reasons, and the ESR has quite a different view, seeing it as a medical act that needs to have quality and care standards associated with it.'

Luis Donoso

Technology for e-health is ready and the business case is clear. But, without guidelines, says the ESR, sending images puts patient care at risk

In a campaign aimed at restoring a medical view of telemedicine, over the past year ESR has issued position papers on telemedicine and participated in policy discussion in Brussels with the EC.

Luis Donoso MD is a member of the Executive Council of the ESR and the point man in the society's campaign on e-health. Also the head of radiology services at the Hospital Clinic of Barcelona, Dr Donoso said the ESR distinguishes carefully between telemonitoring of patients at a distance on the one hand and teleradiology on the other. 'Teleradiology,' he said, 'is not equivalent to tele-reporting radiological images, but it is a medical act in its own right.'

There are key differences between these two telemedical practices, Dr Donoso underlined, saying teleradiology is an expansion of a well-established medical practice with the secure transmission on a telematic network of acquired images and their remote interpretation. 'We would like to emphasise that the medical act is not only a report but includes evaluation of examination requests, selection of the most appropriate imaging strategy, optimisation of the examination performance, customisation of the imaging protocol, and integration of imaging and medical information into the report.'

Published studies proposing that telemedicine activity increases efficiency and economics refer mainly to telemonitoring projects, according to the society. 'Cost savings for teleradiology cannot come at the expense of quality care and patient safety,' Dr Donoso said.

Drawing a hard line in the sand on teleradiology, he delivered ESR's core position: 'The quality of care to the patients is improved only when teleradiology makes available a remote radiologist in cases when there is not a radiologist available at the site or a local radiologist is easily available. If a doctor based in Belgium provides a report in the UK, he or she must have the proper accreditation to do so in the UK,' he explained. 'There must be an agreement between the local radiologist and the teleradiologist, and the regulation of teleradiology should be the responsibility of the member state where the patient undergoes the imaging procedure.'

This core position of anchoring accountability to the site of image origin is central to ESR's insistence on a legal framework and to draw boundaries around the growing trend toward 'ghosting radiology', or outsourcing to distant centres for second opinions and reading of routine exams. 'The problems with ghosting is not economic but ethical, as illustrated by the case of one company that signed off on hundreds of radiology exams that the contracting firm had never reviewed,' he pointed out.

Christian Herold

According to Dr Herold, the ESR is not trying to insert a gatekeeper system into the radiology chain but to reassert a fundamental need for proper guidelines, an appreciation for quality evaluations and a concern for patient rights.

Radiation exposure from cardiac CT

Setting the record straight

By Joseph U. Schoepf MD FAHA, Professor of Radiology and Medicine and Director of Cardiovascular Imaging at the Medical University of South Carolina, Charleston, USA

Recent reports on cancer risk from radiation at CT have sparked new concern and discussion in the medical community as well as in the general public. It has been suggested that CT may be responsible for up to 2% of all cancers. At coronary CT angiography using retrospective ECG-gating the effective dose to a 70 kg adult is estimated at ~ 12-20 mSv with current equipment. These effective doses may be compared to an average effective dose from natural background radiation of ~ 3 mSv per year, as well as with current US regulatory dose limits of 50 mSv per year for radiation workers (e.g., radiologists and medical physicists), 1 mSv per year for members of the public, and 5 mSv to the foetus of a radiation worker.

More importantly, patient effective dose from CT should be compared with other diagnostic examinations that utilise ionising radiations, including cardiac catheterisation and those involving the administration of radiopharmaceuticals. Representative effective doses for cardiac catheterisations are 5 to 10 mSv, and average patient doses in nuclear medicine examinations are ~ 15 mSv for ^{18}F cardiac PET, ~ 20 mSv for a rest/stress ^{99}mTc labelled Sestamibi procedure, and ~ 40 mSv for a ^{201}Tl scan.

Some of these tests are quite liberally prescribed in daily practice; however, the radiation associated with them has largely escaped public attention.

It has been suggested that radiation risks in cardiac CT can exceed 1%, where this value was computed for a 20-year-old female patient receiving ~ 29 mSv. However, pursuant to the nature of atherosclerotic disease, the typical patient population who undergoes coronary CT angiography has a median age of ~ 60 years. Increasing a female patient's age from 20 to 60 years would reduce the breast cancer radiation risk by over an order of magnitude. A uniform whole body dose of 20 mGy to a 60-year-old, which corresponds to an effective dose of 20 mSv, has an average radiation risk of induced cancer of ~ 0.1%. For 60-year-old women the risk is about 40% higher than that of men at that age. The average cancer risk for an effective dose of ~ 20 mSv may be compared with US population cancer incidence (42%) and mortality (22%) in 2007 as provided by the American Cancer Society.

It is important to re-emphasise that current radiation risk estimates are based on extrapolation of data derived from atomic bomb survivors and other sources, and have never been directly observed for any population exposed to CT radiation. Accordingly, it is well recognised, by all leading authorities on this topic (i.e. BEIR, UNSCEAR and ICRP), that there are very large uncertainties associated with any risks that are generated at doses of ~ 20 mSv.

Medical practice deals with individual patients where it is important to bear in mind that it is the same individual who receives the benefit as well as bearing (any) radiation risk. Under these circumstances, the key question that needs to be posed is whether our usage of ionising radiation associated with diagnostic examinations is appropriate. An appropriate answer to this question should make use of the latest principles of radiation protection practice - justification and optimisation. Justification requires an examination to be performed only when indicated, which requires that the patient benefit to exceed (any) radiation risk. For any indicated examination, optimisation requires that no more radiation should be used than is needed to obtain the diagnostic information.

In clinical practice, examinations should keep patient doses As Low As Reasonably Achievable (ALARA) and eliminate unnecessary radiation. Focusing on these two radiation protection principles maximises the benefit to our patients and minimises radiation risks. Ignoring the benefit side of the risk/benefit equation, as happens when only the magnitude of the radiation dose (and corresponding risk) is addressed and disseminated in the general public through the lay press, does a disservice to our patients.

Real harm could be inflicted on any individual patient who was deterred from having an indicated examination that provides valuable diagnostic information affecting important patient management decisions. If used responsibly and appropriately in a patient who would otherwise undergo cardiac catheterisation with the small, but very real risk of severe complications, the benefit from the non-invasive nature of CT substantially outweighs the theoretical cancer risk from ionising radiation. Accordingly, the pendulum may have swung too far in our current discussion on radiation risk and increased efforts at educating patients and referring physicians on the risk/benefit ratio of non-invasive imaging are in order.

On the other hand, the individual assessment of the patient's risk/benefit ratio and the commitment to keep radiation exposure at a minimum is incumbent on us as the stewards of radiation at medical imaging. Accordingly, all means to lower radiation dose at cardiac CT are welcome and should

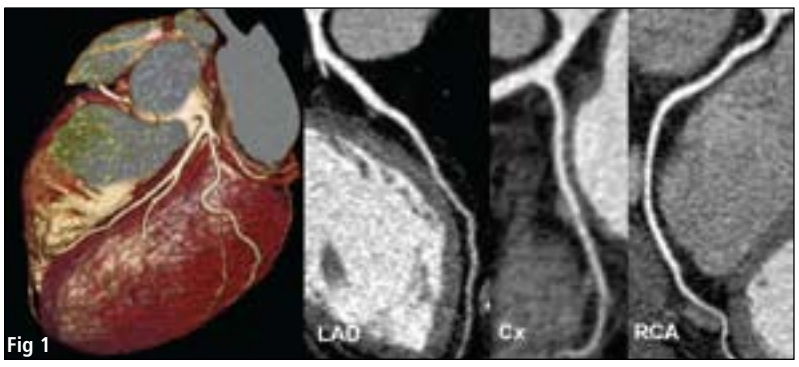


Fig. 1: Prospectively ECG-triggered coronary CT angiography study in a 49-year-old woman with atypical chest pain and equivocal stress test with an effective radiation dose equivalent of 2.4 mSv, obtained on a 64-slice dual-source CT scanner (Somatom Definition, Siemens). 3-D volume rendering and curved multiplanar reformations of the left anterior descending (LAD), circumflex (Cx), and right (RCA) coronary arteries show normal vessels enabling confident, non-invasive exclusion of coronary artery stenosis at radiation dose levels that are lower than the average annual background radiation from natural sources.

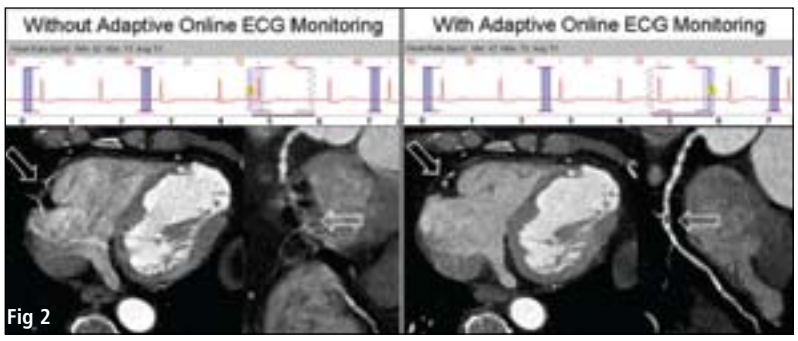
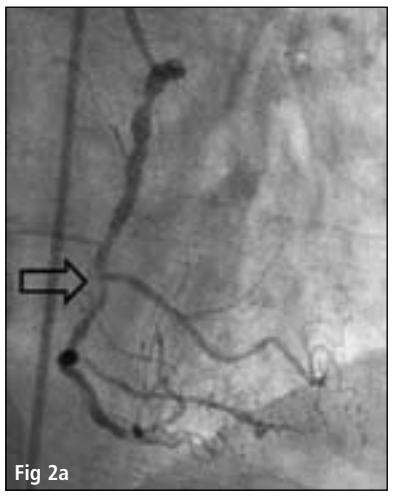


Fig. 2: Prospectively ECG-triggered cCTA study in a 57-year-old man with suspected coronary artery disease obtained on a 128-slice single-source CT scanner (Definition AS+, Siemens). Adaptive online ECG-monitoring recognises the occurrence of a premature beat during scan acquisition, pauses the scan, and resumes scanning once the normal heart rate returns. Study shows significant stenosis in the mid-right coronary artery caused by predominantly non-calcified plaque confirmed by invasive catheter angiography (2a).



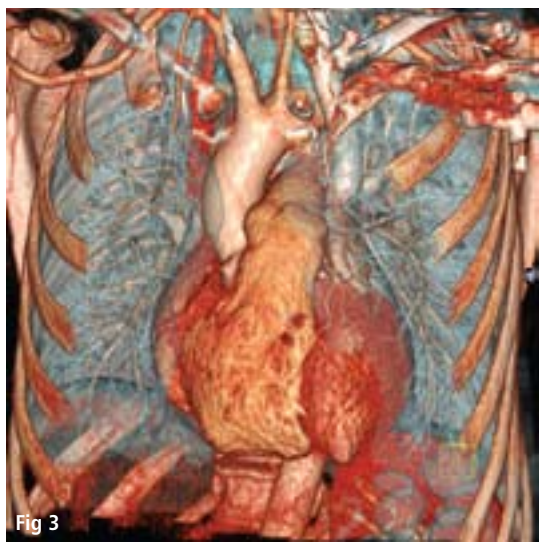
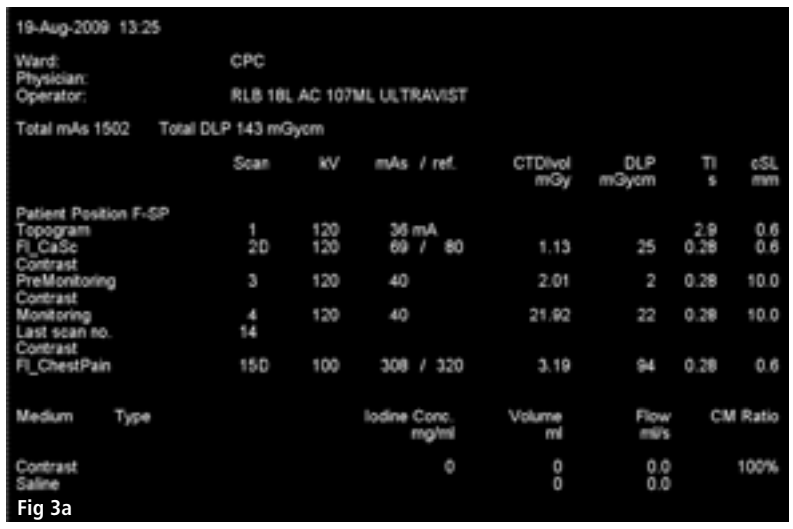


Fig. 3: 'Triple-Rule-Out' CT study of the entire chest in a 51-year-old woman with acute chest pain obtained in highpitch, prospectively ECG-triggered ('Flash') mode within less than a second scan time on a 128-slice dual-source CT scanner (Definition Flash, Siemens). The study enables reliable exclusion of thoracic pathology (A) with a Dose Length Product (DLP) of 94 mGy cm (3a), which corresponds to less than 2 mSv in effective radiation exposure.



Landwind: High performance systems and yet affordable

KeenRay DR200Mate

The Mirror2*plus*, a top of the range, colour Doppler diagnostic system was demonstrated by Landwind Medical during the 63rd CMEF exhibition held this April in Shenzhen, China.

'According to the practical clinical demand, Mirror2*plus* is substantially upgraded on other devices of the kind, as a general purpose colour Doppler unit,' the firm points out. 'It is a completely shared service system that supports a variety of applications, providing a broad range of solutions in the areas of general imaging, OB/GYN, and cardiology. Adapting MPSoCs computing architecture, which breaks the limitation of previous platform, the system becomes faster and more stable, and especially image quality is significantly improved. All these powerful features bring the full range of medical solutions to enhance diagnostic confidence.'

The KeenRay DR200Mate

Landwind also describes its DR200Mate mobile digital radiography system as being affordable, despite the high performance. 'DR200Mate provides premium image quality based on its state-of-the-art digital technology, such as High-frequency Stable Operating, Intelligent Overload Protection, Precise Exposure Alarm, and FPD technologies. It also has powerful functions, such as optimised clinical workflow, outstanding operability, efficient APR function, fast bedside imaging, automatic image processing and fully DICOM compatible.'

Mirror2*plus*

Further details:
www.landwindmedical.com
Phone contact: +86-755-83933788
E-mail: sales@landwindmedical.com

be utilised. There are time-honoured approaches such as ECG-dependent tube current modulation and use of lower tube voltage in younger, slimmer individuals, which should be used whenever possible.

However, the most profound radiation dose savings have been reported with the recently rediscovered technique of prospectively ECG-triggered coronary CT angiography. This technique comprises sequential acquisition of transverse sections with application of radiation only during a predetermined interval during the cardiac cycle (ordinarily diastole) and had been the default method for ECG-synchronisation of scan acquisition with electron-beam CT. Compared with the constant application of radiation during slow pitch spiral acquisition inherent to retrospective ECG-gating – the most widely used method for ECG-synchronisation with MDCT – prospective ECG-triggering enables performing coronary CT angiography at a fraction of the effective radiation dose equivalent (i.e. 1-4 mSv).

The main limitations of prospective ECG-triggering have been the inability to evaluate cardiac function and, more importantly, to retrospectively (i.e. after an acquisition) change the co-registration of image data with more suitable phases of the cardiac cycle, which is one of the hallmarks of retrospective ECG-gating. Also, patients with arrhythmia have traditionally not been eligible for prospectively ECG-triggered examinations because arrhythmia naturally precludes reliable co-registration of image data with the desired cardiac phase.

There are various technical attempts at improving the robustness of this acquisition technique vis-à-vis faster and more irregular heart rates. These include prolonging the acquisition interval during the RR-cycle to provide more flexibility in choosing the most suitable phase of image reconstruction, or adaptive online monitoring of the ECG for the occurrence of extra-systoles in order to ensure image acquisition only during the desired cardiac phase.

As always, scanner technology is rapidly evolving and the heightened awareness regarding radiation exposure already has accelerated the development of instruments and acquisition strategies that are capable of imaging the heart at much lower radiation dose than current CT systems. The newest CT scanner generation, for instance, enables routinely imaging the heart within a single diastolic phase (i.e. ≈ 250 msec) and a radiation exposure of less than 1 mSv. The embrace of this and future low-radiation dose technologies along with careful individual consideration of the risk/benefit ratio and increased efforts at patient and physician education likely represent the best strategies for ameliorating prevailing radiation worries associated with cardiac CT.

Cardiac MRI at 7-Tesla

During conventional electro-cardiology, interference from electromagnetic fields (EMFs) tends to diminish image quality due to cardiac motion. To exclude that interference an acoustic cardiac triggering (ACT) approach, also called MR stethoscope, has been developed to trigger cardiac MRI at 7-Tesla. Developed by researchers at the Experimental and Clinical Research Centre (ECRC) in Berlin-Buch, Germany, the new technology will soon enable cardiac characterisation at tissue-level and promises to bring new insights into cardiac function and myocardial (patho-)physiology.

Due to the heart's location in the middle of the thorax, surrounded by inhomogeneous tissue structures, and its on-going motion, up to now precise cardiac Magnetic Resonance Imaging (CMRI) has presented a technical challenge for researchers. However, some apparently invincible problems in cardiac imaging with 7-Tesla MRI seem to be almost solved. As reported in our Online-Edition (www.european-hospital.com 11/12/09) Professor Mark E Ladd and researchers at the Erwin-Hahn Institute for Magnetic Resonance Imaging, Essen, have developed applicable radio frequency (HF) antennae and coils that allow complete penetration of the deep-lying heart with HF, which avoids HF-inhomogeneities. This is seen as an important premise to receive complete and precise images of the heart.

ECG triggering, one of the remaining most difficult challenges, has now been tackled by ECRC researchers in a cooperation run by the Max Delbrück Centre for Molecular Medicine and the Charité.

ECG triggering did not work reliably with the 7-T scanner and, to some extent with the 3-T, which led to an increase of artefacts. Consequently, the corrupted images were not suitable for diagnoses. 'To avoid artefacts due to cardiac motion and flow constraints, cardiac imaging requires high-speed, efficiency and precise synchronisation of data acquisition with the cardiac cycle,' explained **Professor Thoralf Niendorf**, physicist and head of the Berlin Ultrahigh Field Facility (B.U.F.F.) at ECRC. 'Up to now synchronisation was achieved by using ECG to trigger the MRI. Indeed, being an electrical measurement, ECG brings along the risks of interference with the MR-system, inter alia by electromagnetic and magneto-hydrodynamic effects. This interference increases with increasing magnetic field strength. The stronger the magnetic field, the


Thoralf Niendorf

higher the probability of artefacts in the ECG-trace; in other words instead of a precise ECG-recording, we receive a knitting pattern. Consequently, there will be an erroneous triggering and therefore a blurred image.'

Thus the research team developed an alternative method to trigger the MRI-scanner – Acoustic Cardiac Triggering (ACT). 'We were – in another, relatively new field of MR-application – phonetics – discussing how to scan the larynx and movement of vocal folds,' Prof. Niendorf continued. 'I came across the idea of using acoustic signals to detect motion.' The researchers transferred this concept to cardiac MRI and began a collaboration with cardiologist **Professor Jeanette Schulz-Menger**, at the HELIOS Hospital, in Berlin-Buch, to examine the applicability and clinical efficacy of MR-Stethoscopes to cardiac MR at 7-T.


Jeanette Schulz-Menger

The MR-Stethoscope consists of four elements: an acoustic sensor, acoustic waveguide, signal processor and a coupler linked to the MRI system. Like the chest piece of a common stethoscope, when located on a patient's chest the acoustic sensor registers cardiac sounds. In a specially developed procedure the acoustic signals are transformed into a trigger signal, mimicking the basic waveform of an ECG. The MR-Stethoscope is compatible with common MRI-scanners and does not need any hard- or software changes.

A first clinical study (published: *European Radiology* online. 12/09) showed proof of concept by comparing left ventricular function assessment using ECG and ACT triggered MR-Imaging at 1.5-T and 3-T. Meanwhile, Prof. Niendorf's and Prof. Schulz-Menger's team studied the feasibility of acoustic triggering at 7-T, using a whole-body human MR scanner with an 8-channel transmit-system at the Berlin Ultrahigh Field Facility (B.U.F.F.). They received exciting results: 'We achieved reliable and accurate CINE images of the beating heart with sharp contours. We can ensure, at 7-T, the standard we know from MR-Imaging at lower magnet fields. Testing the different methods the failure rate with ECG-triggering at 1.5-T came to a negligible 5% but, at 7.0-T, the rate was 40%. However, the MR-Stethoscope eliminated those failure rates,' said Prof. Niendorf.

Prof. Schulz-Menger added: 'With appropriate radio frequency coils and triggering devices in place we hope to achieve a kind of *in vivo* microscopy. In other words, we will examine and characterise the myocardial tissue with, up to now, unmatched precision. We can already achieve an in-plane spatial resolution of 1mm^2, together with slices as thin as 2.5 mm with the 7-T scanner. You can even see subtle anatomical features, such as trabeculae and the right ventricle, in great detail, all in a non-invasive way, excluding harmful radiation exposure.'

Cardiac MRI at 7-T is expected to advance the ability to differentiate myocardial diseases, e.g. inflammation, or fibrosis, and to monitor disease processes. Considering the challenges and opportunities, Prof. Niendorf pointed out: 'By reminding us that previous limits on resolution, speed, and contrast are not fundamental, our efforts and results encourage us to connect basic research to clinical applications – and vice versa. Whilst today's (ultra)high Field CMR techniques remain in a state of creative flux, productive engagement in this area continues to lead us into the heart of the matter.'

Worldwide, 7-T scanners are still confined to research; they are not licensed for clinical routine. Besides – these scanners, with the strength of about 1,500,000 times that of the earth's magnetic field (between 30 to 60 micro-tesla) are currently too expensive for clinical use: the 7-T scanner at B.U.F.F., for example, costs around €8 million. Despite these constraints, Prof. Niendorf and Prof. Schulz-Menger are convinced that their research will bring important knowledge of heart disease risks factors and disease processes – all of which could help to develop new diagnostic strategies and therapies.

Report: Bettina Döbereiner

MRI of the lung

Ready for broad clinical application


Hans-Ulrich Kauczor

The lungs had to be regarded as the black hole for MRI for a long time. However, since the introduction of substantial improvements in hardware and scanner technology, there is certainly light at the end of the tunnel.

MRI offers two main advantages for the diagnostic pathways for pulmonary diseases applied today.

First, MRI provides comprehensive structural and functional assessment of the lungs in a single thirty-minute-examination, and has the potential to yield quantitative measurements. Using a standard protocol, pathologies of the lung parenchyma can be easily characterised by T1-weighted, T2-weighted, inversion-recovery, fat suppression, contrast enhancement and diffusion-weighted imaging. Functional assessment might encompass MR angiography of the pulmonary arteries, perfusion of lung and/or tumours, blood flow, (right) heart function, and ventilation.

MRI might even simplify the current diagnostic work-up for patients presenting with suspected pulmonary disease, because a lot of the results traditionally obtained from pulmonary function test, lab test, chest X-ray, echocardiography, CT, scintigraphy might become available from a single imaging technique, namely MRI.

Second is the lack of ionising radiation. Certainly, no dose is better than high dose, but no dose is also better than low dose. This holds especially true for children, women, and repeated follow-up examinations for disease surveillance or therapy monitoring.

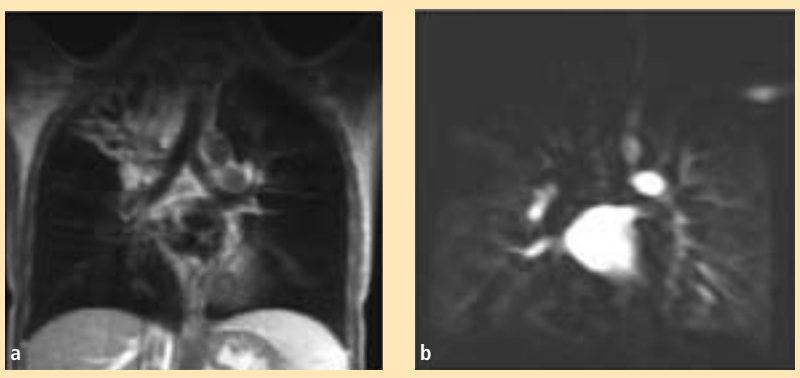


Fig.1: Cystic fibrosis lung disease. a) Bronchiectatic destruction in the right upper lobe, bronchiectasis in all other lobes. b) Perfusion defect in the right upper lobe matching bronchiectatic destruction.

The clinical indications for MRI of the lung are straightforward. All cross-sectional imaging in children with pulmonary disease or abnormalities should be MRI. The best example is cystic fibrosis. Patients suffering from this chronic inflammatory disease need regular, annual imaging for disease surveillance and/or therapy monitoring. Since life expectancy soon will rise above 40 years, repeated CT scans would simply lead to an unacceptable amount of radiation accumulated over the years.

Indications in adults include, but are not limited to, pulmonary hypertension; T-staging of lung cancer or whole body MRI for M-staging, as well as chronic obstructive airway disease such as COPD and asthma.

The latter is an extremely important application, because the incidence of COPD and asthma is increasing all over the world. It is a benign disease, which has a great social and economic impact and might benefit substantially from more in-depth understanding and imaging. This has led the German Federal Ministry of Education and Research (BMBF) to launch a network of scientific and medical competence in 2008. This competence Asthma and COPD network, called Asconet, consists of two major projects. One is Asthma-MRI. This focuses on establishing MRI as an imaging method for the diagnosis and monitoring of COPD and asthma without radiation exposure. 'The close collaboration of specialised scientists and medical doctors from three Universities (Heidelberg, Mainz, Würzburg) and the Fraunhofer Institute Mevis in Bremen gives us the chance to know more about the coherences of COPD and its related diseases,' said Professor Hans-Ulrich Kauczor MD (Heidelberg University), speaking for Asthma-MRI. 'We accepted the challenge to develop new diagnostic methods to advance therapy and prevention of chronic pulmonary diseases like asthma and COPD.'

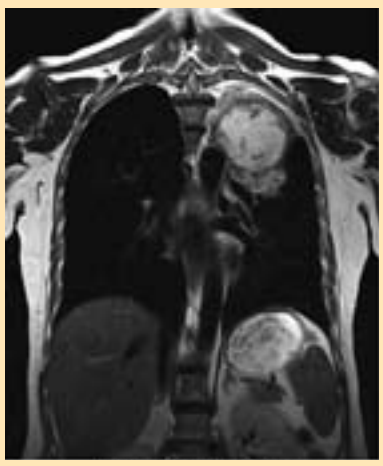


Fig.2: Cystic fibrosis lung disease: Small cell lung cancer in the left upper lobe

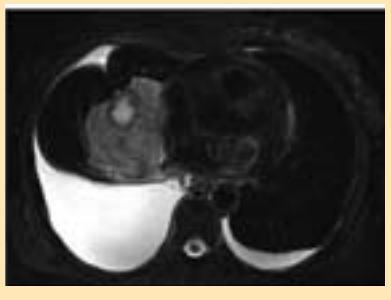


Fig.3: Non-small cell lung cancer in the right lung with concomitant pleural effusion


Fig.4: Bronchopneumonia in the left lower lobe

Two years down the line, MRI for COPD should be ready to be rolled out for broader application throughout Germany, starting within the second major project of the competence network COSYCONET. The core of COSYCONET is a cohort of 3,000 registered patients. 'To determine the frequency of co-morbidities, we are going to observe and examine regularly 3,000 patients, all suffering COPD of different severities', explained Professor Claus Vogelmeier (University of Marburg), who is chairman of Asconet. MRI will then be used to phenotype COPD lung disease and assess systemic, inflammatory co-morbidities.

However, the MRI protocol developed by Asthma-MRI is not only set up for use within the COSYCONET-Study but should also be established as a diagnostic clinical tool accompanied by recommendations for appraisal based on a software platform with dedicated tools for the individual parts of the protocol.

Hans-Ulrich Kauczor

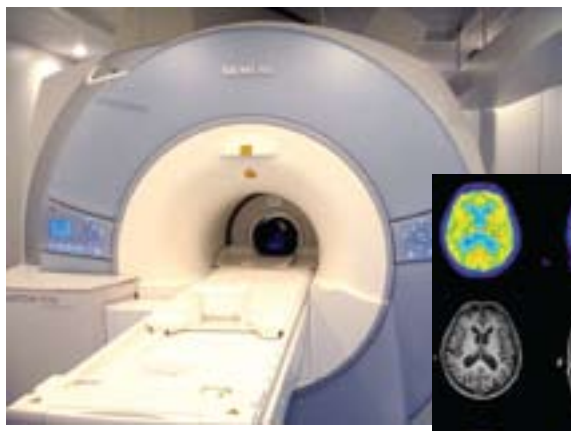

Axel Wismüller

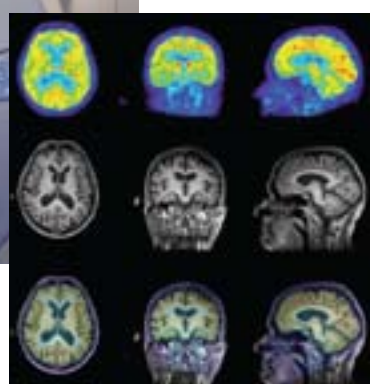

Bernd Jähne

Image processing

Highlighting probabilities and possibilities

Experts who gathered for the *Image Processing for Medicine 2010* workshop in Aachen, Germany, in March, were welcomed by Professor Thomas M Deserno, head of the Medical Informatics Department at RWTH Aachen University and organiser of what turned out to be an 'outstanding' scientific programme. *Guido Gebhardt* reports


3-T MR BrainPET scanner



The physician understands the complex physical and chemical processes in the human body; the physicist develops methods to measure and visualise them. Axel Wismüller, of the Rochester Centre for Brain Imaging, University of Rochester, USA, is both physician and physicist.

He and a team of researchers aim to develop novel intuitively intelligible computational visualisation methods for the exploratory analysis of high-dimensional data from biomedical imaging. 'Specifically, the focus of our research is on developing robust and adaptive systems for computer-aided analysis and visualisation that combine principles and computational strategies inspired by biology with machine learning and image processing/computer vision approaches from electrical engineering and computer science.'

The Centre has a whole body 3-Tesla Siemens MRI scanner and several high-field magnets, and the researchers work at two complementary levels: mathematical algorithms for computational image analysis, and pattern recognition in clinical real-world applications.

Application areas range from fMRI for human brain mapping, MRI mammography for breast cancer diagnosis, image segmentation in multiple sclerosis and Alzheimer's dementia to multi-modality fusion, biomedical time-series analysis, and quantitative bio-imaging.

When discussing the practical application of segmentation in Aachen, he observed: 'In medical informatics one is constantly moving between technical feasibility, clinical relevance and practical implementation of new methods.'

One innovation in medical imaging is computer-supported radiology, which automatically segments pathological structures, i.e. vessel and organ delineation are automatically recognised. Although a method not widely used yet, this has great potential. Registration, image sequence analysis and classification are the essential elements of automated segmentation.

Computer-supported image analysis is concerned with multidimensional data. The three spatial coordinates are complemented by data about tissue properties. Automated segmentation methods are considered very promising, particularly for diagnosis and therapy of Alzheimer's and multiple sclerosis. However, Prof. Wismüller's team wants to use existing knowledge to monitor the progress and therapy success of many other illnesses in order to apply the segmentation process economically.

The segmentation of the vocal tract, one of his study areas, is a highly interesting application. Researchers synthesise sounds mechanically to support speech training in logopedics. The vocal tract of practised speakers is recorded with MR sequences while phonemes are articulated. The sounds generated by mechanical synthesis clearly conformed audibly to the phonemes. The sound synthesis is based on computational methods that analyse the volume of the vocal tract and determine which sound should be spoken with the respective shape of the vocal tract.

Other applications of segmentation are breast cancer and osteoporosis where the texture of lesions is analysed or the mechanical stability of bones is predicted.

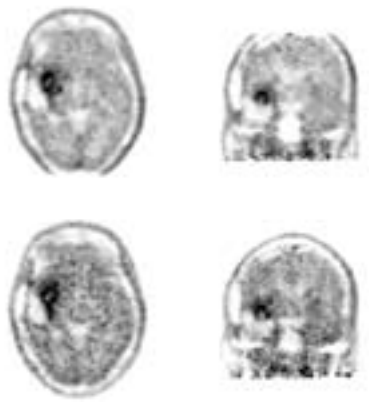
3-T MR BrainPET scanner makes MR-PET possible

A prototype of a new bi-modal scanner has been installed in the Institute of Neuroscience and Medicine, in Jülich, Germany. The scanner combines MRI and PET for brain studies.

The PET detector is located within the bore of the MRI scanner, which makes simultaneous measurements possible. The MR component consists of a commercially available 3-T MRI scanner, whereas the PET detector BrainPET is a new development. The read-out electronics of the PET are based on avalanche photodiodes (APDs) that can be applied in the magnetic field. The inner diameter of the PET ring, consisting of 12 cassettes, is 36 cm, so that an MRI head coil can be inserted into the ring.

The first tests were conducted to analyse count rate behaviour and resolution. To assess the image quality of simultaneous MR-PET, phantom studies were performed. The image resolution in the centre was between 2.1 and 2.5 mm in x, y and z directions. First MR-PET studies showed no visible artefacts from the MR image and FDG-images provided high-resolution delineation of the cortex.

Preliminary tests and studies confirm that MR-PET imaging is possible using this newly developed hybrid scanner. Human studies show that the MR images show minimal artefacts, while the BrainPET detector provides excellent image resolution.



The PET system saturates at activity concentrations that are higher than those expected in brain studies of glucose or receptor metabolism.

Robust characteristics and segmentation procedures: New approaches

'Medical image processing is full of unanswered questions. Today, we are at about the same point where optics was 150 years ago,' said Professor Bernd Jähne, who researches new methods of medical visualisation at the Heidelberg Collaboratory for Image Processing (HCI).

Founded in 2008, within the context of the Excellence Initiative of the Federal Republic of Germany, HCI employs over 80 researchers to identify basic scientific questions in order to solve the problems of the future.

At the HCI, Prof. Jähne and team are involved in basic research, and not concerned with concrete applications. The questions – and answers – they formulate are estimated to become market-relevant in about a decade.


Left: Professor Thomas Deserno with former German Health Minister Ulla Schmidt (centre)

Robust characteristics present an enduring subject. So far, they could only be defined and computed in theory with respect to well-defined, mathematical variances, such as noise, rotation, scaling, affine and perspective depiction. In this case, a specific application would be automated shape recognition – in the medical context this would be the recognition of tissue structures from various angles and under different light.

ToF (Time of Flight) imaging, one of HCI's research focuses, has already shown promising results. Similar to an ultrasound system, signal source and receiver are contained in one unit, supplying depth information about tissue. Light is then emitted and the time until the sensor has detected the reflection is measured. A phase shift occurs. Phase shifts and time differences provide an indication of the object's distance from the source and the surface properties. Colour-coded images are created that supply clear information on the tissue. The aim is to detect tumours better and completely resect potentially malignant tissue.

ToF imaging is a new method with much potential, although there are still some systemic weaknesses. The first systems with only one light source will be ready for commercialisation in a few months. However, it will take a good 10 years until objects can be handled that are also illuminated with ambient light.

With every new segmentation method it is important to obtain a meaningful image with as few clicks as possible. Expert knowledge should be available in seconds, to delineate healthy tissue and tumours in real time. Research focuses on the recognition and identification of boundary layers: Where does a vessel or organ end, and where are the tumour's boundaries?

Pre-operative breast MRI

The Netherlands – Performing pre-operative breast MRI in all women with invasive lobular carcinoma (ILC) can reduce the need for re-excision, according to a study conducted through two major cancer centres - the Radboud University Nijmegen Medical Centre and the Netherlands Cancer Hospital/Antoni van Leeuwenhoek Hospital.

The study's coordinator Dr Ritse Mann (Dept. of Radiology, Radboud University) said: 'We investigated whether the performance of pre-operative breast MRI in women with ILC – approximately 15% – would be beneficial for these women in terms of outcome. It has been clearly demonstrated that the performance of pre-operative MRI, if adequately conducted and analysed, does improve the estimation of tumour extent. It was, however, uncertain whether this better delineation could be translated to better surgery.'

In a project that involved close cooperation between the departments of radiology, surgery and pathology, the researchers stratified patients with ILC into a group of patients who underwent pre-operative MRI and a group of patients who only underwent mammography and ultrasound in the pre-operative evaluation. 'Subsequently we assessed the rate of re-excisions, the rate of mastectomies and the time to final surgical therapy in these groups,' he said.

'Our study shows that, in experienced hands, the knowledge of breast MRIs can be successfully transported to the operating room and be effectively used to reduce the rate of unsuccessful operations, especially in the difficult cases that ILC usually present.

The rate of tumour positive margins that re-excision was indicated for dropped dramatically from 27% to 9%, without an increase in the rate of mastectomies.

'Moreover, while the need for re-excision almost doubled the time to complete surgical therapy, pre-operative MRI can be performed easily in the waiting time for surgery.'

He added that the study findings were significant because it showed the performance of a simple diagnostic test – a 15-minute breast MRI scan - may save many women from unnecessary secondary surgery.

In The Netherlands, more than half of university hospitals and major teaching hospitals now perform breast MRI. 'In Europe, breast MRI is becoming a well-accepted clinical modality. The Eusobi guidelines for the performance of pre-operative breast MRI endorse the use of pre-operative MRI in all patients with invasive breast cancer, though currently only for screening of the contra-lateral breast.


Ritse Mann

'The fact that we can show that it is also good for evaluating the primary tumour is only strengthening this advice.'

Among clear benefits for patients: they are less likely to require secondary surgery after an initially failed attempt to excise the tumour radically. 'This reduces anxiety, improves the cosmetic outcome and reduces time to final surgical therapy. They do not need to worry about unnecessary mastectomies, as the knowledge from the MRI can actually be used to better delineate the tumour and hence perform an adequate lumpectomy. Findings that will change the therapy to mastectomy should be biopsied first,' he added.

For clinicians, pre-operative breast MRI means the multidisciplinary team has a clearer idea of the tumour they are treating and can adapt their therapeutic plan to the actual tumour characteristics. 'Early indications are that this technique is cost-effective as it results in a decrease in the rate of re-excisions and less operating theatre time is necessary, which might decrease waiting times for surgery.'

While no cost-analyses have been performed, in the Netherlands a breast MRI costs around €300, while surgery amounts to €5000.

Dr Mann stressed that it is essential to understand that working with breast MRI is substantially different from mammography. 'Rather than the conventional 2-D approach from mammography, breast MRI is truly 3-D and needs to be appreciated in this way. This is a challenge for both radiologists and surgeons alike.'

The next step is to investigate whether pre-operative MRI also has an effect on long-term outcomes, such as recurrence and survival, and whether the results can be extrapolated to patients with other types of tumour.

Report: Mark Nicholls


Sectra MicroDose

Single Shot Spectral Imaging

Will this be the future of mamma diagnostics?

The limitations of mammography are well documented, yet it is still the gold standard in breast cancer detection - particularly due to the positive cost-benefit ratio. Due to prohibitive costs, MRI exams are performed only in well-defined cases. The HIGHREX project (www.highrex.eu) aims to evaluate Single Shot Spectral Imaging (SSSI) technology for use in mamma diagnostics. The consortium is led by Professor Mats Danielsson, founder of Sectra Mamea and inventor of photon-counting technology for breast diagnostics. Charité Berlin, a clinical partner in the project, is responsible for the development of contrast-enhanced Spectral Imaging. **Dr Felix Diekmann**, assistant medical director at the Clinic for Nuclear Medicine at Charité, discussed SSSI in an interview with *Meike Lerner*


Felix Diekmann

'Single Shot Spectral Imaging (SSSI) is based on tomosynthesis, a rather new 3-D mammography technique developed to overcome, at least partially, the overlapping of structures, one of the major limitations of mammography,' explained Dr Diekmann, at the Charité Nuclear Medicine Clinic. 'If, in addition, iodinated contrast media is applied, a further limitation of conventional mammography could be overcome: poor tumour contrast. This is where slit-scan tomosynthesis, using a photon-counting detector, comes in; it is particularly well suited for breast imaging since its spectrum splitting technology allows dual energy visualisation of the contrast media in a single scan – and with low dose – while generating a 3-D image of the breast. The long-term objective is to develop a financially viable procedure that offers the same image quality as breast MRI.'

Are there advantages in SSSI over photon-counting?

'In the German mammography screening programme, several facilities perform 2-D mammography based on photon-counting detectors. The new method – slit-scan tomosynthesis with Spectral Imaging – can build upon the experiences gathered in these facilities and the existing detectors can be used. 3-D breast imaging and the application of iodinated contrast media are new features in mammography. 3-D procedures avoid overlapping of structures, which to date reduces the visualisation of tumours. The other major issue in conventional mammography – low tumour contrast – is addressed with the use of contrast media. In brief, the new approach promises to offer significantly increased detection of breast cancer.

'The new procedure shows very promising results, particularly in women with dense breast in respect of surrounding tissue. At this point, it is only used when one of the established procedures and modalities (clinical examination, ultrasound, MRI) give reason to suspect a tumour. The current study aims to answer the interesting question of whether contrast-enhanced tomosynthesis with Spectral Imaging is superior or inferior to MRI. Although a final answer can only be offered after the study has been completed, we are seeing some rather encouraging results.

'The procedure is faster and easier to perform than breast MRI. For the first time ever, it allowed us to visualise certain pathological changes in the breast, such as lobular intra-epithelial neoplasias (LIN). Spatial resolution is much better than in MRI, which means the morphology of lesions is easier to assess. Additionally, unlike MRI, tomosynthesis can visualise calcifications – particularly important since micro-calcifications often indicate DCIS, ductal carcinoma in situ, considered a preform of invasive cancer.

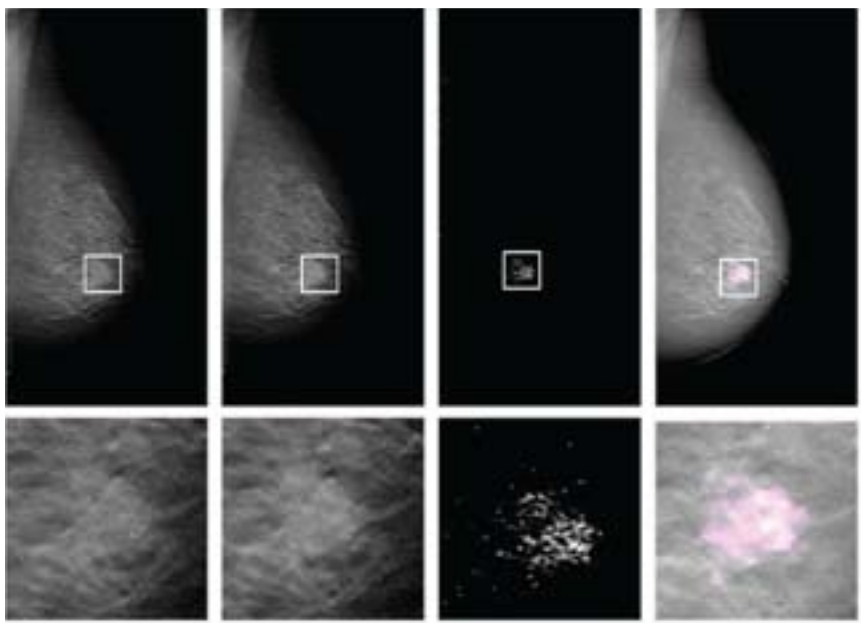
Could SSSI replace MRI?

'The research project aims to develop a procedure that can be used as an alternative to MRI. This approach makes sense, in view of the financial pressures in healthcare: a procedure that offers the same or better diagnostic quality as current methods, while being cheaper and more widely available, is desirable. However, designing the new procedure as a mere add-on to conventional diagnostics is more problematic, since it will reduce the new procedure to just another expense item. We need to mention that at this point in research the new procedure does show certain disadvantages. For example in MRI, so-called water imaging using a T2-weighted sequence is a routine application in certain cases, such as fibroadenoma diagnosis. In Spectral Imaging that's still pie in the sky.'

Are there other research approaches using contrast media?

2-D mammography also offers the possibility to visualise contrast media. Only recently, I published

Slit-scan photon-counting spectral imaging: 3 mm tomosynthesis slices of a retromamillary tumour before and after application of contrast media, subtraction (iodine image), colour map overlapping the iodine image with the original



a first, large clinical evaluation of this procedure in the *European Journal of Radiology*. We used GE Healthcare's *Senograph 2000D* with temporal subtraction. As far as I know most published studies on the use of iodinated contrast media in mammography were performed with this equipment, some even applying a sort of Spectral Imaging, meaning two images were acquired, one with low and one with high energy. Since two images need to be taken, motion artefacts are much more of an issue than in tomosynthesis with Spectral Imaging, where only one image is required, because the photon-counting detector separates the high and low energy spectrum. There are some promising studies on dual energy tomosynthesis using flat panel detectors.

'In addition to the approaches described, other research projects are aiming to overcome mammography limitations. One method that showed promising results is laser mammography, which is also being used at Charité-Virchow-Kliniken and which applies tolerable contrast media very well. The advantage of the method is the fact that it does not involve radiation exposure. The current major disadvantage is poor spatial resolution.'

The value of tomosynthesis in breast diagnostics

The MVZ RNR Leverkusen Am Gesundheitspark (Germany), part of the RNR MVZ GmbH Association, is one of the most important breast diagnostics centres in the region, treating tens of thousands of patients annually. In line with this full capacity utilisation, the equipment at the practice is of the highest standard. Recently, tomosynthesis was installed, enabling the centre to offer patients the entire range of breast diagnostic systems


Juliane Terpe

The range of diagnostic equipment at the Am Gesundheitspark mammography practice is used for preventive as well as curative purposes. Just a few months ago the previous mammography equipment was replaced by Hologic's *Lorad Selenia Dimensions* for conventional mammography and tomosynthesis. Since then, along with her team, diagnostic radiologist Dr Juliane Terpe, one of the heads of the Am Gesundheitspark mammography practice, has particularly benefited from the dual usability of the system, because the digital full field mammography equipment can be used for conventional, 2-D mammography as well as tomosynthesis.

'As a specialist practice and screening centre we carry out tens of thousands of examinations a year – with many of these turning out to be complicated cases. We do everything we can to give each woman her diagnosis and our recommendations as constructively and quickly as possible,' Dr Terpe said. Although tomosynthesis is not a standard part of the mammography screening programme the centre uses it daily. If, after a mammography and ultrasound scan, there is an ambiguous diagnosis, Dr Terpe and colleagues are entitled to carry out additional imaging using tomosynthesis within the context of breast diagnostics. The reconstructed tomographic images produced via tomosynthesis have a thickness of 1mm and therefore guarantee increased diagnostic certainty by suppressing overlaying tissue structures and minimising the image detector noise. Thus breast tissue assessment can be improved.

Dr Terpe does not believe that tomosynthesis and MRI are competitive procedures for an additional breast diagnosis. 'Tomosynthesis is a radiodiagnostic procedure that cannot be compared to MRI. Breast diagnostics has always been a multimodal concept where different imaging procedures have given doctors complementary information. The order of diagnostic assessment remains the same: First mammography, then ultrasound. After these come tomosynthesis and finally MRI, to rule out further masses in the case of a known tumour, for example.'

The radiation dose of tomosynthesis is comparable to that generated by conventional mammography. However, its benefit is enormous. Due to the high spatial resolution it is much easier to detect microcalcifications and densifications. 'Some tumours simply present as very small, architectural changes during conventional mammography,' Dr Terpe explained.

'You can then see only two or three lines on the images which look wrong; the remaining area is covered by the surrounding tissue. This is why in the case of dense breast tissue is of particular advantage, if we can scroll through the individual layers of the breast with tomosynthesis. This also allows us to determine whether microcalcifications are grouped or spread. This means, whether it is a benign or malignant change of the glandular tissue, as in the case of mastopathia (benign, non-inflammatory change of the breast glands). Scrolling gives us in the best possible way to see whether, and how many, microcalcifications can be seen in each tomographic image. In addition, in the curative field this procedure also makes it easier to distinguish between scar tissue and a relapse.'

Dr Terpe can no longer imagine the practice without this innovative tomosynthesis equipment. 'We can now offer the complete range of modalities for breast diagnostics. Complicated cases can now be tackled much quicker and safer. We can show patients that they can expect the best possible quality from us, otherwise only found in a few university hospitals.'

** This equipment is distributed in Germany via MMS Medicor Medical Supplies GmbH*
Details: http://www.medicor.de/

Re-inventing mammography

Contrast-enhanced digital breast exam promises faster, affordable and accurate diagnosis in community clinics

The overall success of MRI in diagnosing breast cancer and the exploding demand for breast MRI, in particular, have caused a scanner shortage in much of Europe.

Dr Jean-Pierre Pruvo, Chairman of the French Society of Radiology, recently raised the alarm: 'We have hundreds of thousands of women in France at risk for breast cancer, yet we do not have the means to provide a breast examination by MRI, which is clinically proven to be superior for detection than conventional mammography.'

While Dr Pruvo is lobbying the government in Paris to buy MRIs, on a hill overlooking the capital at the Gustave Roussy Institute for Cancer, Dr Clarisse Dromain has developed a next-generation examination based on X-rays – a more readily accessible technology for hundreds of thousands of women awaiting diagnoses.

Initially, Dr Dromain turned to a modified full-field digital mammography system to capture numeric data sets, rather than fixed film images, as the data can be processed by software to enhance contrast and improve visibility.

Key to the breakthrough is a high-performance scanner re-engineered by GE Healthcare with an innovative capability called Contrast Enhanced Spectral Mammography that separates the X-ray energy spectrum to reveal a new level of functional data, specifically the growth of new blood vessels feeding a tumour.

To highlight this vascular activity in a breast with a suspicious mass, Dr Dromain injects a standard iodine-based contrast agent.

The benefit of this new method, called *Contrast Enhanced Spectral Mammography* (CESM), reaches far beyond France, offering a faster and more affordable alternative to MRI breast examinations worldwide.

'The clinical evaluations of this technology are very promising,' said Dr. Dromain, who presented results from exams with 120 patients at the congress of the European Society of Radiology.

In an interview reviewing her findings, Dr Dromain explained that the potential for CESM '...is to eliminate, in many cases, a need for further MRI examinations'.

A CESM exam takes from five to 10 minutes, compared to 40 minutes on an MRI scanner, and it is a fraction of the cost, she said, adding that, in the majority of cases, confidence in the diagnosis is high enough that a patient can be told the results the same day. 'In my own examinations of patients I've been able to see the spread of a cancer perfectly well with CESM, and follow-up exams with an MRI validated exactly the same indications,' Dr Dromain said. Indications for CESM, she pointed out, are similar to indications requiring a breast MRI scan and CESM presents a potential to better characterise tumours where a combined mammography and ultrasound exam is inconclusive.

This new technique may prove to be most useful in routine clinical practice for the staging of cancers and the selection of patients for biopsy, she said.

Other potential clinical applications for CESM include monitoring breast cancer recurrence, verifying any response to anti-angiogenesis therapies, and localising catheter-based wires use for breast biopsies, because MRI-guided procedures remain difficult and very time-consuming, she explained.

For routine practice, CESM offers many advantages, being immediately available, without special scheduling of patients and it is well-accepted by patients happy to be diagnosed sooner. No special training of staff is required, because patient positioning and image acquisition are similar to a conventional mammogram, Dr Dromain concluded.

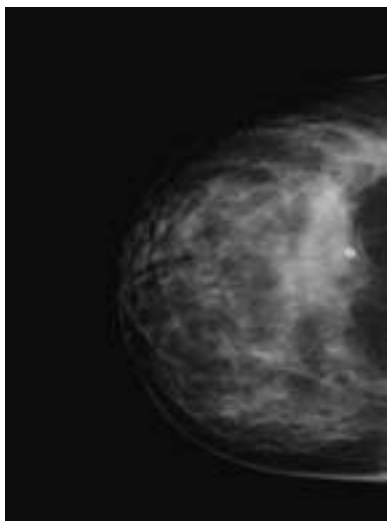


Fig 1a: Standard mammography image

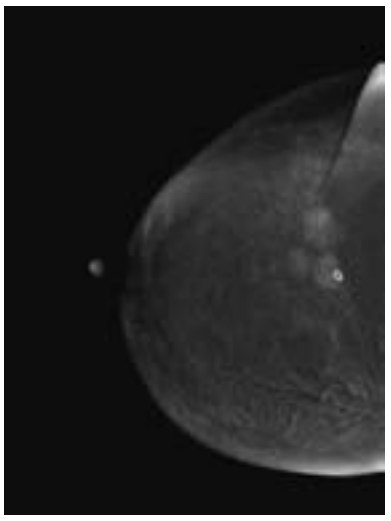


Fig 1b: Same breast with CESM angiogenesis image clearly highlighting three distinct masses

CESM moves beyond screening

CESM is not intended as a screening modality representing a new capability that moves the widely accepted X-ray modality from the front-end of the patient pathway to a higher level of diagnosis in the clinical setting.

More than the combination of contrast enhancement with digital mammography, the innovation in CESM centres on the capability for spectral imaging integrated into GE Healthcare's *Senographe Full Field Digital Mammography* system.

Picture the difference between a digital photo of a house and an infrared image of the same house that reveals the functional information of heat loss. The vessels in a tumour are not the same as normal blood vessels, and the contrast media rapidly leaks from the tumoural vessels, which is what is seen on the image, Dr Dromain explained.

Multiple image acquisition is the second significant modification of the CESM system, as it acquires images at different X-ray energy levels rather than the single view in traditional mammography.

One image acquired in the conventional mammography range of 26 to 32 kilovolt peak (kVp) provides morphological information describing the physical structures. One second later subsequent data is acquired using voltages in the 45 to 49 kVp range, capturing the diffusion of a contrast agent within the breast and revealing functional information.

These data sets are then combined, using a proprietary algorithm in the GE image processing platform with advanced features and high-performance viewing tools, to create a single recombined image for analysis.

'There is a direct correlation between the recombined CESM image and a conventional mammogram, so it is very easy to compare and analyse, not only for radiologists but also for oncologists and surgeons,' Dr Dromain pointed out. (See images for a comparison.)

Hardware modifications to the scanner for the clinical investigation developed in partnership with GE include a rhodium filter to optimise image quality, which has now been integrated into the Senographe system at the Gustave Roussy Institute, and a specially modified filter to shape the high-energy X-ray spectrum to maximise sensitivity for the low concentration of the contrast agent.

Contrast enhancement introduces the essential technique distinguishing CESM from traditional mammography as an iodinated agent carried by the blood illuminates vascular function. 'The contrast media accumulates, allowing us to see, and then to characterise the tumour pathologically,' she said, 'which is why we can consider the contrast media a marker for tumoural angiogenesis.'

Once a tumour reaches two millimetres in size, she explained, it needs its own blood supply to grow, 'so tumoural angiogenesis not only tells us the nature of the tumour but also indicates the probability it will grow and metastasise'.

For a CESM exam, a woman with a breast abnormality suspected to be a cancer receives the contrast agent intravenously and waits two minutes as the solution diffuses throughout her body. After injection, her breasts are compressed in during the (as usual) uncomfortable mammography, and the spectral mammography images are acquired.

The total radiation exposure for the woman corresponds to a dose 1.2 times greater than a digital screening exam, 'which, on our system, is already well below the dosage recommendation for screening,' Dr Dromain added. The total duration of the exam is five to 10 minutes depending on whether the doctor wants to image one or both breasts.

'To this point we have demonstrated the technique works, and now we need to establish the place of CESM in radiology. CESM,' she said, 'could well be the technology of the future.'

Dr Dromain foresees that regulatory approval based on clinical investigation at the Gustave Roussy Institute '…will open the possibility for other centres to gain experience and develop the techniques, such as exploring potentials of the contrast media, or even experiences CESM with 3-D with tomosynthesis'.

The German Senology Congress
CELEBRATING 30 YEARS OF BREAST CARE

1-3 July 2010

The German Senology Society has campaigned for women's breast health for 30 years. Founded in 1980 on the then very novel concept of organ-related, interdisciplinary, scientific cooperation, today a large percentage of the society's 1,800 members are gynaecologists, radiologists, surgeons and internists. Senology is interdisciplinary, emphasised Congress President **Professor Ingrid Schreer**, radiologist and till recently head of the Breast Centre at the University Women's Hospital in Kiel. 'Today's breast centres prove the meaningfulness and necessity of this multidisciplinary concept, from diagnosis to treatment to aftercare, which has also been successfully adopted by other organ centres and disciplines.'

Thus, although focused specifically on breast cancer, the scientific programme contains a wide variety of topics, including radiodiagnostics. 'Many imaging procedures are still at the research stage, but there have already been exciting developments and successes, which we will present at the congress. In particular, there have been many advances in the development of technologies specifically designed for the breast – the rediscovery of scintigraphy is one. With the help of new gamma cameras the size of a mammography scanner, the breast is scanned and not the entire body. This has improved the technical quality of image recording so that this procedure now achieves 90% both for sensitivity and specificity. However, the problem of the high radiation dose associated with scintigraphy (five times higher than those for mammography) remains.'

Prof. Schreer is particularly pleased that two renowned international speakers will participate in the Senology Congress. In his lecture headed *Mammography Screening 2020?* Professor Edward M Azavedo (Radiology Dept. Karolinska Hospital, Stockholm) will discuss the Swedish mammography screening programme, established in the 1980's which is still considered an international leader. And, results from the evidence-based study *Review of Preoperative Magnetic Resonance Imaging (MRI) in Breast Cancer* in the context of a discussion forum titled *Preoperative Breast MRI and preoperative Case Conference*, will be presented by renowned epidemiologist Dr N Houssami, breast physician at the Royal Hospital for Women, Sydney, Australia.

Dr Houssami's research on the current state of knowledge about the application of MRI for early detection of breast cancer links in with a current debate that caused a stir. In particular, the German media reported that, although MRI was the safest method for the diagnosis of breast cancer, it was never used in practice due to cost. This coverage caused considerable confusion among screening patients. 'Houssami's international data analysis shows, in an impressive way, that MRI can on no account replace mammography,' Prof. Schreer pointed out. 'MRI is only indicated for a very small number of patients at high risk, and these women are already receiving the appropriate care in the 12 centres for women with an increased hereditary risk of breast cancer and ovarian cancer.'

The session *Breast Care Nurse: An assessment in a European Context* – a first for the congress – will be presented under the guidance of Professor Bettina Borisch, President of the advisory committee on breast cancer at the Swiss Cancer League, and Dr Martin Steiner, regional head of the Professional Association of Gynaecologists in Baden Württemberg.

Since Great Britain introduced breast care nurses (BCNs) in the 1980s, this specialist role has been established all over Europe. However, BCNs undergo very different types of training and have different competencies in the various countries. The session will introduce the BCN programme at a European level and examine the feasibility of transferring it into the national health system. 'The breast care nurse plays an essential part with regards to helping women diagnosed with the disease,' Prof. Schreer explained. 'They provide personal advice and support from the first diagnosis and communicate with the patient through the entire treatment process. This makes them highly specialised experts in care, which requires the respective, standardised training.'

Ingrid Schreer

Along with updating all primary treatment concepts, e.g. surgery, adjuvant and neo-adjuvant, representatives from politics and science will discuss political aspects of care and health with the audience, including the consistent implementation of the S-3 guidelines on the early detection of breast cancer and better handling of interval carcinomas in mammography screening.

Forget space restrictions and reconstruction

Something that often obstructs a pioneering medical spirit is simply a practicality: the lack of space. For many hospitals, investment in new medical equipment is linked with construction and reshaping the hospital's architecture – sometimes impossible because of the infrastructure. This was precisely the situation at the University Hospital Geneva (Hôpitaux Universitaires de Genève = HUG) when Professor Osman Ratib, Head of Nuclear Medicine, began to consider the installation of the first whole-body PET/MR to be installed in Europe. Fortunately, he was only mildly disturbed by the space problem and far from forsaking the project just because of it. Consequently, the HUG and Philips Healthcare celebrated the inauguration of the innovative hybrid system in Geneva at the end of April – and they already presented some convicing results


Osman Ratib

Visitors to the new site in Geneva generally experience two 'Wow!' effects. The first relates to the installation itself and the second to the way in which it was installed. The distinctive feature in the second is that the whole-body PET/MR was delivered on a truck – virtually ready to use: the system and all its components, such as injector room etc. was pre-installed in a container station 200 kms away from the hospital. This container was then transported to Geneva and placed directly against the hospital walls, and connected to the radiology department by a new door. This door was the only hospital construction needed – and the only one possible due to the infrastructure. 'For the installation of our new scanner we could benefit from a completely new design of a container that was conceptually devised by several small companies here in Switzerland,' said Prof. Ratib. 'The idea behind it was to pre-install the scanner in a large container that is specifically adapted to the size and the requirement of high technology equipment. This significantly reduced costs and time for the installation.'

Geneva gains Europe's first whole-body PET/MR - all without a ruffle


The Philips PET/MR system

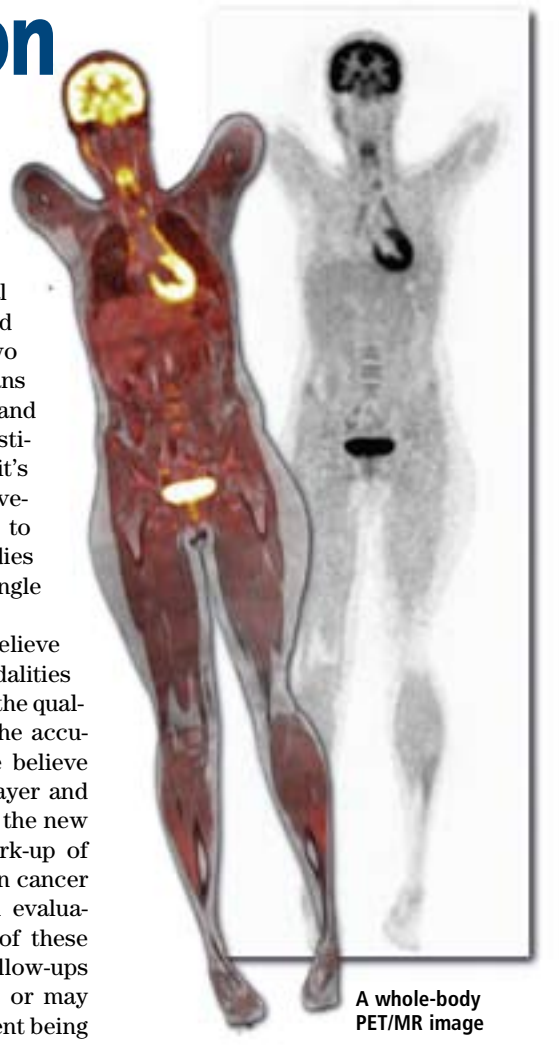
From the February installation to the real premiere of a whole-body MRI took another three months. In April 2010 the first scan was performed and by the end of that month 25 patient examinations had been carried out.

Great potential for clinical use

So far, the combined scan by MRI and PET can only be perfomed in terms of clinical evaluations and research, because approval by the FDA is still missing. However, Prof. Ratib has predicted a huge potential for the future. 'Today, many patients already have MRI and PET as part of their clinical follow-up and work-up, and get those two studies at two separate times, which means they have to come twice and have two different investigations done. We think it's going to be a major improvement in patient comfort to be able to do the two studies at the same time in one single machine.

'On the other hand, we believe that having those two modalities together will also improve the quality of our diagnoses and the accuracy of our diagnosis. We believe it will become a major player and have an impact in some of the new strategies and clinical work-up of some patients, especially in cancer and, more particularly, in evaluation of efficacy of some of these treatments and patient follow-ups to detect those who may, or may not, respond to the treatment being applied.'

Consequently, Prof. Ratib and his team will focus on evaluating the benefits of PET/MR for head and neck cancer, prostate cancer and breast cancer. The first examination results, which were shown during the inauguration presentation, were convincing. 'MRI images provide anatomy and tissue characterisation combined with metabolic imaging from PET; we can now see tissue function and metabolism. In combination with new molecular tracer we are able to see and follow some tissue characterisation and activities very precisely. So hybrid imaging is very promising, especially with regard to so called personalised medicine.


A whole-body PET/MR image

Whole-body PET/MR

The combination of the two modalities had long been a problem because the magnetic field created major artefacts during the PET scan. Philips Healthcare overcame this by providing sequential MRI and PET aqcuisition with stand-alone PET and MR scanners face-to-face, together with an innovative rotating bed, which accurately positions the patient inside each scanner.

The installation in Geneva is the second worldwide, the other being at the Mount Sinai School of Medicine, New York.

Both are equipped with a 3-Tesla MR and PET, using the latest Time of Flight (ToF) technology.

Extremity MRI in a specialised radiology practice

The number of MRI scans carried out on arm and leg joints in a specialised radiology practice is high and constitutes a significant part of MRI scanner use. Such is the case at the Remigius Ärztehaus in Leverkusen and the RNR Dortmund MVZ, both specialist surgeries within the RNR Association, one of the largest radiological networks in Germany. To meet demand, both establishments have installed ONI MSK Extreme high-field, open configuration extremity MRI systems. During an EH interview with *Meike Lerner*, Walburga Schantzen (WP), radiology specialist and unit manager at RNR MVZ GmbH, explained the reasons for investment in specialist modalities still rarely found in private practices


Walburga Schantzen

Walburga Schantzen: In our MVZs (Medical Care Centres) we offer patients the whole range of MRI scans so that examinations are made as comfortable as possible. The acquisition of an extremity MRI was made for the same reason, but in both cases brought with it some specific issues. In the case of Leverkusen, we provide entire radiological care for patients at the neighbouring Remigius Hospital, which, among others, has a well equipped, specialist orthopaedics department. Therefore the need for an extremity scanner here resulted not exclusively from the needs of our own outpatients but to a large extent from those of in-patients at the hospital. The 1.5-Tesla extremity MRI has been operational, alongside the 1.5-Tesla whole-body scanner, for about eight weeks.

In Dortmund we decided at the beginning of the year to install a 1.0-T extremity MRI scanner, which has since been supporting the 1.5-T scanner. The main reason for this acquisition here was that structural restrictions would have made the installation of a second whole-body MRI impossible.

Apart from these pragmatic considerations, what are the advantages of these 'handy' scanners?

WP: We've found that the most noticeable advantages are those for examinations of the hands and elbows. These are particularly uncomfortable for patients in a whole-body MRI scanner because they mostly have to position their arms above their heads. The MSK Extreme offers a significantly more comfortable alternative for this type of examination. The same applies to diagnosis of the foot or ankle. However, for examinations of the knee we still use the whole-body scanner a lot, because the positioning of the knee in the extremity MRI scanner can sometimes be uncomfortable for patients.

Additionally, we also make use of more conventional modalities if there is diagnostic ambiguity due to the restricted field of vision. It doesn't happen that often, but sometimes there are cases where, during a knee examination, we detect a tumour, a suspicious growth on the distal femur, which is then further investigated during another examination.

In both locations, the ONI scanners have turned out to the best possible addition to our existing range of equipment for the diagnoses of joint problems, which allows us to make the 'trip through the tube' as comfortable as possible for our patients.

Details: www.medicor.de
German distribution: MMS Medicor Medical Supplies GmbH

ONI MSK 1.0 and 1.5 Tesla extremity MRI

The extremity MRI generation is particularly suitable for examinations of the hand, wrist, elbow, foot, ankle and knee. Patients benefit from a quick, comfortable examination, with no risk of claustrophobia because during the exam the patient sits in front of, or next to the magnet, depending on the specific body area to be scanned, and this is then positioned within the compact tube.

AQi 4.4.5 software with iPad support

NEW

A 4.4.5 version of the Aquarius iNtuition advanced visualisation server-based software suite, including support for the newly-released iPad, was launched in April by TeraRecon. The company, which provides advanced 3-D imaging systems for medical and industrial applications based on its patented image processing technologies, reports: 'While not intended for clinical diagnostic use, iNtuition support for the iPod Touch, iPhone and iPad provides a convenient and expedient way to obtain access to images, advanced visualisation and other advanced techniques, through an intuitive, mobile, multi-touch and image-centric user interface.'

Results from the installation and running of the iNtuition on iPad can be watched on YouTube (*http://bit.ly/bmvz65*), said TeraRecon president and CEO, Robert Taylor PhD: 'We are now working with our key luminary sites to explore the possibilities of this new medium and we look forward to learn how best to leverage this exciting new platform for advanced visualisation.'

Headquartered in San Mateo, California, the firm's European headquarters are in Frankfurt, Germany.

Details: www.terarecon.com

Molecular imaging
Exploring a new universe

Molecular imaging, the discipline that unites molecular biology and *in vivo* imaging technologies to assess biological activity in the body, promises to open up '...an entire new universe,' declared Dr Ralph Weissleder, of the Centre for Molecular Imaging Research at Massachusetts General Hospital, USA, in the journal Radiology. That was just one decade ago. And he was right. It has indeed done that, *David Loshak* reports

Imaging technologies today are applied in many ways to a score of biomedical applications, says Dr Mark Lythgoe, director of the Centre for Advanced Biomedical Imaging at University College, London, UK. 'We seek to use novel *in vivo* imaging technologies to further understand the mechanisms of disease and develop therapeutic strategies. Furthermore, we aim to deliver a multimodal imaging programme to investigate the molecular, functional and structural consequences of the disease process on a range of different scales.'

The Centre provides high-field magnetic resonance imaging (MRI), a photo-acoustic imaging facility, *in vivo* 2-photon laser-scanning microscopy, ultrasound, bioluminescence and fluorescence imaging, computerised tomography (CT) combined with single photon emission computed tomography (SPECT) and positron emission tomography (PT), all enabling cross-disciplinary work in neuroscience, cardiovascular biology and oncology.

'The development of imaging technology is an essential part of the translational pipeline for drug development and personalised medicine, and is important to research in the pharmaceutical industry,' Dr Lythgoe adds. 'Such strategies will help to remove major bottlenecks in applying new discoveries to the clinic. They will generate the knowledge and understanding to transform human health and well-being.'

As Dr Weissleder predicted, molecular imaging enables earlier detection and characterisation of disease. This means that relatively gross parameters, such as tumour burden and anatomic location, can be improved with specific parameters, such as detection of premalignant molecular abnormalities, angiogenesis growth factors, tumour cell markers or genetic alterations.

Such imaging assessment allows, with new targeted therapies, assessment of therapeutic effectiveness at a molecular level well before phenotypic changes occurred - the study of pathogenesis in intact micro-environments of living systems. And it provides three-dimensional information far faster than had been possible with time-consuming, labour-intensive, invasive conventional techniques such as histological analysis.

In only a decade or so then, molecular imaging has revolutionised the practice of medicine and patient care. It provides earlier than ever detection by disclosing information that would otherwise require exploratory surgery or costly diagnostic tests (if available). And, by helping to understand the basis of disease, not just the end result, it even promises to help prevent disease.

Molecular imaging today encompasses multiple image-capture techniques, cell/molecular biology, chemistry, pharmacology, medical physics, biomathematics and bio-informatics, observes Professor Sanjiv Sam Gambhir, head of nuclear medicine at Stanford University, California, USA. Nuclear medicine he explains, '...uses radio-labelled molecules (tracers) that produce signals by means of radioactive decay only. But it also uses those and other molecules to image via means of sound (ultrasound), magnetism (magnetic resonance imaging) or light (bioluminescence and fluorescence), as well as other emerging techniques. Nuclear imaging has established itself as an indispensable tool in pre-operative diagnostics.'

Several other fields offer a range of imaging technologies to produce signals. These vary in five key respects - spatial resolution, depth penetration, energy expended for image generation (ionising or non-ionising), availability of injectable/biocompatible molecular probes, and the detection threshold of probes for a given technology.

Because each imaging technique has its advantages and drawbacks, Prof. Gambhir notes, a variety of approaches are needed for the increasingly sophisticated biological interrogation of cells that molecular imaging now offers.

For example, PET, which uses high energy gamma rays for image generation, has high sensitivity but low spatial resolution. By contrast, SPECT uses low energy gamma rays but, also, has low spatial resolution to set against its capacity to image multiple probes simultaneously.

Optical bioluminescence and optical fluorescence imaging use visible light or near-infrared; both have high sensitivity but low spatial resolution. On the other hand, MRI uses radio waves to generate morphological and functional imaging but has low sensitivity and requires long scan and post-processing time.

CT employs X-rays for anatomic imaging (bone and tumour) but has limited molecular applications and limited soft tissue resolution. Ultrasound has the advantages of real time imaging and being cheap. It has limited spatial resolution but can be used in photo-acoustic imaging to disclose tissue on an mm-cm length scale.

The proven value and even greater potential of imaging in intra-operative procedures is exemplified by a new suite at the Health Sciences Centre, Winnipeg, Canada, which provides multi-modality image guidance capabilities. It includes an interventional theatre for neurovascular procedures such as stroke management, an operating room for neurosurgery and a diagnostic centre.

Developed by the Canadian company IMRIS, a leading provider of image guided therapy, its systems feature fully integrated surgical and interventional suites that incorporate MRI, CT and fluoroscopy for intra-operative imaging during neurosurgical, cardiovascular and neurovascular procedures.

The suite includes a bi-plane angiography system and an MR scanner that can be moved readily from imaging to surgery or intervention without transporting the patient, ensuring the optimum position for all procedures. MR images can be taken before and during procedures to assess tissue condition and can also be used with fluoroscopic images during neurovascular procedures.

Another significant recent development in this field has been the facility to use high-resolution imaging and guidance via optical coherence tomography. That permits transfer of diagnostic capabilities from the pathology lab to the operating theatre, enabling real-time tissue visualisation and point-of-care decisions.

Choosing and using a PACS

With four hospitals, each with its own radiology department, and the central Institute of Radiology located at Höxter the Catholic Hospital Association (KHWE) Weser-Egge, Germany, needed communication improvements. 'We're dependent on fast, smooth work processes to meet high and legitimate demands. Therefore, all information needs to be constantly available hospital-wide,' explained Dr Martin Traupe, Director of the Institute.

Together with an engineering company, the facility – plus radiologists and other specialists – specified their needs and conditions. The central archive should be centred in St Vincent Hospital, so communication between buildings with relatively poor connections had to be attained, along with IT reliability and simple administration. 'From a technical perspective, the integration of all modalities, including nuclear medicine, was essential to achieve complete image management in the facility,' Dr Traupe pointed out.


Martin Traupe


Thorsten Krian

In a multi-stage process, an *Enterprise PACS JiveX*, from the Bochum IT provider Visus, was selected '... the strongest solution for the radiologists,' said IT manager Thorsten Krian. ' It's fast, clearly arranged, easy to use and functionally mature. Also it's technologically highly developed and fits very flexibly into the existing infrastructure with the SAN by DataCore.'

After a short training period clinicians discovered the benefits: images ready for diagnoses immediately after exams – and usually completed the same day. Individually adjusted hanging protocols significantly speed up diagnosis by process standardisation. Image processing options, e.g. zooming and magnification, provide further support. For comparison, previous digital images can be recalled quickly and easily.

As the quality and speed of diagnoses increases, patients' waiting times are reduced. With the same number of personnel the number of patients examined is expected to increase steadily. The preparation for clinical discussion is easier – almost along with diagnosis. Additionally, new cases may be considered spontaneously without first have to obtain the images. So on-call interdisciplinary issues can also be resolved.

Now there are no more conventional radiographs. 'Finding and retrieving images and findings does not apply,' said Dr Traupe. 'The ward physicians can give their patients faster information and also parts of the findings can be copied directly into the doctor's letter.'

Source: Visus Technology Transfer GmbH

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Imaging of myocardial viability and perfusion with dual energy CT and dynamic DSCT

Authors: B Ruzsics, T Henzler, C Fink, S O Schoenberg, Joseph U Schoepf MD

Meet the experts

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DECT has the potential to evaluate changes in the status of the myocardial blood supply in addition to the analysis of coronary artery morphology. It has to be mentioned that current DECT approaches are based on static non time resolved coronary CT angiographic scans. DECT exploits the fact that tissues in the human body and the intravascular iodine-based contrast media have unique spectral characteristics when penetrated by different x-ray energy

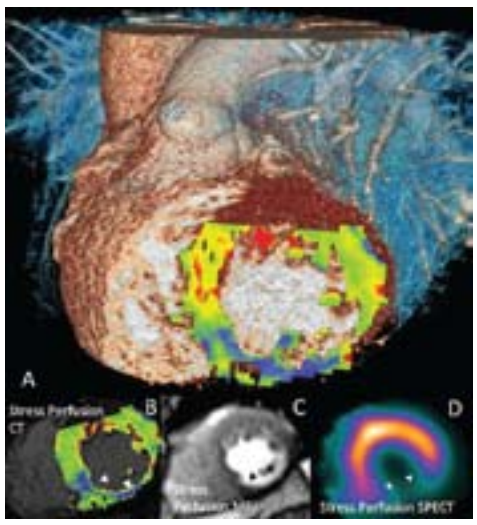


Figure 1: 64-year-old man with past history of inferolateral myocardial infarction. Absolute myocardial blood flow (MBF) image shows a perfusion defect of the anterior and anterioseptal wall of the left myocardium. The perfusion defect was confirmed on perfusion MRI, delayed enhancement MRI (C) and on SPECT (D)

levels. This property enables the mapping of the iodine (and thus blood) distribution within the myocardium demonstrating the hemodynamic significance of non-invasively detected coronary artery disease with a single contrast-enhanced exam. In a recently published study by our group, ECG-gated DECT of the heart showed 92% accuracy for detection of >50% stenosis and an accuracy of 94% for the detection of myocardial ischemia compared to single photon emission computed tomography (SPECT).

Although cardiac computed tomography (cCT) has shown very good diagnostic accuracy for the detection of coronary artery disease, the physiologic significance of many lesions can be uncertain.

Furthermore, the presence of calcified atherosclerotic plaque reduces the ability to differentiate significant stenosis from non obstructive plaque. Rapid evolution of multi detector-row computed tomography (MDCT) technology continues to enhance the role of this technique in the work-up of coronary artery disease.

Recently, MDCT has been proposed as a stand-alone modality for integrative imaging of coronary heart disease, i.e. the comprehensive assessment of cardiac anatomy, function, perfusion, and viability. Single-energy and dual-energy CT techniques based on dual-source CT (DSCT) technology have been proposed for this purpose

A drawback of DECT acquisition of the heart is that the temporal resolution of DSCT decreases from 83 to 165 ms, because the 2 tubes that enable quarter-scan reconstruction during routine, DSCT coronary angiography are used to generate different energy spectra in DE mode. However, the temporal resolution of DECT is identical to that of conventional single-source 64-slice CT scanners. In order to preserve the high temporal of DSCT we have recently evaluated the feasibility of a novel hybrid reconstruction algorithm for DECT which combines both, quarter and half-rotation reconstruction with high- and low-pass filtering techniques. The hybrid reconstruction algorithm used in this study had a 91.4% sensitivity, 94.7% specificity, 82.1% positive (PPV), and 97.7% negative predictive value (NPV) for detecting significant stenosis versus 85.7%, 93.2%, 76.9%, and 96.1% with a standard DECT reconstruction algorithm.

Adenosine-stress dynamic myocardial volume perfusion with second generation DSCT

Recently, second generation DSCT was introduced which compromises two 128-section detectors that provide greater coverage compared with first generation

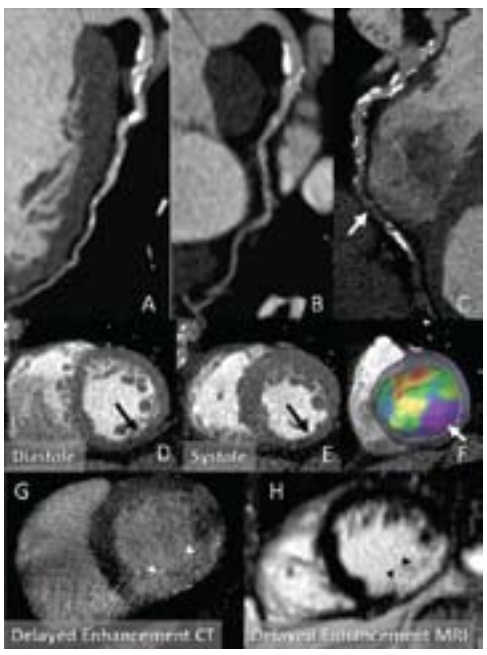


Figure 2: Curved multiplanar reformats of the left anterior descending (A), circumflex (B) and right (C) coronary arteries of the same patient. Coronary CT angiography reveals distal right coronary artery occlusion (arrow in C). Functional analysis shows inferolateral akinesis (arrows in D, E, and F). First-pass stress perfusion CT (G) demonstrates inferior and inferoseptal perfusion defect (arrows), which was confirmed on perfusion MRI. This perfusion defect corresponds to known chronic infarction, as confirmed by delayed enhancement CT (G) and MRI (H) (arrowheads)

DSCT. This system provides the ability of performing dynamic perfusion imaging by means of a dedicated 'shuttle' mode that captures the passage of a contrast medium bolus through the myocardium.

In the 'shuttle' mode of second generation DSCT (SOMATOM Definition Flash, Siemens Healthcare, Forchheim, Germany) the table shuttles back and forth during image acquisition between two adjacent anatomic positions with 300 mm/s acceleration. This acquisition mode can also be performed in an ECG-triggered fashion. Given a detector width of 38 mm, and a 10% overlap between both acquisition ranges, the anatomic coverage of this imaging technique is 73 mm. In a recently published study we applied this acquisition technique for the purpose of myocardial perfusion assessment during contrast medium infusion and under pharmacological stress with adenosine as a component of a comprehensive CT based protocol for integrative imaging of cardiac structure, function, perfusion, and viability. In this study we found a strong correlation between stress first-pass myocardial perfusion and delayed enhancement imaging with CT and the myocardial perfusion assessed on stress MRI and delayed enhancement MRI.

In conclusion, both static DECT 'perfusion' and dynamic myocardial volume perfusion imaging techniques are novel promising tools of cCT angiography which allow estimating the significance of atherosclerotic lesions in a single examination. DECT has the advantage of a lower radiation dose and a single contrast material administration whereas dynamic DSCT volume perfusion allows real time resolved rest and stress imaging of myocardial perfusion.

Additionally, we would like to invite you to the second transatlantic ACSI meeting, on 25-26 June 2010 in Mannheim, Germany.

This transatlantic symposium is held annually, alternating between a transatlantic partner and Mannheim, Germany. Our partner this year will be the Clínica de Diagnóstico por Imagem (CDPI), Rio de Janeiro, in conjunction with the Department of Diagnostic Radiology of the University of Rio de Janeiro.

Four topics (MRI, CT, PET and imaging economics) will be presented in a two day programme by international experts in clinical imaging as well as technical and economic developments.

We are pleased to offer you a very attractive and innovative programme and look forward to welcoming you in Mannheim this June.

Further information: www.mr-pet-ct.com.

CROSSING FRONTIERS

The largest exchange of electronic patient records across national borders is the first step in an ambitious European plan for expanding e-health. *John Brosky* reports on the recent 2010 European Connectathon held in France

In 2011 more than 30,000 hospital caregivers in 10 European countries will participate in an exchange of electronic patients' records (EPRs) in the world's largest, first-ever cross-border connection of e-health systems.

Brussels refers to this as a 'large-scale e-health implementation', and while it is easy to laugh about the bureaucratic language, it was the careful, go-slow approach of politicians, and not technology wizards, that brought about this landmark achievement.

In any language, the project – called European Patient Smart Open Services (epSOS) – can be said to be moving quickly across a landscape that is famously fragmented by diverse healthcare systems, and in a field that has stubbornly defied the best efforts to bring the benefits of IT to patient care.

The European Commission provided funding of €11 million and set a deadline of 36 months for the large-scale implementation. *(See EH issue 5/08)*.

According to Fredrik Linden, the project's coordinator, 350 people are now actively completing the tasks outlined in 10 different work

PHOTO IS COURTESY OF JEAN-BAPTISTE

Two software engineers and an IHE-Europe monitor (yellow) solve a coding problem to connect two health information systems

packages that will prepare the ground for the test operations in 2011. 'There are many significant issues to be solved to fulfil the Commission's vision of e-health as an enabler for continuity of care both within the Member States and across borders between the Member States,' he explained, when interviewed by *European Hospital* during the recent European Connectathon in Bordeaux, France, where he reported on epSOS progress. 'The epSOS project picked only two small issues out of this context, yet they are proving to be a world-class challenge.'

It took the epSOS work groups a full year just to sort out the legal implications among Member States of transferring EPR data and then to arrive at a framework agreement that will create a 'circle of trust,' Fredrick Linden reported.

A related set of problems, which has been solved, was patient identification, a headache for IT developers, even when sending data from one hospital department to another, and the equally troublesome need to identify healthcare professionals who are authorized to open patient records.

The availability of EPRs in 12 different countries is uneven, he explained, and poses a two-sided puzzle because e-prescription data sets are separate from the databases recording the dispensation of medications.

The work groups burned up another 12 months defining the technical specification needed to connect national systems at different levels.

A critical principle of epSOS is not to alter any Member State's current health information system, choosing instead to create a technical interface that will allow these different systems to work together, or interoperate – which explains why he and members of epSOS work groups were in Bordeaux for the European Connectathon.

The critical next step in the epSOS development, he explained, will be a 'Projectathon' to test the technical interface for transferring patient medical summaries and medication data, which is planned for early 2011. Once the systems are verified during the connectivity marathon, the large-scale implementation will go forward.

The Projectathon will be run on the same model as the European Connectathon organized by the non-profit association Integrating the Healthcare Enterprise (IHE), but reserved exclusively to countries participating in the epSOS project and the vendors whose systems support the technical architecture.

'When you are testing interoperability, it is rare that the problem is only on one side,' said Claudio Saccavini, who is a veteran monitor of the IHE-Europe Connectathon and recently led a project connecting hospitals in the Venato region of Italy. 'The big advantage for Connectathon is that everyone is working together in the same room and companies can work out the system problems and solve them quickly.'

IHE-Europe is formally part of the epSOS project team working with the 12 Member States under the Commission's large-scale implementation model, and the association represents 35 industry partners.

The first phase of the real-time epSOS implementation in 2011 will be an exchange among the 10 participating countries that Fredrik Linden called 'any-to-all', to demonstrate the systems are connecting correctly. While there are 12 Member States formally participating in the epSOS project, he explained that five of the original Member States are not ready to participate in the test operation, while three other countries not part of the original epSOS group have asked to participate leaving the final participation at 10 countries for the patient data exchange in 2011.

In the second phase of the large-scale implementation, needing the involvement of thousands of healthcare workers, each country will act out a real-world script requiring detailed EPRs. For example, the medical requests from Sweden and Denmark are built around the Oresund Bridge that connects the two countries and carries 20,000 people daily, including tourists and visiting workers from other Member States who frequently turn up for medical care.

France will use Erasmus students for its scenario, either requesting or sending medical data to the student's home country.

In his presentation at the European Connectathon, Fredrik Linden announced that 11 more European Member States have asked to join the epSOS project. In response, the Commission is now preparing a proposal for funding a 24-month extension of the epSOS project under its 7th Framework Programme, which will bring the new Member States onboard.

The success of the epSOS project has encouraged the Commission to go further with the participatory model to advance a vision of e-health not only as an enabler for patient care but also as a driver for technological innovation and job creation.

Benoit Abeloos, the project officer for eHealth with the Commission's Directorate General for the Information Society& Media, told participants at the European Connectathon a 'very large-scale implementation' is currently being planned.

Targeting a horizon of 2014, the European Large Scale Action (ELSA) aims to raise the game for European e-health by covering the full landscape from research and development through to a full-scale deployment of technologies in a programme involving national health authorities, patient organisations, various European industries, academic institutions and clinical experts.

Further details: www.epsos.eu

WoHIT 2010

Spain – The World of Health IT Conference & Exhibition (WoHIT) – the first joint eHealth conference of the European Commission and the Healthcare Information and Management Systems Society (HIMSS Europe) – was held in Barcelona this March, creating Europe's largest gathering of Information and Communication Technologies (ICTs) stakeholder groups as well as end-users, hospital CEOs, practitioners and patients.

For two decades, the European Commission has been supporting EU research through the funding of more than 450 projects for a total of €1 billion, enabling Europe to take the lead in research and innovation in the field. During the 8th Ministerial eHealth Conference, EU ministers outlined a joint vision and policy priorities on how to make eHealth more accessible, interactive and customised to patients.

The declaration, which outlines a vision and identifies key objectives to be achieved in the next ten years, is crucial, said Neelie Kroes, Vice President of the European Commission. 'This is what we believe – the ministers, governments and the Commission. It's also our to-do list. It's the beginning of a new era. Time is not our friend. We have to start with eHealth implementation now. Unless we embrace eHealth today, our health systems will not work tomorrow. The key is a single European eHealth market.'

Among IT firms demonstrating innovations, Dell introduced Mobile Clinical Computing (MCC), a mobile solution for hospital IT that gives clinical staff bedside access to patient data. No matter on which terminal a clinician logs in, the latest electronic patient record (EPR) can be accessed. 'Roaming throughout the hospital – this advantage is a big benefit for the quality of patient care,' said Paul Curley, Clinical Director of the NHS Mid-Yorkshire Hospital, UK. 'It's time-saving; we have all needed the latest available data to discuss the next diagnostic or treatment steps.'

Management of a hospital's high data volumes with quick, secure and reliable access to required data are major challenges for manufacturers. 'A professional understanding of the complexities of migrating from paper to EPRs in the modern healthcare environment is the basis to implement an efficient network. Backup and archiving are fundamental to any data management strategy,' said Tony Cotterill, CEO of BridgeHead Software. 'Healthcare storage virtualisation [HSV] helps hospitals to realise the full potential of EPR systems, because HSV empowers hospitals to meet their growing storage needs without compromising on the current hardware brand or media type. HSV separates applications from the storage device, allowing multiple applications to tap into the same resources and increasing overall utilisation of the storage resource.'

At WoHIT (from left): Renzo Taal, EMEA Healthcare Director at Dell, with Paul Curley, Clinical Director IM&T Mid-Yorkshire NHS Trust

Patient focused citizen services are needed not only during any hospital stay, but also prior to admission. For several years Finnish public healthcare organisations have been running the SMS Pre-Call Request service provided by Tieto, an interactive SMS solution. The SMS Pre-Call Request service asks each patient, beforehand, whether the date and time of an offered appointment are suitable, thus reducing the need to reschedule appointments. 'Pre-Call Request reduced cancelled appointments by 20%,' Arto Ryymin, Executive Vice-President of Healthcare & Welfare, pointed out. 'It brings significant health benefits, eases the daily routines of healthcare professionals and improves organisational productivity. In addition, this service makes the appointment booking process more patient-oriented.'

eHealth could potentially solve some of Europe's pressing healthcare problems, caused by more people demanding more care in an ageing society. But it also encompasses some great economical opportunities. Let's go for it.

Report: Denise Hennig

Tyrolean hospitals share patient data

Austria – Seven hospitals in the Tyrol region are now online with an IHE cross-enterprise document sharing (XDS) network centred at Innsbruck University Hospital. About 4,000 patient discharge letters are exchanged daily and 4,000 queries managed.

Florian Wozak, a member of the project development team, reports that the network is fully integrated with clinical information systems, connects the products of different vendors of health information systems, and significantly, conforms to the requirements for the Elektronische Gesundheitsakte (ELGA), Austria's planned electronic patient record.

Historical records from the community hospitals were being uploaded at a rate of 250,000 transactions registered daily, he said.

Ingmar Gassner MD, at the Department of Paediatrics, University Hospital Innsbruck, reviews radiology records with a colleague using the shared network

Begun in 2002 at the University for Health Sciences, as a research project called health@net, the original goal was to interconnect the central Innsbruck University Hospital with general practitioners (GPs) and specialty practice groups. 'After some work we decided to shift the focus of this project for direct communications to patient-centric electronic health records (EHR),' he explained. The introduction of an architecture for a cross-enterprise document sharing (XDS) network by the international user-driven organisation Integrating the Healthcare Enterprise (IHE), '…was similar to our own planned designs and we decided to migrate our prototype architecture toward a fully XDS-compliant infrastructure.'

In January 2009, the registration process, uploading the content for the repositories, began with the Tyrolean State Hospitals (TiLAK) and then step-by-step after that with the community hospitals.

The architecture for the Tyrol network was tested over a three-year period at IHE Connectathons in Europe and the USA.

As a further security measure, the Tyrol network runs on a layer of a dedicated Austrian eHealth infrastructure that is part of the ELGA programme and is independent of the internet, connecting healthcare institutions, as well as physician practices.

'Physicians today want everything relevant to a patient's care pushed to their inbox, so we want to cover this workflow by providing all information,' he said, adding: 'We focus on integrating a system the way it will be used, as we have learned that usability is very important for the success or failure of health IT projects.'

Leipzig's winning IT network

iSOFT scoops top Financial Times Deutschland award

A telemedicine network project currently being implemented in the Leipzig region has won Australian IT firm iSOFT the top award in the *5th Ideenpark Gesundheitswirtschaft* (Idea-park Healthcare) competition, presented by the *Financial Times Deutschland* at its annual FTD-Health Conference in Berlin. The awards are given for projects that contribute to greater transparency, productivity and efficiency in the German healthcare system.

The competition judges included Heinz Lohmann (Consultant in the healthcare sector), Sophia Schlette (Kaiser Permanente), Matthias Schrappe (Advisory Council), Ulrich Wandschneider (Mediclin), Jürgen Wasem (University of Duisburg-Essen) and Nicholas Forster (G + J Business Media), and they analysed and evaluated around 50 nominated projects.

The winning *Telematikverbund Sachsen Nord* (TVSN) project aims to integrate the separate IT structures in eight different clinics to create one effective medical network that will significantly optimise breast cancer treatment in the region. To this end, the partnering organisations are integrating iSOFT's electronic case record solution, a development based on the Fraunhofer Institute for Software and System Technology specification. Medical information should then be distributed seamlessly within the entire network.

First, however, a variety of challenges had to be solved. The IT environments of all the collaborators had to be elevated to a common standard, for example. In addition, the technology necessary to implement a consistent communications and coordination network had to be integrated into the different systems.

Inevitably data protection was another issue. The case record data is stored only for the duration of the specific case; it is automatically deleted when that treatment ends. Additional data security is ensured by the fact that patients must specifically agree to their data storage and use by specific doctors in the network.

'The substantial network infrastructure, which is based on secure internet technologies, shows that the concept goes one step further than most comparable projects,' the competition judges said, adding: 'It also avoids the sensitive data protection topic in a very elegant and efficient way.'

The project will enter a two-year trial period this spring. Results obtained in the clinical tests will then become the basis for fine tuning the system. The findings will also be published and made available to the entire market, in this way helping the German healthcare system towards greater efficiency.

Further details: www.isofthealth.com

TELEMEDICINE

Dutch cardiology network enables real-time consultations

The Netherlands – Physicians connected with the Friesland Regional Cardiology Network can now consult in real-time with specialists at the regional medical centre to determine the best course of treatment for their patients.

The cardiology network not only speeds up the referral process and improves both diagnosis and the clinical decision process, but also is credited with reducing the length of stay for in-patients by, on average, one or two days.

Previously, cardiologists in the region typically referred their patients to the Medical Centre Leeuwarden (MCL) where more than 1,450 percutaneous coronary interventions, 750 open-heart surgeries, 2,100 coronary angiographies and 40 percutaneous aortic valve replacements are performed annually.

Until recently patient records and images were shuttled back and forth between referring centres and LCL on compact discs sent by courier, as attachments to emails, or when possible by fax.

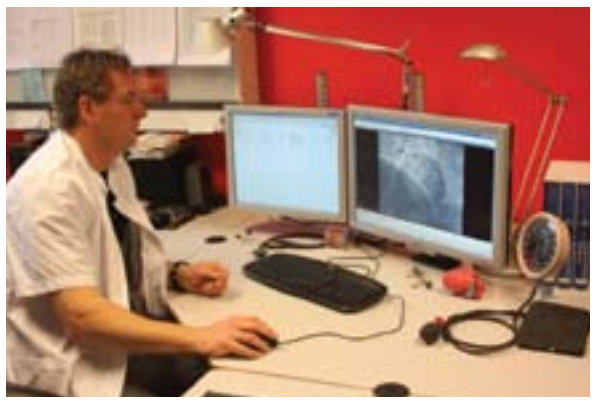
At the end of 2007 the MCL began a six-month pilot programme to test the electronic exchange of data between the cardiology systems at MCL and those at the Nij Smellinghe hospital in Drachten using an open architecture for image sharing developed by the user-driven organisation Integrating the Healthcare Enterprise (IHE).

By the end of 2009, the third and final phase of implementation connected other hospitals in the region to the cardiology network. Adapting legacy systems and image archives to the IHE protocols, to avoid an investment in new systems, was achieved using products developed by Forcare B.V. in Zeist.

Today, from office workstations, cardiologists can consult on advanced clinical images provided by any hospital linked to the network. Once uploaded to the cardiology network, records remain available for consultation at any time so that previous episodes of a patient's care can be consulted in detail, no matter where the care was provided in the region.

Recognising the success of the information exchange in the regional cardiology network, hospitals in the region are currently planning an expansion to other practice areas using IHE architecture.

Report: John Brosky



Cardiologist Marcel van der Linde, sending images for consultation from his office in the Nij Smellinghe Hospital, Drachten

Jan Brouwer, cardiologist at the Medical Centre Leeuwarden, receiving images for consultation

SUCCESS FOR TELE-STROKE SERVICE

A telemedicine project is being used in rural areas of eastern England to enable stroke patients to receive clot-busting drugs within a critical three-hour time window. Adapting video-conferencing facilities, a telestroke service has enabled patients to receive a diagnosis from a stroke specialist, who can authorise thrombolytic drugs to be administered to those deemed eligible

Launched last Autumn with a pilot scheme across four hospitals, England's eastern region telestroke service has proved so successful that plans are now being drawn up to roll it out to more acute hospital trusts in the region.

Dr Liz Warburton, consultant in stroke medicine at Addenbrooke's Hospital, Cambridge, and clinical lead for Anglia Stroke and Heart Network, said: 'Stroke patients need to be administered clot-busting drugs within three hours of the onset of symptoms and can only have this after diagnosis by a consultant. Because of the rural nature of the eastern region of England, it was not always possible to get a patient to hospital on time to get a scan or see a consultant.'

Many patients ran the risk of falling outside the three-hour time window, making them ineligible for the clot-busting drugs that would significantly enhance their chances of a better recovery. However, the East of England Strategic Health Authority (EoESHA) has pledged that most patients should benefit from 24/7 access to stroke thrombolysis. Dr Warburton said to do this with the number of specialists available and the geographical nature of the area was a major huge challenge.

To meet that challenge, stroke specialists looked to telemedicine and a particular example, a successful telemedicine stroke service in Bavaria, southern Germany.

To apply it within an NHS setting the EoESHA set up a telemedicine board of stroke specialists and IT experts to establish a pilot scheme in hospitals in the region where stroke services were relatively advanced: Watford, Southend, Peterborough and Addenbrooke's.

The pilot uses IOCOM software with a 'computer on wheels' (COW), which houses a fixed video camera and an audio link between A&E departments and the specialist stroke consultant.

Working an on-call rota, six consultants – Dr Eoin O'Brien and Dr Patrick Barry from Cambridge, Dr Paul Guyler (Southend), Dr David Collas (Watford) and Dr Peter Owusu (Peterborough) and Dr Warburton, have specially-designed laptops with high quality sound and video links enabling them to examine the patient and read CT images.

Dr Warburton said: 'The consultant can speak to the patient, examine the patient, and conduct an effective remote consultation. The hospital can then upload the brain scan to enable the consultant to make the diagnosis and authorise the use of thrombolytic drugs.'

This has meant patients have a diagnosis within the timeframe, without travelling long distances and – with a shortage of stroke consultants in the eastern region - it provides hospitals and patients access to experienced stroke physicians. 'The benefits for the patient are huge,' Dr Warburton said. 'If they receive thrombolysis within the three hours they are 30% less likely to be disabled after their stroke but, to be fully effective, it is vital to get expert diagnoses immediately. Once diagnosed, they can also be managed locally if they need rehabilitation.'

Additionally, there are staff training benefits and it is cost effective for the health service. Across the East of England there are over 6,000 strokes annually with 10-15% of patients eligible for thrombolysis, though only 1% receives this treatment at present. The EoESHA say if 10% received thrombolysis, an additional 90 patients would be independent stroke survivors equating to an additional cost-saving in the first year of £2.7 million to the NHS and social care in the East of England.

Figures also suggest a saving of £80,000 a year for each hospital joining the network wide on-call rota.

So far, 35 patients have been treated successfully and, once rolled out across the area, EoESHA say the new service is expected to save more than 100 lives annually and enable many more people to avoid long-term disability following a stroke.

'Overall it has been a tremendous success,' said Dr Warburton. 'It has made a real difference to people's lives and we are now in the process of looking to roll it out further across the eastern region.'

Report: Mark Nicholls

LABORATORY & PHARMACEUTICALS

First on-site evaluation of the cobas 8000 clinical analyser

UK – The Poole Hospital NHS Foundation Trust has become the first site, worldwide, to evaluate the full serum work area (SWA) capabilities of the cobas 8000 high throughput clinical analyser. The cobas 8000 SWA platform, incorporating two cobas c701 high throughput clinical chemistry modules together with a cobas e602 immunochemistry module, has been installed in the Trust's Clinical Biochemistry Department, which operates at two laboratory sites and provides biochemistry services for both Poole Hospital and the nearby Royal Bournemouth Hospital.

'Upgrading to cobas 8000 increases our capacity and provides faster throughput of samples,' explained Darren Jose, Pathology General Manager. 'Our current Roche platforms shaved four hours off our run times compared to our previous analysers. With cobas 8000 we are able to save even more time. The system also "future proofs" our service against further workload increases. Our plan is to have two cobas 8000 platforms at each laboratory. These powerful and space efficient platforms will easily cope with our high volume, high throughput work - and we can also run specialist assays (such as specific proteins and therapeutic drugs), user defined assays and low volume tests.'

With 183 different assays, Roche reports that it provides '…the largest menu of tests available on an automated serum work area platform and, with 35 different configurations, cobas 8000 provides in-built flexibility to satisfy demands – both now and into the future. This truly modular platform is the perfect solution for the consolidation of workloads in laboratories running greater than 2.5 million tests per year. In addition to increasing productivity in the laboratories, cobas 8000 also fits with Poole's vision for 'one touch' sample processing'.

'Sample receipt was very labour intensive and slow,' Darren Jose pointed out. 'The cobas 8000 allows us to fully exploit order communications technology. Samples will come into the laboratory already barcode labelled, with the test request already in the system. Then, all we do is load the sample onto the Roche Modular Pre-analytics, and it will proceed automatically through the required analysers before being removed, stored, or even disposed of without any further manual intervention - literally one touch processing, which will save much time and effort.'

The cobas 8000 platform at Poole Hospital will also be linked to the cobas p501 storage retrieval module, further automating and speeding up the sample handling process.

The system has been installed at the NHS Foundation Trust in Poole

Prostate cancer risk assessment

Novel p2PSA marker more accurate than PSA testing

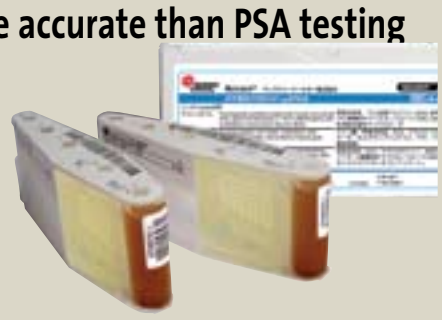
The effectiveness of PSA (prostate-specific antigen) screening on reducing prostate cancer mortality was given a boost in 2009 when the conclusive findings from the 10-year European Randomized Study of Screening for Prostate Cancer (ERSPC) – the world's largest prostate cancer screening study – were published.

From 1992, the ERSPC study randomized 162,000 men, aged 55 to 69, in seven European countries to either a screening arm or a control group. Those screened were given a blood test to detect PSA levels: if it was 3.0ng/ml or more, they were offered a biopsy. The study showed that PSA screening delivers a 20% reduction in mortality from prostate cancer.

However, separate ERSPC findings also confirm that ~30% of detected cancers actually have non-aggressive features and are 'indolent' or slow growing. That's because PSA testing is sensitive but not specific. Dr Bernard Cook, group manager scientific and professional relations immunodiagnostics at Beckman Coulter, Inc., USA, has pointed out: 'With limited ability to discriminate between cancer and benign disease, screening for prostate cancer with PSA remains contentious. While it can help detect some life-threatening tumours, the argument against it is the risk of patients suffering unnecessary and potentially harmful tests and treatment.'

With its new prostate disease marker, p2PSA, and the Prostate Health Index (*phi*) Beckman Coulter reports that it has made a significant breakthrough in improving the specificity of prostate cancer biomarker assessment, which helps reduce unnecessary biopsies.

Named *Access Hybritech p2PSA*, the new marker measures the [-2]proPSA molecule, an isoform of free PSA. Studies have demonstrated that when p2PSA measurements are combined with Access Hybritech PSA and free PSA measurements, the resulting index demonstrates a significant improvement in clinical specificity for prostate cancer detection, relative to PSA and % fPSA alone, in the PSA range 2–10 ng/mL in men >50 years and with non-suspicious digital rectal examination (DRE) findings.(1)



The Beckman Coulter Prostate Health Index is derived by combining the results of three automated blood tests, Access Hybritech PSA, free PSA and the new p2PSA and is now available in Europe for use on the Beckman Coulter Access and UniCel DxI Immunoassay Systems. 'When *phi* is installed, the system automatically calculates and reports the Prostate Health Index test results.' John Blackwood, vice president and general manager at the Beckman Coulter Immunoassay Business Centre, said. 'The *phi* score provides physicians with additional critical information to guide follow-up and treatment decisions for men with an elevated total PSA, including the challenging total PSA range of 2-4 ng/ml.' The firm has also launched an educational website (*ProstateHealthIndex.org*) to inform patients, physicians and laboratory personnel about p2PSA and how to use the new Prostate Health Index. The website also provides links to credible medical resources, the latest unbiased scientific studies and details the benefits of the latest blood test.

Hybrid operating theatres

What defines them, how do they affect surgeons' work and what is their value to hospitals? Christian Tebel, head of Professional Services at TRUMPF Medical Systems, explains

PHOTO: TRUMPF GROUP

Christian Tebel (right) is responsible at Trumpf for planning and conducting international product and application training, global analysis of medical trends in operating theatres and ICUs, and advising clients and employees on matters related to medical applications and clinical concepts.

Basically, a hybrid operating theatre (OT) is a combined operating room containing large imaging equipment, such as MRT and CT, which enables intra-operative diagnostics. If provided for in the hygiene and theatre concept, the hybrid OT can also be used purely as a diagnostics room, or as a classic operating room.

Likewise, operating theatres with integrated in-patient or mobile angiography devices are also called hybrid OTs. Simply imagine an operating room with a completely equipped cardiac catheter laboratory.

This definition of a hybrid OT has gained increasing acceptance because more and more cardiologists and vascular surgeons employ hybrid procedures. Specifically, this means that interventional treatment by means of a vascular catheter, for example, is combined with open surgery.

A hybrid OT enables a multitude of new surgical procedures – for virtually all disciplines. New potential areas of application are emerging especially in trauma and orthopaedic surgery, neurosurgery, cardiac and vascular surgery. For example, the trend in vascular surgery is shifting increasingly from open surgery to endovascular procedures, and also open and interventional therapies are combined. This is feasible in a hybrid OT. Even if open surgery is indicated for endovascular or minimally invasive surgery (MIS) in an emergency, this is possible in one time-saving session involving less risk and strain for the patient. Another example, from the field of neurosurgery: in this case intra-operative imaging serves to update preoperative image and navigation data. This results in key advantages with respect to perioperative delimitation of tumour tissue and determination of resection borders.

Costs

Purchasing large devices, such as MRTs, CTs or angiography equipment, is always a big investment. So it's all the more important to use such equipment as economically as possible. If this is done in a hybrid OT, both human and technical resources can be utilised optimally. Integration of a hybrid OT into the central surgical department generates the most advantages. In particular because a hybrid OT permits interdisciplinary applications and is thus available to the theatre management as an operating room resource. In short, once the hybrid is set up, the clinic can save enormous costs through its use and additionally optimise the selection and quality of treatment methods. This also increases patient and staff satisfaction.

PHOTO: SIEMENS

The complete integration of the operating table into Siemens' angiography systems enables quick rotation and 3-D images using the C-arm

Prerequisites for interdisciplinary use

Key factors include the right room design and an appropriate selection of technical equipment. At the same time the imaging device and operating table must form an integral unit. Planning therefore plays a crucial role, since both the room concept and the technical equipment have to be adapted to the respective in-house procedures and concepts. As for choosing the right operating table system, an interchangeable table top system with a fixed column offers the greatest scope. It ensures that a defined reference point is provided in the room for the imaging devices. Moreover, you can take advantage of the entire spectrum of operating and diagnostic table tops. That's the basis for interdisciplinary use.

An example of an X-ray system suitable for interdisciplinary use in a hybrid theatre is the Siemens Artis Zeego. The C-arm and an exclusively developed version of the Trumpf operating table system TruSystem 7500 work together 'as a team', meaning both devices know where the other is positioned. That's the basis for integrated collision protection. Furthermore, the C-arm and the operating table can be controlled via a joint control platform if necessary.

Installation is not exactly easy. When you equip an interdisciplinary hybrid OT with a CT or MRT, you must first keep the room concept in mind. Nowadays multi-room concepts are also implemented. In this case the large equipment is mobile and can be used alternately in two or even three rooms. No matter whether it involves a CT, MRT or devices like Artis Zeego, in every case there are additional requirements regarding room size as well as control and technical rooms. This is easier to accomplish during the early planning phase for new buildings. If you subsequently install equipment in hybrid OTs, things become more difficult. Frequently, however, adjoining rooms are available for the respective use in central OT units. If they are 'rededicated', and operating theatre logistics, procedures and the OT concept are optimised simultaneously, you kill two birds with one stone.

PHOTO: BRAINSUITE, GÜNZBURG

The BrainSUITE at the Günzburg Regional Hospital incorporates both integrated MRI and neuronavigation

The factors that guarantee smooth incorporation of an interdisciplinary hybrid OT into a central OT unit include precise planning and prompt integration of the users in order to boost acceptance of interdisciplinary use. I mean, not only does the equipment work as a team in the hybrid OT, but also different and, from a historical viewpoint, 'non-OR-related' disciplines must function as a team in the hybrid OT. The same applies to the companies whose medical technology products are to work together in the hybrid OT.

I believe hybrid OTs are the future. Classic open OT procedures are reducing, so it's necessary to integrate imaging into the operating theatre. Disciplines of internal medicine, with their interventional and endoscopic procedures, increasingly work hand in hand with surgical disciplines, with their open and minimally invasive methods. Even radiology cannot avoid this trend towards integration. Specialised departments are increasingly joining forces. Industry must also accept this development. The hybrid OT is one of the main drivers of this development. No supplier can cope with the complexity of the hybrid OT alone; teamwork is called for.

PHOTO: BRAINSUITE, GÜNZBURG

Intra-operative diagnostics in neurosurgery in Günzburg's hybrid theatre

Trends always involve hurdles. Mostly they naturally relate to available budgets. Another factor in the case of hybrid OTs is that an understanding regarding optimum exploitation of resources must grow and even greater focus must be placed on the importance of cooperation between clinics, planners and industry. If we succeed in overcoming these hurdles, the realisation of hybrid OTs will become more than just a trend!

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3-D endoscopy for image guided surgery

Jochen Penne

Segmental liver resections and ablative therapies require accurate and precise tumour localisation.

Because the peritoneal cavity is subject to deformations caused by respiration and topological changes in the surgical site during an intervention, the transfer of MRT and CT tumour data into an intra-operative setting remains a technical challenge.

At the Pattern Recognition Laboratory in Friedrich-Alexander University Erlangen-Nuremberg, researcher Jochen Penne (Dipl. Med.-Inf.) is focusing on the acquisition of 3-D surface scans of the surgical site even during minimally invasive interventions.

To acquire 3-D surface scans he uses a novel scanning device: With a Time-of-Flight (ToF) based 10 mm laparoscope he acquires 3072 3-D surface points at 20 frames per second with an average precision of 0.89 mm. The spatial resolution used is comparable if not superior to alternative techniques, such as laser range scanners, although the researcher is using only off-the-shelf technology components.

His endoscope system consists of two laparoscopes, one equipped with a colour sensor and the other with a ToF sensor to acquire the 3-D surface scans and grey value images. With effective illumination of the site, with an optical reference signal in-depth information is gained via a pixel-wise phase-delay measurement between emitted and received reference signals.

The researcher's experiments have shown that overlaying the ToF image and colour image produces precise 3-D images suitable for image guided surgery.

Jochen Penne expects this new technology will be available within 12 months.

The MR-guided intra-operative surgical suite

Intra-operative MR imaging is still uncommon in Europe – particularly in neurosurgery. One of the first neurosurgery departments to work with a 3-T MR is in the Central Military Hospital in Prague. The experience and initial clinical findings from treating more than 300 patients, over a two-year period, was reported at this year's ECR.

When EH correspondent *Meike Lerner* asked Dr David Netuka about the type of interventions performed in the hospital's image-guided neurosurgery suite, he explained that there are two major areas in which his department mainly uses the intra-operative MR scanning option: pituitary adenomas and gliomas.

'In the case of pituitary adenoma, we use all the modern technologies, such as endoscopy, but still cannot be 100 % sure that we have removed everything. In that case, we stop the procedure, and transfer the patient from the operating theatre (OT) to the MR suite to perform intra-operative scanning. We then review the scans and decide whether we achieved our goal, or not. Is there


David Netuka

a residuum that's amenable for resection, or should we quit the procedure? Previously, you did the surgery without intra-operative scanning and waited three months for full MR scanning. With pituitary adenomas, it's quite tricky to do MR scanning one day after surgery because of the possibility of haematoma and postoperative changes. We do it nowadays, but in the neurosurgical literature, the value of early postoperative MR scanning is questionable.'

In April 2008, GE Healthcare's 3.0-Tesla and 1.5-T Magnetic Resonance Neurological Suite was integrated into an operating theatre at the hospital. This uses 3-D imaging to navigate and validate treatments, helping to help increase the accuracy and speed of interventions and improve patient outcomes. 'Since then,' Dr Netuka said, 'we've been able to increase the number of radical resections by 20 % in a group of

The neurosurgeons found 36 % of procedures, initially considered complete, are continued, confirming that image-guided surgery holds an important role in neurosurgery

150 of those 300 patients. And we got the results that this increase was not connected with an increase of morbidity. If you are more aggressive in surgery, you could increase the morbidity but this was not the case.

'For the glioma patients, not only the extent of resection can be enhanced, but we also try to decrease surgical morbidity by using functional images and tractographies. Here, we observed less second stage surgeries.'

Along with better patient outcomes, workflow has improved. 'The MR suite is next to our operating theatre, so we only open the door and the surgical table is moved to the MR suite where we slide the patient into the MR scanner. Together with the neuroradiologist we discuss the cases we want to do in the OT, and then we select the sequences we want to do intra-operatively. It takes 12-15 minutes and everything is much faster; it works smoothly. But the crucial point is the cooperation between the neurosurgeon and the neuroradiologist.

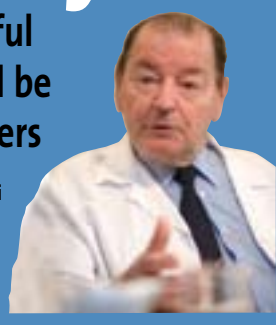
Another important point: There are always concerns that if you do intra-operative scanning, and move the patient into another room, there may be an increased risk of infection. We can show there has been no increased risk of infections due to intra-operative scanning.'

Asked about other fields in which this practice could be of value, Dr Netuka said: 'A quite innovative approach is its use for spinal cord tumours. Another interesting field is intra-operative tractography. The other point is intra-operative spectroscopy – detection of a tumour remnant with a different imaging modality – which may be useful in the future.'

Peripheral nerve surgery

To help patients to attain functionally useful movement, international standards should be mandatory for physicians and health insurers


Robert Schmidhammer


Hanno Millesi

Neurosurgery has seen enormous progress, which should benefit as many patients as possible. However, according to Professor Hanno Millesi MD, director of the Millesi Centre for Surgery of Peripheral Nerves, Wiener PrivatKlinik (WPK), a private hospital in Vienna, Austria, 'Obsolete methods are still used; methods are perceived incorrectly, because they are often confused with problematic predecessors, and sensible methods are applied incorrectly – or not used at all. All of this is to the patients' disadvantage.'

In the run-up to the *Third Vienna Symposium on Surgery of Peripheral Nerves* (19 –21 March 2010) Prof. Millesi demanded scientifically verified, international standards for peripheral nerve surgery to be mandatory for physicians and health insurers. If, for example, in an accident a few decades ago a motorcyclist tore the plexus brachialis, the nerve bundle responsible for arm movement, from the spinal cord, the arm was usually amputated for want of an alternative. 'Today,' said Prof. Millesi, 'we could restore that arm and function with neurosurgery; afterwards the patient won't play the piano but he will be able to open doors and he will suffer less pain.'

Medically and ethically problematic is the fact that, in many such cases, public hospitals do not apply current surgical treatment standards that aim to attain functionally useful movement. In general, specialised experts are not consulted. A current study from Austria shows that hardly any operations are performed to improve functions. Prof. Millesi emphasises that the situation is not much different internationally. 'It must not be a matter of coincidence whether a patient is seen by a physician who knows about the modern treatment options and whether the health insurer is willing to assume the costs for a sensible and modern treatment,' he said.

At the symposium three spectacular innovations, developed in Austria, were presented. The first accelerates nerve regeneration using impulse waves. Torn nerve connections only grow back at a rate of one millimetre a day. It has now been found that impulse waves can accelerate this process significantly – almost treble in animal experiments. Low energy impulse waves – i.e. extremely short acoustic impulses, comparable to those used to crush kidney stones – have been used, each for a millionth of a second. 'The tissue is only *shaken* for a moment, assisting the healing effect,' explained Dr Robert Schmidhammer, partner in the Millesi Centre for Surgery of Peripheral Nerves at WPK and head of the department for neuro-regeneration of the Ludwig Boltzmann Institute for Traumatology.

The second innovation restores the biceps function for patients whose plexus brachialis has been entirely or largely torn from the spinal cord, without having to sacrifice other important nerve functions. Previously, in such cases, one of the two important diaphragm nerves needed for respiration was diverted to the upper arm. However, this meant that many patients had problems because their respiratory muscles then only functioned on one side. 'Instead, we apply the *end-to-side* method, the best option in this case. The fibres of the diaphragm nerve are not diverted but *tapped* on the side,' Dr Schmidhammer explained. Thus free nerve transplants are placed to connect to the nerve for the biceps. As soon as the nerve fibres arrive there, in the course of their regeneration the nerve that controls respiration also bends the elbow. After a brief period in which the arm is moved by every intensive breath, the brain learns to distinguish these movements.

The third innovation serves to prevent and relieve chronic neuropathic pain. According to the principle 'use it or lose it' brain regions not used for their original tasks are either used for other functions or shut down. In the case of a nerve injury it can take months until the nerve connection to the target organ is restored. During this period, without stimulation the brain forgets the ability to recognise and interpret stimuli from the affected region. Instead intense chronic neuropathic pain can occur. 'We have found a way at least to retard this process,' Dr Schmidhammer announced.

Patients are asked to touch a sensor with their numb hand repeatedly and to follow this movement with their eyes. The highly specialised sensor transmits an optical signal and tone, both of which are recognised by the brain. This optical and acoustic information stimulates the tactile centre, which, without such stimulation would rapidly forget its ability. 'This procedure substantially shortens the rehabilitation phase with respect to higher sensitivity,' he concluded.

Surgical treatment of nerve damage is important because the injured nerves can lead to intensive chronic neuropathic pain syndromes. Prevention consists of timely restoration of interrupted nerve connections, respectively elimination of the cause of pain at the nerve itself. 'Unfortunately, such sensible operations are often avoided, although the operation costs are far outweighed by the savings in analgesics,' Hanno Millesi reflected.

Report: Michael Krassnitzer

The Surgical Planning Unit

Soon essential for complex procedures

Surgical planning is complex. Today's surgeons can utilise information from various sources – including CT and MRI images, as well as f-MRI, PET or electro-physiological signals. For minimally invasive surgery (MIS) these additional imaging data are of particular importance, in that they enable precise navigation within

the body. However, the ability to assimilate all the separate data and create a coherent picture on which to base surgical planning depends very much on a surgeon's level of experience. Currently that leaves the less practised disadvantaged.

The situation will soon be history, believes **Professor Jürgen Meixensberger**, Director of the Board at the Innovation Centre for Computer-Assisted Surgery (ICCAS) and Director of the Clinic and Polyclinic for Neuro-Surgery at Leipzig University Hospital in Germany.

ICCAS, part of the medical school of Leipzig University, has developed a globally unique high-tech room for surgical planning, in which all available patient data are converted into an animated 3-D patient model. 'The Surgical Planning Unit (SPU) is the ideal platform for strategic surgical planning,' Prof. Meixensberger explained. 'It allows us to discuss the complexity of an intervention beforehand and thus offers perfect training grounds for less experienced surgeons.'

Asked how medical imaging and IT is combined in the SPU, he said that generally the radiology department supplies the surgeon with several types of slice images, acquired in different planes: axial, sagittal and coronal. 'He has to use his imagination to create a 3-D image from these data. That's fine for an experienced surgeon, but might be a bit more problematic for a less experienced colleague. In the SPU information technology takes over the task of human imagination. The software generates an animated 3-D image of the entire organ based on the different volume data that were acquired before. Then, different layers, such as skin or bones, can be removed to reveal where exactly a tumor is located and which sensitive regions, such as arteries and nerves, are involved.'

Is the SPU tomorrow's surgical workbench?

'Absolutely: The SPU not only allows identification of the surgical method suited best for the individual patient, but the intervention itself can be simulated either virtually or on a plaster model. Thus complex or new techniques can be trained. Moreover, the SPU provides the ideal platform, for example, for the so-called tumour boards to discuss the complexity of a case and define the surgical strategy: What are the relationships between the risk structures? Where are the resection margins of the tumour? Where is the best access?

'Furthermore,' he added, 'in a next step, the data are linked to surgical support systems, such as device navigation or distance alarm systems, which means that the modelling information is forwarded directly to the OR and the surgeon can focus completely on the intervention itself.'

Is SPU applicable for all surgical operations?

'At ICCAS we primarily deal with issues surrounding ENT, neurosurgery and cardiac surgery. In two of our SPU research projects we are looking for the ideal heart valve replacement, or for the ideal hearing aid. But many other applications, such as soft tissue surgery of the liver, benefit from the equipment. However, one has to take into consideration that the generation of a virtual 3-D model from various imaging modalities is still a rather time-consuming task. Converting 10 million data from a volume data set into an organ model takes a whole day. Therefore our research and development team is looking at ways to further accelerate data processing, so that, at some future date, we'll be able to plan all clinical cases, not only the complex ones.

Funding - 'Our SPU prototype was financed by the German Federal State of Saxony with costs amounting to about €700,000. Integration of hardware and infrastructure was the most expensive task. We have already received inquiries from USA and French institutions that are interested in our approach.

'In addition the SPU presents an entirely new space culture within a hospital, which means that we are also trying to figure out the ideal location of such a planning unit. Surgical planning and simulation are tasks that are neither part of radiology nor of the OR, but are performed outside diagnosis and actual surgery. Thus, an SPU could also be conceived as a remote telemedical service. I'm convinced that, above all, hospitals offering complex surgical procedures will soon be equipped with an SPU.

Interview: Karoline Laarmann

Jürgen Meixensberger

Keeping up with innovations and standards

The 3rd Central European Congress of Surgery (CECS), held alongside the 5th Croatian Congress of Surgery, drew over 300 participants to Dubrovnik at the end of April – 43 more than the previous gathering. 'Medical knowledge and equipment, therefore surgical techniques and instruments, are rapidly evolving almost daily. We have to keep each other up to date with current achievements and treatment results in order to improve our methods of treatment upon which our patients rely,' said Congress President Professor Bozidar Zupancic, Head of the Children`s Surgery Clinic at Children's Hospital Zagreb, Croatia, during an interview with EH reporter *Karoline Laarmann*

Bozidar Zupancic

Speaking of developments in minimally invasive surgery (MIS), Professor Bozidar Zupancic emphasised that surgeons must work closely with manufacturers so that the instruments are adjusted to fit the surgeon's needs. 'We depend on breakthroughs and advances in light sources, optical devices, HD cameras and related equipment because better visibility and detail sensitivity mean better control over the operating field. Ports, different surgical instruments and accessories, sutures, and improvements in postoperative care all require a synergy between user and provider. MIS has provided the possibility to reduce the size of postoperative scars and automatically reduced mutilation of the tissue, especially at skin level, which is one of the most important factors in the patient's life, other than life itself, of course.

'We shouldn't forget to mention NOTES (natural orifice transluminal endoscopic surgery), which is a step towards "no scar surgery", because the entire operation is performed through natural orifices. The application of this technique is still controversial, but nevertheless demonstrates how far the medical industry and surgical techniques have gone.'

The challenges in paediatric MIS are similar to those in general surgery, only on a smaller scale and with certain characteristics associated with paediatric population and pathology, Prof. Zupancic pointed out. 'As always, financial challenges present the largest obstacle. The equipment required for MIS as well as physician training is expensive and have to be coordinated within our budget limits. Luckily, donations play a significant role. We are very grateful for the generosity and nobility of the donors who help us help our little patients.

'MIS is widely applied in paediatric surgery, especially in urology and abdominal surgery. In urology we perform cystoscopy on daily basis. Also, we are currently the only paediatric hospital in Croatia that performs retroperitoneoscopy for certain renal conditions. Transumbilical laparoscopically assisted appendectomy is basically a standard procedure and we have fantastic results in using this method. Palomo's laparoscopic procedure is a standard operation, we rarely perform the classic procedure anymore. Nissen's procedure for GERD is also performed. MIS plays a big role in paediatric orthopaedics and gynaecology as well.

'These are just highlights of application of MIS in our Clinic and we give great importance in training our residents and attending surgeons so that the span of MIS procedures expands and improves.'

Surgeons must be able to perform classic operations, he pointed out, particularly for trauma patients, acute abdominal conditions and other diagnoses that arrive daily. 'A complete surgeon is one who can manage those conditions. Today, as the range of procedures, diagnostic, therapeutic possibilities and technology expands from one standpoint and focuses from the other, specialised surgeons are certainly needed to comprehend methods applied in one field (e.g. urology) and master them. If every general surgeon performed all surgical procedures, treatment results would not be as good as today, when we have specialised surgeons. General job-related requirements for a surgeon are dexterity, problem solving skills, determination, commitment and willingness to sacrifice most of his time and energy on improving himself as a surgeon.'

Maintaining standards

Working conditions must meet all sanitary and safety standards for the medical teams and patients, the professor pointed out. 'Internal and external surveys are conducted to monitor the level of quality and, so far, we've had no negative remarks, of which we are certainly very proud. On the other hand, unfortunately, as far as physician numbers goes, we also follow the worldwide trend of a downgraded reputation of the medical profession. In other words, education is very time consuming and lasts longer than for other professions. Lifelong education and keeping up to date with current trends and technology also decreases the popularity of a medical career. As in other countries, we lack young physicians as well as nurses. Young people know these are demanding professions and many do not see themselves studying for 6-7 years in order to apply for residency and study for another 4-6 years. Alas, they have to study their whole lives if they plan to be at the top of their game.'

IT and surgery

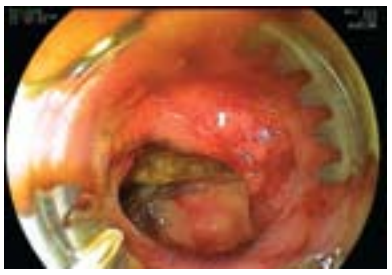
Speaking of the 'vast possibilities of the symbiosis of IT and medical engineering', Prof. Zupancic said: 'Robotic surgery exists and will probably develop further and become a certain standard as time passes. The same happened with MIS. Laparoscopy was long thought as controversial. Resistance to implementing it into standard surgical procedures has been enormous. In time it has found its place under the stars, as will other procedures that are being developed.

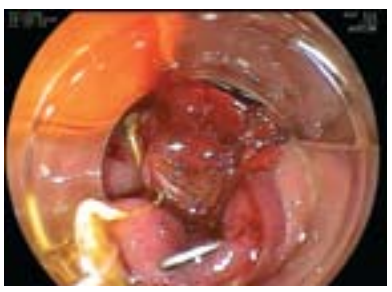
'IT also offers long range video conferences and consultations in real time. Trading information, ideas and knowledge is much less complicated nowadays, thanks to IT. Presumably, new technologies will primarily help diagnostic methods to evolve faster in comparison to surgical procedures and accessories. That's the way it has always worked because surgeons must accept and feel comfortable and safe using new technologies, whereas if you improve the image on a new MRI or CT machine then nobody will question if it should be put to general use.'

Congress presents transvaginal pancreatic resection

Advanced endoscopes have already transformed certain surgical procedures. Thanks to minimally invasive surgery (MIS), such as NOTES (Natural Orifice Translumental Endoscopic Surgery), even bowel resection can be relatively scar-less. Such procedures are entering gastroenterology, as presented at the 40th Congress of the German Society of Endoscopy this March. This year's congress president, gastroenterologist **Professor Jürgen Hochberger**, director of the Medical Clinic III at St. Bernward Hospital, Hildesheim, discussed developments with EH Managing Editor *Meike Lerner*.

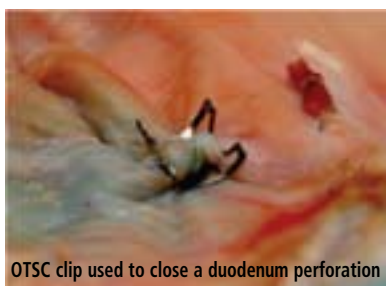
'Gastroenterologists have so far been a little cautious about the use of NOTES. At the congress the first experimental approaches, such as a transvaginal pancreatic resection in a pig, were carried out live – in partnership with the Federal Research Institute for Animal Health – with great interest and success. It will certainly take some further developments in equipment before these interventions become possible for humans. However, over the last few years our experience has taught us that these surgical innovations have also been very productive for our field. The *Bear-trap*, along with other, novel coagulation forceps, is an example of this. The bear-trap is an "over-the-scope-clip" that is ejected through a novel mechanism by the end of an endoscope to cover a sutural insufficiency, or a resection defect – a huge progress for our daily work. With the help of new coagulation forceps we can now also coagulate much thicker vessels, in laparoscopic as well as endoscopic applications. Thanks to these developments, the endoscopic coagulation of the splenic vein, via NOTES, is feasible in the future.





Endoscopic submucosal dissection (ESD)

'Flexible resection procedures represent an enormous progress in our daily clinical work. A good example is the case of a patient in our clinic who had an 11cm x 7cm change in the rectum removed endoscopically. In this particular case, the mucous membrane, over 90% of the wall circumference, was completely resected – without complications. Only a few years ago this patient would have been a case for the surgeon, resulting in him being given a stoma. We were able to spare the man this fate.



OTSC clip used to close a duodenum perforation

Prof. Hochberger

'An important point that goes along with all these advances in the field of flexible endoscopy is training in the new procedures, which have now become so complex that years of experience is required. In my view, a separate discipline will establish itself in the medium term – a combination in training for surgery and gastroenterology.

Coloscopy using a colon capsule

'The data available in this field is not yet very comprehensive – but the existing findings are very promising. A new generation of capsules has cameras on both sides – with a really brilliant resolution and energy-saving rest phases when the capsule remains in one location. The easy handling – for the patient as well – and good sensitivity compared to the guaiac test could even qualify colon capsules as a suitable screening procedure for bowel cancer. This is a development I am very excited about.'

Video Capsule Endoscopy

A new era for the digestive tract explorations

By Jean-Francois Rey MD, Department of Hepatology and Gastroenterology, Arnault Tzanck Institute in Saint Laurent du Var, France

In 2000, the Israeli firm Given Imaging introduced Video Capsule Endoscopy (VCE), a new technology initially devoted to small bowel examination. Since then, the EndoCapsule from Olympus Japan, MiroCam from IntroMedic Korea and some less advanced devices from China have been introduced as technical competition for some new areas, such as oesophagus or colon. Stomach examination is still not possible because VCE movements are linked to the digestive motility and we do not have a manoeuvrable capsule yet.

The Olympus EndoCapsule

For small bowel examination, VCE has become, in a few years, the gold standard for non-invasive examination, because traditional Barium follow-through, CT scan or MR have limited technical possibilities. On the other hand, digestive enteroscopy is restricted by the time consuming and cumbersome examinations. In a few years, various companies have achieved improvement in image quality, but the most important feature is the image analysis through a software reducing the time of reviewing multiple data with various possibilities: quick mode, expressed mode, skipped mode, overview mode, red signal in case of bleeding.

All software improvements allow a quicker and more efficient reading of capsule data. In 80% of cases, VCE is useful for the diagnosis of bleeding lesions, more often angiomas, but also tumours. It has proved clinically useful for suspected Crohn's diseases, NSAID side effects and, at a lesser level, complicated celiac diseases, Peutz-Jeghers syndrome or familial polyposis. The main obstacle for clinical use is the lack of reimbursement in numerous countries; as the cost of the device is around € 500 and healthcare providers are still reluctant to accept a full reimbursement. They are afraid of the important number of misused indications, such as irritable bowel syndrome.

Other than small bowel, the capsule had been used in clinical study of the oesophagus, without clinical benefit over traditional endoscopy. Colorectal cancer screening seems more promising with the capsule, but the cost benefit requires more clinical investigation as the main obstacle is to obtain a complete bowel cleaning.

In summary, capsule examination is a very potentially useful tool. As the current capsule cannot be guided, it needs technical improvements but, in the future, it could take over some endoscopic diagnosis examinations.

ORTHOPAEDICS

The 11th EFORT Congress

2-5 June Madrid, Spain

This year's European Congress for Orthopaedics, Orthopaedic Surgery and Traumatology, organised by the European Federation of National Associations of Orthopaedics and Traumatology (EFORT) in tandem with the Spanish Orthopaedic and Traumatology Society (SECOT) Congress, is expected to draw 7,500 international participants.

'For the first time, we are organising plenary sessions to present state-of-the-art treatments in four important subjects in contemporary orthopaedics: arthroplasties, trauma, bone and joint tumours and musculoskeletal infection,' EFORT President Professor Miklos Szendroi, Director of the Department of Orthopaedics of the Semmelweis University at Budapest, Hungary, told EH reporter *Karoline Laarmann*

On 4th June, Professor Miklos Szendroi, renowned specialist in metastasis bone disease surgery, will host the plenary session *Bone and joint tumours: Surgical and non-surgical treatments in tumour care in Europe*.

Statistically, over 1.2 million new cancer cases are diagnosed annually in the USA alone, and about 25% of these primary tumours (mostly breast, lung, kidney and prostate) can spread or metastasise to the skeleton. While there is rarely a cure for metastatic bone disease, palliative treatment for this painful condition has improved immensely over the last two decades due to external radiotherapy and chemotherapy. Because the tumours weaken bone, pathological fractures are highly likely. Therefore, surgery plays a more and more important role in reducing pain and regaining skeletal function, significantly improving patients' overall survival rate and quality of life.

'This change of paradigm in the treatment of metastatic bone and joint tumours leads to an increased need not only for experts but also for general orthopaedic surgeons to acquire skills in tumour diagnosis and to know about therapy management options,' the professor emphasised. However, the decision to proceed with surgery is complex and must be individualised for each patient: 'Treatment of metastatic bone disease needs interdisciplinary team work. The patients have to be referred to highly professional oncological teams in specialised medical centres.'

Miklos Szendroi

Besides palliative treatment, such as nailing fractures, it is now possible to remove bone metastases radically, in limb-saving surgery, if the tumour is solitary – a demanding intervention for the orthopaedic surgeon. A bone affected by lesions must be removed and replaced by an endoprosthesis. 'There has been much going on in the development of new special tumour endoprosthesis material and design over the last 35 years,' he pointed out. 'Endoprosthesis systems moved from custom-made to modular models, which give the surgeon more freedom at the operating table. The growth of bone metastasis is a dynamic process; whereas in the past it could have happened that, during the fabrication of custom-made endoprosthesis, the tumour already increased in size, the modular systems can be plugged in step by step as needed. In addition, the worn-out time of the material has extended from five to over 10 years.'

Besides surgical options in solitary metastases of bone, the plenary session will also address the key role of prognostic factors. Above all, a careful evaluation of the therapeutic benefit of surgical interventions for the patient should be carried out. Next to the stage and type of primary cancer, the most important prognostic parameter is performance status, which quantifies a patient's general well-being.

Questioned about the huge variations in treatment and education strategies in orthopaedic surgery and trauma care across Europe, Prof Szendroi said: 'This doesn't necessarily mean that the quality level of treatment is better or worse in the different countries. What I experience, with growing concern, is a gap between the West- and East-European areas, which even deepened during the last economical crisis. As an example, there's a new endoprosthesis on the market that shows good results for patients suffering arthritis of the ankle joint. In my home country, Hungary, it could not be introduced because of financial limitations.'

At least at the Madrid EFORT congress, European orthopaedic surgeons will have a big opportunity to contribute and share scientific knowledge and findings, as well as to raise awareness of future trends.

CERAMTEC©

Computers make prosthetic legs fit better

The fit of a prosthetic leg is a vital element in determining how well an amputee will function and adapt to the device. Historically, this has been a time-consuming art performed by skilled prosthetists. Today, computers have added science to the mix.

Prosthetic devices are not compatible with the physiology of the human body. Their limitations require regular adjust to accommodate for changes in an amputee's size and body volume, as well as changes in gait as they become more adept at using a prosthesis.

A real–time gait analysis system using a combination of hardware and software is one such innovation. The Computerised Prosthesis Alignment System – or Compas – consists of a device with embedded sensors that attaches to a prosthetic limb and measures gait, balance and other dynamic forces while an amputee is standing or walking on any type of terrain at any speed. It uses wireless technology to transmit this information to an automatic gait analysis software loaded on a personal computer.

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Compas attachment to patient prosthesis

The data is analysed, and a sophisticated computer model predicts whether a prosthetic device is misaligned, and if so, how it is misaligned. This is calculated through kinetic measurement analysis. The system shows the prosthetist precisely what is happening biomechanically, and recommendations are provided in easy-to-follow format. The prosthetist makes adjustments with a wrench.

The system's hardware consists of a metal plate installed near the socket of the prosthesis (left image) and a diagnostic module that attaches to it (right image). The plate has silicon strain gauges to measure various forces going through the prosthetic device and electronics and memory to enable this information to be converted into digital format and stored. When a patient visits a prosthetist to have adjustments made, the diagnostic module is attached to the plate. It projects a line on the floor or ground as a patient walks, and a gyroscope measures the rotation of the limb.

Compas technology is based on direct measurement of socket reactions, and uses a database of over seven million data points that measure exactly how socket reactions change with alignment alterations. The system is based on the theory that a prosthesis could be aligned in a consistent way if observed performance and sensations could be captured and measured while a patient was walking.

The Compas has embedded sensors

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The company designing this technology is Orthocare Innovations, with offices in Oklahoma City, Oklahoma and Seattle, Washington. Founded in 2006, it developed the system with grant assistance from the U.S. National Institutes of Health and the U.S. National Centre for Medical Rehabilitation Research. When the product began to be commercially sold in 2009, Compas was named as one of the 100 most technologically significant products of the year by *R & D Magazine*.

Prosthetists have reported that the system makes the process of fitting a limb faster and easier for themselves and for the patient. However, expertise is still needed to achieve an optimum fit for a patient. It's just that art of fit is now being combined with science.

Report: Dot M McSherry, i.t. Communications