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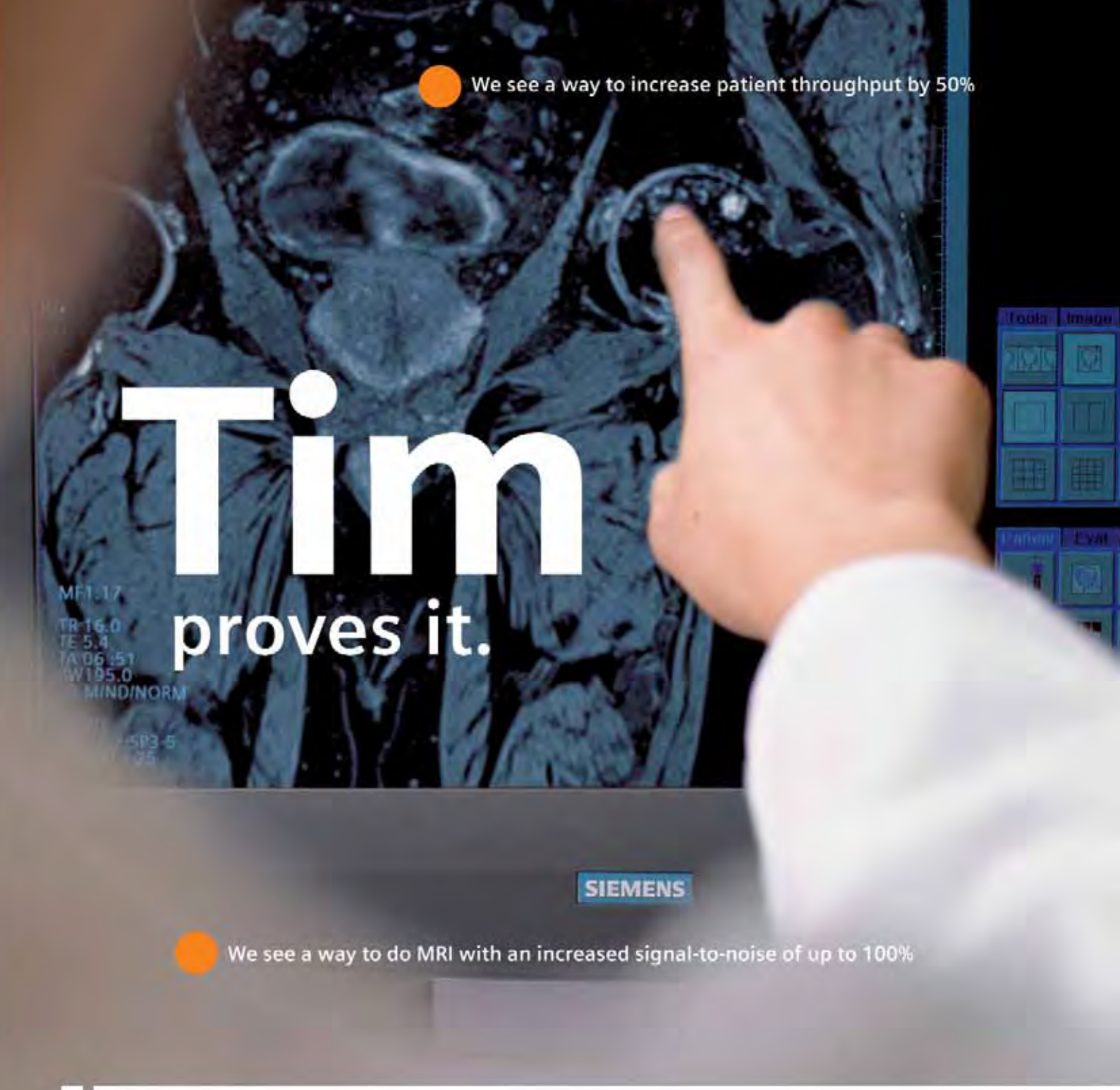

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The Future of Interventional Radiology

prof. Iain McCall
Editor-in-Chief
EiC@imagingmanagement.org

The term 'Interventional Radiology' represents diagnostic and therapeutic procedures that are minimally invasive and guided by an imaging method be it fluoroscopy, ultrasound, CT or MRI. These procedures, developed over many years by radiologists, have become core components of the services offered by radiology departments and an essential part of management of many disorders. The success of these techniques has required many adaptations in the way patients are treated and the roles and responsibilities of the clinicians involved. There is increasing strain on radiology departments due to insufficient radiologists and an inadequate allocation of financial resources for consumables and staff time necessary for treating often complex conditions. While this is recognised by radiologists it is not always appreciated by managers and rarely by purchasers. In order to change this situation a number of points need to be addressed.

It must be recognised that radiologists are responsible for the care of the patient while they are providing treatment in the same manner as any other clinician and this must be recognised in their job plan and the facilities available to them. They need outpatient facilities to review patients prior to treatment and for follow-up and they also require access to beds which may be in day care facilities or for longer term treatment. The patients may be the sole clinical responsibility of the radiologist or in conjunction with other clinicians and radiologists must have sufficient clinical training and knowledge to manage those cases for which they are taking responsibility.

The radiologist involved in interventional procedures must be given the appropriate time in their work plan to undertake the clinical part of their work and the recording of work undertaken by radiology departments must be weighted accordingly to reflect this. A major reallocation of funding must also be made to radiology, which is often disadvantaged by payment systems.

It is often the case that the same procedure undertaken by a radiologist and a non-radiological clinician receive widely differing payments, as within radiology they are classed as a test compared to a full clinical episode in other hospital departments for exactly the same process. The DRG system covers the whole clinical episode and is usually allocated to the clinical department not to radiology which receives considerably less than is commensurate for the work undertaken. When interventional radiology techniques become the main therapeutic modality for a clinical condition the resource allocations are often not transferred and the original clinical area reduced to allow for the change in the treatment algorithm.

It is therefore essential that radiologists undertaking interventional procedures and minimally invasive treatments are enabled to perform these tasks safely and with adequate resources. This edition of the journal focuses on a number of these areas and should increase the understanding of radiology and hospital managers and also purchasers of the requirements of a successful interventional radiology service.

Prof. Iain McCall

Annual 'Management in Radiology' (MIR) Congress

Join Europe's Most Prominent Experts, October 5 – 7 2006

Dear colleagues and friends,

On behalf of the Local Organising Committee, it gives me great pleasure to invite you to attend the 9th edition of 'Management in Radiology' (MIR) 2006 Congress in Budapest. This unique platform, initiated to address significant managerial issues that affect the imaging industry from a scientific point of view, offers a wealth of opportunities to exchange experience, introduce new tools and concepts and draw together a wide range of leading professionals, both speakers and delegates.

An Auspicious Background

Although this marks the first occasion on which the annual MIR meeting will be held in Budapest, our beautiful and hospitable capital city, representatives of the field of imaging in Hungary have long been affiliated with and present at MIR meetings since it was first initiated. This clearly demonstrates our support and belief in the essential role this annual meeting plays in underpinning proper management practices.

The great advantages of organising such a meeting in one of the "freshmen" countries of the EU, are twofold: on the one hand it brings cutting-edge, hot topics of radiological management closer to the specialists of these countries; and on the other hand it provides an opportunity for members of the MIR community to collect first-hand experiences from an environment differing in many aspects from their own traditions. The synergism of these two factors may result in better understanding of this rapidly developing region and more extensive involvement of experts from these countries in the activities of MIR.

Expert Scientific and Educational Programme

Thanks to the invaluable contributions of many experts from all over Europe, the scientific and educational programme of this year's meeting promises to be both intellectually provocative, and at the same time very useful from practical points of view, both for radiology and management specialists. Alongside a constructive and current programme, the planned social events give you at least a small sample of the taste and feeling of Budapest and Hungary. We kindly encourage you to take the opportunity to get acquainted with the great historical monuments and exciting 21st century developments of this city.

Once again we look forward to meeting delegates, both old and new, and to welcoming you to the banks of the Danube for a successful and hopefully memorable scientific event.

Prof. Dr. András Palkó

President of the Local Organizing Committee of MIR 2006

Welcome to Budapest

Cultural and Historic Attractions

Dear colleagues,

It is with great pleasure that I cordially invite you to Budapest to participate in the 9th Annual Meeting of 'Management in Radiology' (MIR). Over the past nine editions, MIR has developed into a unique, pan-European initiative designed specifically to support best practice in management in the imaging industry. I am delighted to introduce to those of you who have not yet experienced it, the many attractions of this year's location.

Budapest - Your Destination

This year's venue for the MIR Meeting is the well-appointed Hotel Sofitel****, located centrally on the river side of the Danube, opposite the Royal Castle in Budapest.

I have no doubt that delegates will experience a scientific and welcoming atmosphere in Budapest, with a wealth of opportunities to renew old acquaintances and establish new links. We look forward to receiving not only members of MIR, but also non-members from Europe and overseas as well as their guests and families.

Why Come to Budapest?

Budapest is the most beautiful city for me in the world, and such a historic and charming venue provides an ideal setting for this year's MIR congress. Budapest is situated astride the Danube; the capital gives a glimpse of the diversity of Hungary from the pleasant green of the hills of Buda to the wide flat plain of Pest. Its numerous attractions include the Royal Palace on the Castle Hill, the waterfronts of the majestic Danube, the flowered haven of Margaret Island, the traditional city centre on the plains of Pest, and its famous bridges.

Budapest is also famous for its historical heritage, architectural grandeur, art collections and thermal spas. The city merits international attention this year, as it commemorates the 50th anniversary of the heroic struggle against the Red Army and Soviet colonisation.

Cultural Attractions

The Hungarian State Opera was built between 1875 and 1884 in Italian neo-renaissance style. The balcony on the façade has balustrade railings, with an arcaded driveway underneath. In the niches on both sides of the driveway stand the statues of Francis Liszt, the most famous Hungarian composer of the nineteenth century, and of Francis Erkel, creator of Hungarian National Opera and the first director of this Opera House. The statues on the corner projections, between the Corinthian half-columns, represent Terpsichore, Erato, Thalia and Melpomene, the muses of dance, romantic poetry, comedy and tragedy. Either on Thursday, October 5th or on Saturday, October 7th you will have the opportunity to enjoy Mozart's 'Don Giovanni'.

As you can see, Budapest's cultural and historic grandeur mean that is not only a destination for all leading professionals in the imaging industry with an interest in the exchange of information and networking possibilities offered annually by the MIR meeting, but also a rich and diverse location in itself. We look forward to welcoming you to Budapest during the first week in October 2006.

Adam Mester M.D., Ph.D.

Member of the Local Organising Committee

MIR 2006 Programme Highlights

'Current Trends and Future Priorities'

Here we offer a sample of some of the leading speakers and topics to be included over this leading three-day conference taking place from October 5 – 7, 2006, in Budapest, Hungary.

For full programme details or to register online, please visit www.ewgmr.org.

Thursday, October 5

- The End of Radiology as an Independent Specialty: Managing Imaging of the Future
  Ncola Strickland

- Radiologic Communication: A Legal Duty, A Moral Imperative
  Leonard Berlin

- Managing Radiological Staff in a Regional Digital Imaging System
  Lluis Donoso Bach

- Demise of PACS as we knew it: The Next Generation with Streaming Digital Archiving
  Hanna Pohjonen

- Multilingual Structured Reporting across Borders
  Hans Blickman

- Image Management Solution for Multi Disciplinary Applications
  Peter Mildenberger

- New Approaches to Web Based Education in Radiology
  Harvey Neiman

- An Incentive System for Radiologists in an Academic Environment
  Edward I. Bluth

Friday, October 6

- The National EPR and the Inclusion of Medical Imaging
  Michel Claudon

- CD-Rom for Image Exchange – The Quality Assurance Initiative of the German Roentgen Society (DRG)
  Peter Mildenberger

▸ Leadership Impact and Strategies
Johan Bloem

▸ Maximising Efficiency in the Imaging Departments via Business Intelligence Reports and the Equipment Utilization Reports
Jan Schillebeeckx

▸ How Radiology Practises can Increase their Productivity - Findings from an Empirical Study
Jonathan Sunshine

▸ How to Manage Research in an Academic Department of Radiology
Gabriel P. Krestin

▸ Radiology: The Viewpoint of the University's Vice-President for Research
Mathias Langer - Elmar Kotter

Saturday, October 7

▸ Teambuilding from Communication to Cooperation
Gerhard Pohl

▸ Mergers of Radiology Departments
Pablo Ros

▸ Development and Experience with a Computer Aided Quality-Management System
G. Pache – Elmar Kotter

▸ Performance Indicators in Radiology
Silvia Ondategui-Parra

REGISTRATION FORM

Please return this form to: MIR Office, Antonio Santoro
Fax: +39 06 50 934 250 (please dial 0 before 6) or e-mail to: mir@ewgmr.org

(Please write in capital letters)

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FIRST NAME

INSTITUTION

ADDRESS

ZIP CODE

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Specialty: Radiologist ❑ Informatics ❑ Other ❑

Association News

New IHE Member in Israel

IHE Europe welcomes new member IHE Israel (www.ihe-il.org), which was officially initiated on 17 May 2006, in the presence of Mr. Charles Parisot, Vendor Co-Chair of IHE-IT Infrastructure. IHE Israel currently counts more than fifty registered members and is part of the IHE Europe initiative. The User Co-Chair is Ziv Rosenbaum and the Vendor Co-Chair is Roni Zaharia.

Next Events

The IHE Europe Cardiology Integration Profiles will be demonstrated at the World Congress of Cardiology in Barcelona (2-6 September). IHE-Europe will also be present at The World of Health IT 2006 Conference & Exhibition, 10-13 October in Geneva.

WWW.IHE-EUROPE.ORG

24th International Congress

The recently held 24th International EuroPACS Conference, which took place June 14 - 17 2006 in Trondheim, Norway, addressed a wide range of information technologies and related topics, over the three days of this leading European conference. With cutting-edge topics ranging from Image Processing and CAD, to Broadband and PACS, and Security Issues, the conference proved once again that it is the central gathering point for specialists in medical imaging, digital x-ray, PACS and digital systems for eHealth.

The programme offered almost a hundred different scientific lectures, workshops and meetings and focused on the latest and most significant developments in clinical practice, research and education within digital radiology. Roald Bergstrom, President of the 24th EuroPACS Conference, and Jacob Hygen, Managing Director KITH, would like to thank all speakers and registrants for participating in the success of this event.

WWW.EUROPACS.ORG

Results Announced From CARS 2006

The 20th International Congress and Exhibition of CARS 2006 (Computer Assisted Radiology and Surgery) was successfully held at the Osaka International Convention Centre in Osaka, Japan with 855 congress registrants from 43 countries. The meeting was organised by Hironabu Nakamura MD, PhD (Professor of Osaka University Graduate School of Medicine) and Kiyonari Inamura, PhD (Professor of Kansai University of International Studies) under the auspices of the Japan Institutes of Computer Assisted Radiology and Surgery and the Science Council of Japan.

A broad spectrum of medical and technological disciplines was represented at CARS 2006 with tutorials, special presentations and scientific papers and posters covering topics on information technologies in radiology and surgery for clinical application fields, including:

- Medical Imaging, e.g. CT, MR, US, SPECT, PET, DR, Molecular Imaging, and Virtual Endoscopy
- Image Processing and Display
- Hospital-wide PACS and Telemedicine
- Computer Applications for e.g. Neurosurgery, Head and Neck, Orthopaedics, Ear Nose and Throat, etc.
- Image Guided Therapy
- Surgical Robotics and Instrumentation
- Surgical Navigation and Simulation

WWW.CARS-INT.ORG

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GE imagination at work

ECRI Europe
A NONPROFIT AGENCY

ECRI Offers Selection and Purchasing Recommendations

Choosing the right MR system involves careful planning and selecting of benefits and features that meet the needs of healthcare facilities. ECRI recently published an evaluation of three 1.5-tesla MR systems. The in-depth article published in ECRI's Health Devices journal provides information on selection criteria, extensive product specifications, and detailed results and analysis from ECRI's testing to assist healthcare organisations in selecting and purchasing an MR system.

ECRI offers guidance on options to consider during the selection process, such as different field strengths, gradient systems, coils, channels, and specialised imaging features. In addition, ECRI details offerings of three 1.5-tesla MR systems marketed by GE, Siemens, and Toshiba. The systems are rated for two different uses: inpatient imaging (performed in hospitals) and outpatient imaging (most often performed in imaging centres). Additionally, the systems are evaluated and rated according to their ability to meet the needs of three specialised applications - breast and cardiac imaging and functional MR imaging. In this issue, ECRI found key differentiators between models: each of the three models received a preferred rating in at least one specific category of use.

WWW.ECRI.ORG.UK

ESMRMB
European Society for Magnetic Resonance in Medicine and Biology

ESMRMB 2006 – Congress Details Announced

The 23rd Annual Scientific Meeting of the ESMRMB will take place in Warsaw, Poland, from 21 – 23 September, 2006. The course venue is the Gromada Conference Centre in Warsaw.

The ESMRMB is a multidisciplinary society dedicated to the development and application of magnetic resonance techniques in medicine and biology. Its annual meetings aim to provide a stimulating platform where clinical and basic researchers meet, share their latest findings and discuss new ideas.

Warsaw is a quite obvious choice for the venue of this scientific meeting: it is an exciting, truly European capital. An impressively large and active MR community is present in the country and last but not least members of the Local Organising Committee have been founding and active members of our Society.

Scientific Programme

The Scientific Programme Committee (SPC) chaired by Professor Klaas Prüssmann has prepared a well-balanced and exciting programme. The programme will cover Teaching Sessions, Plenary Lectures, Mini-Categorical Courses, Debates, Discussions and Scientific Sessions with the highest possible scientific quality. The aim is to give a multidisciplinary perspective on the hottest and most recent topics in our scientific field. The collaboration with our Polish colleagues will be underscored with a back-to-back meeting of the Polish MR Society on Wednesday.

Committed to ESMRMB traditions, the scientific programme of 2006 combines ample space for current research with topical overview lectures and advanced MR education. This year's Sir Peter Mansfield Lecture will be delivered by Prof. John Griffiths, speaking about "Cancer Metabolism - From the Molecule to the Patient". Besides planning the meeting contents, the SPC has also reviewed the meeting format, seeking ways of adjusting it to changing needs and expectations.

As a result, two attractive format modifications have been introduced. The meeting's educational profile has been enhanced by extending the traditional teaching programme across the whole conference. This change is intended to increase flexibility in tailoring your personal itinerary, whether you are a basic scientist or a clinician, fairly new to MR or a seasoned expert. Also, the schedule has been slightly condensed to form a compact meeting of three days; Thursday morning to Saturday night. The overall number of sessions has been preserved, so this change comes at no expense to programme scope or diversity, instead offering more session choices than previously.

WWW.ESMRMB.ORG

EUROPEAN COURT OF AUDITORS

Monitoring EU Funds

The European Court of Auditors is the external audit institution of the European Union and acts as its "financial conscience". Founded in 1977 in Luxembourg, it is independent from other European Union (EU) institutions. Its task is to keep track of EU funds, making sure that the Commission manages it properly. Based on their Annual Report, the European Parliament gives the Commission final discharge for the execution of every annual budget.

Ilze Raath
Editor European Affairs
europe@emceurope.com

Established on 22 July 1975 by the Treaty of Brussels, the Court started operating as an external Community audit body in October 1977. Since the signing of the Treaty of Maastricht, the Court has been recognised as one of the five institutions of the European Communities.

Main Role

The Court independently audits the collection and spending of European Union funds by the institutions, European development funds and other EU agencies and bodies. Furthermore, they investigate whether financial operations have been properly recorded, legally and regularly executed and managed to ensure efficiency and transparency. The Court's role, as external auditor, is to assess the financial management of the budget as a whole.

What Does This Mean in Practice?

In practice, this means that the Court examines the paperwork of any organisation handling EU income or expenditure. Any irregularities are reported to the European Parliament and Council. The Court's audit responsibilities have been extended to Community funds managed by outside bodies and by the European Investment Bank.

Their findings are published in various reports, which draw the attention of the Commission and the member states to any problems. These publications are:

- the Annual Report on the implementation of the European Union budget for each financial year;
- opinions;
- specific annual reports on European Union bodies; and,
- special reports on subjects of particular interest.

One of its most important functions is to assist the budgetary authority (European Parliament and Council) by issuing a report on the previous financial year. The content of this report plays an important role in the Parliament's decision whether or not to approve the Commission's handling of the budget. If approved, the Court sends the Council and the Parliament a statement of assurance that European taxpayers' money was judiciously spent. Before the European Union's financial regulations are adopted, the Court gives their opinion. They may comment at any time on specific issues or give an opinion at the request of an EU institution.

Court Officials

- **Members**

According to the EC Treaty, the Court consists of one Member from every Member State. These Members are appointed by the Council, after consultation with the European Parliament based on nominations by every Member State. Members of the Court are chosen on the basis of having worked for an auditing institution in their country of origin or their spe-

cific qualifications. They work full-time for the Court. Their term of office is six years and can be renewed.

The Members sit as a college that is the main decision-making body of the Court. The annual work programme sets out the tasks that every Member is responsible for implementing. Specialised audit staff assists them.

For the sake of efficiency, "chambers" (with a limited number of members each) can be set up to adopt certain types of reports or opinions.

• **President**

A President whom the Members elect from amongst their number heads the Court. The President's term of office is three years and is renewable. His/her role is that of 'primus inter pares', or 'first amongst equals'. S/he has to chair Court meetings and ensure that decisions are implemented and all the institution's activities are properly carried out.

Furthermore, the President is responsible for the legal service and the external relations department, regarding the discharge authority, other EU institutions and the supreme audit institutions of the Member and beneficiary States.

• **Secretary-General**

The Secretary-General, the most senior official in the institution, is appointed by the Court. His/her duties include managing the Court's staff and administration, such as professional training and translation services (a unit for every official language) as well as the Court's secretariat.

• **Human Resources**

The entire staff comprises about 760 auditors, translators and administrative support. The Court employs nationals from all the Member States to ensure a balanced spread of linguistic and professional skills. Staff comes from a wide range of backgrounds, from both the public and private sectors e.g. accountancy practice, internal and external audit, law and economics, etc. The recruitment policy follows the general principles and employment conditions of the EU institutions, and its workforce comprises both permanent civil servants and staff on temporary contracts.

Internal Organisation

The Court operates as a collegiate body with its Members adopting audit reports and opinions by majority vote. Meetings are not open to the public. The Court draws up its own rules of procedure governing its internal operation, which are then submitted to the Council for approval.

The auditors are divided into audit groups that are sub-divided into various specialised units, which cover the different areas of the budget. The CEAD audit group (Coordination, Evaluation, Assurance and Development) is responsible for the coordination of the Statement of Assurance, quality assurance and the development of the Court's audit methodology. The Court assigns each Member to a group, which is chaired by a "Dean". Members of the group elect the Dean from amongst their number for a renewable two-year term. The Dean's role is to ensure the smooth running of the group and its divisions in agreement with all the Members of that group.

Administrative Committee

The Administrative Committee, composed of Members representing the audit groups, takes care of administrative matters requiring a formal decision by the Court. Since 2004,

the Court may adopt documents without discussion based on a two-thirds decision of the Members of an audit group or the Administrative Committee. The Court also appoints an Internal Auditor who reports to the Audit Committee (comprised of three Members of the Court and an external expert).

The Court is financed from the general budget of the European Union, which the European Parliament adopts after consultation with the Council. The budget amounted to about € 95 million in 2004, representing 0.1 % of the total expenditure of the European Union and 1.6 % of the total administrative expenditure of the EU institutions and bodies.

At the Court's behest, an external audit firm audits its financial statements. These results are then communicated to the European Parliament and the Council. The financial statements and accompanying audit report are published in the Official Journal and on the Court's website.

Audit Scope

The Treaty requires the Court to audit the implementation of the general budget of the European Union, the European Development Funds as well as the financial statements of EU bodies and agencies. The scope of audits ranges from financial statements to detailed examinations of specific budgetary areas or management topics. These audit tasks are divided into:

- recurrent audit tasks, which have to done every year such as the financial statements of the European Union, the European Development Funds and of all other bodies and agencies set up by the Union; and,
- selected audit tasks. The Court selects budgetary areas or management topics of specific interest for detailed audit.

The Court works independently of national governments and other EU institutions. They are free to decide on topics, what they want to audit and when they want to present their observations and publicise findings.

Selecting Topics and Identifying Tasks

The Court selects a number of budgetary and management topics every year, but does not audit every budgetary area in depth every year.

As a basis for identifying audit tasks, the Court regularly undertakes a risk analysis of the entire audit field considering issues such as known problems or weaknesses, financial significance and findings of previous audits. The Court ranks these potential tasks by priority based on the results of the risk analysis and the need to ensure a balanced coverage of budgetary area. In addition, specific concerns of the European Parliament, the Council and the public at large are also considered before the final selection of audit tasks is made.

The Court's audit policies are largely based on INTOSAI Auditing Standards and International Standards on Auditing – issued by the International Federation of Accountants – that have been adapted to suit the European Union context.

Under the Treaty, the Court has right of access to any information it requires to carry out its tasks. The auditors do on-the-spot checks at the various EU institutions, at the premises of bodies or legal persons managing funds on behalf of the Union, including all levels of administration dealing with EU funds.

The European Anti-Fraud Office (OLAF)

Every year the Court reports on the management of the budget, any irregularities and suspected fraud. The European Commission and the Member States are primarily responsible for preventing, detecting and investigating errors and irregularities. The Court's task is to assess how well they have fulfilled their duty, and then suggests improvements.

When fraud, corruption or any illegal activity is identified, the matter is communicated to the European Anti-Fraud Office (OLAF). The Office was given responsibility for conducting detailed administrative anti-fraud investigations, instigating prosecutions in Member and beneficiary States, and recovering EU funds. A special independent status was conferred upon the Office.

How is an Audit Carried Out?

Every audit is carried out in three main stages: planning, testing and reporting.

- **Planning**

The Court's work programme is planned on a multi-annual and annual basis. The multi-annual plan entails defining and updating its strategy, whereas the annual plan details specific tasks for that year. The auditors prepare an audit-planning memorandum for every audit undertaken. This memorandum sets out the audit scope, approach and audit objectives, and how these are to be achieved in the most efficient and cost-effective way. The planning memorandum is complemented by an audit programme that sets out the audit testing needed in detail. The audit planning memoranda and audit programmes are submitted for approval to the audit group responsible for that task.

- **Testing**

Testing is done to obtain sufficient, relevant and reliable audit evidence that will allow the auditors to reach conclusions on the audit objectives. Teams of two or three collect evidence in accordance with the audit programme within European Union institutions and in Member and beneficiary States. Methods include examining and testing systems and transactions by applying various techniques, e.g. statistical sampling. In some cases, external experts are engaged to provide specialist knowledge. Audit evidence can be obtained in various ways: examining key supporting documentation, physical inspection or enquiry.

- **Reporting**

Audit reports communicate the results of the Court's work to the auditee, the discharge authority and the general public. After completion of the audit work, the auditors draw up a draft audit report ("the Court's preliminary observations") which contain:

- audit observations and findings;
- conclusions on the audit objectives; and,
- recommendations for improvement.

The draft audit report is examined first by the audit group and then submitted for approval by the Court. It is then sent to the auditee (European Commission or other European Union institution concerned) in the context of a bilateral discussion procedure. The auditee checks the report and sends an official reply – taking into account the reactions of the Member States – to the Court. The Court either maintains its original observations or changes them to correct any errors or ambiguities, depending on the reply. Finally, the auditee's reply is published with the audit report. At the end of the bilateral discussion procedure, the Court formally adopts the definitive audit report.

Benefits for the EU citizen

As the Court of Auditors is the financial conscience of the European Union, it stands to reason that citizens expect to see and reap the benefits of its existence. In practice, both the Commission and, for over 80% of EU expenditure, multiple administrative layers in Member and beneficiary States are responsible for managing EU programmes. Increasingly, day-to-day administration, management and control of EU funds are undertaken at national and regional levels, resulting in more transparent decision-making to the citizen.

Both political scrutiny and close media attention – especially to cases of fraud or misuse – necessitate the European Court of Auditors' role as external auditor of the European Union.

The Court's Vital Role

Although not infallible, the Court strives to uphold its mandate by providing the best possible service in an expanding European Union. The Court achieves this;

- by publishing its reports the Court helps promote trans parency and accountability in the management of European Union funds;
- through its audit work the Court helps ensure that EU funds are collected and used in accordance with the appli cable rules and regulations;
- its audit observations and re commendations help managers of EU funds improve their per formance and contribute towards improving sound financial management; and,
- its audit reports serve as a basis for the democratic scrutiny of the utilisation of EU funds by the European Parliament and the Council.

Industry News

Matrox Display Controller Boards RoHS-compliant

Matrox Graphics Inc. display controller boards, including the Matrox MED Series, RAD Series, TheatreVUE Series and AuroraVX Series have been shipping as RoHS-compliant boards over the last few months.

The European Parliament and the Council of the European Union adopted a Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment, known as the RoHS Directive. This Directive will restrict placement on the EU market of electrical and electronic equipment containing lead, mercury, cadmium, hexavalent chromium, PBB, and PBDE as of July 1st, 2006.

Matrox RoHS-compliant medical display controller boards are form, fit and function equivalent to their non-RoHS-compliant counterparts, and are drop-in compatible. Existing Matrox software, drivers and graphic BIOS operate transparently with the RoHS-compliant versions.

Agfa HealthCare Preferred Vendor for Major PACS Project

Agfa HealthCare announced that it has been selected by the Toronto East Network (TEN) as the preferred vendor for the region's PACS project. Requiring the integration of several RIS and PACS systems from different vendors, this project will utilise Agfa's IMPAX solution.

The TEN PACS Project is a joint initiative commissioned by a voluntary consortium of 16 hospital corporations. In cooperation with these hospitals and Canada Health Infoway, the TEN PACS Project Management Office has defined a three year phased implementation strategy for the creation of a shared Diagnostic Imaging Repository for images and reports.

Agfa HealthCare will provide its IMPAX solution for current non-PACS sites in the TEN and for the implementation of a regional Diagnostic Imaging Repository. The Repository will allow all participating hospital corporations to centrally store image and report data, and to access relevant prior patient images, regardless of which TEN site acquired them.

Kodak Applies for FDA Approval for CR Mammography

Kodak has applied to the U.S. Food and Drug Administration (FDA) for approval of its CR system for mammography and the company is currently conducting clinical trials at several sites in the U.S. and Canada. The mammography feature captures mammography and general radiography exams with the same computed radiography (CR) platform. Capturing mammography images requires the use of specialised KODAK mammography cassettes and screens.

Kodak currently offers a broad portfolio of mammography solutions including CAD for mammography; PACS that includes a KODAK CARESTREAM Mammography Workstation offering special display protocols and tools designed to enhance radiologists' productivity; and a laser imaging system with special software for printing digital mammography images.

Barco Wins Frost & Sullivan Award for 3D Imaging Software

Frost & Sullivan has awarded Barco with the Customer Value Award for VOXAR 3D, a portfolio of advanced visualisation software and clinical applications. According to Frost & Sullivan, Barco's VOXAR 3D software provides customers with the best value for their investment in an advanced visualisation solution for a PACS environment.

Frost & Sullivan granted the award to Barco because of VOXAR 3D's cost-effective deployment options, which provide unlimited access to advanced visualisation toolsets and clinical application modules everywhere users need them throughout the hospital.

In addition, Barco received the Award because it has extended the value of its VOXAR 3D software with the introduction of specific clinical applications. In 2005, Barco received FDA 510(k) clearance from the U.S. Food and Drug Administration for two innovative additions to the VOXAR 3D product line. VOXAR 3D VESSELMETRIX was approved for quantitative vessel analysis of CT and MR angiographic studies; VOXAR COLONSCREEN was approved for reading CT colonography studies of symptomatic and asymptomatic patients. These FDA approved clinical application modules add greater value to the VOXAR 3D product line by providing dedicated, clinical-focused tools for specific imaging applications.

Planmed Applies to FDA for Full Field Digital Mammography System

Planmed has recently submitted a premarket approval (PMA) application to the Food and Drug Administration (FDA) for the company's Planmed Nuance* Full Field Digital Mammography System. Planmed hopes to receive the application approval before the end of the year.

The Planmed Nuance is based on amorphous selenium (a-Se) detector technology. Planmed plans to offer two detector sizes. Customers may choose either the 17 cm x 23.9 cm Bucky or the optional 23.9 cm x 30.5 cm Bucky which will accommodate

most patients. The Nuance unit will also be equipped with the integrated MaxView Breast Positioning device, which provides more chest wall tissue on imaging exams.

SIEMENS

Siemens Completes Acquisition of Diagnostic Products Corporation

Siemens has completed its acquisition of Diagnostic Products Corporation (DPC), marking a significant milestone for Siemens as it enters the in-vitro diagnostics (IVD) market. Together with DPC, Siemens Medical Solutions will become the first full service diagnostics company. Yesterday, DPC shareholders approved the merger of DPC into a wholly owned subsidiary of Siemens Medical Solutions, Inc. In the merger each share of DPC common stock was converted into the right to receive a cash payment of $58.50 per share. Founded in 1971, DPC is a global leader in immunodiagnostics, focusing on developing, manufacturing, and distributing automated body fluid analysers and tests, such as those related to cancer and cardiac disease, as well as hormone and allergy conditions.Matrox RoHS-compliant medical display controller boards are form, fit and function equivalent to their non-RoHS-compliant counterparts, and are drop-in compatible. Existing Matrox software, drivers and graphic BIOS operate transparently with the RoHS-compliant versions.

NEC

NEC Develops Design Method for Large Scale & High Speed LSI

NEC Corporation (NEC) and NEC Electronics Corporation (NEC Electronics) announced that they have succeeded in the development of a new design method for large-scale integrations (LSIs) with more than 50 million transistors, operating at a speed of several hundred megahertz. NEC and NEC Electronics' new design method introduces a "Border Moving Method" into the design process, which completely eliminates the need for the budgeting process and re-designing of hierarchical blocks, dramatically shortening the total length of time required for backend design for large scale and high speed LSI to 1/3 of the conventional design method.

SECTRA

Inauguration of Sectra's New Office in the Netherlands

Sectra Communications Dutch branch office was recently inaugurated in the Hague, the Netherlands. The inauguration was held in presence of around twenty invited customers, among these representatives from the Dutch Ministry of Interior, the Dutch Ministry of Foreign Affairs, the International Crime Court and Eurojust.

Sectra's Country Manager in the Netherlands, Jeroen de Muijnck, hosted the inauguration at Sectra's local office in the Zürich Tower in central Hague. The office is well-placed in the city centre, near Sectra's customers within the various ministries in the Netherlands.

Sectra's CEO, Dr Jan-Olof Brüer held a welcoming speech, addressing the need for secure interoperability within European countries as international threats to communications are nowadays viewed on a global, rather than national territorial perspective.

INVESTING IN INTERVENTIONAL IMAGING

Which Technology is Worthwhile?

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New Techniques in Interventional Imaging

Interventional radiology is one of the youngest, fastest-growing specialties in medicine. The technology of diagnostic imaging is progressing at an equally rapid rate as the development of new techniques of intervention based on new instruments and material but, above all, on the creativity of the human mind. The domain of interventional radiology includes almost all body systems, as any area that can be imaged radiologically can also be treated under imaging guidance. The vascular system is the most prominent field of intervention which can be divided into therapeutic vaso-occlusion or embolisation and revascularisation.

Embolisation involves tumour feeding arteries, bleeding arteries, aneurysms, arteriovenous malformations or fistulas. More recently venous occlusion was introduced in several clinical situations such as varicocele, erectile dysfunction due to venous leakage, and lower limb varicose veins. Inferior vena cava (IVC) filters are a unique technique for protection against pulmonary embolism without occlusion of the IVC. Revascularisation includes mainly balloon angioplasty and stenting of stenosed or occluded arteries, thrombus aspiration and local thrombolytic therapy. More recent revascularisation techniques are laser angioplasty, cryoplasty, and brachytherapy.

Applications of Interventional Imaging

Interventional tumour management is a broad field which involves various techniques based on different physical and medical principles. Regional transarterial chemotherapy of malignant tumours is another category that can be combined with embolisation or performed solely as chemoperfusion. Tumour biopsy and thermal ablation can be guided by X-ray fluoroscopy, ultrasound, conventional CT, CT fluoroscopy and open/closed MRI. Radiofrequency waves, laser, microwave, and galvanotherapy (direct electric current) are all used as mechanisms of ablation through extreme heating, whereas cryoablation depends on extreme cooling. Percutaneous alcohol injection and brachytherapy are other methods of chemical or radiotherapy ablation.

Breakthroughs in spinal interventions include vertebroplasty, disc prolapse aspiration, disc chemonucleolysis and image-guided nerve blockage for pain management. Under normal circumstances, these procedures can be performed on an outpatient basis without the need for a long hospital stay with all its financial and manpower requirements. These techniques mentioned represent most but not the complete range of interventions available in practice or research. New techniques are being added to the list at an amazing pace.

Advances in Technology

Interventional imaging is dependent on imaging systems. We are privileged now to experience a breathtaking rate of development in imaging equipments. Both CT and MRI are highly valuable for image-guided interventions and vascular imaging with regard to intervention planning. The development of multidetector row CT (MDCT) and CT fluoroscopy gave CT the chance to stay ahead and maintain a key role in vascular and interventional imaging. Interventions can be performed under CT fluoroscopy guidance in near real-time imaging. CT angiography is nowadays comparable to MR angiography and even to conventional angiography with regard to sensitivity and specificity and is a valuable, quick and minimally invasive screening technique in peripheral, visceral, coronary and cerebral arterial diseases.

However, this is only possible due to the multidetector row advantage, which allows faster imaging of the contrast medium bolus with minimal loss of information and hence superior spatial and temporal resolution and also more efficient 3D reconstruction. The more the numbers of detector rows, the more these advantages are pronounced. With the advent of 64-slice CT, interventions can sometimes be performed without the need for CT fluoroscopy as the whole area under examination is covered by one scan in a fraction of a second.

"New techniques are being added to the list at an amazing pace."

Benefits of MRI

MRI has also shown remarkable development with the production of machines up to 4 Tesla while 3 Tesla MRI is now widely supplied by Gems, Philips and Siemens for clinical applications. The benefits of higher field strength are mainly an improved signal-to-noise ratio, hence diminished acquisition times and/or better spatial resolution at equivalent acquisition times and improved patient comfort (shorter examination time due to parallel acquisition, diminished noise level, and shorter magnets). An increase in the magnetic susceptibility effects is an associated shortcoming but is sometimes an advantage for certain types of examination.

Open low-field MRI units (0.2-1.5 Tesla) are used in many centres partially in diagnostic studies for claustrophobic patients or other patient-related reasons. However, in future they should play a bigger role in guided interventions, which would be more valuable in the broader context.

Although all percutaneous procedures, whether biopsy, drainage or ablation, can be successfully performed under CT guidance, the superior soft-tissue contrast afforded by MRI makes it attractive to interventionalists for less risky access to lesions and better monitoring of ablation. A small monitor console in the MRI room is more practical for near real-time surveillance of the procedure.

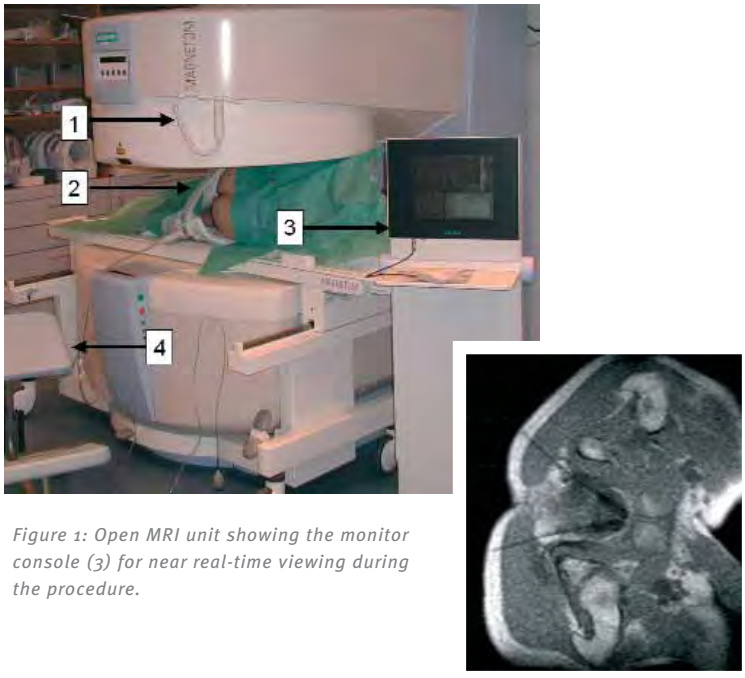

Figure 1: Open MRI unit showing the monitor console (3) for near real-time viewing during the procedure.

The necessity of using MR-compatible needles and applicators increases costs by approximately 10 - 15% in comparison to a similar procedure under CT guidance. MR-guided interventions can sometimes take a little longer than CT-guided interventions. This is why open MRI could not replace CT for routine use in all interventions and should be warranted only for selected cases where other imaging techniques lack tissue con-

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trast or vascular conspicuity to provide safe access.

Angiographic Devices

There are some angiographic devices which are not always abundant in interventional units although the need for them is progressively growing. They deserve a large share in the budget of interventional imaging. Stent-grafts used successfully nowadays in thoracic and abdominal aortic and iliac aneurysms and dissections are an example.

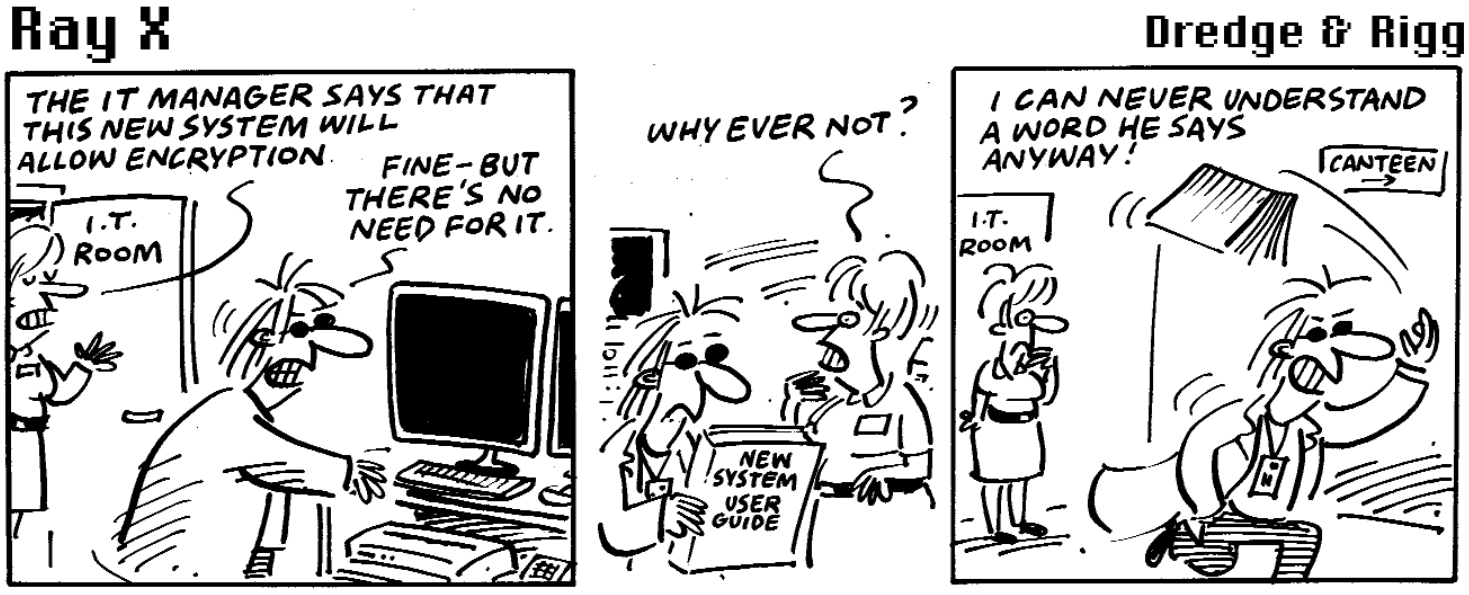
The use of limb extensions and fenestration has extended its applications to cases with iliac, renal and mesenteric involvement. Endovascular repair has proved to be a cost-effective alternative compared with open surgery for the elective repair of abdominal aortic aneurysms.Another type of stent-graft is the covered stents which have a valuable role to play in the treatment of large bleeding arteries that cannot be considered for embolisation. They are also used during transjugular intrahepatic porto-systemic shunts (TIPSS) and percutaneous biliary drainage (PTD) to reduce the probability of endostent mucosal growth and narrowing.

Rapid exchange angioplasty catheters and balloon-expandable stents are much more practical than over-the-wire counterparts especially in sophisticated cerebral, renal or below-knee angioplasty. They are much easier to use and can be more accurately applied which increases the technical success.

"Interventional Radiology is one of the fastest-growing specialties"

Conclusion

In conclusion, there are a myriad of ways in which interventional imaging is developing not only in terms of the diseases in which it can treat but also the technology that is facilitating it, into an exciting and forward-looking field for the provision of better standards in healthcare.



ORGANISATIONAL ASPECTS OF AN ACTIVE IR GROUP

Adapting the Environment for Optimal Healthcare

Interventional radiology is a continuously emerging field, recognised today by the entire spectrum of the medical community. Beyond political and strategic aspects of general radiological organisation, the specific nature of interventional radiology strictly regulates how it must be organised within a department of radiology, both for the quality of patient care and for optimal function of the whole department.

Routine Interventions

When it comes to managing a daily IR practice, two levels of activity can be distinguished. The first level relates to simple invasive acts, diagnostic or therapeutic, not requiring specific equipment, but at the same time, requiring the whole "radiological armamentarium" for guidance. To name but a few, percutaneous guided biopsies, infiltrations of nervous roots, stereotaxic manage of breast lesions, etc. These techniques use ultrasound (US) guidance, x-rays, CT and even MR and are carried out using current equipment of a department of radiology under strict rules of asepsis. They have the disadvantage of demanding longer machine occupation times than diagnostic explorations, therefore raising the question of whether equipment should be exclusively dedicated to this type of activity.

"Synergy within the department is the key to success"

Concerning MR, nowadays there are machines that allow easier access to the patient (open MR or broad opening) as well as MR-compatible material, but again the much longer times of machine occupation for these acts, can constitute an obstacle to the development and use of MR-guided IR.

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Special Interventions

The second level is related to more demanding interventions, requiring a specific, dedicated and well-equipped structure, that should be organised in an autonomous way to deal with the patient's and radiologist's needs. In this article, we will concentrate on the organisation of such specific structure; firstly, how to organise the activity of IR in an isolated area, and secondly, why we need an isolated area.

Although interventional radiology is qualified as minimally invasive, its increasing complexity in more and more fragile patients coupled with the frequency of combined interventions, entail a major infectious risk if they are not performed in optimal aseptic conditions. This risk must be minimised by appropriate adaptation of the physical environment and working practice. Moreover, if working conditions are not acceptable, most combined interventions such as aortic stent grafts will be carried out in the surgical room.

Finding the Best Location

What is the best location for an IR suite, from an organisational perspective? There are several options that can be proposed that vary according to the physical proximity between the department of radiology and the operating theatres, and also to the importance and the types of interventional activities carried out.

In my opinion, there are two options. The first is to install an interventional suite inside or close to the surgical operating room in order to benefit from access, circuits and the aseptic conditions of surgical suites. This solution implies a complete restructuring of the room to meet radiation protection requirements and to offer sufficient space to install several modalities. However, the use of mobile equipment cannot provide the same performance as angiography machines, and operating rooms are not designed for the safe use of x-rays. The second option is to create inside the radiology department, an isolated section that complies with all required radiological and surgical prerequisites.

Why Have an Isolated Suite?

The IR area must be physically autonomous and isolated from the rest of the department, but at the same time, closely connected to other diagnostic radiology facilities. Total isolation allows

application of appropriate standards of asepsis and hygiene: controlled access, organisation of different and separate traffic (e.g., patient, staff, sterile and contaminated material), inside the section. All the rules of surgical hygiene must be applied. The advantage in terms of safety is obvious and the risk of nosocomial infection is reduced. The interventional section has to become a "no-microbe area". Permanent presence of surgical and anaesthetic equipment is required.

External Communications

The IR section should also allow a close link with external diagnostic radiology and clinical services. Connections relate to the communication between the professionals implied, radiological images and access to clinical patient information. A proper hospital network carrying clinical and biological information and images is essential.

Other Factors

The installation of this kind of specialised area, should take into account additional peripheral spaces:

- Rooms for preparation of the patients
- Boxes for ambulatory patients
- Post-intervention monitoring
- Rooms for radiologist and anaesthetist consultations

The direct assumption of responsibility of patient care by the interventional radiologist, implies the need for access to hospitalisation beds.

Equipment

Until the last few years, the basic equipment of an IR suite included angiography and later ultrasound equipment. The developments of core interventional technologies revealed the need for links in the same room of angiography equipment with a slice-imaging technique.
The association of fluoroscopic real-time guidance with a CT imaging device allows targeting by a 3D-guided puncture, followed by deployment of any therapeutic device.

These type of interventions can be carried out in a CT room, aided by a portable fluoroscopy unit. Conversely, access to the patient is difficult, the irradiation dose to the patient and staff is not negligible, and moreover, the conditions of asepsis in such environments can be insufficient. Incorporating a CT scanner and angiography equipment in the same area has been proposed, but in addition to the high cost, this configuration requires extended space.

The expansion of flat-panel technology in angiography brings an attractive solution. Thanks to rotational angiography, it is possible to obtain 3D reconstructions, as well as CT-like images whose quality is sufficient for the majority of interventions requiring percutaneous guidance and/or immediate post-interventional checks. Access to ultrasound equipment is also essential, whether it comes from portable equipment or from a device fixed to the stand.

"The recent proliferation of technologies poses financial challenges"

The increasing use of MR for guidance of interventions can lead to the association of MR-equipment for angiography. In addition to guidance, MR is in certain cases, the only method that allows an immediate evaluation of the therapeutic result. This option necessitates the specific installation requirements such as extended surface, specific Faraday screen room, possibility of transferring the patient between the two machines, machine dedicated or not, separated access, compatible material, etc. The recent proliferation of technologies that use certain physical agents for tissue destruction, has lead to a growing interest from the department of radiology, of acquiring diverse equipment to perform radiofrequency ablations, cryotherapy, focused ultrasounds, etc., posing once more, difficult financial challenges to be solved by the department.

Conclusion

The specific nature of interventional radiology, which necessitates specialised conditions, justifies a great professionalism on behalf of the radiological discipline. This includes creation of a specialised structure, its organisation, the choice of methods of guidance and the choice of therapeutic agents. Those conditions can be only be created by collaboration between radiologists, industry, technicians, clinicians and hospital administration. A synergy inside the department between the diagnostic and interventional activities is the key to success, and the best way of preserving this activity within the house of radiology.

CLINICAL CARE IN INTERVENTIONAL RADIOLOGY

Innovations Raising Standards of Healthcare

Minimally invasive procedures that began as "therapeutic alternatives" have now become first choice procedures, resulting in important changes in patient care. The clinical management of patients has altered with the progressive incorporation of these techniques and certain specialties such as surgery with the use of laparoscopy or gastroenterology with endoscopy have updated and even renamed their area of expertise.

Unique Skills Called For

The development of interventional procedures within radiology has led to some idiosyncrasies. The interventional radiologist, among other specialists, has a detailed and unique anatomical knowledge, is trained in the versatility of the use of different imaging methods and often finds ways to carry out interventions with greater cost-efficiency. However, the daily programme of an interventional radiologist is primarily devoted to undertaking procedures and reporting them. The "agenda", usually, does not include time for daily rounds, time to talk with the patient, to explain the procedure or to evaluate clinical results.

There are no established rules regarding training requirements or resources needed, leading to a low level of representation within the hospital. At present there are three areas in which an interventional radiologist relates to the patient; perform the procedure in the best possible way; focus our work within a multidisciplinary team in which each does what they know best, and referral to the IR by the general practitioner (primary care physician).

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Better Training

Interventional radiologists require more extensive clinical training, so that they have a greater involvement in the direct clinical management of the patient. In order to respond to this, training of interventional radiologists has certain essential requirements. In general, current training programmes are based on a five-year model, preceded by one year of clinical internship. The first three years are devoted to a general core radiological training, and the last two are more flexible to enable trainees to undertake more specific training with a clear clinical objective. With this scheme it is intended to obtain specialists that all have basic radiological skills but who also have specific training either in general radiology with the development of subspecialty interests or to focus on a single subspecialty.

In this way, the system is adaptable to the needs of different countries and hospitals, and is flexible enough to include residents who have decided at an early stage their preferences. Some senior specialists argue that, if the resident has decided, at the initial part of the training programme, to be an "interventionalist", it is not so useful to follow specific areas of radiology indepth but rather to have major involvement in more specific issues related to IR. Under general radiology training, in addition to the final two years, the third common core year should focus on training in the desired subspecialty.

Improving Resident Programmes

It is therefore essential to incorporate clinical training modules within the training programme. In addition to the preliminary internship year, the

resident should have a structured period in which they can get experience in other disciplines such as anaesthesia, surgery, emergencies or internal medicine. During this period, the resident will provide on-call cover to the relevant area. This training should be between eight to twelve months and should be additional to the five-year radiology training programme. "Organ-related" distribution of the departments should be generally adopted with the aim of increasing clinical involvement of the radiologist and by offering an increased clinical interchange with colleagues of other specialties. Then, clinical training should be incorporated in all the different subspecialty programmes of radiology.

A Specific Daily Schedule

Daily working schedules should be modified accordingly. Daily work in radiology departments is scheduled according to assigned time-slots for each procedure. This includes both time needed to perform the exam and to do the final report. For some radiological procedures this can be reasonably predicted. With the incorporation of new cross-sectional technologies with which the time to obtain the images is continuously decreasing but, on the other hand, the time to do postprocedural evaluation is clearly increasing, radiologic performance is neither easy to schedule nor to evaluate. This difficulty is evident in IR, since procedures have to be evaluated and discussed with the patient and other colleagues. Productivity should not be evaluated exclusively according to the number of procedures performed but with other "indicators" such as their added-value or the impact that they have in adopting new decisions for the daily clinical practice.

The "interventional radiologist", therefore must be properly trained for this task. At the same time, management should understand and recognise the time spent as an essential component of the procedure. The specialist should spend the appropriate ward and outpatient time to properly prepare patients for the procedure and do follow-up.

The Role of Multidisciplinary Meetings

With this in mind, radiologists should attend as many interdepartmental sessions as necessary. In these sessions the different therapeutic approaches should be discussed, as well as recent developments in treatment. This represents a proactive approach in the search for new patients and in offering our services to other specialists.

New interventional radiology installations not only should be well equipped and built to operating room standards, but also have the space for running a clinic. Thus there will be a properly structured and equipped area where directly referred patients may be seen, information may be given to patients, post-procedure follow-up may be performed or any events that may arise may be dealt with. In the same way beds should be allocated for admitting patients.

Reassessing Income

The income received for the procedures performed should reflect the actual cost of the whole process of patient care for the procedure and the skill involved in undertaking it. As the therapeutic alternative to open surgery is, in many circunstances, a percutaneous-interventional procedure, which may have similar clinical results it is curious, that the payment for a surgical procedure is very different (i.e., higher) to that performed by the interventional radiologist. Therefore the economical aspects of interventional radiology require review.

Few radiologist candidates will opt to enter a training programme to learn percutaneous procedures if the payment systems remain as they are at present. Not only because they get lower payments when performing the same procedure as a surgeon but also because they can often find better reimbursements if they perform a diagnostic study instead of a complex interventional procedure.

Final Requirements

In conclusion the requirements and work pattern of interventional radiologists have a number of differences from other radiological subspecialties and it is not a matter of comparing, but of understanding these differences. Productivity should not be analysed just by looking at the number of patients treated or procedures performed. If interventional radiology is to thrive it is necessary to address these issues in order to recruit new specialists and to provide satisfactory working conditions.

LEADING INTERVENTIONAL RADIOLOGY ACROSS EUROPE

Interview with Prof. Johannes Lammer

PROF. JOHANNES LAMMER

CHAIRMAN, DEPARTMENT OF ANGIOGRAPHY AND INTERVENTIONAL RADIOLOGY, UNIVERSITY OF VIENNA/AKH
PRESIDENT OF CIRSE

How did you come to be involved in interventional radiology?

I am currently a Professor of Radiology and the Director of the Department for Interventional Radiology, at the Medical University of Vienna. I have always had a strong interest in interventional radiology, which is why I chose this specialty at a very early stage in my career. Due to this interest, I became very strongly involved in the activities of the Cardiovascular and Interventional Radiological Society of Europe (CIRSE), which is the ideal platform for European interventionists. Thanks to the support of my colleagues, I was made Treasurer of the society in 2001. Two years later I became its Vice-president, and following a further two years, its President.

How is CIRSE leading interventional therapy across Europe?

Since CIRSE was founded in 1985, it has become the largest subspecialty society in radiology, organising the largest non-cardiac endovascular meeting in Europe every year. We have an excellent Programme Planning Committee, headed by Prof. Michael Lee from Dublin, Ireland, ensuring we cover the latest topics in the field, as well as new therapies, such as interventional oncology, carotid stenting, etc. Even though our annual congress is definitely the highlight of our scientific year, we carry out many more activities in the field of training and further education throughout the year. One of our most important projects is the so-called European School of Interventional Radiology (ESIR), which consists of courses on interventional procedures held in different European countries.

Is CIRSE active in the education of young interventionists?

An important part of our educational activities are the CIRSE Foundation education and research grants. Our education grants are given to young interventionists who want to learn a new procedure and can only do so by completing part of their training at a different European hospital. With our education grants we try to encourage research in Cardiovascular and Interventional Radiology, enhancing scientific knowledge and developing new interventional diagnostic and therapeutic techniques. Furthermore our society is drawing up standards of practice documents and creating many opportunities for e-learning, such as E_IR (an online tool making educational material from the CIRSE Meetings available at all times) and a platform in EPOS. As you can see, our activities are very multi-faceted, the main focus being education and research.

What are the main issues concerning the development of interventional radiology in Europe?

The main benefit of interventional procedures is of course that they are less invasive, which results in lower morbidity and shorter hospital stays, which means lower costs. The main obstacles for the growth of interventional radiology is not a lack of funding, however, but rather the fact that most people are not aware of these benefits. This is a big problem, since interventionists often depend on other physicians to refer their patients to them. Only a well-informed patient will ask for referral rather than leaving this decision exclusively to the referring physician or consult an interventionist directly. Interventional cardiology seem to be a more developed science than interventional radiology because it focuses on one organ only, which is why it is easier for the public to understand. Furthermore there are simply more cardiologic patients

What changes are essential for the future of interventional radiology?

At present, there are general outlines of the European Society of Radiology (ESR) for interventional radiology across Europe, which work very well, rather than having individual practice guidelines for every country. Also, every department of interventional radiology should have an outpatient clinic for the clinical examination of patients and an in-patient clinic, i.e. a dedicated ward for the procedures to be carried out. In the future, interventional radiology will replace many open surgical procedures, such as vascular and oncologic surgery. Fortunately, there is no lack of residents who are interested in becoming interventional radiologists. The specialty is very attractive and it is easy for trained interventionists to find a good job, since there is a strong need for them.

FUNDAMENTALS OF DIGITAL MAMMOGRAPHY

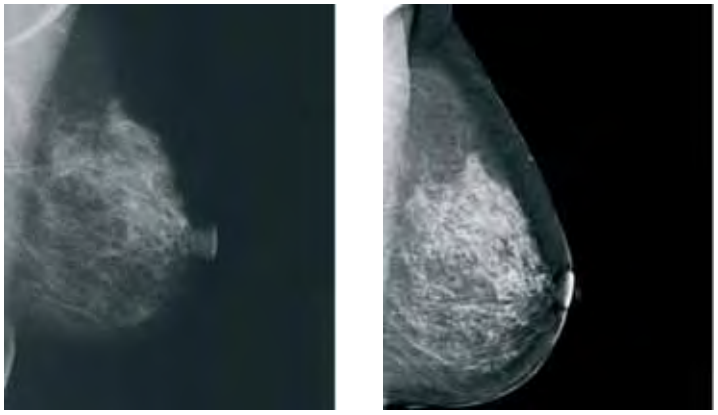
Current and Future Advances in Mammographic Detector Technology

Andrew P. Smith, Ph.D.

New developments in detector technology and computers are altering the landscape of mammography imaging. Full Field Digital Mammography (FFDM) offers the promise of revolutionising the practice of mammography through its superior dose and contrast performance. Advanced applications made possible through digital imaging, such as automated computer-aided diagnosis and 3D tomosynthesis are expected to further improve diagnostic sensitivity and specificity

INTRODUCTION

New flat-panel X-ray detectors offer extremely high quantum efficiency and high resolution, bringing lower dose and improved image quality mammograms. Digital detectors for mammography can be categorised as indirect or direct conversion detectors. Indirect conversion systems suffer from resolution degradation caused by light spread in the scintillator, and from poor quantum efficiency caused by the use of thin scintillators. Direct conversion digital detectors utilise a direct-conversion method of imaging, wherein the X-rays are absorbed and the electrical signals are created in one step.



MLO.Left - Screen Film Image MLO.Left - Digital Image

The same patient imaged with the same radiation dose on a digital mammography and a screen-film system, shows the superior dynamic range of digital mammography.

Systems using amorphous selenium represent the most advanced direct conversion technology for digital mammography. Selenium is an ideal material for a mammography detector, because it has high X-ray absorption efficiency (approaching 100% at mammographic X-ray energies), extremely high intrinsic resolution, low noise and a well-established manufacturing process.

FFDM SYSTEMS: FIELD OF VIEW

The field of view for FFDM systems is very important. In order to be able to image most of the adult female population, the imaging field of view must be similar to the size of the largest screen-film cassette commonly used in screen film imaging, 24 x 30 cm. Detectors that are the size of the smaller cassette, 18 x 24 cm, require imaging and tiling of many images to cover the field of view for larger breasts. Detector performance is commonly quantified by two metrics: Modulation Transfer Function (MTF) and Detective Quantum Efficiency (DQE).

MTF is a measure of resolution and DQE is a measure of dose efficiency. The MTF for screen-film is superior to indirect conversion detectors, while the MTF for direct conversion detectors are superior to both.

The DQE of indirect conversion detectors is superior to screen-film, however the DQE of selenium direct conversion detectors is seen to be superior again to both screen-film and indirect conversion detectors. With superior DQE at all spatial frequencies, selenium detectors offer the potential for both improved image quality and lower patient dose.

ADVANCES OFFERED BY THE DIGITAL AGE

Digital images offer a variety of new and improved applications. The digital image provides image archiving and retrieval advantages over film, and facilitates the use of computer-aided diagnosis. Systems with high quantum efficiency, especially at increased X-ray ener-

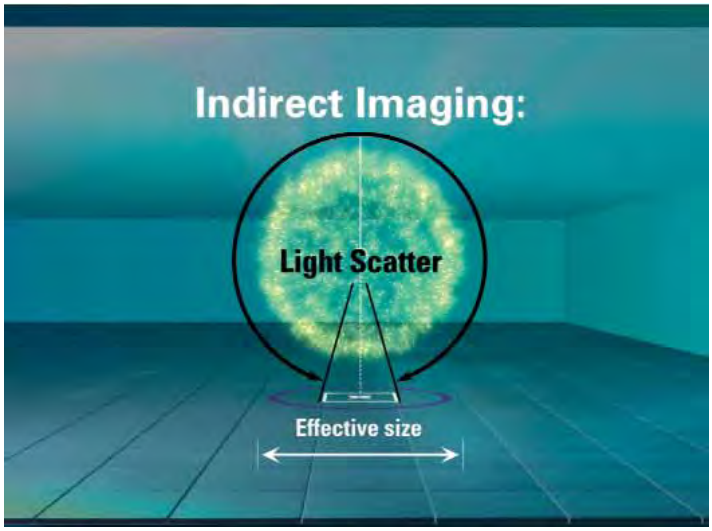
gies, offer the possibility of decreased breast compression. Future applications such as stereo mammography, breast tomosynthesis, contrast enhanced digital mammography and other imaging modalities, are under investigation. Such advances will provide improved diagnostic information and reduced image confusion from overlapping structures. These 3D imaging tasks will benefit from the high quantum efficiency that selenium detectors offer. The digital detectors will also be able to be used for full-field and high resolution stereotactic breast biopsies and diagnostic imaging tasks. It is essential, however, that full-field digital systems perform its primary task well, i.e. breast screening. It is hoped that the potentials for improved image quality, lower dose and advanced imaging applications will result in improved diagnostic accuracy.

SCREEN-FILM MAMMOGRAPHY

Conventional film systems use intensifying screens to capture X-rays and reduce radiation dose. X-rays that pass through the tissue are collected by phosphor screens. These screens are often constructed of rare earth phosphors such as gadolinium oxysulfide (Gd_2O_2S) that output light upon absorption of X-rays. When an X-ray is absorbed, the resultant light scintillation creates a number of light photons that spread and illuminate the film in a distribution cloud. Film in close proximity to the screen captures the light photons, and the image is obtained by exposing the film. An important parameter to understand is the thickness of the intensifying screen. Thicker screens capture more X-rays and are therefore more dose efficient and higher speed. However, thicker screens also create more light scatter and blurring of the image. Therefore, it is impossible to offer a screen-film system simultaneously offering the highest possible resolution and lowest possible radiation dose. This trade-off between radiation dose and image quality must be optimised for the specific clinical application. As the screen is made thicker, the cloud of light on the film will increase in size, on average. This reduces the resolution of the system, however the system's sensitivity increases because the thicker phosphor increases the probability that the incoming X-ray will be absorbed. Thus screen-film systems have a performance trade off between speed and resolution. Because X-rays are absorbed with a decaying exponential spatial distribution, in a screen-film mammography system the film is placed at the entrance surface of the scintillating screen. While a screen-film system offers several advantages, there are significant disadvantages; there is a narrow range over which it can detect small differences in contrast; frequently the entire image is poorly exposed because of film's stringent requirements for proper exposure, resulting in repeated imaging; film granularity affecting detective quantum efficiency at high optical densities and visibility of microcalcifications; processing time and storage space.

DIGITAL MAMMOGRAPHY DETECTORS

Digital technology offers the potential for several advances in mammography detectors. Because images are captured as a digital signal, electronic transfer and storage of images is possible, eliminating physical storage and distribution required by film. Digital systems offer a large dynamic range of operation, improving visualisation of all areas of the breast and increasing exposure latitude.



Indirect-Conversion Detectors utilize a layer to absorb the x-ray and generate light photons, which are detected by a photodiode array. Light scatter degrades resolution. Cesium iodide detectors and Computed Radiography (CR) use this technology.

Also, the digital format allows grayscale adjustment to optimise contrast for every imaging task. Softcopy reading, computer-aided diagnosis and 3D imaging offer additional and potentially important opportunities for improvement in mammographic systems.

DIGITAL DETECTOR TECHNOLOGY

There are two methods of image capture used in digital mammography that represent

different generations of technology: indirect conversion and direct conversion.

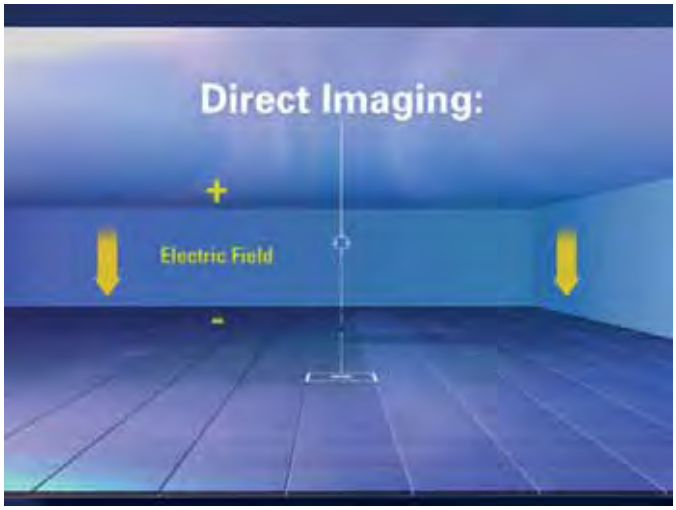
Indirect-Conversion Digital Detectors

The earliest digital mammography systems used a two-step process for X-ray detection. The first requires a scintillator layer such as cesium iodide doped with thallium [CsI(Tl)] to capture the X-ray energy and convert it to light. An array of thin-film diodes converts light photons to electronic signals captured using thin-film transistors. Some systems, like Charge-Coupled Devices (CCDs), use alternative light collection and readout methods. In both systems, the light sensitive imaging function of film has been replaced by digital light imaging. It is in this sense that these can be seen as an evolution of screen film imaging. Similarly to screen-film, light scatter compromises image quality, and there is a performance tradeoff between spatial resolution and radiation sensitivity. As the scintillator is made thicker, light spread increases resulting in decreased resolution. Because of its columnar structure, CsI(Tl) does not create as much light scatter as other screens. However, compromise between resolution and sensitivity still exists. The placement of the scintillator is more problematic in indirect conversion digital detectors than with screen-film systems.

As with film screens, more X-rays are absorbed near the entrance of the scintillation layer than the exit. While film is placed near the entrance side of the scintillator, a photodiode/transistor array is not transparent to X-rays and the array must be placed on the exit surface of the scintillator. This causes degradation in spatial resolution compared to screen-film. Typical thicknesses of CsI(Tl) used in mammography detectors range from 150 to 250 microns, and these indirect conversion digital detectors exhibit light spreading similar to screen-film systems. Examples of indirect conversion detectors are the Fuji CR plate and the GE CsI/TFT detector.

Direct-Conversion Digital Detectors

Direct-conversion digital detectors represent a technological advance, eliminating problems associated with light scatter inherent in indirect conversion systems. In these systems, a photoconductor absorbs the X-rays and directly generates the signal (direct conversion). Under the influence of an external electric field, holes (or electrons, depending upon the polarity of the applied field) drift towards a pixel electrode and are collected on a pixel capacitor. Because the charges travel along the direction of the electric field lines, they move without lateral charge spreading. This results in an exceptionally narrow point spread response, of about 1 micron. The superior photoconductor for use in direct conversion systems is amorphous selenium (a-Se). Selenium has a long commercial history in xerography, and its manufacturing processes are well known and optimised. Image quality of xeromammography systems was widely acknowledged, but suffered from reliability problems. By depositing selenium on a flat-panel imaging receptor, these problems have been eliminated. In direct-conversion detectors, the response function maintains its sharpness even as the thickness of the photoconductor is increased, so there is no trade off between radiation stopping power and spatial resolution. Using amorphous selenium as the photoconductor, a thickness of 250 microns is adequate to stop more than 95% of the X-rays in the mammographic energy range. Standard screens for use in film mammography only have about 50 - 70% quantum efficiency, and the scintillator CsI(Tl) used in indirect-conversion digital detectors exhibits about 50 - 80% quantum efficiency. Systems using amorphous selenium can achieve almost 100% quantum efficiency. The Hologic selenium detector is an example of direct conversion technology.



Direct-Conversion Detectors use a photoconductor to absorb the x-ray and directly generate an electronic signal. No intensifying screens, intermediate processes, or additional steps are required. Selenium detectors use this technology.

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To receive the complete version of this article, please contact Managing Editor Dervla Sains at editorial@imagingmanagement.org

INCREASING OPERATIONAL EFFECTIVENESS

Ensuring Stable Departmental Growth

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To develop a quality-led, customer-driven and forward looking healthcare facility, heads of departments must implement innovative strategies to enhance clinical service, research, teaching, management, quality, safety, technology and revenues. Are patients fully satisfied? Is the available budget being used in the best possible way? Can enough resources be allocated to non-clinical academic tasks? What about the future growth of the department? A key factor in meeting the demands of patient care, education and research, is having a holistic overview and strategy for developing your department and identifying tools to increase this operational effectiveness.

What is Operational Effectiveness?

Operational effectiveness is the capability of producing results according to specifications in a timely fashion (quality), using human and material resources to result in adequate services for customers. It is the cornerstone of any successful enterprise, which can be defined as one with adaptability, wise use of resources and an ability to adjust to a rapidly changing external environment, while maintaining its focus on core values. There are four levels in the growth of an organisation:

- Operational effectiveness: Is the department meeting at least minimum performance standards?
- Cost effectiveness: Is the department using available resources in the best way?
- Commercial effectiveness: Are customers satisfied?
- Strategic effectiveness: Are current operational strategies ensuring the future success of the department?

Best Practice in Change Management

One of the ways we can ensure that any changes implemented for the success of the department are solid and reliable, is to take them one level at a time. Only when change has achieved its goal at each level should one consider moving on to the next. In this way, the process of development will be swift, coherent and focused. If more than one level is addressed at the same time, the process will drain resources from day-to-day operations and become unstable.

Taking a controlled approach to development and change at an operational level means that business product or workflow redesign should only be carried out if the existing process is working sufficiently to cover the time needed to implement change. The stability of any new integration takes time and planning.

For instance, it can be seen that 10% of all business mergers fail because there is no integration at top level. In order to adapt infrastructure to new, more sound strategies, operational effectiveness, i.e., the basic running of the department, should be optimised. This process is characterised by a singular focus on the department and needs a top-down approach because a clear direction, priorities, and speed are of the utmost importance.

The next phase (cost-effectiveness) is also internally oriented but should also use the input of the working floor. Input from human resources lower in the organisation enhances the process of improving cost-effectiveness and also increases motivation. Motivation is one of the most important factors leading to success. The next two phases (commercial and strategic effectiveness) are focused on the outside world and definitely need the input of the entire department.

What Determines Infrastructure?

Operational effectiveness means that the product lines (producing clinical output, research and education) of the enterprise run smoothly. At a minimal level this is operational integrity, and at

top level this means that a department meets high internationally recognised standards. The infrastructure of the department is a major determinant of operational effectiveness. As well as the availability and exchange of data, assets such as human resources, technology, and budget are all factors that determine the operational effectiveness of the existing infrastructure.

Development and use of resources and informatics are therefore pivotal in improving operational effectiveness. Only if operational effectiveness is reached may the enterprise move to the highest levels of development. It goes without saying that unless basic operational standards are met, no other steps should be considered. Even if a department is meeting minimally effective operational standards, i.e., quality standards are being met and the budget is being respected, this of course does not ensure that it is at its most cost-effective and therefore that the commercial and future success and stability of the department is being maximised.

Conclusion

Prioritisation is the key tool when implementing improvements or changes without undermining the elasticity of the organisation. Elasticity is the ability of the department to adapt or even generate change, without damaging its own structure. Using too much or too little elasticity will affect improvements to operational effectiveness and is instrumental in keeping an organisation vital and dynamic.

PART 2

LIVE 3D ECHO BRINGS REAL-TIME BENEFITS IN PAEDIATRIC CARDIAC CARE

Making a More Accurate Diagnosis

Advances in ultrasound technology are making it possible for physicians to obtain clearer images of the heart than ever before, which is critical in being able to accurately diagnose and provide appropriate treatment for young cardiac patients with congenital heart defects. From a business perspective, real-time three-dimensional imaging of the heart is enabling hospitals and clinics to improve workflow through faster exam times and improve their patient management and satisfaction.

In the field of paediatric cardiology, recent advances in echocardiography have improved numerous aspects of care ranging from prenatal detection of heart defects to surgical planning. Using STIC technology and Live 3D Echo, images can be rotated and cropped to view the beating heart from all angles. As a result, physicians are able to obtain a complete view from multiple perspectives, providing immediate and improved perspective on spatial relationships. The full volume datasets obtained from Live 3D Echo technology also facilitate more accurate quantification of heart function and ejection fraction; a key indicator of heart health. These tools assist the physician in making a more accurate diagnosis of the young patient – and give surgeons an advantage in pre-surgical planning.

Prenatal Evaluation of the Foetal Heart Using STIC

An emerging technology with great potential for improving the detection rates of congenital heart disease is STIC, or four-dimensional ultrasonography with spatiotemporal image correlation (STIC).

In the U.S., guidelines for performance of foetal cardiac examination by the American Institute of Ultrasound in Medicine (AIUM) recommends extending the examination beyond the four-chamber view to include the outflow tracts of the

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foetal heart whenever technically feasible. However, evaluation of the outflow tracts is the most difficult part of the extended examination of the foetal heart.

"Visualisation of the right and left outflow tracts is crucial for the diagnosis of cardiac anomalies that affect the aorta and pulmonary arteries, and for which morbidity and mortality can be improved by accurate prenatal diagnosis," said Dr. Luís F. Gonçalves, Assistant Professor of Obstetrics and Gynaecology, Wayne State University, Perinatology Research Branch NICHD/NIH/DHHS, Hutzel Women's Hospital, Detroit, Michigan.

Indeed, many sonographers have difficulty obtaining and interpreting these views. Reasons for this difficulty include lack of operator experience, foetal motion during the examination, or the small size of the foetal heart.

Diagnosing and Treating Congenital Heart Defects

Live 3D Echo ultrasound has shown real value in diagnosing congenital heart defects and helping the paediatric cardiologist and surgeon plan life-saving surgery following birth. With 3D, volume data can be archived and displayed in multiple planes as well as in rendered volumes, showing the motion of the cardiac chambers and allowing more accurate quantification of heart function. In addition, 3D Colour Flow allows the physician to better appreciate the blood flow through heart valves and septal defects.

Real-time three-dimensional imaging is proving to be instrumental in helping physicians better diagnose the exact nature of a condition and determine an appropriate course of action. Live 3D Echo is relevant to surgery or other interventions by providing the ability to obtain volumetric images of the heart, and to crop and slice those images real-time in a manner that was not possible before. By being able to view these images from relevant perspectives, surgeons now have the ability to prepare a precise surgical plan, minimising surprises. "All these clinical applications can be done in a controlled, standardised manner, allowing for assessment of heart anatomy and function more easily than with 2D," said Dr. Girish Shirali, Director of Paediatric Echocardiography, Medical University of South Carolina.

Improving Care for Children

An additional benefit of Live 3D Echo is its rapid image acquisition time, which is advantageous in scanning young children who cannot sit or lie still for extended periods.

And, since full-volume images can be manipulated offline, additional scans are often not necessary. The quick acquisition time of Live 3D Echo also does not require sedation of children who might be anxious about imaging procedures or who are too young to hold themselves still.

"Exposing young children to ionising radiation is always a concern in medical imaging," said Dr. Shirali. "By using ultrasound, this concern is eliminated, especially for patients that may require multiple exams as part of their diagnosis and course of treatment."

Why is 3D Ultrasound so Important?

Congenital heart disease is a serious health problem. As the leading cause of death among congenital anomalies, the medical community should strive to improve the detection rate for these conditions. Tools such as 3D/4D ultrasound have the potential to decrease the dependency on operator skills, speed up the diagnostic process and improve diagnostic accuracy.

With time, it is likely that all ultrasound systems will have 3D/4D capabilities as a standard feature. Accordingly, learning to quickly and accurately extract the best diagnostic information is important for all physicians and clinicians as hospitals and clinics continue to improve patient care.

Part Three of this series will appear in the next issue of IMAGING Management:

- **Beyond the Heart: Innovations in Radiology**

As ultrasound technology continues to evolve, so too are the applications. From diagnostic applications to treatment methods, we'll offer a look at the evolving applications already in development and how they can help clinics control costs.

OptiVantage™ DH

contrast under control

Convincing

Contrast Delivery System for Dual Head Injector CT Protocols

Fully programmable powerhead: For highest patient-side safety. Allows to change protocols without changing rooms.

Tilt enable: Enable button not active until enabling sequence has been properly followed and powerhead is tilted downward.

Patency check: Injection of saline flush prior to contrast injection, to check for venous access.

Contrast delivery solution: Just with a simple change of the faceplate, the OptiVantage™ DH can accomodate prefilled syringes.

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OptiVantage™ DH

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POWER INJECTORS IN COMPUTED TOMOGRAPHY

Increasing Medical Safety

Many Computed Tomography (CT) exams necessitate the use of intravenous injection of contrast media, to make specific organs, blood vessels or other tissue types stand out from surrounding structures. Until the early 1990's, CT scanners employed long scan times using 'step and shoot' technology. To scan an average patient for the chest, abdomen and pelvis with 10mm sections at 15mm centres would require some 50 sections at 10 seconds each- about 5 minutes of scan time for a very breathless patient who has been asked to breath hold for 50 separate scans.

Initial use of contrast involved the radiologist in the scan room performing a hand injection of contrast media, typically 100 mls. It was only possible to acquire a relatively short number of scans with the contrast in the optimum circulatory phase and there were concerns about the consistency of timing and flow rates, which were very operator dependant.

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New Technology Saves Time

The advent of slip ring technology allowed a scan to be acquired as a single volume of information, (spiral or helical scanners), reducing scan times to approximately 20 seconds per body area. Multi-detector row scanners now allow scan times of only a few seconds per body region. Many CT protocols now require multiphase scans, where one body region is imaged with the contrast at different circulatory phases, using a single contrast bolus. New power injectors need to allow tight control of flow rate, volume and timing of the injection. Recent developments in cardiac and angiographic CT have shown advantages in using a saline bolus following the contrast, reducing the volume of contrast required. Several manufacturers are currently offering double headed injectors in the UK market, including Medrad's Stellant CT Injector, Medtron's Injectron CT 2 Injector, the E-Z-EM Empower CT Injector and Tyco Healthcare's Optivision DH CT Injector

Safety Considerations for Power Injectors

As injections are often remotely triggered by the operator in the CT control room, there are two main safety issues. The first involves the injection of air into the vein, potentially causing an air embolus in the pulmonary arteries or cerebral circulation, causing a stroke (in the presence of an intracardiac right to left shunt). The volume of air may be a few mls. caused by not purging the connecting line or may be as much as 100 mls., if an empty syringe is inadvertently used. The second, extravasation of the contrast into the surrounding tissues, can cause damage due to toxicity. This is usually very painful, and may lead to breakdown of the tissues. CT injectors currently on the market address these problems in different ways but share many common characteristics.

Characteristics of Power Injectors

Flow Rate

- this is adjusted in steps of 0.1 ml. from 0.1 - 9.9/10 mls. If the flow rate is too high for the vein being used it can cause an increase in pressure leading to venous rupture and resultant extravasation into the subcutaneous tissues.

Delivery Pressure

- to reduce the risk of extravasation it is essential to be able to programme a maximum pressure limit which may vary depending on size of the vein and flow rate of the injection. Once this pressure limit is reached, flow rate is reduced and a warning flashes on the screen. The operator then has the option to pause the injection to check that extravasation has not occurred.

Volume Ranges
- different volumes of contrast and saline will be required dependant on the area being scanned, scan protocol and patient considerations such as weight of the patient and kidney function. All the above injectors have a maximum syringe size of 200 mls. for both the contrast and saline sides.

Syringe warmer
- To reduce viscosity, the contrast is pre-warmed to near body temperature which reduces adverse effects. Once the syringe is positioned on the injector it is kept at this temperature until required.

Configuration
- injectors are available as either ceiling- or pedestal-mounted.

Specific Features

- The E-Z-EM Empower injector has a patented patch, placed over the injection site that detects change of electrical impedance in the skin caused by extravasation and pauses the procedure before harm is done. The device registers extravasation volumes of less than 20mls. This injector also has a tilt sensor/lockout which prevents an injection unless the injector is tilted vertically downwards beyond 270 degrees to help minimise the risk of air bubbles reaching the syringe tip. System arming and flow rate manipulation can all be performed at the injector head.

- Medrad's Stellant injector has an automated system for filling syringes with contrast and saline and for advancing/ retracting the syringe plungers which reduces loading/ unloading time and increases efficiency. There is a patented system to prime the extension tube which controls waste and spillage of contrast and a 'keep vein open' feature which pulses a small amount of saline to maintain vein patency. For cardiac scanning this system can inject saline and contrast concurrently in order to provide images of the right side of the heart with dilute contrast. The syringes used have moulded fluid dots allowing easier detection of air in the syringe.

- The Medtron Injectron CT2 has overcome the problem of trip hazards from electric cables by using a wireless touch screen remote control. It has the ability to inject saline and contrast concurrently and also has a 'keep vein open' feature.

- Tyco Healthcare's OptiVantage DH has the ability to use prefilled syringes. According to a study by the American Society of Radiologic Technologists, the use of prefilled syringes was based upon four factors; saving time, improving cost effectiveness, enhancing healthcare quality and improving patient safety. This injector is programmable at the injector head and also features a tilt sensor/lockout to reduce the risk of air embolus. This injector also has a patency check feature similar to the Medtron 'keep vein open' feature.

Advantages of Intravenous Administration

In current practice, intravenous contrast is used almost universally for body scanning unless there are specific clinical reasons or where contrast is clearly unnecessary. If contrast is not used then the soft tissues of the body cannot be distinguished from one another. Contrast may be taken up by normal structures differently, depending upon the nature of their blood supply, enabling us to appreciate differences. Diseased organs may exhibit abnormal uptake or enhancement of contrast. Upon injection of contrast through a peripheral arm vein, contrast flows first through the right side of the heart, through the lungs, onto the left side of the heart and then out of the heart into the arterial system and perfuses through organs of the body. So it follows, that scan timing related to contrast injection rate and circulation time of the patient may allow imaging of the organs in the circulatory phase of choice (Figure 1 a-c).

Also, evaluation of blood vessels can be made very rapidly, with many invasive procedures now replaced by a CT scan. For example, the whole heart may be scanned in less than 10 seconds and we are able to evaluate not only the coronary arteries but also gross morphological cardiac structure and function.

Conclusion

CT is being increasingly used as a rapid, easily accessible 'one stop shop' for the diagnosis of acute chest pain, which is a very common clinical presentation for a wide variety of potentially life-threatening pathologies. The prescriptive and careful approach to the use of intravenous contrast use has become vitally important, as CT technology continues to advance at a rapid rate.

ANALOG MAMMOGRAPHY
PRODUCT COMPARISON CHART

ECRI is a totally independent non profit research agency designated as a Collaborating Centre of the World Health Organization (WHO). Such organisations are appointed to contribute to WHO's public health mission by providing specialised knowledge, expertise, and support in the health field to the WHO and its member nations. ECRI is widely recognised as one of the world's leading independent organisations committed to advancing the quality of healthcare with over 240 employees globally.

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ECRI's focus is medical device technology, healthcare risk and quality management, and health technology assessment. It provides information services and technical assistance to more than 5,000 hospitals, healthcare organizations, ministries of health, government and planning agencies, voluntary sector organizations and accrediting agencies worldwide. Its databases (over 30), publications, information services and technical assistance services set the standard for the healthcare community.

All of ECRI's products and services are available through the European Office, addressing the special requirements of Europe and the UK. Utilising some of the world's largest health related databases, help, support and guidance can be given to our European clients at a local level.

FOOTNOTES TO THE PRODUCT COMPARISON CHART

ON PAGES 32 - 34

ECRI

E1 These recommendations are the opinions of ECRI's technology experts. ECRI assumes no liability for decisions made based on this data.

Planmed

P1 Marketed in Japan by Shimadzu Corporation.

P2 User-selectable normal AEC (mAs) or advanced AEC (mAs, kV); kV and thickness compensated; flex-AEC automatically selects sensors.

P3 User-selectable normal AEC (mAs) or advanced AEC (mAs, kV); kV and thickness compensated

P4 Complies with IEC 60601-1, IEC 60601-2-45, IEC 60601-1-2 (EMC) and IEC 60601-2-28 (x-ray tube assemblies). Meets requirements of CSA, DHHS, and UL.

P5 autoload Bucky with MaxView/MaxView-ready units.

GE Healthcare

G1 This was valid only in USA at time of publishing, which might have significant difference to prices in Europe.

Hologic

H1 Please note: The Affinity is CR compatible and meets European mammography requirements.

Publication of all submitted data is not possible: for further information please contact ECRI or editorial@imagingmanagement.org.

	ECRI *E1*
MODEL	**Analog Mammography**
WHERE MARKETED	
FDA CLEARANCE	
CE MARK (MDD)	
GENERATOR TYPE	High-frequency, single-phase
kV RANGE	22-35
mAs RANGE	4-600
mA range	Up to 100
Time range, sec	0.02-8
AEC DETECTOR	Yes
Parameters controlled	kV,mAs, anode/ filter
X-RAY TUBE	
Anode type	Rotating
Heat capacity, HU	300,000
Heat dissipation rate, HU/ min	60,000
Target/ filter combinations	Mo/ Mo, Mo/ Rh
Focal spot size, mm	0.1 and 0.3
POSITIONING ASSEMBLY	
Collimation	Yes
18 x 24 cm	Yes
24 x 30 cm	Yes
Movement locks	Electromagnetic
Assembly movement	
Rotation,	-135 to +180
Vertical, cm (in)	100 (39.4)
SID, cm	66
Scale guide	Distance and pressure
HANDSWITCH	
RADIATION OUTPUT	
mR/ sec @ 28 kVp	····›800
RADIATION SHIELD	
L x W, cm (in)	
Thickness	
COMPRESSION SYSTEM	Manual, automatic, fine adjustment
Force, newtons	200
SCREEN-FILM SYSTEMS	All (unless digital)
GRID RATIO	5:1
BUCKY	For both film sizes
MAGNIFICATION DEVICE	Yes
STEREOTATIC DEVICE	Optional
FILM ID SYSTEM	Yes
LABEL PRINTER	Optional
POWER REQUIREMENTS	
H x W x D, cm (in)	
WEIGHT, kg (lb)	
OPTIONAL ACESSOIRES	
PLANNING & PURCHASE	
List price, std configuration	
Warranty	
Delivery time, ARO	
Training	
Year first sold	
Number installed	
Fiscal year	
OTHER SPECIFICATIONS	

Planmed	Planmed	Planmed	GE Healthcare
Nuance Classic [P1]	**Sophie** [P1]	**Sophie Classic** [P1]	**Diamond**
Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes
Constant potential, high-frequency, 80 kHz, single phase	Constant potential, high-frequency, 80 kHz, single	Constant potential, high-frequency, 80 kHz, single	Single-phase, high-frequency, 3.6 kVA (2.5 kW)
20-35, increments of 1kV	20-35, increments of 1kV	20-35, increments of 1kV	15-39, increments of 1 kV
1-720	1-720	1-720	2-500
42 small focus, 120 large focus; available with a tube that gives 35 mA with small focus and 110 mA with large focus	42 small focus, 120 large focus; available with a tube that gives 35 mA with small focus and 110 mA with large focus	42 small focus, 120 large focus; available with a tube that gives 35 mA with small focus and 110 mA with large focus	30-100
0.1-5 broad focus, 0.1-9.9 fine focus	0.1-6 broad focus, 0.1-9.9 fine focus	0.1-6 broad focus, 0.1-9.9 fine focus	0.02-10
Flex-AEC with 48 detectors	Solid state with 3 independent sensors	Solid state with 3 independent sensors	AutoPoint, 8 discrete detector arrays
mAs, kV [P2]	mAs, kV [P3]	mAs, kV [P3]	Time, kV, mA, filter, detector
Rotating, oil and fan cooled	Rotating, oil and fan cooled	Rotating, oil and fan cooled	Rotating, dual-angle
300,000	300,000	300,000	300,000
56,000	56,000	56,000	60,000
Mo/ Mo, Mo/ Rh	Mo/ Mo, Mo/ Rh	Mo/ Mo, Mo/ Al; optional Mo/ Rh	Mo/ Mo, Mo/ Rh, Mo/ Al
0.1 and 0.3	0.1 and 0.3	0.1 and 0.3	0.1 and 0.3
Automatic	Automatic	Automatic	Automatic
Yes	Yes	Yes	NA
Yes	Yes	Yes	NA
Motorized	Motorized	Motorized	Motorized
+180, -135, motorized, isocentric, adjustable speed	+180, -135, motorized, isocentric, adjustable speed	+180, -135, motorized, isocentric, adjustable speed	185
60 (23.5) motorized, adjustable speed	60 (23.5) motorized, adjustable speed	60 (23.5) motorized, adjustable speed	77 (30)
65	65	65	66
Digital display of force, thickness, and angle	Digital display of force, thickness, and angle	Digital display of force, thickness, and angle	Digital
Yes	Yes	Yes	Yes
1,300	1,300	1,300	≥840
Optional	Optional	Optional	Yes
185 x 75 (73 x 30)	185 x 75 (73 x 30)	185 x 75 (73 x 30)	194 x 81 (76 x 32)
0.5 mm Pb equivalent or 0.3 mm	0.5 mm Pb equivalent or 0.3 mm	0.5 mm Pb equivalent or 0.3 mm	0.5 mm Pb equivalent
Motorized, user-adjustable degressive speeds and force; manual compression, automatic or manual release of compression; digital display for breast thickness and applied force; optional MaxView breast positioning system	Motorized, user-adjustable degressive speeds and force; conventional and Twincomp compression systems, automatic or manual release; digital display for breast thickness and applied force; optional MaxView breast positioning system	Motorized, user-adjustable degressive speeds and force; automatic or manual release of compression; digital display for breast thickness and applied force; optional Twincomp or MaxView breast positioning system	Motorized, bidirectional ECS, SoftTouch manual
Selectable to 200	Selectable to 200	Selectable to 200	0-250
9 user selectable; 1 user configurable for AEC	9 user-selectable; 1 user-configurable for AEC	9 user-selectable; 1 user-configurable for AEC	NA
5:1, 34 lines/cm	5:1, 34 lines/ cm	5:1, 34 lines/ cm	5:1, ROC equivalent 6:1
18 x 24 cm; 24 x 30 cm reciprocating	18 x 24 cm; 24 x 30 cm reciprocating	18 x 24 cm; 24 x 30 cm reciprocating	18 x 24 cm; 24 x 30 cm
1.6x, 1.8x, 2.0x	1.3x to 1.8x, motorized and continuosly adjustable	1.6x, 1.8x	MultiChoice single device 1.6x, 1.8x, 2x
Microprocessor-controlled Nuance Classic Cytoguide/Nuance Classic DigiGuide	Microprocessor-controlled Cytoguide/ DigiGuide	Microprocessor-controlled Cytoguide/ DigiGuide	Delta 32
Network ID camera	Network ID camera	Daylight ID system or network ID camera	Dataflash Plus
optional	Optional	Optional	NA
208-240 10% VAC; 50/60 Hz; 15A	208-240 10% VAC; 50/60 Hz; 15A	208-240 10% VAC; 50/60 Hz; 15A	198-264 VAC; 50/60 Hz; 16A
103 x 76 x 100 (40.4 x 29.9 x 39.2)	98.5 x 76 x 90 (38.8 x 29.9 x 35)	98.5 x 76 x 90 (38.8 x 29.9 x 35)	194 x 68 x 121 (76.5 x 27 x 48)
180 (396)	160 (352)	160 (352)	350 (771)
MaxView breast positioning system, side access positioning system, Nuance Classic Cytoguide/DigiGuide, network ID camera, perforated or rectangular localization paddle with scale and crosshair, high-lip paddle, accessory storage unit, shield, turnable base, CR interface	Cytoguide, DigiGuide, network ID camera, rectangular localization paddle with scale and crosshair, high-lip compression paddle, MaxView breast positioning system, radiation protection screen, accessory storage unit, CR interface, flex-AEC	Cytoguide, DigiGuide, network ID camera, perforated or rectangular localization paddle with scale and crosshair, high-lip paddle, MaxView breast positioning system, Twincomp compression, radiation protection screen, accessory storage unit, CR interface, flex-AEC	3-D imaging with TACT (tuned aperture comp.tomography), specialty paddles
NA	NA	NA	$137,791 [G1]
NA	NA	NA	1 year; parts, labor, and glassware
NA	NA	NA	30 days
NA	NA	NA	2 day, 16 CEUs
NA	1991	1996	2000
NA	NA	NA	500+
February to January	February to January	February to January	January to December
Dual control panels; automatic Rh filter selection; fully automatic technique selection based on tissue thickness and composition; compact and transportable; automatic release; antiblooming (bias) circuit; automatic view angle; help-code display; built-in calibration and maintenance system. [P4]	Dual control panels; automatic Rh filter selection; fully automatic technique selection based on tissue thickness and composition; compact and transportable; automatic release; antiblooming (bias) circuit; automatic view angle; help-code display; built-in calibration and maintenance system; autoload Bucky. [P4]	Dual control panels; automatic Rh filter selection; fully automatic technique selection based on tissue thickness and composition; compact and transportable; automatic release; antiblooming (bias) circuit; automatic view angle; help-code display; built-in calibration and maintenance system; [P4, P5]	ParkBack tube head; AutoPoint automatic detector selection; PaddleLogic; motorized cassette loading. Meets requirements of IEC 60601-1, ISO 9001, MQSA, and UL.

	ECRI [E1]	HOLOGIC®	HOLOGIC®
MODEL	**Analog Mammography**	**Lorad Affinity Series**	**Lorad M-IV Series**
WHERE MARKETED		Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes
CE MARK (MDD)		Yes	Yes
GENERATOR TYPE	High-frequency, single-phase	Constant potential, high-frequency, inverter	Constant potential, high-frequency, inverter
kV RANGE	22-35	20-39, increments of 1kV	20-39, increments of 1kV
mAs RANGE	4-600	3-500	3-500
mA range	Up to 100	10- 100	10- 100
Time range, sec	0.02-8	Up to 5	Up to 5
AEC DETECTOR	Yes	Solid-state	Solid-state
Parameters controlled	kV,mAs, anode/ filter	Automatic time/ kV/ filter	Automatic time/ kV/ filter
X-RAY TUBE			
Anode type	Rotating	Mo, rotating	Mo, rotating
Heat capacity, HU	300,000	300,000	300,000
Heat dissipation rate, HU/ min	60,000	60,000	60,000
Target/ filter combinations	Mo/ Mo, Mo/ Rh	Mo/ Mo, Mo/ Rh	Mo/ Mo, Mo/ Rh
Focal spot size, mm	0.1 and 0.3	0.1 (small), 0.3 (large)	0.1 (small), 0.3 (large)
POSITIONING ASSEMBLY			
Collimation	Yes	Automatic	Automatic
18 x 24 cm	Yes	Automatic	Automatic
24 x 30 cm	Yes	Automatic	Automatic
Movement locks	Electromagnetic	Electromagnetic, fail-safe	Electromagnetic, fail-safe
Assembly movement			
Rotation,	-135 to +180	+195, -155, digital readout	+195, -150, digital readout
Vertical, cm (in)	100 (39.4)	71-140 (28-55) motorized	63.5-140 (25-55) motorized
SID, cm	66	65	65
Scale guide	Distance and pressure	Digital readout	Digital readout
HANDSWITCH		No	No
RADIATION OUTPUT			
mR/ sec @ 28 kVp	⋯›800	≥800	⋯›1,500, 60 cm
RADIATION SHIELD		Yes	Yes
L x W, cm (in)		185 x 60 (73 x 24)	190 x 80 (75 x 31)
Thickness		0.5 mm Pb equivalent	0.5 mm Pb equivalent
COMPRESSION SYSTEM	Manual, automatic, fine adjustment	Manual, motorized in both directions; precompression, full compression; dual footswitch	Manual, motorized in both directions; precompression, full compression, dual compression modes; dual ,footswitch
Force, newtons	200	110-178 full compression, 300 manual	89-178 full compression, 300 manual
SCREEN-FILM SYSTEMS	All (unless digital)	Up to 3, programmable	Up to 3, programmable
GRID RATIO	5:1	HTC or 5:1 linear, focused standard	HTC or 5:1 linear, focused standard
BUCKY	For both film sizes	18 x 24 cm, 24 x 30 cm	18 x 24 cm, 24 x 30 cm
MAGNIFICATION DEVICE	Yes	1.8x	1.8x
STEREOTATIC DEVICE	Optional	Stereotactic compatible	Optional StereoLoc II
FILM ID SYSTEM	Yes	Rapid ID Flasher	Integrated AutoFilm ID
LABEL PRINTER	Optional	Optional	Optional
POWER REQUIREMENTS		200-240 VAC 10%; 50/60 Hz; 25 A	200-240 VAC 10%; 50/60 Hz; 35 A
H x W x D, cm (in)		178 x 76 x 109 (70 x 30 x 43)	190 x 64 x 128 (75 x 25 x 50) gantry, 189 x 81 x 43
WEIGHT, kg (lb)		268 (588)	384 (800) gantry, 91 (200) console
OPTIONAL ACESSOIRES		HTC grid and FAST paddles (standard on platinum models), various compression paddles, magnification table, localization kit; 10 cm coned down, aperture, view, or integrated markers	HTC grid and FAST paddles (standard on platinum models), various compression paddles, StereoLoc II, DSM, localization kit, barcode reader, accessory cabinet, integrated markers, MIS interface
PLANNING & PURCHASE			
List price, std configuration		NA	NA
Warranty		1 year, parts; 2 years prorated, x-ray tube	1 year, parts; 2 years prorated, x-ray tube
Delivery time, ARO		≥2 weeks	≥30 days
Training		2 days on-site	2 days on-site
Year first sold		2002	1996
Number installed		NA	3,300
Fiscal year		October to September	October to September
OTHER SPECIFICATIONS		18 x 24 cm SRL 2000 ;Bucky; 24 x 30 cm SRL 2000 Bucky; HTC grids; FAST paddles, various paddles; magnification platform; full-field magnification; aperture; face shield; radiation shield; Rapid ID Flasher; dual-function footswitch; auto aperture; integrated markers available [H1]	18 x 24 cm SRL 2000 Bucky; 24 x 30 cm SRL 2000 Bucky; HTC grids; FAST paddles, various paddles; magnification table; face shield; radiation shield; AutoFilm ID; dual-function footswitch *Please note: The M-IV is CR compatible and meets European mammography requirements.*

OVERVIEW OF HEALTHCARE IN HUNGARY

Assessing Today's Challenges

Imaging plays an integral role in medical care and hospital management today. Unfortunately, imaging is not considered a main priority for healthcare in Hungary at the present, and the commonly seen issues facing general medical care also exist in imaging. Underfinanced medical care is the basic problem of the Hungarian health services. The medical care's ratio related to GDP is only one third of the ratio compared to European countries in general, but in some fields even less. Morbidity and mortality rates in Hungary do not compare well with current European figures. Diagnostic activities, included imaging are not concentrated well. There are 154 hospitals for 10 million inhabitants in Hungary, with 84 thousand beds in total. Active medical care is served by 60,000 beds, with the remaining 24,000 for chronic and rehabilitation cares. This structure is not optimal. Many social problems have to be solved at medical level. Elderly people in all societies are increasing in number and chronic hospice care demands are increasing steadily.

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Crises in Healthcare

An imbalance in the provision of healthcare has significantly contributed to the above-mentioned problem. Historically, Hungarian medicine is too hospital-centred. As a result of this, there are grave problems in healthcare facilities other than hospitals, such as the structure of the system, financial problems, unequal access of patients to medical care, not successfully managed during the past 15 years. Some reforms were initiated to combat this during different types of governments. The result of this was a weakening of the hospital sector and a failure of privatised general practitioners in the old structure to take on more of the burden.

Imaging as well as healthcare in general is also faced by a crisis of human resources owing to the lack of financial reward in relation to other European countries for healthcare workers. The negative impact of this can be seen in diagnostic fields like radiology, nuclear medicine, laboratory diagnostic and pathology. There are theoretically 40,000 physicians in Hungarian healthcare today, but only 34,000 of them are active in our country. In our hospitals 2500-2600 of specialists/consultants have fallen though the net due to the poor rewards on offer for an extremely demanding job. However, the most worrying area is radiology, missing 30% of trained radiologists from the system.

Disharmonic regulations in healthcare provoke difficulties not only for imaging management, but for all hospital management and for medical care organised outside hospitals. European directives related to workload and working hours and the vague legal status of doctors have added to trained workers leaving the profession. Some variations of the legal status of doctors offered flexible solutions to overcome the shortage of radiologists in hospitals. Recently these mixed employment versions became strictly limited, causing severe difficulties for imaging services in hospitals.

Technology of the 21st Century

Shimadzu Europa GmbH, Duisburg, Germany Phone: +49 (0) 203-7687-0 E-mail: medical@shimadzu.de www.shimadzu.de

Reliability and advanced technology add value and increase safe diagnosis

In 1896, just a few months after Wilhelm Conrad Roentgen's discovery of X-rays, Genzo Shimadzu Jr. and Professor Muraoka of Kyoto University succeeded in taking the first X-ray images in Japan. This was the starting point for a 110 year long tradition in medical technology. Since then, the list of success stories especially in X-ray technology is extensive. Together with analytical instruments, medical technology has turned Shimadzu into one of the leading suppliers world-wide. The systems are at home equally in medical practices and hospitals.

Today, Shimadzu develops, manufactures and distributes a broad range of diagnostic systems in all areas of clinical application – computer tomography, Digital Subtraction Angiography (DSA), cardiovascular systems, digital radiography & fluoroscopy systems, ultrasound and general radiography equipment. The latest developments include angiography systems with C-arm rotation speeds of up to 60 degrees/second, two digital color Doppler ultrasound units and mobile X-ray systems.

Heartspeed with direct- conversion Flat Panel Detector "Safire".

The next milestone in Shimadzu's X-ray technology is the so-called "Safire" flat-panel detector, the world's first large format FPD which converts X-rays directly into electronic signals using amorphous Selenium.
The direct-conversion technology offers distinct advantages in image quality and dose efficiency in comparison with indirect-conversion flat panel. The current image amplifier technology, inferior in image quality and dose efficiency, will soon become obsolete.

Remote controlled table "Sonialvision Safire".

"Safire" merges economic with diagnostic benefits

Introducing the "Safire direct-conversion FPD" to the medical sector enables digitizing of all X-ray related diagnostic imaging. This allows faster diagnosis, improved diagnostic capabilities and accelerated remote medical diagnostics. In Japan, over 100 "Safire" systems are already in use. The 23 x 23 cm (9-inch-square) or 43 x 43 cm (17-inch-square) "Safire" FPD can be used both for still images and fluoroscopy. Historically, for medical diagnostics, X-ray film has been used. But recently, with increasing implementation of digital and information technology in the medical field, the need for a high-resolution, high-sensitivity direct-conversion flat-panel detector has been keenly awaited as an appropriate X-ray detector for high-tech medical practices.

How does the "Safire" flat-panel technology work?

Compared with the indirect-conversion flat panel, the new direct-conversion technology now creates clearer high-resolution images with less signal deterioration and reduced noise. The top layer of the flat-panel detector, an X-ray conversion film, converts X-rays passing through the patient's body directly into electric signals using amorphous Selenium. A TFT (thin-film transistor) array then collects the signal from each pixel and transfers the data immediately to the processing system.
The direct-conversion flat-panel detector is far more sensitive than conventional X-ray films. It produces still images as well as fluoroscopic images which are qualitatively equal to or better than film, even when the X-ray radiation emitted is reduced from one half to one third of conventional X-ray examination. This dramatically reduces the dosage exposure to the patient.

Shimadzu has traditionally invested heavily in research and development. The company has always followed a simple yet vital concept: offering the best diagnostic system possible, combined with high patient- and user-friendliness.

Shimadzu medical systems are being used on every continent. The experience gained all over the world is integrated into the design of new systems. Hence, every single user can benefit from the know-how gathered world-wide.

SHIMADZU

Problems of Diagnostic Radiology in Hungary

Diagnostic radiology in Hungary is insufficient to requirements due to shortage of staff and to the lack of high-tech equipment and infrastructure. Underfinanced healthcare in general and inability to cover the real costs of radiology are responsible. Digital radiology for example is cost-effective for the long run, but bulk investment requirement works against it.

Private diagnostic radiology centres are a good model of concentration of human and technical resources at cost-effective measures, but private radiology services have less participation compared to Hungarian radiology versus other fields of medicine, where higher percent of private capacities are available.

Raising the Standard

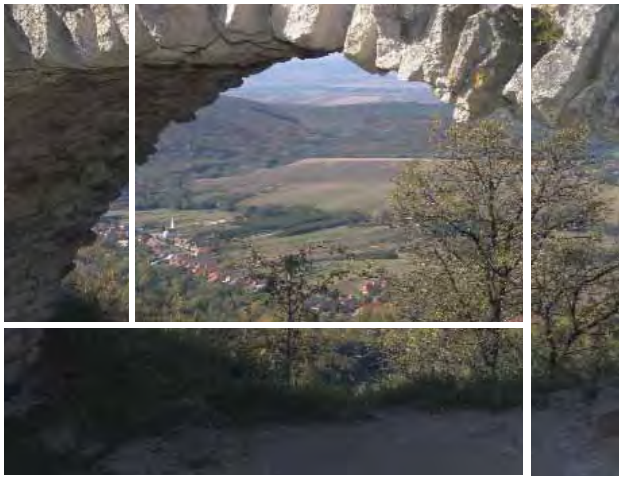
The centralisation of healthcare is the optimal strategy for reaching higher levels of medical service. Concentration of providers and techniques, and concentration of human resources could result in more cost-effective hospital care. A new structure is required based on major morbidity factors. The dominance of oncologic, cardio-vascular and geriatric patients require specific imaging facilities.

The centralisation of oncology – starting this year – into major special centres is a good example of a positive trend. Instead of compensating financial support for these centres related to increased volume of patients, unfortunately financial resources have decreased versus last year's volume. The development of oncotherapy was worsened this year by a drop in reimbursement levels for oncology medication. Centralisation without compensation and without development is an example of how not to do it. On the other hand, a reduction of health provision sites is not necessarily bad. This necessitates the clear planning of capacity transfer in major centres based on the opinions of the specialist's professional boards.

Essential Changes

Ownership and proprietorship must become clear and transparent rather than today's confused mix: state governmental, local governmental, private, foundation related, church related hospitals, etc. We need harmonisation in line with European guidelines. New investments are needed in the near future. After decades of underfinanced healthcare without private capital this would be impossible. Private health provision in Hungary is now only 20%. This level is highly inhomogeneous. In some fields 100% private care already exists, in some other fields nothing. Involvement of private capital has to be strictly regulated by the law.

Hospital-based curative versus preventive health-



care is the norm in Hungary. Instead of rapid changes in this field a longer period of development could result in a change of attitude for patients. Quality control and digital radiology, teleradiology and telepathology consultations are most urgent requirements of the near future. Collaboration of disciplines has to be coordinated at the level of hospital management. Also, the heterogeneity of hospitals is too large. One third of hospitals are centralised major hospitals, helping in education ad postgraduate training organised by four university regions.

Conclusion

In summary, instead of the incomplete and unproductive changes experienced in the Huingarian healthcare system so far, well planned active development is required with sufficient financial support. Without investment no development can be reached. Rational and professional planning is required as well as more active participation in education and training. Effective healthcare has to be based on realistic estimation and coordination of both requirements and capacities.

DEALING WITH ORGANISATIONAL CONFLICTS

Challenges Faced by Department Heads

Radiology departments in the four Hungarian University Medical Schools (UMCs) are organised around three major tasks: patient care, research and training (graduate, postgraduate and CME). The structure is organised accordingly; departments are directed by a University Professor acting as Chairman and at the same time as Head of the department. The focus of patient care activity of these departments traditionally exceeds the service provided for other departments of the medical school, and usually the department of radiology acts as a regional centre possessing the necessary skills and equipment for taking care of even the most difficult cases.

Role of University Radiology Departments

Training obligations are threefold in these centres. The main duty is teaching radiology to medical students in the form of lectures, seminars and practicals, not only in Hungarian, but – for foreign students – also in English and German.

Departments of radiology are also responsible for training radiology residents in their own premises, and at the same time for the organisation of training in all departments of their region. It is also their duty to set standards and provide opportunities for credit-based CME of radiologists both locally and at a regional level. Scientific activities are performed in the form of basic and clinical research in cooperation with other specialties, nowadays mostly in connection with computer applications (CAD), contrast material development, experimental neuro-imaging, neuro-tractography, functional imaging, etc.

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Human Resources

The staff of an average university department consists of about a hundred employees, of whom approximately 25% are medical doctors (cca. twenty specialists and five residents), 70 % are x-ray technicians, CT/MR operators, and nurses specialised in interventional radiology and the rest take care of PACS, computers, administration and maintenance. The Head of the department directly controls the staffing procedures and professional activities of the radiologists and indirectly –via the cooperation of a chief technician – the other employees.

Future Challenges

We face three potential threats here: one is that the number of residents entering radiology training has fallen behind the number of retiring radiologist specialists in the last decade; the other is that the private sector offers significantly higher wages to radiologists than the academic centres; the third is that it is more attractive for young specialists to continue their professional career abroad. Investment in teleradiology solutions may be of temporary help, but in the long run it may cause further difficulties, especially in the field of research and graduate/postgraduate training.

Financial Concerns

The Head of the university department is responsible for the budget, which is a difficult task because of the constant insufficiency of financing healthcare activities (which is the main source of income) compared to other expenditure. Other incomes, mostly resulting from training activities, are not able to counterbalance the negative balance of the overall budget. Theoretically research is funded by grants; however in practice the available university and other resources are rather limited. The explanation of the fact that despite all these difficulties it is still possible to manage an acceptable level of function lies in the extremely low wages (On average per month; CT/MR Operator 300€, Radiology Resident 300€, Assistant Professor 750€, Full Professor 1500€).

The insufficiency of financing makes it extremely difficult to purchase the most up-to-date technology in these institutes, resulting in the controversy that rather typically the private centres and even some community hospitals possess high-end equipment much earlier than the university centres. This fact explains the unusual marriage between university departments and private serv-

ice providers, since that is how the necessary investments may find their path to the academic centres, which, on the other hand, have to do their best to bring about a contract that guarantees all important conditions indispensable for ongoing high quality training and research activities.

Conclusion

University departments of radiology face many challenges: on the one hand they are at the front line of all the actual turf battles and have to keep pace with the ongoing scientific and technological revolution both in research and training, while on the other hand they face increasing difficulties to find the necessary funds and the appropriately dedicated and enthusiastic staff to answer these challenges.

The solution to these problems may be to make the financial and technological environment in the academic radiology departments much more attractive, for which we have to achieve a change of paradigm in the attitude of politicians and other decision-makers responsible for health care, higher education and research.

MANAGEMENT ISSUES IN A NATIONAL RESEARCH PROGRAMME

A Multidisciplinary Approach

In South-west Hungary, three years ago, a regional imaging research programme was commenced within the framework of the European Development Programme entitled "Management of Human Resources 4.3". It was created using both funding from the University of Pécs as well as significant financial support from the European Community.

Aim of the Project

The aim of this project was the establishment of a multidisciplinary screening and diagnostic centre of preventive medicine. While mortality rates in Hungary remain among the highest in Western Europe, in the first phase actualised valid data of morbidity were the expected result. In parallel with the existing project to improve the health services in Pécs another project was defined for the integration of the different hospitals and outpatient ambulatory systems. Scientific analysis and follow up of health indicators in the second phase were designed to prove the effectiveness of integrated health services. The outcome of the research and management project is expected to show disease prevalence based on more effective patient management. The estimated improvement of health indicators in this way is 5 - 10% in five years, without increasing costs, or even using less expensive medical care.

How the Project is Set Up

The screening programme consists of running both standalone and mobile diagnostic units including first line digital chest X-ray, digital mammography, clinical screening of cervical cancer, visual defects, musculoskeletal diseases, gastrointestinal bleeding, cardiac and vascular disorders. Second line diagnostic procedures are supported by full spectrum imaging modalities, from US to interventional radiology. The infrastructure is based on new equipments, like 64 slice MDCT, flat panel chest and breast x-ray and ultrasonography, including echocardiography, vascular ultrasound and high resolution probes. Rotation DSA offers 3D angiography and is related to early diagnosis of cases leading to more cost effective interventional therapy. The mobile unit is in a truck with digital chest and breast X-ray, medical office, gynaecological instruments, blood sampling, and a table to view visual defects.

Management of the Centre

Management of the diagnostic centre is integrated in the University and coordinated with respon-

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sible leaders from the city and county. Management of the radiology service of the diagnostic centre is integrated within the department of radiology, led by the Chairman.

Management of the screening programme organised by the preventive workgroup, consists of representatives of all disciplines led by an administrative coordinator. The project manager is independent of the University. Inter-departmental challenges related to collaboration in the diagnostic screening centre have beneficial effects on medical teams of different disciplines working together. There is no doubt that these coordinated efforts bring colleagues together. This promotes collaboration in regular daily workflow as well.

Quality Control and Budgeting

Quality control and auditing is carried out within the framework of the University's general rules. Special reports to EC Council are required also, including coordinated plans for organising internal and external screening visits. In this system well organised multidisciplinary collaboration is required. The budget from the EC-supported regional screening programme is allocated only for investments, meaning that running costs have to be covered by regular reimbursement from health insurance.

Screening activity itself is not limited administratively by the health service on one hand, but no additional financial reimbursement is available on the other hand. While an increasing number of early diagnosed patients resulted from effective screening, the reimbursement volume in Hungary is decreasing.

Benefits for Undergraduates

The education of undergraduate students benefits from the existence of this diagnostic centre. A very important lesson for them that will hopefully filter through the next generation of radiologists, is that a preventive attitude has to be highlighted versus a conventional curative attitude. Early diagnosis promotes more effective therapy for less expensive costs and offers better quality of life for patients after therapy. Information technology like PACS, RIS and HIS within the University of Pécs is already complete, and web based teleradiology (AccessNet, Aspyra) is available for hospitals in the area.

Expansion of the PACS will promote an integrated healthcare service for the region. Medical safety considerations in screening have high importance. Modern equipment offers technical regulatory functions for dose reduction in general, but special low dose techniques especially for screening programmes are already safe. The majority of Hungarian radiological departments use nonionic contrast media.

Conclusion

The future of the project is dependent on a solid reimbursement structure, depending on international scientific collaboration and publications. In this respect we have developed trilateral scientific activities, as well as collaborations with other University Medical Centres. Numerous international studies are running in the Department, focused on thrombotic vascular diseases and oncological treatments. Each of these collaborations increases the modernisation of our healthcare system in Hungary and cements the future development of this major national project.

DEVELOPING THE SCIENCE OF RADIOLOGY IN HUNGARY

Experiences of a Department Head

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As Head of the department of radiology since 1992 at the County Hospital of Zalaegerszag, I am part of a large hospital with a total staff of 1700 that is responsible for the medical care of a region that numbers 301,000 inhabitants and covers a territory of 3784 km2. There are 37,000 inpatients per annum, and one million outpatients. A progressive policy towards medical care in the county means that there are three additional subordinated town hospitals in the county. In the department of radiology, we aim to create a structured and transparent healthcare service that benefits from proactive working collaborations with other clinical partners, which is also extended to educational and scientific activities.

Technical Development

In 1992, the hospital was privileged to receive investment to purchase brand new radiological equipment including dual-slice CT and 1,5T MRI devices. Four ultrasound machines (two of them with colour Doppler, one with breast specifications) are also available.

Organisation of Staff

Subspecialist head radiologists and radiographers are spread over eleven divisions. Others are rotated with partial overlapping to preserve multifunctional skills. Six radiologists carry out diagnostic and interventional DSA, ten doing CT, seven doing MRI and four responsible for breast examinations. Neuroradiology and paediatric radiology divisions are staffed by board certified subspecialist radiologists. Clinico-radiological teams are brought together once a week to discuss areas such as gastrointestinal, breast, and oncological subjects. In our department, clinicians are focusing on a holistic approach to diagnostic problems rather than taking a narrower view of particular modalities. The most appropriate modality for each clinical question is decided by the radiologists based on cost-risk-benefit estimation. Imaging modalities that are to be applied to each particular diagnostic strategy are discussed with the nuclear medicine team as well. A variety of ultrasound investigations, like transcranial and carotis Doppler, gynaecology and obstetric exams, echocardiography and cardiologic catheterisation are carried out by clinicians using equipment from their own individual departments. Scientific activities are also dealt with by clinico-radiological teams. Twice a week we have set up radiological journal referees by our staff members. Educational meetings are also held weekly for our residents in training. This year the national meeting of radiology residents was organised by the Zalaegerszeg staff.

Quality Control

Since 1996, quality control in our department is based on ISO 9001:2000 certification. Twice a year administrative and practical audit procedures take place. Good collaboration with hospital management and with both regional administration and health authorities promote a financial balance that make it possible to run US, breast, CT, MRI and DSA in two shifts with daily scheduled patient numbers of fifty in CT and forty-five in MRI. During the night urgent investigations are dealt with by one radiologist and two radiographers on duty in hospital and on call support of subspecialists is available for example in case of cholecysta drainage. Morning meetings of the fourteen radiologists offer the chance for reevaluation of the cases as they develop during the night.

Teleradiology

Teleradiology from home is not yet available here, however via the hospital, we have in place a system to obtain second opinions from university centres and national institutions on difficult cases. Clinico-pathological meetings and regular smaller follow-up meetings of cases with retrospective reevaluation help decrease misdiagnoses, mistakes and errors. There are study protocols and regular meetings for revisions, where radiographers also participate. We also hold postgraduate educational meetings for radiographers.

Challenges Facing the Department

The National Insurance Reimbursement Policy is the main problem faced by department management in recent years, restricting the upgrading of equipment and general development of the department itself. Also, since department regulations are not standardised and are frequently changed, it is impossible to create a true long-term strategy. Unfortunately restrictive financial support have resulted in significant limitations in the provision of diagnostic and therapeutic care this year in Hungary, something which looks unlikely to change in years to come.

However, working with available technological and human resources, we have managed to create an organised and systematic process which allows the best possible patient care we are able to provide, despite limitations.

HOW TO...
ASSESS A BID

WHAT TO LOOK FOR BEFORE YOU BUY

AUTHOR

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In the department of radiology here at the UMC St. Radboud, we have in place an eight- to ten-year investment plan that covers which apparatus needs to be replaced. We have three streams of budget for capital outlay. We reserve 10% of the total value of our current equipment for maintenance and upkeep. We also have budgets for expansion and replacement of equipment which are renewed every seven to ten years. The key factors when assessing a bid, are being thorough, knowing your needs and the capabilities of the equipment, having an accurate inventory and linking the functionality of the equipment to the specific needs of the user.

How to Assess a Bid

The process involves the following steps:
1. Assess in what areas new apparatus need replacement by liaising with technologists and radiologists in that particular area.
2. A plan is submitted to a dedicated budget control committee, who then issue a budget based on list prices from manufacturers.
3. If that sum is greater than EUR275k per item, we initiate an EU bid process in Brussels. There are two timeframes for this process, the first allows vendors 21 working days in which to tender bids, and the second allows 52 days including weekends. Which process we choose depends on the urgency of the bid. For example, for routine equipment needs we choose the 21 day cycle. However, if we are purchasing technology which needs more thorough investigation, we allow more time to reevaluate and adapt our needs.
4. A special bid assessment committee then uses a points system evaluating each offer that takes a thorough analysis of each of the pros and cons involved. The one that fits most of our criteria is the successful bidder. If there is a tie in scores between two bidders, we then ask the radiologist or technologist involved what their 'pre-bid preference' is and we look at added-value areas such as after-sales service.

Getting Added Value

What added value can we ask for from manufacturers? As negotiating tools, options are limited, as mostly whatever extras vendors allow you, they will somehow find a way to charge you or incorporate any costs into the total package. As we are an academic hospital, one of the ways we try to have added value is by requesting extra functionality or software packages, e.g. with a recent CT purchase we requested a virtual colonography package thrown in at no extra charge. Another example is that recently when we purchased a CT scanner for our emergency room, we incurred extra costs since the room had to be remodelled in order to place the machine. The vendor agreed to pay half of these refurbishment costs in order to make the sale.

Turf Battles

When assessing a bid, inter-departmental conflicts may arise when choosing which equipment needs are of highest priority. A major issue for us presently involves the use of ultrasound in our medical facility. Although our imaging department uses eight ultrasound machines, there are a total of seventy in the medical facility as a whole, not all of which are placed in the best way for the needs of the user. We are looking at ways in which to reorganise the distribution of equipment so that it suits the needs of the user and so that high-tech apparatus is not allocated to a department that has no need for the extra specifications. While the individual department may be content to purchase the highest-spec equipment, significant costs can be saved by placing equipment by linking function to a more realistic view of needs. Assessing cost/performance ratio can be helpful here. Do you really need a high-tech device or will it just be used once a week?

Obsolete Equipment

We are also involved in a programme to refurbish obsolete equipment which has outrun its lease and depreciated to the point where it has no inherent financial value. Normally it is policy to return such defunct equipment to the manufacturer who in theory has factored its return into the initial cost of the equipment, but since the last four years we have been sending the apparatus instead to the former Yugoslavia. Just recently we sent a nine year old MR scanner for refurbishment in Berlin where it will after be sent for use in Belgrade.

Conclusion

If the Chair of an imaging department is to make the wisest and most informed choice when assessing bids from manufacturers, cost is not always the most useful barometer. Rather than leaving final purchasing decisions to the head of the imaging department, I am a firm believer in making equipment purchasing decisions on a democratic basis. By listening to the needs and recommendations of appropriate team members, and using dedicated committees whose role it is to oversee the continuing growth of the medical facility as a whole, the most appropriate equipment, which is most likely to provide the best outcome in terms of providing necessary healthcare within financial guidelines, will finally be selected.

INTERVIEW WITH PROF. GEORG BONGARTZ

INTERVIEWEE

Prof. Georg Bongartz

Head General Radiology
University Hospital Basel
Switzerland

Tell us about the background and origins of MIR.

Four radiologists (Paolo Pavone, Italy, Christian Herold, Austria, Gabriel Krestin, The Netherlands and myself) formed the "European Working Group on Management in Radiology" (EWGMR) in 1994, to support young European Radiologists in the development of management skills. The idea met with strong support from major pharmaceutical companies including Schering, Guerbet, Nycomed – now GE, and Bracco. The first workshops were not only financially supported by them but also guided by senior management from the companies. Later, the scientific aspect of management was taken up by EWGMR and the first Management in Radiology (MIR) congress took place in 1998 in Strasbourg. The European Association of Radiology (EAR) found the initiative very attractive and offered the EWGMR a "new home" as subcommittee to the Professional Organisation Committee of EAR, now ESR.

Has the organisation of the MIR annual congress changed since it began?

The annual workshops and meetings were successfully organised by our office in Rome, by Antonio Santoro. Supported by his proactive organisational skills, the initiative became more and more professional. As a result the organisation is now being transferred to the central ESR office in Vienna under the guidance of Peter Baierl. Henrik Silber will organise the next meeting in Oxford 2007, under new incoming MIR Chair, Dr. Nicola Strickland. The MIR board has developed official guidelines; chairmanship lasts two years and the appointment to the board four years. From the initial founding team, only Paolo Pavone and myself are still involved, and both of us will roll out 2007/2008.

How does MIR address its multidisciplinary audience?

Besides clear management topics, technical issues in radiological management like data handling and processing are included into the scope of topics. With this, the entire PACS, RIS, Telemedicine, etc. discussion is part of the concept. We try to balance this out and highlight the management aspect of these purely technical topics in radiology. This mixture makes the MIR congress unique.

Why is MIR such an important annual conference?

Good knowledge of management tools, the insight that your problems are identical to those of others and some guidance in how to deal with them is offered in presentations, discussions and handouts. The intense exchange of personal knowledge and the creation of an international network to identify people that you can ask for help in certain situations appear the most important reasons for people to attend the meetings.

What future plans for the development of MIR are in place?

I hope MIR will gain even larger attention and will be a regular part of the annual ECR conferences. More and more workshops shall be organised to bring education in management closer to all European radiologists. Within the ESR, MIR will probably rise to an independent committee of ESR.

How have new management tools like PACS, teleradiology etc. impacted Chairmen and Managers?

Strongly! Our working life is now getting away from personal teaching and contacts and more into office-based work. Communication takes place by writing emails and reporting by electronic media. While all this may positively affect workflow and the quality of the work, the interpersonal contacts and the entire social part of our work is endangered. Leading a department via electronic communication is extremely difficult because personal contacts are still one of the main motivators and visibility is mandatory to keep contact with co-workers. We all must face the problems in the new communication systems and address them properly. For this reason, one of the skills we focus on in management workshops is how to be both Chairman and a balanced social manager at the same time.

Is today's emphasis on productivity in healthcare negatively impacting good management?

At first glance, yes. But this is one of the challenges to address. Although being competitive can be seen as negative, it also produces creativity and awareness. Healthcare today is a challenging industry where not only the individual patient must be taken care of but also the entire community as "stakeholders". The incentive for the individual radiologist is not only to be acknowledged as an "experienced radiologist" but also to be successful and straightforward in your business: to have active and motivated co-workers, a high-level infrastructure and to be able to cooperate at an interdisciplinary level.

Key Seminars & Conferences

AUGUST 2006

31 – 02 21ST BIANNUAL CONGRESS OF THE EUROPEAN ASSOCIATION OF HOSPITAL MANAGERS (EAHM)
DUBLIN, IRELAND
www.eahm2006.ie

SEPTEMBER 2006

2 – 6 WORLD CONGRESS OF CARDIOLOGY
BARCELONA, SPAIN
www.escardio.org

9 – 13 CARDIOVASCULAR AND INTERVENTIONAL RADIOLOGY SOCIETY OF EUROPE CONGRESS (CIRSE)
ROME, ITALY
www.cirse.org

13 – 16 JOINT 31ST EUROPEAN SOCIETY OF NEURORADIOLOGY (ESNR) CONGRESS & 3RD ANNUAL INTER CRANIAL STENT MEETING (ICS)
GENEVA, SWITZERLAND
www.esnr.org

15 – 19 18TH EUROPEAN CONGRESS OF ULTRA SOUND IN CONJUNCTION WITH XVIII CONGRESSO NAZIONALE SIUMB (EUROSON SIUMB 2006)
BOLOGNA, ITALY
www.eurosон2006.com

21 – 23 EUROPEAN SOCIETY FOR MAGNETIC RESONANCE IN MEDICINE AND BIOLOGY (ESMRMB) 23RD ANNUAL MEETING
WARSAW, POLAND
www.esmrmb.org

28 – 30 17TH INTERNATIONAL CONGRESS OF HEAD AND NECK RADIOLOGY
BUDAPEST, HUNGARY
www.ichnr2006.org

28 – 30 4TH INTERNATIONAL CONGRESS ON MR – MAMMOGRAPHY
JENA, GERMANY
www.med.uni-jena.de/idir/mrm2006

OCTOBER 2006

5 – 7 MANAGEMENT IN RADIOLOGY 9TH ANNUAL MEETING (MIR 2006)
BUDAPEST, HUNGARY
www.mir2006.org

21 – 25 JOURNEES FRANCAISE DE RADIOLOGIE (JFR)
PARIS, FRANCE
www.sfr-radiologie.asso.fr

NOVEMBER 2006

5 – 9 48TH ANNUAL MEETING OF THE AMERICAN SOCIETY FOR THERAPEUTIC RADIOLOGY & ONCOLOGY (ASTRO)
PHILADELPHIA, PENNSYLVANIA, US
www.astro.org

14 – 18 MEDICA
DUSSELDORF, GERMANY
www.medica.de

26 – 1 92ND RADIOLOGICAL SOCIETY OF NORTH AMERICA (RSNA) SCIENTIFIC ASSEMBLY AND ANNUAL MEETING
CHICAGO, US
www.rsna.org

JANUARY 2007

25 - 26 12TH EUROPEAN SYMPOSIUM ON ULTRASOUND CONTRAST IMAGING
ROTTERDAM, THE NETHERLANDS
http://www2.eur.nl/fgg/thorax/contrast

FEBRUARY 2007

1 – 3 MR 2007: 12TH INTERNATIONAL MRI SYMPOSIUM
GARMISCH-PARTENKIRCHEN, GERMANY
www.mr2007.org

MARCH 2007

9 – 13 EUROPEAN CONGRESS OF RADIOLOGY
VIENNA, AUSTRIA
www.ecr.org

15 – 20 32ND ANNUAL SOCIETY OF INTERVENTIONAL RADIOLOGY (SIR) MEETING
WASHINGTON DC, UNITED STATES
www.sirweb.org

APRIL 2007

25 - 28 55TH ANNUAL MEETING OF THE ASSOCIATION OF UNIVERSITY RADIOLOGISTS
DENVER, COLORADO
www.aur.org

JUNE 2007

11 - 13 UK RADIOLOGICAL CONGRESS 2007
BIRMINGHAM, UNITED KINGDOM
www.ukrc.org.uk

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JFR
HIGH TECH IMAGING

CNIT La Défense Paris - France

October 21-25

www.sfrnet.org

- Congress Program on line
- Registration and courses enrollment

Highlights

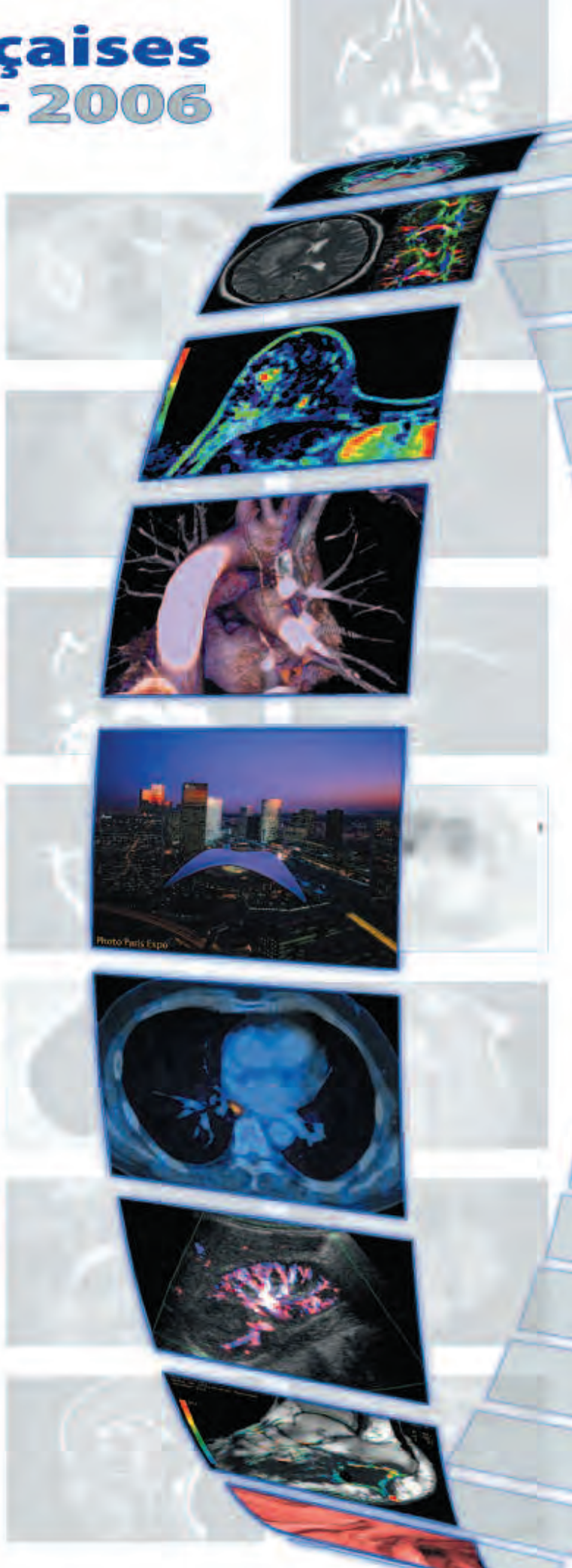
- Medical Personal Record (DMP)
- Molecular Imaging
- Interventional Imaging
- Management

Scientific Program

- 88 Scientific sessions
- 211 Educational courses and Workshops
- and more than 1000 Electronic Scientific Posters

Technical Exhibition

- More than 120 Medical compagnies (15,000^{m2})
- IHE
- Informatic Forum
- Symposiums



SFR

The World of Health IT

Conference & Exhibition

Connecting Leaders in Technology and Healthcare

'06

10–13 October 2006
GENEVA PALEXPO
Geneva, Switzerland

The World of Health IT Satellite Symposia: Key Challenges Facing the Healthcare IT Communities

Leadership

"Towards a Citizen-Centred Delivery World"

Torben Stentoft
CEO, Hvidovre Hospital, Denmark

- Focus on organisational readiness and change and the adoption of IT to provide more "citizen-centred" delivery in healthcare.

Also in this symposium:

- Integrating IT leadership into the healthcare delivery setting
- Benchmarking & Measuring eHealth Success
- eHealth in the EU
- Benchmarking case studies

Physicians

"IT Driving Innovation"

Dr. Lucian Leape
Adjunct Professor of Health Policy, Department of Health Policy and Management, Harvard School of Public Health, US

- Improve patient safety and quality of care by leveraging the power of IT in your healthcare practice.

Also in this symposium:

- The Physician as catalyst for change and innovation in healthcare IT
- Creating value: the intersection of business and medical care delivery
- Security and Privacy Issues Associated with Electronic Data Exchange
- Unlock the secrets of clinical data to improve care delivery

Nursing Informatics

"Quality Frameworks for Enhanced Care and Empowered Nurses"

Prof. Dr. Ursula Huebner
Professor of Healthcare Informatics and Quantitative Methods, University of Applied Sciences, Osnabrück

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Also in this symposium:

- Using technology to measure the impact of nursing care
- Embedding structured terminology within the EHR
- Applying tools and systems to improve outcomes
- eHealth activities in Nursing - national to regional perspectives

All three symposia will be held on Tuesday, 10 October at 12:00-17:30 Geneva PALEXPO.

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