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RADIOLOGY ▪ CARDIOLOGY ▪ INTERVENTION ▪ SURGERY ▪ IT MANAGEMENT ▪ EUROPE ▪ ECONOMY ▪ TRENDS ▪ TECHNOLOGY

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"If one kid dies, it's one too many."

How free physicals, mandatory ECGs and echos are making sports safer for Arizona's high school athletes

Dr. Paul Steingard (left) and Doug McWhorter (above)

Doug McWhorter remembers Saturday, May 1, 2004 like it was yesterday. "It was the worst day of my life," recalls the now 19-year-old college student. "It was my junior year in high school and Coach had mandated that we get our yearly physical at the TOPS event. I got up early but by the time I got to the school, there was a line out the door. I was irritated; I had a baseball game that afternoon. I remember thinking it's a free physical, how good can it be? When my ECG came back abnormal, they had me stand in line for an echo test. I tried to talk the staff into clearing me to play without the ultrasound. Fortunately, they refused."

William J. Rappoport, M.D., F.A.C.C., Arizona Heart Institute (Phoenix, Arizona, USA), was the cardiologist who evaluated Doug that day. "Doug's ECG was grossly abnormal. We did an echo on site and found that he had Hypertrophic Cardiomyopathy (HCM). He had no murmur and no positive features in his family history so a normal physical would have missed it. Because it's a genetic disorder, his entire family was screened. It was a good thing because both his father and brother were also diagnosed with HCM and all had rhythm problems that could have caused sudden death."

Paul M. Steingard, D.O., Steingard Medical Group (Phoenix, Arizona, USA) and founder of TOPS, the Arizona-based organization that provides free physicals to high school athletes, credits his volunteer staff and Philips Medical Systems for saving Doug's life. "We saved the McWhorter kid's life that day because we had the expertise and technology to not only detect but diagnose Hypertrophic Cardiomyopathy. Without Philips support, the cardiovascular portion of our physicals would not be possible. They stepped up to the plate when other medical manufacturers brushed us off. They even let us borrow ECG and echo equipment while we were raising funds to purchase our own." Dr. Steingard says the day TOPS purchased 35 Philips PageWriter cardiograph machines was a happy day. "We're so grateful to Philips for seeing value in what we were trying to accomplish and for being so community-minded and supportive."

As for Doug, he says the TOPS physical was the best physical he has ever had. "As it turns out, the free physical I was so skeptical of ended up being the one I value most."

For more information on this story and Philips Medical, go to www.philips.com/patientstories

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Changing Role of the Radiologist

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Radiologists are practicing in an environment of tremendous change. The changeover from film-based radiology to faster, sharper PACS and the increasing demand for more complex diagnostic procedures, continues to transform the ways in which radiologists work and how they collaborate with other medical healthcare specialists. That role includes interacting more closely with referring physicians and patients within a fast-paced digital environment, identifying solutions to new demands and challenges, and pinpointing and evaluating the newest technologies that provide patients with the widest range of options.

IT, in fact, shapes workflow in this modern climate. New imaging technologies like PACS have revolutionised the way a radiologist works and make it even more essential than ever before that they remain up-to-date with the latest in technology. Because managing radiology IT systems constitutes such a significant portion of the daily workload of department heads, and impacts on the efficient running of almost every area of the entire department, IT is a crucial area of the management of an imaging department.

The advantages brought about by PACS, such as the almost instant access to high-quality diagnostic images for retrieval, interpretation and return to referring doctors is counter-balanced by a hugely increased performance pressure on radiologists and other physicians and clinicians and for IT professionals facilitating the new electronic environment. The challenges brought about by increased collaboration with other radiologists, referring physicians and IT and other nonclinical staff is matched by the need for increased productivity and has in effect, made them more dependent on having the best possible IT and storage systems.

With this in mind, we have addressed PACS & IT in this edition's cover story section, in order to provide information for our readers.

To respond to any of the articles published in IMAGING Management, send your comments to editorial@imagingmanagement.org.

Prof. Iain McCall

Association News

Workshop 2007 Dates Announced

Managers and leaders are under enormous pressure to deliver more, with fewer resources and in faster time. This pressure quickly translates into inefficiency, reduced effectiveness and personal stress, all of which are then transmitted to those people we manage and lead in the form of staff morale, poor motivation, absenteeism, sickness, and high staff turnover, costly both in human and financial terms.

In order to address this, MIR (Management in Radiology) have announced their upcoming winter course, which will take place January 3 - 6, 2007 in Gstaad, Switzerland, where the topic is "The Art of Leadership: Managing Priorities and Managing Stress in Yourself and in Those You Lead". The course discusses the significance of effective leadership in terms of time and stress management. Participants will explore different approaches to the topic, focusing on leading a radiological department.

Attendees will learn how to deal with time and stress issues through analysing their current situation, through simulations, discussions with colleagues and group work. Trainers will present practical tools and lead a lively combination of theory and practice, reflection and feedback.

Topics include:

- Prioritisation
- Managing time
- Coping with stress
- Saying no
- 'Work/life' balance
- Helping others to deal with the challenge
- Finding time for regeneration and renewal.

WWW.EWGMR.ORG

Update from Cardiostim

The 15th edition of Cardiostim, the main world meeting on electrophysiology and cardiac arrhythmia, will be held from June 14 - 17, 2006, in Nice-Acropolis (France). 5,000 participants from 80 countries are expected to attend. This year's programme includes over 1,000 presentations proposed by teams from 50 countries, and will continue to highlight the various electrical specialties in cardiology.

Cardiostim 2006 will feature new live sessions, more space for futuristic topics, an 'Innovation Alley' within the exhibition, gathering start-ups with promising projects, etc. Themes under the spotlight this year include ablation as a treatment for atrial fibrillation, and cardiac resynchronisation in heart failure and telecardiology. Technological innovation will also be omnipresent in a parallel exhibition.

WWW.CARDIOSTIM.FR

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Results Announced from IHE Connectathon Barcelona

Yet another successful event was held during the last week of April 2006, in Barcelona, Spain, by 'Integrating the Health Enterprise' (IHE). This year's Connectathon featured more than 250 participants who attended the five-day event in the La Farga Centre at L'Hospitalet, Barcelona, co-organised by IHE-Europe and IHE-Espagna with the help of StudioSeis. Participants included engineers from 15 countries working for 67 system vendors, and 23 "IHE monitors", working for universities and other public organisations in charge of control tests, under the direction of Eric Poiseau, INRIA, IHE-Europe Technical Manager.

How Does the Connectathon Work?

117 systems were interconnected during the course of the week. Each vendor applied for between one and ten "integration profiles", enabling solutions for what are termed possible "applicative scenarios" from five different but interlinked domains (infrastructure, radiology, laboratory, cardiology and patient care coordination). Each system supports one or multiple "users" playing a certain role in this scenario (e.g. admitting patient, printing image...). By the end of the week, more than 700 vendor/user combinations had been successfully tested, verified and approved, consisting of more than 1,600 tests. In spite of the high competition which arises in this market, IHE enabled vendors to converge in a spirit of cooperation, with the aim of obtaining their "gold star" to be published in the "Connectathon Results Table" (www.ihe-europe.org). Following these compatibility tests, vendors can then publish "Integration Statements" on their own sites, verifying the compliance of their products to the IHE Integration Profile, and simplifying the 'Request for Proposals' emitted by user sites. Hot topics this year included workflow and access to information (mainly inside hospitals), security, patient management and document sharing (inside hospitals but also between hospitals and ambulatory care), and the emerging patient summary.

Results will be presented at the eHealth meeting organised by the European Commission at Malaga in May.

WWW.IHE-EUROPE.ORG

Programme Updates for EuroPACS Annual Meeting 2006

The European Society for the Promotion of Picture Archiving and Communication Systems in Medicine (EuroPACS) Conference is one of the world's largest gatherings of specialists in medical imaging and digital systems for eHealth. The programme for its 24th edition which takes place June 15 – 17, 2006 in Trondheim, Norway, will offer information on the latest and most significant developments in clinical practice, research and education within digital radiology. Physicians, radiologists, scientists and healthcare professionals from around the world will gather to attend a programme made up of scientific and clinical sessions. This year's conference will include 100 scientific lectures about medical imaging, PACS and eHealth, speakers from 26 different countries in the world and twelve different workshops.

Latest programme highlights include:

- 'PACS Implementation & Development in the US', Professor Edward M. Smith, US
- 'PACS and the Clinician', Dr Kjell Borthne, Norway
- 'Why Do I Need Medical Imaging?', Professor Sturla Eik Nes, Norway
- 'The Future of Radiology', Professor Anders Persson, Sweden
- 'The Use of New Technology and Organisational Challenges', Dr Raymond Vogl, Austria
- 'Medical Imaging and Telemedicine - The EU-China Workshop', Dr. Xiaohong Gao

WWW.EUROPACS.ORG

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ECRI Announces New Health Devices Achievement Award

A member hospital will be recognised for its excellence in health technology management with a new award sponsored by ECRI. The Health Devices Achievement Award is an annual award that will be presented to an ECRI member or team of members that describes the most exceptional example of an initiative undertaken at their healthcare facility to improve patient safety, reduce costs, or otherwise facilitate better strategic management of health technology. The award was created to celebrate the 35th anniversary of ECRI's Health Devices membership services and to formally recognise members' efforts. "We would like to honour our member hospitals' commitment to achieving the highest standards of safety, quality, and cost-effectiveness in healthcare," says James P. Keller, Jr., Vice President, health technology evaluation and safety.

The winner of the ECRI's 2006 Health Devices Achievement Award will be announced at the Association for the Advancement of Medical Instrumentation (AAMI) conference, which will be held June 24 - 26, 2006, in Washington, DC. Applications are now being accepted for ECRI's 2006 Health Devices Achievement Award. Submissions should include a 1,000- to 2,000-word essay that addresses the following:

- The initiative(s) and the motivation behind the initiative(s)
- The methodology used
- Any cost savings of the initiative(s)
- Outcomes and impact of the initiative(s)
- Examples and results of the initiative(s) impact

WWW.ECRI.ORG.UK

CARS 2006 20th International Congress and Exhibition

The International CARS Congress, June 28 – July 1, 2006, Osaka, Japan, provides a forum to close the gap between diagnostic and interventional radiology, surgery and informatics and to encourage interdisciplinary research and development activities in an international environment. The main emphasis of the presentations is on information technologies in radiology and surgery for clinical application fields, such as:

- 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, Cardiovascular and Thoracoabdominal Surgery, and Plastic/Reconstructive Surgery
- Image Guided Therapy
- Surgical Robotics and Instrumentation
- Surgical Navigation and Simulation
- AD for Breast, Prostate, Chest, Colon, Liver, Brain, Skeletal and Vascular Imaging

The response to the Call for Papers for CARS 2006 in Osaka counts 497 abstracts, submitted from 34 countries. With this level of submissions, CARS 2006 will provide a highly professional programme for the participants.
The informal federation of societies and congresses of CARS 2006 in Osaka (ISCAS, CMI, CAD, and CAR) continues to provide the necessary cooperative framework for advancing the development and application of modern computer assisted technologies in healthcare. These four organisations with their specific scientific/medical topics complement one another. They give a worldwide lead in interdisciplinary and international cooperation, which will be the foundation of healthcare in the 21st century.

WWW.CARS-INT.ORG

SERIES *EU INSTITUTIONS*
1. European Commission
2. European Parliament
3. Court of Justice

EU News

European Institution Series

This is the final instalment covering the structure and operations of the EU Institutions. Having already covered the European Commission (Autumn 2005), the European Parliament (Winter 2005) and the Council of the European Union (Spring 2006), we now close with an indepth outline of the operations of the Court of Justice of the European Communities.

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THE COURT OF JUSTICE OF THE EUROPEAN COMMUNITIES

The Court of Justice of the European Communities (ECJ) is the judicial institution of the European Union. It was set up under the European Coal and Steel Community in 1952 and is based in Luxembourg and deals with disputes as well as upholding Treaties of the European Union.

The Court's Main Role

The ECJ ensures that the legislation of the European Union is interpreted and applied in the same way in all EU countries, so that the law is equal for everybody. It ensures, for example, that national courts do not give different rulings on the same issues. The Court also makes sure that EU member states and institutions do what the law requires. The Court has the power to settle legal disputes between EU member states, EU institutions, businesses and individuals.

In summary, the ECJ's jurisdiction includes:

- Ruling on references from national courts on how to interpret Community law
- Reviews of the legality of the actions of the Council, the European Parliament and the Commission
- Infringement proceedings brought by the Commission against Member States, when they have failed to uphold Community law
- The submission of legal opinions on whether or not agreements between the Community and other states and international organisations are compatible with EC treaties
- Individual citizens can bring proceedings against EU institutions before the European Court.

Court Officials

The court is composed of one judge per member state, so that all 25 of the EU's national legal systems are represented. For the sake of efficiency, however, the Court rarely sits as the full court. It usually sits as a 'Grand Chamber' of just 13 judges or in chambers of five or three judges.

In addition, there are eight Advocate General whose role is to present publicly and impartially reasoned opinions on cases brought before the Court. France, Germany, Italy, Spain and the United Kingdom each appoint one Advocate General, the others being appointed on a rotation basis from the rest of the member states.

Judges and Advocates Generals on the ECJ must have the qualifications to be appointed to the highest national courts in their Member States or they may be jurisconsults (academic lawyers). Their independence must be beyond doubt. This means that once they are appointed, the may not hold any other office of an administrative or political nature and they may not engage in any occupation, paid or unpaid. Judges and Advocates General are appointed by joint agreement of the Governments to the Member States. They have a renewable term of six years.

Court Workload

Since its creation in 1952, right at the start of European integration with the creation of the European Coal and Steel Community, it has had many thousands of cases brought before it. It sits and hears cases throughout the year. In 2004, the Court concluded 665 cases, a significant increase on the 494 cases brought to a close the previous year.

Before 1989, it dealt with cases referred to it by the Commission, Member States or national courts, which needed a ruling on the applications of EU law. But in that year, it also became a "Court of First Instance" – in other words, it was empowered to hear certain categories of cases such as those on competition law, breach of commercial policy or social policy or disputes concerning EU staff regulations. The Court of First Instance helps the Court of Justice to cope with the large number of cases and it offers citizens a better legal protection. Decisions of the Court of First Instance may be appealed to the ECJ. The Court of Justice and the Court of First Instance each have a President chosen by their fellow judges to serve for a renewable term of three years.

A relatively new judicial body, the European Civil Service Tribunal has been set up to adjudicate in disputes between the European Union and its civil service. This tribunal is composed of seven judges and is attached to the Court of First Instance.

Legal Actions

The European Court of Justice upholds the Treaties and ensures that European law is interpreted and applied in the same way across the EU through various forms of legal action. The four most common types of case are:

- References for a preliminary ruling
- Actions for failure to fulfil an obligation
- Actions for annulment
- Actions for failure to act.

Procedures for Preliminary Ruling

To avoid differences of interpretation of EU law by national courts, the preliminary ruling procedure allows cooperation between national courts and the EJC. If a case comes before a national court that involves an interpretation of an EU law and there is a doubt, it must refer the question to the ECJ. The ECJ will make a decision as to how the law should be interpreted or applied and will send that decision to the national court who must then apply that decision to the case before it.

Procedures for Failure to Fulfil an Obligation

The Commission or a Member State may commence proceedings at the ECJ to force a Member State to comply with EU law. If the ECJ decides that the Member State in question is at fault, the Member State must rectify the situation without delay.

Proceedings for Annulment

A Member State, the Commission, the Council of the European Union or the European Parliament may request the annulment or cancellation of an EU law. This may happen if an EU institution enacts a law that conflicts with EU Treaties. If the ECJ agrees that the disputed law is contrary to the Treaties, it will declare the law null and void. Also private individuals may bring proceedings for annulment to the court – see more below.

Actions for Failure to Act

The Treaty requires the European Parliament, the Council and the Commission to make certain decisions under certain circumstances. If they fail to do so, Member States, other Community institutions and (under certain conditions) individuals or companies can lodge a complaint with the Court so as to have this failure to act officially recorded.

Organisation of the Court's Work

Cases are submitted to the registry and a specific Judge and Advocates General are assigned to each case. The procedure that follows is in two stages: first a written and then an oral phase. At the first stage, all the parties involved submit written statements and the judge assigned to the case draws up a report summarising these statements and the legal background to the case.

Then comes the second stage – the public hearing. Depending on the importance and complexity of the case, this hearing can take place before a chamber of three, five or thirteen Judges, or before the full Court. At the hearing, the parties' lawyers put their case before the Judges and the Advocate General, who can question them. The Advocate General then gives his or her opinion, after which the judges deliberate and deliver their judgement.

Since 2003, Advocates General are required to give an opinion on a case only if the Court considers that this particular case raises a new point of law. Nor does the Court necessarily follow the Advocate General's opinion.

Private Individuals and the ECJ

Perhaps surprisingly, private individuals are also allowed to bring proceedings to the Court to have an EU law annulled if it affects them directly and individually. This can't be done lightly or frivolously, and the individual needs to have legal representation. They do not need to go through their national courts first to bring proceedings to the ECJ. However, there's a stiff penalty if the court decides against the complainant. If they lose the case, they may be liable to pay the costs of both sides. On the other hand, if they win, the EU pays costs and the law will be declared null and void throughout the European Union.

Information on ECJ Judgments

Judgements of the Court are decided by a majority and pronounced at a public hearing. Dissenting opinions are not expressed. Decisions are published on the day of delivery. You can get all the judgments of the ECJ at the following ECJ internet site:
http://europa.eu.int/cj/de/content/juris/index.htm

RULE OF LAW

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The European Union is based on the rule of law. This means that everything that it does is derived from treaties, which are agreed on voluntarily and democratically by all Member States.

The most important treaties are:

- **Treaty of Nice**
  – signed on 26 February 2001, entered into force on 1 February 2003. It dealt mostly with reforming the institutions so that the Union could function efficiently after its enlargement to 25 Member States.
- **Treaty of Amsterdam**
  – signed on 2 October 1997, entered into force on 1 May 1999. It amended and renumbered the EU and EC Treaties. Consolidated Versions of the EU and EC Treaties are attached to it. The Treaty of Amsterdam changed the articles of the Treaty of the European Union.
- **Treaty of the European Union**
  – which was signed in Maastricht on 7 February 1992, entered into force on 1 November 1993. The so-called "Maastricht Treaty" changed the name of the European Economic Community to simply "the European Community". It also introduced new forms of cooperation between Member State governments – for example on defence, and in the area of Justice and Home Affairs.
- **Treaty of Rome**
  – established the European Economic Community (EEC), signed in Rome on 25 March 1957, and entered into force on 1 January 1958. The Treaty establishing the European Atomic Energy Community (Euratom) was signed at the same time and the two are therefore jointly known as the Treaties of Rome.
- **Treaty establishing the European Coal and Steel Community**
  – was signed on the 18 April 1951 in Paris and entered into force on 23 July 1952. It expired on 23 July 2002.

From these treaties (or the EU´s primary law) derive what we call 'secondary law'. This includes three types of legislation:

- Regulations - these become directly part of the national law of the Member States, with no further legal act being required by the Member States
- Directives - these have to be implemented by national laws
- Decisions - these address a specific problem and can apply only to specified states

Not to be mixed up!

Sometimes the many expressions at European level are confusing. Important to note is that the "European Court" or the "Court of the European Union" have nothing to do with the "European Court of Human Rights" (ECHR). The ECHR is situated in Strasbourg in France and is therefore often called 'Strasbourg Court'. This Court has nothing to do with the EU. The ECHR is an institution of the Council of Europe and was created to systematise the hearing of human rights complaints from Council of Europe member states. The Court's mission is to enforce the Conventions for the protection of human rights and fundamental freedom.

Fight for Simplified EU Law

In October last year the European Commission has taken the step to modernise EU legislation and cut unnecessary red tape and over-regulation. It presented a three-year programme to simplify the existing thousands of pages of EU legislation (the "acquis communautaire", which is translated in all twenty EU languages) adopted since 1957. The Commission will repeal, codify, recast or modify 222 basic legislations (all in all more than 1,400 related legal acts) in the next three years. It kicks off with the most heavily regulated sectors, such as cars, waste and construction – and other sectors like foodstuffs (including the notorious EU directive on bananas and cucumbers!), cosmetics, pharmaceuticals or services will follow soon. Commission President Josè Manuel Barroso said: "Simpler EU legislation is one of the main elements of our better regulation programme. It will boost the competitiveness of our companies."

A small mistake has slipped into the article about the 'Council of the European Union' on page 12 of the last edition of IMAGING Management. Though the heading refers to the 'Council of Europe', the article was of course about the 'Council of the European Union'. Therefore also the reference on p. 10 was incorrect. We wish to apologise for the error.

A THREAT TO MRI THROUGHOUT EUROPE?

IMPLICATIONS OF EC DIRECTIVE 2004

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In 2004, the European Commission issued a Directive concerning physical agents with the laudable aim of protecting workers from possible health risks associated with electromagnetic radiation in the workplace. The Directive lays down a minimum safety requirement for all EU nations, and has to be implemented by all member states by April 30, 2008. Although there is little to take exception to in the Directive itself, the values laid down in the Annex to the Directive are exceedingly conservative and may impinge on the practice of MRI in a number of crucial situations.

Aims of the Directive

The Directive sets out a range of action values for magnetic fields as a function of frequency. If the action values are exceeded then the employer is obliged to determine whether the associated exposure limits are also exceeded. Action values, given in units of Tesla, reflect field exposure, whereas exposure limits are given in terms of the current density induced within the body, and are more difficult to calculate. After intense lobbying the exposure limit for static magnetic fields was removed, and there is hence no limit for exposure to the main magnetic field of the MRI system. However, limits for time-varying magnetic fields in the kHz range remain. Such magnetic fields are generated by the switched magnetic field gradients used for spatial localisation in MRI. Furthermore, motion in the gradient of a static magnetic field inevitably results in exposure to a time-varying field, and is covered by the terms of the Directive.

What Effect will the Directive Have?

The Directive will impact the following:

- The field of switched magnetic field gradients used within the MRI system extends outside the magnet bore. Any professional in the vicinity during an investigation may be exposed to fields in excess of the exposure limits. This will impinge on those providing a comforting presence to easily stressed patients during an exam, as well as any exams involving anaesthetics or injection by hand
- The stray magnetic field of modern systems ranges from a few to hundreds of milli-Tesla over the first metre from the end of the magnet bore. Hence a person moving even at a modest speed of about a metre-per-second will be exposed to significant changes in magnetic field. Dependent on the field strength, magnet design and speed of motion, exposure values may be exceeded. Effects in this situation are particularly severe for very high-field systems, particularly with a self-shielded magnet design. Although no static field limit was imposed in the Directive, this regulation will make it difficult or impossible to use some systems
- In interventional MR the interventionalist may be exposed to a combination of the above effects. Precise details depend on the system, but they may be exposed to the same switched magnetic field gradients as the patient, and also move in strong static field gradients.

Why are Thresholds Too Low?

The Directive applies to any exposure, however brief. Exposure limits and action values are taken from recommendations of the International Commission for Non-Ionising Radiation Protection (ICNIRP) made in 1998. Careful reading of the ICNIRP publication reveals that limits were set to avoid physiological effects in general, and not specifically harmful effects.

In contrast, limits for patient exposure are set to avoid peripheral nerve stimulation, which, if induced in extreme form, can result in pain. ICNIRP thresholds are set at about a factor 50 below those for patients. The main physiological effect that ICNIRP guidelines seek to avoid is magnetophosphenes, harmless artifactual flashes of light induced at the retina, interpreted as a possible indicator for effects of magnetic fields on the central nervous system. Magnetophosphenes have been induced in subjects at very high static magnetic fields, but the sensitivity of the visual system falls rapidly with increasing frequency. Magnetophosphenes have not been induced by switched magnetic field gradients in the context of MRI investigations, i.e. if the patient never experiences them it does not seem logical to protect employees from magnetophosphenes at thresholds of around a factor 50 lower amplitude!

Addressing the Situation

In March 2006, representatives including the EAR, ECR, EFOMP, ESMRMB, ISMRM and UEMS visited Brussels for discussions with Commissioner Spidla, the EU Commissioner responsible for Employment, Social Affairs and Equal Opportunities. The delegation received a sympathetic hearing, but changing an established Directive can be a lengthy business. Further contacts between the Commission and representatives are foreseen.

The ESMRMB will run a web-based safety survey to quantify the impact of the Directive on radiological practice. The ICNIRP is at present revising recommendations, and the best hope lies in an increase of thresholds in line with current knowledge. In the short term it is important that the MR user community makes its voice heard. Change to the Directive will be most easily achieved if the European Commission, Council and Parliament all agree that it is necessary, and this will only be achieved by concerted action to bring our case to the Commission, national representatives and MEPs.

Industry News

Agfa Wins RIS/PACS/Speech Contract in The Netherlands

The Isala hospital group in Zwolle, The Netherlands, has chosen Agfa HealthCare for the installation of an extensive RIS/PACS/Speech solution which will integrate medical patient information flows between its two sites. The decision is the result of a stringent tender procedure that followed EU regulations that govern tenders received by public institutions.

Shimadzu Introduces New Flat-panel Technology

Shimadzu has introduced a new flat-panel detector (FPD). The 'Safire' offers the first detector with direct-conversion technology, and advantages in image quality and dose efficiency in comparison with indirect FPD technology. The new technology enables clearer high–resolution images with less signal deterioration and reduced noise. The top layer of the FPD, an x-ray conversion film, converts x-rays passing through the patient's body directly into electric signals using amorphous selenium. A thin-film transistor array then collects the signal from each pixel and transfers the data immediately to the processing system.

Philips Acquire Witt Biomedical Corporation

Philips will acquire Witt Biomedical Corporation, an independent supplier of haemodynamic monitoring and clinical reporting systems used in cardiology catheterisation laboratories (cath labs). Subject to receipt of regulatory approval, Philips will acquire Witt Biomedical for approximately USD165 million. The transaction is expected to close in the second quarter of 2006.

Both companies expect to benefit by offering customers an integrated suite of best-in-class technologies for the cath lab department, leading to increased sales in cardiovascular x-ray, cardiology picture archiving and communication systems (PACS), and in haemodynamic monitoring and reporting systems. In haemodynamic monitoring and clinical reporting systems, Witt Biomedical was the largest independent supplier in the United States in 2005, and was the number 2 supplier in the global market.

Industry News

matrox
Graphics for Professionals

Matrox AuroraVX Boards to be Sold with NECDS-J Medical Displays

Matrox Graphics Inc., a manufacturer of graphics solutions, has announced that NECDS-J will offer the Matrox AuroraVX Series™ display controller board with its medical MD21GS-3MP, MD21GS-2MP displays in Japan. The AuroraVX Series of display controller boards maximise display output options, powering up to three displays from a single low-profile PCI Express board. The AuroraVX3mp supports a Navigation Console (NC) up to a resolution of 2 MP, along with two Twin Imaging Displays (TIDs) of 2 MP or 3 MP each.

NEC

NEC Display Solutions Introduces New Professional Display Series

NEC Display Solutions, a provider of flat panel desktop and large-screen displays announced its new series of professional LCD monitors - the NEC MultiSync 90-series. The new NEC MultiSync 90-series, which will replace the MultiSync 80-series, contains over 25 new or improved features that produce crisper, clearer images, enable better control and connectivity, increase energy efficiency and provide greater adjustment versatility, including in-plane switching (IPS) and vertical alignment (VA) LCD module technology.

In addition, the NEC MultiSync Professional 90-series also contains Eco-related features such as AmbiBright and Eco-mode that will manually or automatically adjust the display's brightness relative to the ambient lighting, providing optimal power management for greater energy efficiency and longer product life.

PLANAR

Planar Introduces First Medically Certified 4-MP Colour Display

Planar Systems, Inc. has unveiled the Dome® EX line in Europe, which includes the first 4-MP colour diagnostic display medically certified for the healthcare field. Designed for use in areas such as radiology, cardiology, nuclear medicine, PET/CT, dermatology and the OR, Planar's Dome E4c features a widescreen, 16:9 format that simplifies comparison studies by eliminating the image split associated with dual-head monitors, providing more screen space for multiple images. The Dome E4c, along with Dome E2c and E3c, enhances visualisation of various colour modalities, 2D colour imaging, image fusion, and 3D imaging.

HOLOGIC®

Hologic Make New Acquisitions

Hologic have entered into definitive agreements to acquire both Suros Surgical Systems and R2 Technology. Suros Surgical Systems, a privately held manufacturer of minimally invasive surgical technologies focused on breast biopsy and tissue removal provide the ATEC® (Automated Tissue Excision and Collection) line of products for percutaneous, automatic vacuum assisted breast biopsy systems, ancillary breast biopsy devices and biopsy site markers. The purchase price for the transaction will be $240 million (subject to adjustment), plus a two-year earn out.

R2 Technology, a global expert in the field of computer-aided detection (CAD), will be purchased for $220 million (subject to adjustment) payable in shares of Hologic Common Stock. R2 Technology pioneered the

use of CAD for mammography in 1998 when the ImageChecker system became the first CAD system approved by the FDA for screening mammography. The ImageChecker CAD system was also the first system approved for use with digital mammography.

Toshiba Presents Computer-assisted Tomography Device

Unveiled at the recent American College of Cardiology (ACC) Meeting, a new investigative computer-assisted tomography device developed by Toshiba can create high-resolution, nearly instant pictures of a patient's heart - literally in one heartbeat. "The 2nd spec 256-Multislice CT seems to be a promising next generation CT for coronary and cardiac imaging," said Akira Kurata, MD, PhD, a cardiologist on the clinical staff in the department of radiology at Ehime University School of Medicine in Japan. Dr. Kurata illustrated how the new 256-multislice CT can detail cardiac anatomy precisely enough to capture a coronary artery image that is similar to the same image seen in coronary angiography. "This device requires just one beat of the heart in order to develop a whole heart image," he said. The device is in experimental use in Japan.

GE Healthcare Launches Centricity RIS/PACS Software

GE Healthcare has introduced the next-generation Centricity RIS/PACS 3.0. which handles the demands of high volume departments, large stand-alone hospitals, and even entire hospital networks. Centricity RIS/PACS 3.0 conforms to IHE standards, and integrates RIS and PACS data seamlessly into a user based solution for radiologists, clinicians and technologists. Centricity PACS AW Suite, a new application, gives clinicians tools for sifting through most data-intensive procedures - optimising workflow, image quality, applications flexibility and reporting speed.

"Centricity RIS/PACS is more than a combination of discrete RIS and PACS functions. It is the truly integrated technology for image and information management in radiology. In bringing together all of GE's strengths and experience in information technology, imaging, and process improvement, it thereby creates a radiology solution focused on information and workflow needs," said Juergen Reyinger, General Manager at GE Healthcare Information Technologies EMEA.

Key features include fast image storage and display of large datasets coming from multi-slice CTs. To take advantage of the new developments in modalities like 64 slice CT, GE provides advanced applications beyond the basic 3D inside a PACS, such as for advanced colonography and advanced vessel analysis.

Sectra to Integrate New Radiology Method

Sectra, a manufacturer of equipment for radiology exams, plans to integrate new technology into future products, based on a doctoral thesis entitled "Computer-aided Detection and Novel Mammography Imaging Techniques" by Hans Bornefalk, named "Best Student Contributor" at a major conference for radiology technology in the US.

To grow, a cancer needs to form its own blood vessels, which are often of poor quality. In contrast radiology, a contrast substance such as iodine is injected into the bloodstream so that blood vessels can be seen on the radiology images. "You can precisely separate the X-rays above and below this threshold value and highlight the differences between the blood vessels and surrounding tissue in a totally different manner," relates Hans Bornefalk. This new method to increase the efficiency of contrast radiology may open the way to earlier and more reliable diagnosis.

REQUIREMENTS FOR A MULTIDISCIPLINARY TEAM MEETING ROOM WITH PACS

CHOOSING THE RIGHT SETTING AND EQUIPMENT

Once your hospital becomes filmless, with a hospital-wide PACS (Picture Archiving and Communications System), all radiological images are only visible in digital format. It is important to remember that the Multi-disciplinary Team (MDT) meeting becomes the "showcase for PACS" to all clinicians in the hospital. It is thus vital to plan an MDT room which is fully fit for this purpose. Within the Imaging Department here at Hammersmith Hospital, we have implemented a new MDT room where the vast majority of our 30+ MDT metings take place on a weekly basis. There is a lead clinician in charge of each MDT, and a lead consultant (staff) radiologist respon-sible for the associated imaging. Most of the MDTs have a second consultant radiologist in attendance, who provides a second radiological opinion if required, and who covers for his/her colleague during periods of leave.

The purpose of an MDT meeting is to review the imaging studies (and histo-pathology) on patients currently under the care of a particular clinical discipline, in the light of their clinical symptoms and findings. Based on this assessment, future management and treatment is planned.

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MDT Room Environment

When designing the MDT room, it was important to ensure that it should have a modern, clean look, so that it provides a pleasing environment in which to work. Chairs need to be moderately comfortable, although not sumptuous, bearing in mind the constraints of the National Health Service (NHS) budget! There are small flip-up tables attached to each chair for the audience to take notes (it is useful to have some chairs designed for left-handed people, with their attached tables on the left-hand side). Flooring is synthetic durable vinyl, with a wood pattern. This was chosen for practicality, since it is often impossible to stop audience members

bringing food or drinks into the room for lunchtime and evening meetings, and carpet flooring is not easily washable in the case of the inevitable spillages! Waste bins are provided in the rooms to encourage users to keep it clean.

Technical Requirements

The imaging studies being reviewed have almost always already been reported. Thus the PACS monitors used and the overhead display images need only be of review quality, rather than of the highest diagnostic quality. We use dual 1 megapixel monitors and two LCD projectors each of 1,397,760 pixels (1365 horizontal x 1024 vertical) and 220W UHB lamp. The viewing conditions are of paramount importance. In our opinion, it is essential to have a continuous dimmer switch light, which can be lowered to a level optimal for viewing images, whilst allowing the audience to take notes. There should be full blackout blinds at the windows, although with a facility to have less extreme blackout should the room be used for other purposes, such as general meetings. We have chosen full blackout roller blinds, with an inner set of independent vertical navy blue slatted blinds for use during non-radiological meetings.

Figure 1: Radiologists attend an MDT meeting

We have chosen to invest in a dual headed PACS workstation, with both of its monitors projected, via separate overhead projectors, onto large wall screens (as seen in figure 1). The modest additional cost of having a dual headed workstation with dual projection is more than vindicated by the vast improvement in the display of radiological images thus obtained. It means that different imaging modalities on the same patient can be simultaneously compared, and that current and historical imaging studies can be clearly displayed simultaneously for easy comparison by the audience.

Workstation Requirements

Regarding the PACS workstation itself, this needs to be a review PACS workstation rather than a diagnostic workstation. Landscape style, rather than portrait style monitors are preferable since all the overhead projection equipment derives from the commercial film industry, and is designed to synchronise best with landscape style screens, as for television and cinema film viewing. Web browsers, running on ordinary PCs, generally do not incorporate sophisticated PACS software. It is this sophisticated PACS software which is so useful for MDTs. Such software includes folders, which can be populated with the names of the patients to be reviewed at the MDT and more precisely, with the exact study to be reviewed at the meeting.

In contrast, web browser technology generally only permits searches on the name of the patient, or hospital number, and most web browsers do not allow folders of specific examinations or patients to be made up in advance. We advise the use of sophisticated PACS software for an MDT conference room because we insist that the MDT list be compiled at least 12 hours in advance of the meeting. It is the responsibility of the clinicians attending the MDT to compile their PACS folder in advance, including the precise studies they wish the radiologist to review. PACS folders can also be used to assemble anonymised images for teaching seminars, also held in the MDT room.

Good Preparation is Key

The compilation of MDT conference folders on PACS allows the radiologist to prepare for the MDT, reviewing these studies in private in advance of the meeting, so that (s)he can give a succinct and didactic synopsis of the pertinent imaging findings in front of the MDT audience, without wasting time while (s)he reviews the images on the fly. In this way the clinicians and the patients get the best deal, with careful review of the images and comparison with previous studies and other modality imaging having been performed in advance by the radiologist responsible for the particular MDT radiology.

As this radiologist reviews each patient's images in turn during the meeting (s)he can then choose to discard that patient from the folder once reviewed, or can leave the patient's images in the folder if the patient is to be reviewed the following week, or should follow-up actions be required, for example, adding an addendum to the issued report or arranging for other imaging studies to be performed. At Hammersmith Hospitals Trust, we have chosen to have our speech recognition software also fitted to the PACS workstation in the MDT room, so that the radiologist can add an addendum in real time at the meeting to the report, capturing any differences in opinion from the radiologist who issued the report, and/or recording the decision taken at the MDT as to further management, for example proceed to a PET scan or making a note of the histopathological findings.

Figure 2: Don't forget Security!

Other Useful Additions

Our MDT room contains a microscope, which can also be projected onto the overhead monitors directly as well as a stand-alone PC with internet access, which can then be used to access literature during the meeting, or to display imaging studies sent into the MDT for review, from outside referring hospitals. We have found it necessary to install a DICOM viewer as well as a JPEG image viewer onto this stand-alone PC, since not all imaging studies referred to us on CD have a self-launching viewer incorporated onto the disc.

A simple wall panel in the room allows either the left or the right, or indeed both PACS monitors to be slaved to the overhead projectors, or for the stand-alone PC or microscope (or video recorder/DVD player also in the room) to be shown simultaneously on the overhead projector.

Don't Forget Security!

All this expensive technological equipment needs protection against theft, which is why we have a 6-digit door code lock on the door (see figure 2). Security cannot be overemphasised, and despite the precaution of this lock, we have still experienced a theft of the PC flat screen due to failure to leave the door properly closed overnight, but then, after all, the Hammersmith Hospital is right next door to one of the largest high security prisons in London.

PACS, TELERADIOLOGY, TELEMEDICINE AND eHEALTH IN NORWAY

HOW INFORMATICS ARE IMPROVING HEALTHCARE

Norway provides extensive health services and a well-developed social security net. About 35% of the annual Norwegian state budget, or 7 - 8% of the gross national budget, is spent on health and social care, making it one of the European countries – and the Nordic country – with the highest level of public spending on health per capita. The health and social care sector in Norway, as in other modern societies, faces significant challenges. Its part of the nation's GNP is already substantial, and the increasing mean life expectancy and falling birth rates will dramatically increase the future burden. A specific Norwegian challenge is low population density, the consequences of which mean long travelling distances to medical services, to hospitals which are scattered, not all of which offer a full range of services.

National IT Strategies for Health and Social Care

Investment in IT and making broadband available throughout the country is part of the Government's e-Norway plan, which has established ambitious goals for IT development within both the private and public sectors. IT is also an important tool in the process of implementing the latest national health reforms such as:

- Regular GP: Every citizen has one doctor
- Free choice of hospital
- Central government ownership and responsibility of hospitals and specialist health services.

IT is regarded as a useful tool to improve health services, particularly in primary care. With several national action plans for IT development in the health and social sectors, the main objectives in the action plans have been:

- Stimulate electronic interaction and exchange
- Strengthen and increase collaboration and efficiency of health and social sevices
- Improve contact with patients, clients and those in need of care
- Improve the quality of services
- Central government founding of new telemedical pilot projects.

PACS and Teleradiology

During the year 2006, all hospitals in Norway will have digital x-ray with RIS and PACS installed, making Norway one of the first countries in the world to be fully digitised. In Norway teleradiology services have been provided since 20 years ago. Teleradiology is in use for consulting in emergencies, for second opinions and for consulting between hospital and primary healthcare.

Integration is a key requirement for all PAC systems. PACS has to be integrated with RIS and RIS has to be integrated with HIS/PACS. Initially PACS was a departmental unit but nowadays it is a part of an enterprise system. The role of RIS and PACS within the hospital has evolved, and is now moving towards full integration with PACS as the imaging layer of the EPJ (Electronic Patient Journal). In the future the PACS will be invisible for the clinician. They will only see and work with the EPJ with the PACS as an integrated part.

Hospitals in Norway have chosen different solutions for RIS and PACS. Although all image communication uses the DICOM standard, in our experience, information exchange is not seamless between hospitals. The focus is on integration and exchange of information across hospitals. Norway has joined 'Integrating the Healthcare Enterprise' (IHE) and participates in a Scandinavian mirror-group. The IHE is an initiative designed to stimulate the integration of the information systems that support modern healthcare institutions. Today Norway is pioneering the use of the new IHE Integration Profile, XDS-I, 'Cross-enterprise Document

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Sharing for Imaging'. By mid-2006 the new XDS-profile will be used for sharing information between different PACS and RIS-systems at different hospitals within a region. The purpose of the XDS-profile is to share clinical documents between hospitals, keep track of every document and to have a common EPR.

Its fundamental objective is to ensure that in the care of patients, all required information for medical decisions is both correct and available to healthcare professionals. The approach employed in the IHE initiative is not to define new integration standards, but to support the use of existing standards. The XDS design principle is that one single registry is a single query/access point and holds indexing data about all documents available from multiple repositories in the Affinity Domain. The information to be shared includes one or more of the following:

- Imaging studies that include images acquired on a broad range of different modalities, as well as evidence documents (e.g. post-processing measurements/analysis outcome), and presentation states
- Diagnostic reports resulting from the interpretation of one or more related imaging studies provided in a ready-for-display form
- A selection of diagnostically significant images associated with the report content

Information Security with Shared Physical Storage

Some regions in Norway have implemented PACS as a regional solution for all health enterprises within the region. In such a regional system one solution is that health enterprises share a physical storage unit for the PACS and RIS information. Due to Norwegian health legislation, health enterprises are not allowed to share patient information indiscriminately. This means that a shared physical storage unit must be divided into logical storage areas for each health enterprise so that access can be linked between them. The health legislation also specifies that access to information owned by a different health enterprise must be evaluated and approved for each individual access.

EHR: The Core of Patient Information

According to Norwegian legislation, each healthcare service provider has to keep its own records, which can be in digital form, and information between service providers is only to be transferred on a need-to-know basis. A national EPR standard was released in 2001. This standard mainly covers issues related to architecture, archiving and security. A requirement specification for health stations and healthcare in primary schools, and another for community care, are based on this standard. With few exceptions, all GPs and private specialists have EHR systems and nearly all hospital patients are covered by an EHR.

Most modern digital image departments consist of components supplied by multiple manufacturers, and it is not uncommon for the modalities, RIS and PACS to come from different suppliers. This is made possible by proper use of agreed international standards, mostly DICOM and HL7, which have been further refined in recent years by the IHE initiative. Furthermore, the use of DICOM allows third party equipment to access images from the PACS, and this is regularly used for specialist applications such as 3D processing or orthopaedic templating. However, this open choice of equipment does not, in practice, extend to one of the most expensive parts of a current PACS – reporting workstations used by radiologists.

PACS AND RADIOLOGY REPORTING WORKSTATIONS

GPWL VITAL TO MAXIMISE BUYER CHOICE

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Why Requirements Differ for Reporting Workstations

To understand why this barrier exists for reporting workstations, but not for clinical workstations, consider the user's starting point. On a clinical workstation, the starting point is a particular patient, making standard DICOM query/retrieve ideal, quickly providing a list of studies for that patient and access to those images without worrying about whether or not they have been reported. The short delay due to image selection and retrieval is unlikely to be significant in the context of a clinical encounter or complex image manipulation. A radiologist however does not start by looking for a

particular patient, and instead needs the digital equivalent of a "pile of film packets", so the system must provide a list of examinations which are:

- Complete and ready for reporting
- Not already reported
- Not in the process of being reported by another radiologist
- To be reported by the current user, either specifically or as part of a group

None of this information is made available by standard DICOM query/retrieve mechanisms, so a more appropriate "reporting worklist" is required, which in practice is also expected to provide filtering by urgency, modality, referral source, etc. The delays and user intervention described above, though reasonable for a clinical workstation, would not be tolerable for a high-throughput radiological reporting workstation, where the radiologist must be able to progress to the next examination immediately with one click, gesture or voice command.

Put simply, radiologists quite reasonably expect to have a "next" button, requiring studies to have been pre-loaded into the workstation for immediate display. These requirements have been present since the earliest days of PACS, and all respectable vendors provide this sort of functionality. The problem is that virtually all of them are using proprietary mechanisms which are only usable if the PACS and the reporting station are provided by the same vendor, thereby providing a "lock-in" and denying users free choice. This approach was reasonable until 2001, as there were then no standardised alternatives.

Using GPWL Interfaces to Facilitate Buyer Choice

The proper DICOM solution, published in 2001, is not well known by users, perhaps due to its rather misleading and uninspiring name "General Purpose Worklist Management" or the acronym GPWL. This service provides all the interfaces needed to support the provision of images and associated data to a reporting workstation, and most importantly, does so in a vendor-independent manner, such that provision of this facility in a PACS and workstation would enable them to work properly together even if from different suppliers. The features provided by GPWL, as shown in the figure, are:

- A means to query for reporting which needs to be done, including filtering by user, modality and date, as well as reporting status. As a list of studies is provided, this can be used by the workstation to "pre-fetch" the actual images
- A "locking mechanism" to ensure that the same work is not done by two users simultaneously
- A means to communicate to the server that the report has been completed

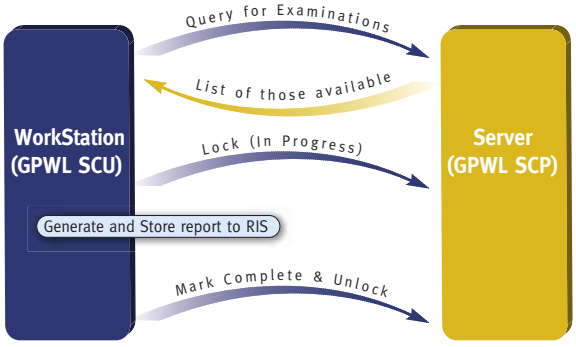
These operations are similar to those used for sending scheduling and update information to and from imaging equipment, as defined by the commonly used DICOM Modality Worklist (MWL) and Modality Performed Procedure Step (MPPS) services. This similarity is quite deliberate, and in fact the underlying DICOM mechanisms are almost identical, the only significant addition being the locking mechanism. Like most useful DICOM services, GPWL has an equivalent profile in Integrating the Healthcare Enterprise (IHE), and in this case the profile is called "Reporting Workflow (RWF)", which is basically an IHE "wrapper" around GPWL, with additional useful specifications about how the report itself should be transferred and stored.

The similarity to MWL and MPPS means that it is technically easy for vendors to introduce this new service in both servers and workstations, but a server implementation requires access to information from both the PACS and the RIS, raising the question of whether the "server" for this service should be the PACS, the RIS or even a broker. This is a local implementation issue, but fortunately does not affect the overall practicality of the service, as vendors already have the required level of data integration for their proprietary alternatives.

Getting Best of Breed Solutions

So why is this service, which has been specified for five years not more widely available? Clearly, it would always be in a buyer's interest to maintain flexibility for future purchases, in order to be able to buy a "best of breed" solution, rather than what happens to be on offer from a particular PACS supplier – after all, it is unlikely that the best provider of storage

DICOM GENERAL PURPOSE WORKLIST OVERALL DATA FLOW



solutions will also happen to supply the best reporting workstations. This is quite apart from the fact that a vendor with a captive market can always charge more than the open market competitive price, so the mere prospect of choice is useful to a buyer. A genuinely open market would also force

CONTINUED

PACS & IT

vendors to adopt more customer friendly policies concerning such matters as Internet access from workstations, which is not allowed by some vendors. At present however, there are few if any compliant systems, and a user who tried to insist on having GPWL functionality in their PACS would have virtually no systems to choose from, so what is the best course of action?

Taking Advantage of GWPL

While a PACS buyer should accept a proprietary solution for workstation integration initially, they should obtain a contractual commitment, enforced by a significant retention, that GPWL server functionality will be included within two years. Given that this requirement was part of the English national PACS procurement (Connecting for Health), for which most of the major PACS providers submitted tenders, they should be able to deliver this if pushed hard enough. Such an approach will avoid the complexities of a multi-vendor initial installation, but enable the buyer to avoid the otherwise inevitable lock-in. Put another way, this whole situation is analogous to the position of basic DICOM services in the mid-nineties:

- In 1994, you could buy a CT scanner which worked well with its own expensive secondary console, but if you wanted flexibility and choice for the future, you needed to insist on DICOM C-STORE
- In 2006, you can buy a PACS which works well with its own expensive tied reporting stations, but if you want flexibility and choice in the future, you need to insist on DICOM General Purpose Worklist.

NEW GENERATION STORAGE SOLUTIONS

A HOLISTIC APPROACH TO DATA MANAGEMENT

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There is no doubt that installation of a PAC system, designed for image and data storage and accessibility, necessitates that the system includes a well-planned disaster recovery and data management structure. New generation storage solutions are proving more efficient than their conventional PACS archive predecessors in achieving this, with an increased level of interoperability that will allow disaster recovery, data management and accessibility, to become better organised and more efficient.

First generation PACS archives were dedicated solutions aimed at long-term preservation of DICOM-based information. There was a single interface to the local imaging modalities and data was accessed quite rarely because of the pre-fetching of relevant priors. Information from other clinical systems, such as cardiology and laboratory data were stored in separate dedicated solutions, resulting in multiple archiving islands inside one enterprise. In fact, despite the benefits brought by the first PACS archives, their lack of integration meant that there was a long way to go before the potential for this technology could be fully realised.

Future Challenges for Healthcare Networks

At the same time, the rising trend in Europe for the consolidation of small practices into larger institutions which are then integrated into expansive healthcare networks exchanging data and expertise, is creating a challenge in utilising the data stored in a set of archiving islands using different solutions from different vendors. There is a clear need for healthcare providers to efficiently manage these disparate storage systems and, at the same time, to meet the disaster recovery requirements of the EU and HIPAA regulations.

There are a number of factors that are driving healthcare organisations to view a holistic approach to the sharing of data and resources across a heterogeneous mix of hardware platforms and software systems as the way forward. Such interoperability is needed to support electronic patient records, which in many European nations are being designed or implemented at a national level. In the United States, many healthcare organisations are consolidating operations, especially regarding ambulatory services, which also require data and resource sharing across enterprises.

Furthermore, as the healthcare sector begins adopting new practices and technologies, such as evidence-based medicine and genomics, the need to link together and analyse the different sources of patient data will become even more paramount. Therefore, it is clear that a comprehensive, holistic approach to data storage and management is the best answer to this problem.

Optimal Data Storage Solutions Today

Consolidation of patient-centric data in a common archiving solution is a growing trend in healthcare IT markets. New start-up companies like Bycast and TeraMedica are emerging in the US, to join established heavyweights such as IBM, Hewlett Packard, and Kodak. The new solutions allow any type of fixed content data including images, laboratory results, video files, etc. to be stored in one system. New generation enterprise archives are configured as network-attached systems and they allow a set of standard interfaces and protocols – not just DICOM.

In new generation solutions, management of data, like the healthcare process itself, is patient-centric, enabling medical data coming from various sources to be consolidated into a patient record and managed as a single object. This allows global functions to be applied to the whole patient record, for example, keeping the patient record on one single media. This object-oriented approach is also a key factor in keeping massive archives efficient and scalable.

An integral part of a modern, streamlined storage solution is a meta-data (index) layer enabling efficient searching and retrieval of patient data. Archived information is by no means dead and has to be retrievable fast and reliably when relevant.

Planning Ahead: How to Avoid Losing Information

An optimal storage solution creates one large virtual system – a grid, but not necessarily one physical storage site. A computing grid is a 'standards-based application/resource sharing architecture that makes it possible for heterogeneous systems and applications to share computing and storage resources transparently'. The advantages of grid computing are, that various systems can interoperate, and computing resources can be distributed throughout an enterprise. As the amount of patient data grows, and analyses become more complex, grid-computing can provide a scalable and efficient technique for meeting the increasing computational needs.

Grid-computing for medical data is being enabled by the adoption of standards for interoperability, and by the use of meta-data techniques for integrating disparate systems and sources of data. The service-oriented architecture (SOA) provides the structures and standards that allow disparate computing resources and services, and data sources, to be integrated into a computing grid.

Technically, a software module is placed above various archives containing meta-data indexes to the full contents of each separate archive. Hierarchies keep track of which meta-data indexes are available at which module instance. Thus searches of large, complex and diverse repositories of data can be completed locally and extremely rapidly. All the meta-data are kept updated and synchronised across instances via various database features. The storage grids also support encryption and compression.

Obsolescence management

In the new generation storage grid solution, the seamless removal and addition of servers and storage slots is possible. This is critical in obsolescence management: storage obsolescence has a three to four year cycle, while patient data have to be stored sometimes for decades. In a grid-based architecture we can build a resilient, self-repairing architecture with no single points of failure. Data can be replicated in real time and it is also possible to determine the number of replicas (including archive indexes) to gain the desired level of redundancy.

In case of a disaster, image storage and retrieval are automatically re-routed to other resources and generation of new replicas starts immediately. Recovery can be completed easily, when the remote archive is directly in use. In conventional settings recovery from a secondary storage device is not allowed because of the hierarchical structure of storage media.

In conventional PACS archives, disaster recovery has been highly reactive and complex or even impossible to achieve in clinical practice, resulting in extended service disruptions. In addition, moving to a data grid rather than relying on traditional long-term archival back-up can provide considerable cost savings.

THE USE OF CONTRAST MEDIA IN PRE-FILLED SYRINGES:

WHAT IS YOUR OPINION?

A SURVEY OF 360 RADIOLOGISTS AND RADIOGRAPHERS AT ECR 2006 – VIENNA

(BY TYCO HEALTHCARE / MALLINCKRODT)*

In March 2006 during the European congress of Radiology (ECR) in Vienna a total of 470 questionnaires were randomly distributed amongst the subscribed congress participants visiting Tyco Healthcare/ Mallinckrodt exhibition area. The surveyed sample represented 29 countries mainly from Europe and 360 of questionnaires were completed and returned, a response rate of 76%.

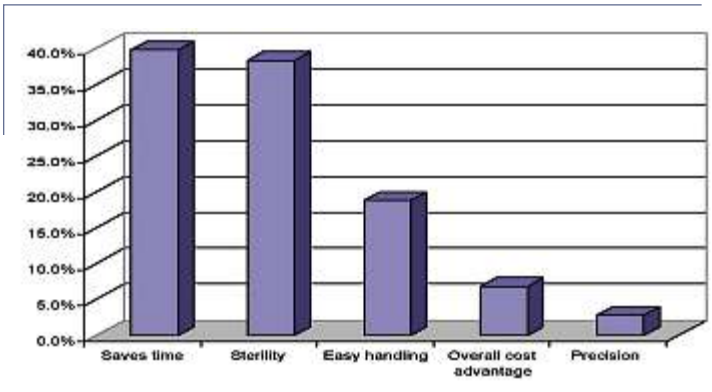
Thirty-eight percent of respondents expressed having past or current experience of using pre-filled contrast agent in their practice. Amongst non-users the most frequent cited reason for not using a pre-filled contrast medium was because of not having compatible injectors.

The results presented here are not statistically analyzed and are purely a reflection of the respondent's opinion.

Amongst imaging professionals who have had experience with contrast product pre-filled in syringes (Pre-filled Optiray®) (n=133)

- *87.2% have found that their department efficiency has increased with the use of pre-filled contrast media*
- *91.1% thought that the use of pre-filled contrast media is safer for patients*

When asked about the benefits of pre-filled contrast media (1)



Specific opinion when comparing pre-filled to bottle contrast media (2)

* Answers analysis by a third party company specialist in conducting market surveys

1) Question: In your opinion, what is the most important benefit of using pre-filled syringes?

2) Question: As a pre-filled user, which of the statement reflects best your view?

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Prescribing Information

OPTIRAY® 160 – loversol 339 mg/ml, PL 18963/10, OPTIRAY® 240 – loversol 509 mg/ml, PL 18963/11, OPTIRAY® 300 – loversol 636 mg/ml, PL 18963/12, OPTIRAY® 320 – loversol 678 mg/ml, PL 18963/13, OPTIRAY® 350 – loversol 741 mg/ml, PL 18963/14

Therapeutic Indications
OPTIRAY™ is a non-ionic X-ray contrast medium. Depending on the preparation, it is indicated for use in cerebral, coronary, peripheral, visceral and renal angiography, in aortography, left ventriculography, venography, intravenous excretory urography and computed tomography (CT) of the head and body. Except for OPTIRAY™ 300, safety and effectiveness of OPTIRAY™ in children has not yet been established.

Posology and Method of Administration
The dosage of OPTIRAY™ depends on the patient, the contrast medium concentration, the type of investigation and the technique used. It may vary between 1 ml and 150 ml, maximum total dose 250 ml or less. Intra-arterial or intra-venous injection.

Contraindications
Proven hypersensitivity to iodine-containing contrast media. Manifest hyperthyroidism.

Special Warnings and Special Precautions for Use
As with all other X-ray contrast media, OPTIRAY™ may cause anaphylaxis or other manifestations of pseudo-allergic intolerance reactions, e.g. nausea, vomiting, dyspnoea, erythema, urticaria and hypotension. Pre-testing cannot be relied upon to predict severe reactions. The thorough assessment of the medical history of the specific patient may be more accurate in predicting potential adverse reactions. A positive history of allergy is not a contraindication, but does require caution. Diagnostic procedures, which involve the use of iodinated intravascular contrast agents, should be performed under the direction of personnel skilled and experienced in the particular procedure to be performed. Serious or fatal reactions have been associated with the administration of iodinated X-ray contrast media. A fully equipped emergency cart, or equivalent supplies and equipment, and personnel competent in recognising and treating adverse reactions of all types should always be available for at least 30 to 60 minutes after administration. Patients with congestive heart failure should be observed for several hours following the procedure to detect delayed haemodynamic disturbances, which may be associated with a transitory increase in the circulating osmotic load. All other patients should be observed for at least one hour after the application, as it has been reported that most of the adverse events occur in this period. The patient should also be informed that allergic reactions may develop up to several days post administration; in such case, a physician should be consulted immediately. Caution must be exercised in patients with severely impaired renal function, combined renal and hepatic disease, anuria, diabetes mellitus, homozygotic sickle cell disease, or monoclonal gammopathy (multiple myeloma, Waldenström's macro-globulinaemia), particularly when large doses are administered. Serious renal effects, including acute renal failure, may occur in these patients. Preparatory dehydration is dangerous and may contribute to acute renal failure. Iodine-containing contrast media may also be hazardous in patients with hyperthyroidism or with autonomous areas of the thyroid gland. In patients with phaeochromocytoma a premedication with alpha-blockers is advisable when the contrast medium is administered intravascularly due to the risk of a hypertensive crisis. Serious neurologic events have been observed following direct injection into cerebral arteries or vessels supplying the spinal cord, or in angiocardiography due to inadvertent filling of the carotids. General anaesthesia may be indicated in selected patients. However, a higher incidence of adverse reactions has been reported in these patients, probably due to the hypotensive effect of the anaesthetic. In angiographic procedures, the possibility of dislodging plaque or damaging or perforating the vessel wall should be considered during catheter manipulation and contrast media injection. In patients with advanced atherosclerosis, serious hypertension, cardiac decompensation, senility, preceding cerebral thrombosis or embolism, special caution should be exercised. Cardiovascular reactions as bradycardia, rising or falling of blood pressure may occur more often. Angiography should be avoided whenever possible in patients with homocystinuria due to an increased risk of thrombosis and embolism.

OPTIRAY™ should be injected with caution to avoid perivascular application. However, significant extravasation of OPTIRAY™ may occur especially during the use of power injectors. Generally, it is tolerated without substantial tissue injury applying conservative treatment. However, serious tissue damage (e.g. ulceration) has been reported in isolated cases requiring surgical treatment.

Undesirable Effects
Side effects are usually mild to moderate, of short duration and resolve spontaneously without treatment. Side effects may consist of headache, nausea, vomiting, sensation of heat and pain, hypotension and skin rashes.

Legal Status
Prescription only

Date of preparation
6-Sep-2002

For specific prescribing information of your country consult the local office of Tyco Healthcare or its representative.

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CONTINUED

PACS & IT

The required retention period for stored information varies country by country and also differs for images and other patient data. New generation storage solutions allow intelligent information lifecycle management to automate and optimise storing of data, taking different national legislations into account. The storage rules can be based on the DICOM meta-data or even diagnosis or other data in the meta-data layer.

Conclusion

In conclusion, next-generation storage solutions deliver fast access to information, comprehensive security and service continuity, simplify storage management and disaster recovery and, notably, lower storage costs. Besides storing individual patient data, the storage grid could also help researchers to identify health-related trends. In this way, they provide direct benefits in a holistic, institution-wide sense, maximising the applications of PACS technology while at the same time making them more efficient and user-friendly.

CARDIOLOGY REQUIREMENTS FOR PACS

DEFINING FUTURE NEEDS

The Robert Bosch Krankenhaus was opened in 1973 and has created a worldwide reputation in medical and surgical care, for pioneering the practical application of innovative IT solutions to improve healthcare delivery. In my position as "Oberarzt", a function that is somewhere between consultant and registrar, I am responsible for our ten-bed intensive care unit, in particular our Cardiac Magnetic Resonance (CMR) unit, which performs 1,500 CMR procedures each year. CMR imaging has emerged as a new non-invasive imaging modality providing high-resolution images of the heart in any desired plane. In our department we have 80 beds, operate three echography machines, one magnetic resonance and two angiography units. We perform 3,500 coronary angiographies, 1,500 percutaneous transluminal coronary angioplasty (PTCA) interventions, and over 6,500 echocardiographies on an annual basis.

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Current PACS in our Department

The leading system, as in most medical facilities, is the Hospital Information System (HIS). Our current HIS is made by ISOFT. This enables us to have one convenient front-end for patient history, images and all other patient data, avoiding time loss in searching for one patient through different systems. While it is of core importance that cardiology PACS should be enterprise-wide and integrated, presently we have a separate PAC system in our department for echography, angiography and CMR and use a blend of service providers to meet our needs.

We also have a local echography PACS with three echography machines and a workstation. Using this set-up, images can only be reviewed at the workstation. Our web-based CMR PACS, in use since four years ago, is made by HeartIT. Images can be reviewed on all PCs in the hospital. For echography we use GE Vingmed solutions with a workstation using a system called ECHO-PAC. For angiography, we have local workstations but not a real PACS, using two Siemens cath-labs with local workstations from Siemens. For radiology our hospital has been using a PACS for the last two years made by Image Devices.

Benefits of Integrated Cardiology PACS

The benefits of integrated PACS in cardiology departments, surprisingly, has little to do with gains in time, which are only

marginal. Recently, as part of our drive to re-evaluate our current system, a consultant assessed possible improvements in real terms. What he found was that while gains of time are only marginal, the improvement in image quality may be considerable and is certainly enough to make an integrated system an essential addition. The main vendors of cardiology PACS on the European scene for stand-alone solutions presently, are GE, Philips and Siemens. For integrated solutions Agfa and Medcon (McKesson) are proving to be leading providers, while in the future HeartIT, Witt working in partnership with Philips, and of course Agfa are shaping up to take the pole positions.

The presence of a comprehensive support solution is a vital part of our decision. In our own case, final decisions on which vendor to purchase new IT solutions from are made by both management and staff, and our chosen vendor must provide back-up consultation services. Future IT upgrades for our department's cardiology PACS, will be based on the need for a web-based system, which can be used on every PC in the hospital to view all cardio exams. The other main criteria is speed as well as image quality.

An Integrated Approach

With systems of the future, the electronic health record will enable referring physicians to view their patient's cardiology studies in an integrated and accessible way. Currently with CMR, we are able to give every outpatient a CD with exam results stored on it. In the future we hope to develop a more comprehensive IT solution for the department that sees it integrated with the HIS rather than as a stand-alone system. Deploying this kind of holistic approach is tricky, not least because although DICOM is an invaluable protocol for the transmission of image data, the proprietary formats such as for echography are an obstacle to a wholly integrated solution. That is why most vendors of cardiology PACS enable sending of images not in DICOM but as mpg4 or animated .gif files. No vendor with pure DICOM viewers can be fast enough.

Challenges Particular to Cardiology PACS

Cardiology departments in hospitals have been far slower to adopt PACS than radiology, purely because there are by necessity far more images and data produced per case. Also, the multimodality nature of cardiology brings specific challenges in synchronising information on a PACS. For example, until two years ago it was not possible to convert our echo loops into DICOM. ECG has yet another format and is difficult to store. Of course there are technical differences in requirements between radiology and cardiology PACS, particularly in the different front-end systems needed in each case. The absolute basic IT infrastructure I consider essential for a department considering purchasing a cardiology PACS, is a deep archive with a long- and short-term storage, PCs and a 100MB net.

ASSESSING PERFORMANCE IN DIGITAL MAMMOGRAPHY TECHNOLOGY

REVIEW OF CURRENT DIGITAL MAMMOGRAPHY SYSTEMS AND CLINICAL STUDIES

There are many ways in which digital mammography can make a difference not only in detecting breast cancers, but also preventing unnecessary biopsies and changing surgical management, by providing better opportunities for the clinician or technologist to manipulate the resulting images, enhancing image quality and ensuring that nothing is missed on the scan.

In this article, I will provide an overview of the latest FDA-approved digital systems, as well as results from important clinical studies about digital mammography, which will perhaps highlight for service providers in greater detail the issues that have arisen in attempts to quantify standards for judging quality.

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Assessing a Digital Mammography System: Image Quality

The digital mammography systems that are currently licensed by the US Food and Drug Administration (FDA) achieve a resolution of up to 5-12.5 lp/mm. The quality of resolution and its importance in assessing a digital mammography system have been the centre of technical discussions for a long time. At a European level, work is being done on an addendum to the section covering "digital mammography" in the European Protocol for Quality Control (EPOQ), of the physical and technical aspects of mammography screening to determine the upper limits of contrast visibility, which would act as a crucial measure of image quality.

The lower requirements of local contrast visibility for digital mammography systems are being justified by the fact that lesions are detected because of their contrast to their background and that contrast visibility or other functions of transmission that use contrast are a more appropriate measure than the modulation transfer function used by film screen systems or the threshold frequency of visual perception that is derived from it.

Overview

In digital mammography, an electronic detector absorbs incoming X-rays and produces an electronic signal that is digitalised in an analogue-to-digital converter and can be therefore be processed, exposed, and stored on a computer. In digital radiography, actual imaging is split into three steps: recording, processing, and reproduction. This means that each individual step can be optimised, and in addition an opportunity arises for electronic imagine transfer via teleradiography.

Quality Control for Digital Mammography

The European Protocol for the Quality Control of the Physical and Technical Aspects of Mammography Screening states that 'A prerequisite for a successful screening project is that mammograms contain sufficient diagnostic information to be able to detect breast cancer, using as low a radiation dose as is reasonably achievable (ALARA).' This quality demand holds for every single mammogram. Quality Control (QC)

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therefore must ascertain that the equipment performs at a constant high quality level.

As QC of the physical and technical aspects in mammography screening starts with specification and purchase of the appropriate equipment, meeting accepted standards of performance. Before the system is put into clinical use, it must undergo acceptance testing to ensure that the performance meets these standards. This holds for the mammography X-ray equipment, image receptor, film processor and QC test equipment. After acceptance, the performance of all equipment must be maintained at the highest level possible.

The QC of the physical and technical aspects must guarantee that the radiologist is provided with images that have the best possible diagnostic information obtainable, and images should at least contain the defined level of information necessary to detect the smaller lesions (see CEC Document EUR 16260). Image quality should be stable with respect to information content and optical density and consistent with that obtained by other participating screening centres, and breast dose must be 'As Low As Reasonably Achievable' (ALARA) for the diagnostic information required.

Further information is available from the European Reference Organisation for Quality Assured Breast Screening and Diagnostic Services (EUREF) at www.euref.org.

FDA-approved Digital Mammography Systems

With this in mind, it is useful to examine the current range of digital mammography systems that hold an FDA licence, in order to provide an overview of how digital mammography technologies are shaping up to improve the quality of their function. These include the Senographe 2000D (GE Medical Systems), which uses a flat panel digital detector of 19 x 23 cm2. The detector is based on a semiconductor layer from amorphous silicium. Also, Fischer Imaging's Senoscan, uses a "slot scan" detector measuring 1 x 22 cm^2 and consisting of four charge coupled devices (CCDs), using a default pixel size of 54 µm. CCD technology converts incoming light photons into mobile charge carriers. The Lorad Digital Breast Imager (LDBI) works with a digital image acquisition system, which consists of 12 CCDs that are arranged in the form of a mosaic, and that are coupled with a large scintillator plate that is thallium doped caesium iodide. This receptor covers an area of 18,6 x 24,8 cm^2. Hologic is, however, not planning further marketing of the CCD-based units but is concentrating its activities on the flat panel digital detector consisting of amorphous selenium.

The last two I will mention here, include a system consisting of Hologic's Selenia, Siemens Novation, and digital mammography systems Instrumentarium and Giotto, from AGFA. The digital mammography system uses a 24 x 29 cm2 flat panel detector, which, instead of a scintillator, has a semiconductor layer of amorphous selenium. Selenium enables the direct conversion of X-rays into electrical charge. Finally, Fujifilm's FCR 5000MA full-field mammography system includes an image-plate reader with a resolution of 50 µm for all mammography formats, with dual-sided reading technology.

Results from Clinical Studies

Is the latest in digital mammography technology, so superior to conventional film-screen mammography systems, that it makes it an imperative acquisition when equipping a modern imaging department? Current results on detection rates for malignancies from important clinical studies are not so sure. In fact it is perhaps the difference in outcome from these studies that throws the most confusion over what the advantages in new technologies really are. Can digital technology definitively quantify how exactly it is superior to its non-digital predecessor?

For example, when Obenauer et al. and Fischer et al. compared digital mammography and conventional screen film mammography in clinical and control investigations, they found comparable results or only slight superiority of the digital technique. In a comparative study of 692 female patients, Venta, Hendrick et al. found that results were in agreement between conventional film screen mammography and digital mammography in 82%, part-agreement in 14%, and no agreement in 4% of results, which they explained by the variability of interobserver agreement. Interobserver reliability is an important factor here, as it measures agreement between two or more subjects rating the same target.

Yet another comparative study of conventional versus digital mammography carried out by Lewin, Hendrick et al., including 4,945 female patients, found that out of 35 cases of breast cancer, the conventional system detected 22 cases and the digital system 21 cases. Authors found no significant difference in detection rate, but a lower recall rate in digital than in conventional mammography (11.5% versus 13.8%, respectively). They did not find a significant difference in the rate of positive biopsies (19% versus 30%). Lewin and Hendrick, in a study in 2002 with 6,736 patients whose condition was generally diagnosed through both imaging modalities, found 42 malignancies in 181 biopsies, of which 15 were detected exclusively though conventional mammography and only 9 through digital mammography. They did not find a significant difference in the detection rate for malignancy, but a lower recall rate for digital mammography.

A study by Skaane et al. (Oslo I) included 1,832 women who were examined with both techniques, where although

authors found no significant differences in the detection rate, a higher rate of air ingress and average parenchymal dosis for the digital system than for the conventional system was noted. This study has met with substantial criticism with regard to different variables, and in addition the results are diametrically opposed to those of Hermann et al., who found a dose reduction of 25% for digital mammography compared with conventional mammography. In 2004 Skaane et al. published a further study (Oslo II) with 10,303 patients examined with conventional and 3,985 patients with digital technology. The results in terms of detection rates for digital mammography were significant better. As Skaane later verified this through observations of investigators by working every day with the digital mammography, he concluded that there is an essential need for at least two to three months training with digital mammography in order to improve accuracy, in contrast to conventional screen film mammography.

Another interesting study which I would like to highlight, published of the Digital Mammography Imaging Screening Trial (DMIST) Investigators Group, the only prospective, randomised clinical trial including a total of 49,000 women, all of whom were examined with both techniques, evaluated separately in 11 institutions found that despite the same detection rate of cancer for all patients, there were significant improvements in results for digital mammography systems in women under 50 years, those with radiological dense breasts and peri-menopausal women.

Conclusion

On the basis of phantom and clinical studies, luminescence radiography with high resolution imaging plates, digital full-field mammography using a digital amorphous silicium detector, digital full-field mammography using digital CCD-detectors and the digital full-field mammography digital amorphous selenium detector has been found to be of equal value or slightly superior to conventional film screen system, information that continues to be of value to healthcare providers concerned with improving both breast cancer detection rates and image quality in their facilities.

In this article, I will present an example of successful budgetary management in a university hospital environment, based on models from our own financial strategy and highlighting consequences for university hospital radiology departments in a climate of oppressive budgetary restrictions.

RESOLVING BUDGET CONFLICTS IN UNIVERSITY RADIOLOGY

HOW TO CREATE A WIN-WIN SITUATION

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Changing Existing Structures

The previous organisational structure of the radiology department at our university hospital, was based on the traditional hierarchical model, i.e., one Chairman responsible for each of the three pillars of the department; clinical radiology, radiological research and education, the latter including both student teaching and specialisation of junior members of the team.

In more than 50-70% of the university hospitals I have visited over the last twenty years, financial management of the radiological department was the job of the hospital administration, and the radiologist only acted as a sort of consultant. This situation changed dramatically when a new type of hospital administrator was introduced on the scene, compounded by extreme financial restrictions due to a more or less bankrupt healthcare system and the end of governmental funding for the needs of the university hospital. In the nineties, radiologists in leading positions in most German university hospitals became responsible for financial planning and especially for the planning of their large-scale investments e.g., CT, MRI, PACS, etc., while faced with more competitive demands of third party fund-raising activities and a shrinking pool of available money, especially for high-tech research, due to the fact that most governmental funding agencies demanded private-public partnerships in research areas such as CT and MRI.

A Solution to the Crisis

In my experience, there are three commonly held but different viewpoints when dealing with budgetary crises and they are as follows:

1. The well-known 'laissez-faire' attitude which translates as 'I'm a radiologist, I'm responsible for patient care, if I slash research and teaching budgets I can still do an adequate job, leaving financial concerns to the hospital administration'. Unfortunately, this is an attitude I saw in a surprising number of university hospitals, and clearly this is not a strategy to develop a modern, well-balanced budget.

2. The second option sees the responsibilities of the Chief Radiologist and the Managing Director of a university hospital divided in two separate roles, one only responsible for clinical radiology, and one being the financial manager. The drawbacks of this are that if each entity has the same power, provided they have the same goals and strategy, they can perform equally well for clinical radiology and the department as a whole. Unfortunately, conflict will inevitably arise when both demand to use the same limited resources equally in both areas. Who will make the final decision?

'A good Chair should be able to give away some power, for the good of the department'

3. Continuing life-long learning offers a third, in my opinion optimal, solution. In this scenario, you have two people, one a university radiologist doing clinical radiology, clinical research with interesting basic research, the other a specialist in basic research having strong connections to clinical radiology but no direct clinical responsibility. Both should have an interest in their respective management, which is management of the clinical department and research management including third party fund raising for both. Both should be in the position of being Chairman, one clinical, one research. But they should be tightly linked together so that cooperation in both fields is mandatory for the success of the department.

Two Chairs, One Department: How to Unify Them?

The question therefore remains: how can tight links between two Chairs be established in order to secure a unified approach to budgetary conflicts? These two persons have to act together, to represent the department as a whole, ergo both should be responsible for scientific, financial and teaching benchmarks for the whole department. If at the university hospital or in the country a system of financial support by the government is established which is closely linked to scientific output, the volume of third party funding and, to the financial well-being of the department, this can act as an external framework which will set up the necessary tight links. If one Chair failed to cooperate, both would run into problems. But is this system feasible in real life?

Putting it Into Practice

In Freiburg, we have established this system, meaning that at present, we have two Chairmen in the Department of Radiology, one for clinical radiology, department management and clinical research, and the other for research and research management. We both share responsibility for scientific output, for third party funding income, and for the financial well being of the department of radiodiagnostics.

We started this cooperation nearly ten years ago, voluntarily but without splitting the Chairmanship, officially cementing the partnership four years ago. The results of this mean that the department has enjoyed a minimum annual financial profit of 1,000,000 Euro over the last ten years from clinical radiology, the amount of third-party funding more than doubled, the scientific output in clinical and basic research papers is high enough to get extra money from the faculty and the government, and to be ranked equal to basic research units. Finally, we increased the number of radiologists working in clinical radiology and in clinical research from over 20 to nearly 30. We have created forty basic research positions for scientists with a non-medical background and for medical doctors only working in research, whereas originally we only offered four.

Conclusion: Creating a Win-Win Situation

Clearly, the traditional hierarchical idea of good Chairmanship has to be relegated to history, in order to create a win-win outcome for the financial situation, for research, for teaching, and for clinical radiology. A good Chair should be able to give away some power, for the good of the department. In order to achieve this, someone in a position of leadership has the tricky task of integrating clinical radiology and research with sound business administration, at the same high level they devote to their clinical work. Devolving power and responsibility to two closely-knit leaders gives departments a greater chance of solidifying and augmenting financial resources for the future.

MANAGEMENT TRAINING IN NORWAY

CHALLENGING RADIOLOGISTS TO BECOME FUTURE LEADERS

A solid grounding in management and business administration is a crucial asset to healthcare leaders who want to manage their departments in the best way, and to create growth and consolidation for our profession. Management is particularly demanding for radiologists, who are not only leaders of diagnostic functions, but also of technology and IT activities in the hospital. This is belied by the paucity of radiologists in Norway acquiring MBAs or striving for positions of higher responsibility, something this article will delve further into.
The Faculty of Medicine in the city of Trondheim is closely connected to the technical university in the city, which has a focus on developing amongst other things, medical technology. The research and teaching institution in medicine and health, St. Olav's Hospital, is closely linked with the technology part, giving possibilities for exciting developments in imaging. However, there has not been a radiologist as faculty head of department since many years. This is characteristic of the culture amongst radiologists in Norway, of ignoring management education and avoiding positions that make administrative demands on them they are ill-equipped to deal with. This lack of faith in the merits of management training will have a serious impact on the future development of our professional interests on a national and international level.

Current Management Training Facilities

In Norway, radiographers tend to take positions of leadership in imaging departments, with the radiologist reporting to them. Presently, in two of our six university hospitals, the head of the department is a radiographer who has undergone approximately one year of administration training. Current education requirements for all medical specialists in Norway necessitates just one short, compulsory week of intensive management training, consisting mainly of lectures concluded by a final exam. This focuses not only on basic administrative issues, such as organising workflow and quality control, but also leadership skills. The brevity of this training is compounded by the trend for radiologists working in the healthcare system here, not to seek positions of responsibility in their career path. It is a matter of great concern as to how we can challenge this lack of interest through MBAs or supplementary courses.

In fact, out of the six university hospital facilities in this country, I am the only Chair of a radiological department with formal management training at university level, holding an International Masters degree in Health Administration. The University of Oslo offers this course, designed for all healthcare professionals, in which 28 students attend full-time during half a year, taking six or seven exams which they must pass. Then they must be part-time students until they have finished, which takes between six months and two years, and finally write a thesis. It covers essential management training areas such as leadership, psychology, quality management, economy, methodology, statistics and project management. The Norwegian Medical Association also offers a three week course in management which is carried out over a year whereby students must hand in reports periodically. Fortunately, many hospitals have management training in-house for all managers, though it is seldom a full and comprehensive programme.

Basics of Good Management Training

A good management training course, in order to properly educate leaders of the future, must cover:

- Administrative tasks such as organising schedules and rotas
- Leadership skills, learning how to handle and lead people, as well as yourself
- Managing phases of development (project management), including both competence and technology projects
- Professional, economic and financial strategies
- Human resources
- Economy

The most paramount management skill that underpins each of these is the psychology behind true leadership skills. Clearly, a leader that attempts to complete each single task themselves without learning to rely on the appropriate team members will not do his department justice. Learning how to manage your team in the most efficient way can have a significant impact on the success of professional goals, from areas such as time management to staff productivity. Also, being conscious of the competence and skills you lack, and strengthening your leadership by recruiting and relying on people that have them, is mandatory. The question remains, how can we convince radiologists in Norway that these are essential skills necessary for the development of a long-term career, and that they should strive to climb the ladder as in other Western countries?

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MANAGEMENT TRAINING IN NORWAY

Learning to Delegate

The role of Chair of a modern radiology department is unrecognisable from how it was ten years ago, particularly in the field of IT. The implementation of RIS/PACS systems has been the biggest revolution faced by department heads in recent years. However, now that 100% of radiology departments in Norway are 'PACSified', coping with the exponential increase in demand for advanced imaging techniques (e.g., multislice CT, 3D imaging, MR, spectroscopy and minimally invasive therapy), has replaced this as the primary concern of a department head. In our department, I have created an internal 'Technology Operations' team responsible for radiological IT issues as well as space and equipment management. The leader reports directly to me. One of the reasons I am so emphatic in my belief in the fundamental need for management training for radiologists, is that to effectively address rising demands such as those described above, which stretch the traditional definitions of what a department leader should be beyond recognition, the psychological as well as the practical elements of good leadership as part of holistic management training are a fundamental skill. Without a good grounding in management skills, radiologists miss out on the opportunity to claim their role as leaders of the imaging departments of the future and to have the satisfaction of leading a good and effectve department of radiology.

PART 1

LIVE 3D ULTRASOUND SOLUTIONS

ACCURACY KEY FOR IMPROVED HEART FAILURE MANAGEMENT

Heart failure, the inability of the heart to pump sufficient blood to meet the metabolic demand of the body, impacts millions worldwide every year. Implications of heart failure are broad and have become a tremendous economic burden. Worldwide, heart failure affects nearly 23 million patients. In Europe, nearly 14 million people suffer from heart failure, a number that is expected to reach 30 million by 2020, according to the European Society of Cardiology.

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Dr. Ivan Salgo

Heart Failure Investigations

Programme Director

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Addressing the increased scope and severity of heart failure, the American College of Cardiology (ACC) and the American Heart Association (AHA) issued updated heart failure management guidelines in 2005. The defacto paper helps physicians diagnose and treat patients, as recommended by ACC and AHA's panel of experts. Guidelines recommend use of the term heart failure instead of congestive heart failure, and recognise the value that cardiac resynchronisation therapy (CRT) brings in improving quality of life and exercise capacity in patients who respond to CRT. Revised guidelines recognise diastolic heart failure as clinical heart failure, even with normal ejection fraction (EF). Guidelines also expand the number of patients eligible for implantable cardioverter defribrilators (ICD) based on low ejection fraction (EF) of 30%.

However, worthy to note in the revised guidelines is use of Live 3D Echocardiography in diagnosing the variety of conditions that contribute to heart failure, with recommendations on use of Live 3D Echo in diagnoses.

The primary role of Live 3D Echo in clinical practice is to provide minimally invasive, cost-effective answers to the clinical questions of structure, function and risk. Measurement of cardiac function anatomy can be a time-consuming, costly task often relegated to the research department, which typically uses expensive offline systems to evaluate cardiac function. Live 3D Echo, a faster, less expensive method, has the capability to accurately measure cardiac anatomy and function to improve quality of care and diagnostic confidence.

Accuracy Critical in Improving Patient Management

Obtaining accurate images of a patient's ventricular size and measuring a patient's EF is critical in improving management of patients with heart failure and reduced liability since the greater the accuracy, the greater the chance for a physician to make an educated diagnosis. Besides EF, understanding LV remodelling as with LV size of diastolic and systolic volume and wall thickness is important. Many patients with heart failure have coexisting valvular disease. In fact, some patients who have a dilated heart can actually have leaking through the mitral valve, known as mitral regurgitation, which can adversely affect valvular function. Additionally, the use of CRT, or use of a pacemaker to improve synchronous timing of LV contraction, is an emerging medical therapy being used to treat heart failure patients.

The role of Live 3D Echo in treating heart failure patients is critical in enabling physicians to obtain accurate images. In the past, the role of ultrasound in obtaining an accurate EF was a challenge using 2D ultrasound, which previously provided only single dimensional views. 2D views cause foreshortening of the image, meaning the true view through the apex is not possible. As a result, even the most seasoned physician or sonographer can never be completely sure they are obtaining a true view. Technological advancements in ultrasound technology enables accuracy by reducing apical foreshortening errors, and helps avoid geometric assumptions because it uses all the voxels in the data set. This is critical in providing accurate quantification in a semi-automated fashion by providing an EF in a matter of seconds leading to potentially greater accuracy in diagnosing a condition, faster exam times, and improved patient care.

Live 3D Echo in Cardiac Resynchronisation Therapy

While obtaining EF volumes for ventricular modelling is important, Live 3D Echo for use in CRT is gaining more attention in certain heart failure patients. As a result, a variety of echo solutions are under development for more advanced CRT assessment. One such advancement is Live 3D Echo's role in assessing the regional LV wall motion in CRT patients. CRT is a treatment option for certain patients with heart failure, specifically patients who exhibit conduction abnormalities and have a reduced ejection fraction as well as symptoms of HF. Cardiomyopathy and heart failure in moderate to severe patients are caused by an abnormality of the heart's electrical system, resulting in an uncoordinated contraction of the heart muscle. The most common abnormality is a delay in electrical conduction through the left bundle branch. Since this delays the electrical signal in traversing the LV, the right ventricle may contract before the left instead of simultaneously as it should in a normal cardiac rhythm. Another relevant aspect is the LV needs to contract simultaneously. It may have delayed contractile segments and this may lead to pumping inefficiency and adverse remodelling and dilatation of the left ventricle. The result is an uncoordinated contraction of the heart muscle, reducing the pumping ability of the weakened heart muscle.

Improving LV Function

CRT based on biventricular pacing may improve the LV function in patients with heart failure and left bundle branch block (LBBB) and may restore normal coordinated pumping action by overcoming the delay in electrical conduction caused by LBBB. This occurs with a unique type of cardiac pacemaker that continuously monitors the patient's heartbeat and delivers a tiny electrical charge to stimulate the heartbeat when necessary. While the response to CRT may vary, studies have demonstrated modest improvements in exercise tolerance, heart failure class, and quality of life. It is still a significant goal in cardiac imaging to identify definitively the best patient candidates who will be responders to CRT.

2D echo provides images of the LV. Its advantages are ease of use during a conventional 2D examination, high frame rate and availability of quantitative tools for analysis of wall motion patterns. However, it does not assess the LV in its entirety.

2D Doppler techniques allow wall motion analysis at high frame rates. This is useful in assessing for example, transmural patterns of thickening. Nonetheless, only motion in the direction of the Doppler ultrasound interrogation is part of the analysis. The spectrum of cardiac mechanical function is more complex. While 2D and Doppler echocardiography allow the direct evaluation of the mechanical dysynchrony, it is nearly impossible for either of these devices to examine all 17 segments of the LV. MRI, long considered the gold standard for assessing LV, cannot be used due to the metal found in the special pacing device and issues regarding potential magnetic inductance of leads. In this case, the use of Live 3D Echo in combination with semi-automated contour tracing algorithms can be an ideal tool for analysing regional LV wall motion in CRT patients.

Live 3D Echo allows a comprehensive analysis of LV wall motion before and during CRT and, in contrast to conventional 2D echo, the comparison of all LV segments. Live 3D Echo also helps obtain quantifiable data and acquire images more rapidly.

Conclusion

In summary, advances in ultrasound technology are making it possible for physicians to obtain more accurate images of the heart than ever before, a critical factor in accurate diagnosis, and provide appropriate treatment for heart failure patients. From a business perspective, Live 3D Echo is enabling hospitals and clinics to improve workflow through faster exam times and improved patient management by being able to provide a timely, more accurate diagnosis. New ultrasound capabilities are providing many healthcare facilities the opportunity to expand services without major capital expenditures.

Parts two and three of this series will appear in forthcoming editions of IMAGING Management:

- **Live 3D Echo Delivers Benefits in Paediatric Cardiac Care**

As cardiac ultrasound technology evolves, the medical community is rapidly realising important benefits in the field of paediatric cardiology. Live 3D Echo is helping physicians and clinicians deliver faster exam times to quickly and accurately extract the best diagnostic information.

- **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.

DIAGNOSTIC MODALITIES
TARGET CAD

REVIEW OF TECHNOLOGICAL ADVANCES

In recent years the development of new technologies across the range of imaging modalities has delivered most benefits to cardiovascular imaging. The result is a wide choice of modalities available to provide diagnostic and prognostic information on the presence and outcome of coronary artery disease (CAD). Imaging providers and ultimately payers have the task of defining a new diagnostic algorithm.

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Visualising the Arteries and Identifying Stenoses

Conventional x-ray angiography was given a facelift in 2000 with the introduction of flat plate digital technology but was the patient already in decline? Conventional angio scans are falling as MR and CT 'slice' up the body between them: MR in the head and neck for cerebral and carotid studies, CT in the abdomen. Iliac/femoral studies comprise around half of all vascular investigations, while MR looked to have been the method of choice but lack of hardware in many sites may allow CT in. In the heart, x-ray angiography (cardiac catheterisation) remains pre-eminent but for how long? MR has problems in imaging cardiac vessels at resolutions high enough to be of clinical use, although this hasn't stopped sales of cardiac packages, which at €250k add as much as 20% of the price of a 1.5T MR unit. At the last RSNA meeting in Chicago, companies were pushing 64-slice CT as a potential alternative to image the cardiac vasculature.

"Providers, payers and patients are winners if modalities are used where most effective"

Cardiac CT has been around for more than five years. As more slices have been added, it has become increasingly attractive. Patients pose a challenge due to irregular heart rates. Equally, the time needed to reconstruct and reformat the image dashed any realistic notion of patient throughput. Today a dataset, which from a 64-slice scanner may be 1,200 images, can be reconstructed and reformatted in less than ten minutes. Companies are now keen to stress that their scanners are fast enough to beat patient arrythmias.

The Siemens Somatom Definition scanner launched at the RSNA is currently seen as the ultimate toy. Whether the 'dual

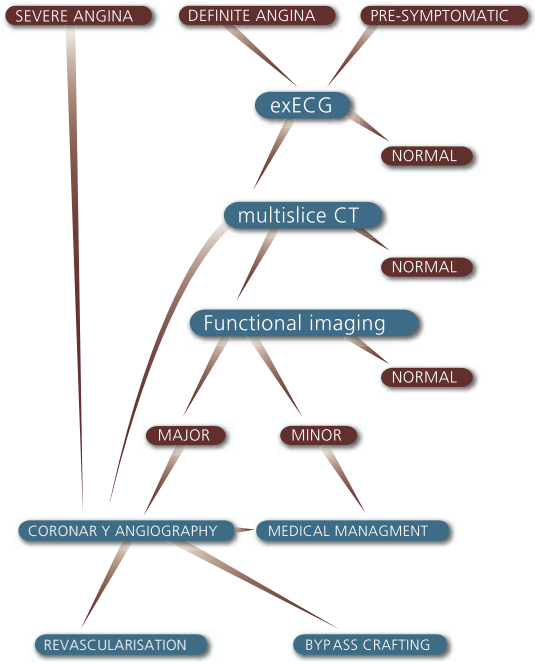

Figure 1: Future cardiac diagnostic algorithm

multithread helical' scanner which has dual tubes and detectors is the future of CT is uncertain but others will need to match or better its specifications. By tailoring data collection to the cardiac cycle, dose is reduced by half that of a regular 64-slice scanner. The reported price ($2.7 -$3.2m) is twice that of a conventional 64-slice CT, but with a complete scan taking 5 - 6 seconds, 30 patients per day is achievable, bringing a cardiac CT angiogram in at a quarter of the price of a conventional study. Next year who knows. At the same meeting, Toshiba exhibited its (work in progress) 256-slice scanner which can image the heart in one beat.

Monitoring perfusion

An alternative approach is to see how well myocardium is perfused. Functional imaging studies were traditionally used for pre-symptomatic patients or where there is less likelihood

"Functional imaging studies were traditionally used for pre-symptomatic patients or where there is less likelihood of severe CAD"

of severe CAD. Technetium or thallium scans performed using a nuclear medicine camera are the technique of choice. Popular in the US, it is less used in Europe and is hampered by issues of image interpretation.

Ultrasound or echo is restricted by a lack of regulatory approval governing the use of contrast agents which are the key to perfusion studies. MRI is a strong challenger but cost and siting has restricted its placement to specialist cardiac centres. PET using 13N ammonia is regarded as the gold standard but requires an on-site cyclotron although 82 Rubidium, which can be produced cheaply using a generator, has been suggested as a possible alternative.

Hybrid Systems

Manufacturers are promoting new generation dual modality scanners for cardiac imaging. Developed initially for oncology applications, PET/CT garnered most interest at the recent RSNA. However, it is difficult to envisage how a PET study will change outcomes in the majority of examinations where CT has also been performed. If the perfusion scan is only to check cases where CT is equivocal why not graft a nuclear camera onto a 64-slice CT? In Chicago, Philips was showing the 16-slice SPECT/CT Precedence, although others were less convinced of market potential.

Which Techniques Will Suit?

In Western Europe the majority of patients present with angina, a small percentage are pre-symptomatic and enter the diagnostic algorithm because of predisposing factors; raised cholesterol, heavy smoking, abnormal ECG, etc. This varies from the US where pre-symptomatic patients comprise a far higher proportion of referrals. Both groups pose different challenges. The likelihood of coronary stenosis in the first group is high and the risk/benefit of radiation is low.

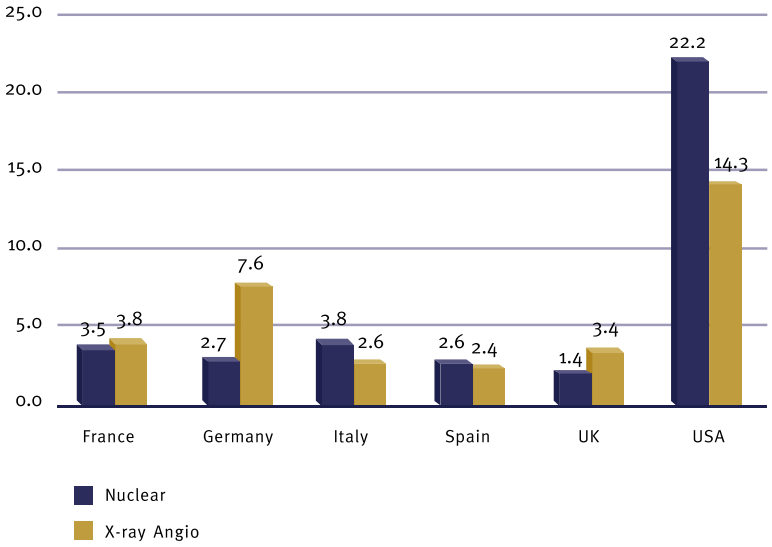

Figure 2: Cardiac angiography vs nuclear medicine (studies per 1,000 popn)
Source: Medical Options

In pre-symptomatic patients the risk/benefit needs to take account of radiation dose in an outwardly healthy individual.

The cost of a diagnostic exam is primarily defined by equipment cost and throughput. Variable costs, primarily contrast agents and radiopharmaceuticals are an important item in some studies. PET/CT is expensive. Two patients per hour reflects an achievable throughput while radiopharmaceuticals are in excess of €400. 64-slice CT is cheaper as double the number of patients can be seen and contrast, at under €25, is cheap.

Safety is primarily related to radiation dose and favours ultrasound and MRI. PET and 64-slice CT deliver doses in excess of three times that of a chest x-ray and are less

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suited for repeated studies. The requirement for vascular intervention poses a small but finite risk in the case of x-ray angiography in addition to x-ray dose.

Where the likelihood is 1 in 100 of the patient requiring revascularisation, either a cardiac stent (PCI) or bypass graft (CABG), perfusion studies can confirm the absence of disease but throw up many false positives. Together with true positives this requires around a quarter of patients to be followed up. The situation gets worse as prevalence increases. Over a third of patients will show positive if one in ten patients go on to have PCI – common for those attending chest pain clinics.

"Sensitivity and specificity numbers are only starting to be published and a number of manufacturers are sponsoring multi-centre trials"

Modalities with sensitivity and specificity in excess of 90% are the choice when the incidence of disease is high but less sensitive tests may be attractive where incidence is lower and the test has other merits like safety or cost. Nuclear medicine, ultrasound and MRI are all contenders. Where the likelihood of disease is high, conventional angiography wins out. Where does this leave CT?

Sensitivity and specificity numbers are only starting to be published and a number of manufacturers are sponsoring multi-centre trials. In March 2006, GE announced a 20 centre trial along with bullish statements from trialists of the likely impact of CT on practice guidelines. It certainly seems likely that 64-slice will approach sensitivities and specificities of 95%.

What Will Win Out?

There have been a number of false dawns. Four years ago manufacturers were pushing the merits of 4-slice CT for cardiac imaging while the cardiac potential of MR has been pushed since the mid-eighties. 64-slice does however appear to be the one. Despite problems with irregular heartbeats, radiation dose and calcified vessels, accurate diagnosis can be made in the majority of patients. Taking our pre-symptomatic population with an incidence of 1% requiring revascularisation, CT will identify 5% as positive requiring follow up. Follow-up choices are cardiac catheterisation or a perfusion exam, the latter to eliminate false positives.

If CT makes inroads then perfusion studies will lose out. In a study which we carried out in the last quarter of 2005, European nuclear medicine practitioners saw limited (<2%) growth in nuclear cardiac procedures. Diagnostic angiography is also threatened, reduced to the second choice modality for all but the seriously ill while MR's cardiac potential is outshone by the rise of CT. Providers, payers and patients may be winners, but only if modalities are used where most effective. A change in imaging mix could allow more pre-symptomatic patients to be followed up within the same budgetary envelope.

		Accuracy	Safety	Cost
Stenoses	MRI	+	++++	++
	MSCT	+++	+	+++
	X-ray	++++	++	+
Perfusion	SPECT	+	++	++
	PET/CT	+++	++	+
	MRI	++	++++	++
	U/s CE	+	+++	++++

CARDIAC ULTRASONIC SCANNING SYSTEMS PRODUCT COMPARISON CHART

HEALTHCARE PRODUCT COMPARISON CHART

ECRI Europe
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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 health-care 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.

Amongst its many products and services ECRI is pleased to provide readers of IMAGING Management with sample information on Cardiac Ultrasonic Scanning Systems designed for use in medical imaging from its Healthcare Product Comparison Chart System (HPCS), which contains over 280 reports. The HPCS reports contain extensive information about the technology, its purpose, its principles of operation, stage of development and reported problems.

This extract from our database contains model by model specifications for easy assessment and review. The Cardiac Ultrasonic Scanning Systems Product Comparison Chart includes ECRI's 'Recommended specifications' (generic templates) which can be used for comparison and tendering purposes.

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.
GE Healthcare	*G1*	2,6 intraoperative; 2-5 CW pencil
	G2	and Doppler, TVI, TTI, SRI, strain
	G3	and Doppler, TVI, TTI
	G4	simultaneous real time 2-D and Doppler
PHILIPS	*P1*	with harmonics and true electrocautery suppression; OMNIPlane adapter supports use of OMNI III
	P2	fetal echo STIC, stress, SonoCT, XRES, iScan
SIEMENS	*S1*	memory allocation, adjustment
	S2	Doppler tissue imaging, convergent

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

	ECRI [E1]	PHILIPS	PHILIPS
MODEL	**Cardiac Ultrasonic Scanning System**	**EnVisor**	**HD11**
WHERE MARKETED		Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes
DICOM 3.0 COMPLIANT		Optional	Optional
CONFIGURATION		Conventional	Conventional
APPLICATIONS			
Cardiac		Yes	Yes
Vascular		Yes	Yes
Other		Abdominal, OB/GYN, intraoperative, small parts, pediatric, urology, musculoskeletal, TEE	Abdominal, OB/GYN, intraoperative, small parts, pediatric, urology, musculoskeletal, TEE, prostate
PROBE TYPES, MHz			
Mechanical sector		NA	NA
Annular array		NA	NA
Linear array		3.5-5.6, 4.5-10, 3-12, 5-12, 6-15	4-8, 3-12, 5-12, 7-15
Curvilinear (convex) array	2-7.5	2-5, 3.5-8, 5-7.5, 4-8, 5-8	2-5, 4-8, 5-8, 5-9
Phased array		2-4, 3-8, 5-12,	1-3, 2-4, 3-8, 4-12
Multifrequency	2-7.5	Adaptive‹····1····›	Adaptive extended operating frequency ranges
Single-plane TEE	2-7.5	NA	NA
Biplane TEE	2-7.5	NA	NA
Multiplane TEE	2-7.5	2-7 OMNI III	2-7 fusion [P1]
Pediatric TEE		No	No
Others		1.9, 5 nonimaging; 1.9 transcranial, endocavity, endovaginal	3-D 2-6, 3-D 4-8, 3-D 3-9v; abdominal and OB/GYN 3-D
SECTOR ANGLE	30	76-124 adjustable	Adjustable
FRAME RATE, fps 30	256	Up to 298	320 (color), 785 (2-D)
GRAYSCALE LEVELS	Yes	256	256
PREPROCESSING	Yes	Yes	Yes
POSTPROCESSING		Yes	Yes
MAXIMUM DISPLAY DEPTH, cm		24	30
IMAGING MODES			
M-mode display	Yes	Yes	Yes
M-mode and 2-D	Yes	Yes	Yes
Harmonic imaging	Yes	Yes	Yes
3-D display		Yes	3-D, 4-D, MPR abdominal and OB/GYN
Color flow mapping	Yes	Yes	Yes
Doppler			
CW	Yes	Steerable	Yes
PW	Yes	Steerable	Yes
Other		TDI, angio, harmonic angio	TDI, angio, harmonic angio, [P2]
Power		Yes	Yes
Frequency, MHz		2-15	1-15
Velocity display	Yes	Wide range, depends on image parameters	Wide range, depends on image parameters
PRF, kHz		22-56	Wide range, depends on image parameters
Duplex	Yes	Yes	Yes
Triplex mode		Yes	Yes
FUNCTIONALITY			
Digital calipers	Distance, area	Yes	Yes
Spectrum analyzer	Yes	FFT	FFT
Selectable dynamic range		Yes	Yes
Adjustable transmit focus		Yes	Yes
Dynamic receive focus		Yes	Yes
Measurements on VCR replay		Yes	Yes
DISPLAY FUNCTIONS			
Pan/zoom			
Real-time image	Yes	Yes	Yes
Frozen image		Yes	Yes
Cine	Yes	Yes	Yes
Max number frames		Not specified	1,000
SINGLE/DUAL MONITORS		Single	Not specified
SPLIT SCREEN		Single/dual/quad	Not specified
IMAGE STORAGE METHOD		MOD, videotape, CD, online information management, up to 30 sec CLR, 3.5 floppy disk, hard drive	CD, 80 GB hard drive, optional MOD
Capacity, number of stored images		40 GB with 34 GB storage capacity	Depends on size of image and capacity of storage device
PHYSIOLOGIC DATA	ECG	ECG, auxiliary input, body marks with probe indicator	ECG, auxiliary input, respiration, heart pulse, contact sensor
ANALYSIS PACKAGES			
Cardiac scanning		Yes	Yes
Vascular scanning		Yes	Yes
Stress echo		Yes	Yes
Others		Abdominal, OB/GYN, small parts, pediatric, musculoskeletal	OB/GYN
POWER REQUIREMENTS VAC		90-240, 47-63 Hz	Not specified

	ECRI [E1]	SIEMENS	SIEMENS
MODEL	**Cardiac Ultrasonic Scanning System**	**ACUSON CV70**	**ACUSON Sequoia C512**
WHERE MARKETED		Worldwide	Worldwide
FDA CLEARANCE		Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes
DICOM 3.0 COMPLIANT		Yes	Yes
CONFIGURATION		Yes	Yes
APPLICATIONS			
Cardiac		Yes	Yes
Vascular		Yes	Yes
Other		TEE, Intracardiac, Abdominal Intraoperative	TEE, Intracardiac, Abdominal Intraoperative
PROBE TYPES, MHz			
Mechanical sector		NA	NA
Annular array		NA	NA
Linear array		Yes	Yes
Curvilinear (convex) array	2-7.5	Yes	Yes
Phased array		Yes	Yes
Multifrequency	2-7.5	Yes	Yes
Single-plane TEE	2-7.5	No	No
Biplane TEE	2-7.5	No	Yes
Multiplane TEE	2-7.5	Yes	Yes
Pediatric TEE		No	Biplane, multiplane
Others		CW Doppler; Intracardiac, Intraoperative	CW Doppler, intracardiac cathether, epiaortic intraoperative, endocavity, transvaginal
SECTOR ANGLE	30	90	Up to 140
FRAME RATE, fps 30	256	160	⇢700, variable
GRAYSCALE LEVELS	Yes	256	256
PREPROCESSING	Yes	Yes	Yes
POSTPROCESSING		Yes	Yes
MAXIMUM DISPLAY DEPTH, cm		24	36
IMAGING MODES			
M-mode display	Yes	Yes	Yes
M-mode and 2-D	Yes	Yes	Yes
Harmonic imaging	Yes	Yes	Yes
3-D display		Yes	Yes
Color flow mapping	Yes	Yes	Yes
Doppler			
CW	Yes	Yes	Yes
PW	Yes	Yes	Yes
Other		Directional power mode	HPRF, SST, spectral,[S2]
Power		Yes	Yes
Frequency, MHz		2-13	1-15
Velocity display	Yes	Yes	Yes
PRF, kHz		Yes	NA
Duplex	Yes	Yes	Yes
Triplex mode		Yes	Yes
FUNCTIONALITY			
Digital calipers	Distance, area	Yes	Yes
Spectrum analyzer	Yes	FFT	FFT
Selectable dynamic range		Yes	Yes
Adjustable transmit focus		Yes	Yes
Dynamic receive focus		Yes	Yes
Measurements on VCR replay		Not specified	Yes
DISPLAY FUNCTIONS			
Pan/zoom			
Real-time image	Yes	Yes	Yes
Frozen image		Yes	Yes
Cine	Yes	Yes	Yes
Max number frames		Variable, dependent on mode, [S1]	Variable, dependent on mode, [S1]
SINGLE/DUAL MONITORS		Single	Single
SPLIT SCREEN		Yes	Yes
IMAGE STORAGE METHOD		DIMAQ-IP workstation, CD-R, videotape, KinetDx, DICOM, digital dynamic clips	Videotape, KinetDX, DIMAQ integrated workstation, embedded DICOM, MOD, digital dynamic chips
Capacity, number of stored images		Variable, dependent on image parameters	Variable, dependent on image parameters
PHYSIOLOGIC DATA	ECG	Yes	ECG, PCG, respiration
ANALYSIS PACKAGES			
Cardiac scanning		Yes	Yes
Vascular scanning		Yes	Yes
Stress echo		Yes	Yes
Others		On-board reporting, Edge assisted EF	Broad range of analysis for clinic and research
POWER REQUIREMENTS VAC		100/240, 50/60Hz	100/240, 50/60Hz

	GE Healthcare	GE Healthcare	GE Healthcare	GE Healthcare
	LOGIQ 7	**Vivid 7 Dimension**	**Vivid 7 Pro**	**Vivid 3 Expert : Vivid 3 Pro**
	Worldwide	Worldwide	Worldwide	Worldwide
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	
	Conventional			
				Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Abdominal, OB/GYN, breast, small parts, transcranial, urology, musculoskeletal, pediatrics/neonatal, intraoperative	OB/GYN, intraoperative	OB/GYN, intraoperative	OB/GYN, intraoperative, Flexi View
	NA	NA	NA	NA
	NA	NA	NA	NA
	3-7, 4-10, 5-13	7, 10, 12, M12	7, 10, 12, M12	7, 10, 12
	2-5, 3-8, 4-11 microconvex	3.5, 5, 8, M7, E8	3.5, 5, 8, M7, E8	C358, C721
	1.5-3.5, 4-10, 4.4-10	3, 5, 7, 10, M3	3, 5, 7, 10	3, 5, 7, 10
	Yes	All probes	All probes	All probes
	Not specified	NA	NA	NA
	Not specified	NA	NA	NA
	2.9-7	6 adult, 9 pedric	6 adult, 9 pediatric	6
	Not specified	9	9	9
	5-13 linear matrix; 3-8 convex matrix; 2-4 phased matrix; 2-4 sector matrix; [G1]	i8L, i13L epicardial; E8C endovaginal; 2D, 6D pencil	i8L, i13L epicardial; E8C endovaginal; 2-D, 6-D pencil	i8L, i13L, i739, T739 intraoperative; E721 endovaginal; 2D, 6D pencil
	Not specified	90 FPA, 128 CLA	90 FPA, 128 CLA	90 FPA, 120 E721
	Variable to 150	Up to 750	Up to 750	Up to 300
	256	256/12-bit	256/12-bit	256/12-bit
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	30	30	30	30
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	No	Vascular
		Yes	No	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Color, power, HPRF	Color, simultaneous real-time 2-D [G2]	Color, simultaneous real-time 2-D [G3]	Color, 3-D vascular,[G4]
	Yes, 3-D grayscale and color	Yes	Yes	Yes
	Not specified	Probe dependent	Probe dependent	Probe dependent
	Yes	Yes	Yes	Yes
	0.64-30	50	50	50
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	30-110 dB	30-110 dB	range 40-100 dB
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes			
	Yes	Yes	Yes	Yes
	Yes	Yes; also frozen-image magnify	Yes; also frozen-image magnify	Yes; also frozen-image magnify
	Yes	Yes	Yes	Yes
	Variable	100,000 with out zoom, 1,500,000 with zoom	100,000 with out zoom, 1,500,000 with zoom	~24,000 (200 fps x 120 sec)
	Single, 17 high-resolution	Single	Single	Single, high contrast, 17 : single, 15
	Yes	Dual/quad	Dual/quad	Dual/quad
	Hard disk, MOD, CD-R, videotape, DVD+R	HD, MOD, CD, DVD, USB flash card, VCR, black-andwhite and color printer	HD, MOD, CD, DVD, USB flash card, VCR, black-andwhite and color printer	HD, MOD, CD, VCR, black-andwhite and color printer
	40 GB hard disk, 1.3 GB MOD, CD-RW, DVD	80 GB	80 GB	40 GB
	ECG, phono, variable gain/trace control	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes
	General, fetal, biometry, urology	Advanced analysis tools for velocity or strain traces, curved AMM, TSI, and others	Advanced analysis tools for velocity traces, curved AMM, and others	Anatomical M-mode FlexiView
	100-120/220/240, 50/60 Hz, 1,200 VA	110-120/220-240	110-120/220-240	110-120/220-240

GE Healthcare



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GE Ultrasound – diagnostic imaging in motion.

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THE FRENCH HEALTHCARE SYSTEM

THE CHANGING FACE OF HEALTHCARE IN FRANCE

Many significant aspects of the French healthcare system have changed over the last few years, and will continue to impact the future of healthcare provision in France, as it adapts to the complexity of modern medicine

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Access to Care is Changing

Since its inception in 1945, the public health insurance programme (social security system) has provided cover to all legal residents of France, but even now, a small part of the population has no access.

Originally this programme was based on professional activity ('Bismarck' model). Despite groups such as the self-employed and agricultural workers who have their own funds, the main fund covers 80% of the population. Funds are financed partly by employer and employee contributions but in another ever-increasing part by personal income taxes ('Beveridge' model). On the basis of this funding, uniform rates of reimbursement are available for all citizens.

Most health insurance entities are private, jointly managed by both employer and employee federations, under the State's supervision. This joint management is subject to discord as the total amount of public money is annually decided by the Parliament, the rate of reimbursement and contributions for the funds being decided by the Cabinet, and tariffs to ensure operating systems are negotiated between funds and healthcare professions.

75% of total health expenditure is covered by the public health insurance system, and the remaining amount is covered both by patients themselves and supplementary private health insurance companies. As a wide range of goods and services are covered by these funds, co-payments were increasingly implemented to limit consumption and expenditures, and are now relatively high for many out-patient services. For example, 30% of the cost for a physician's visits are charged to patients, and 40% of specialists are allowed to charge more than the going rate.

In January 2000, a public supplementary insurance programme ("CMU") was implemented to ensure poor citizens (meaning 10% of the population) have access to healthcare since few have supplementary insurance. Theoretically access to care is free of charge for them as all public co-payments are covered by this insurance, and as health professionals are not allowed to charge more than the going rate.

However, discussions are underway on how to have a more efficient and equitable healthcare service by defining a set of goods and services available for all and 100% publicly financed. The remaining goods and services would be available for those who opt to pay for them, whether or not they rely on private insurance.

Until January 2006, access to care was unlimited in France and patients could see as many physicians as they wished. This may explain France's high rank in WHO's rating, without taking in account its efficiency. This year a kind of gate-keeping system has been initiated in France as patients had to designate their own individual GP, and must now be referred by this GP in order to be fully reimbursed by specialists.

The State's Role is Evolving

Since 1991, healthcare planning has been discussed at regional level, and policy-making continues to be discussed through the SROS plans (regional plans of healthcare organisations). In February 2006, the third level of this plan ("SROS 3") was delivered for the next 5 years. One of the

changes it brings affects radiology equipment, specifying that, for example, in the Greater Paris area (Ile de France) the number of CT machines will increase from 171 to 201 and MRI machines from 114 to 146.

Changes in Care Supply

Hospitals

In France, the core of the healthcare system are hospitals, and care is directed more to very specialised and technical curative aspects, and less to preventive and community services. There are two main categories of hospitals: pubic and private for-profit; as well as some private not-for-profit hospitals. 65% of the total number of beds are in the public part, and most of these hospitals are obliged to ensure continuity of care, teaching and training. University medical centres are more concerned by these obligations and in delivering more complex forms of care. Private for-profit hospitals are funded on fee-for-service remuneration and are more involved in technical procedures such as surgery, which are financially easier to manage.

A general tendency to a decrease in the number of beds has been observed during the last years (8.4 / 1000 inhabitants) and all public and private establishments are progressively monitored on the same payment systems ("T2A"). This is a sort of activity-based cost system introduced in 2005, in order to progressively replace the two different modes of funding that existed before (a public one and a private one).

Health professionals

Physicians play a key role in the healthcare system, and in France approximately 200,000 of them are licensed to practice. But as the number of medical students is limited by the Ministry of Health, retirement of currently active doctors will result in a decrease in the number of physicians in the coming years. Half of these are general practitioners and half are specialists, of which 7,000 are radiologists. Physicians and other professionals work in public establishments (2/3 in hospitals and 1/3 in others) or in private practice. Approximately 40% of them are public employees and paid by the government, while the other 60% work in private practice and are paid on a fee-for-service basis, with prices negotiated by physician's unions and public health insurance funds.

Since 1971, every five years a contract ("convention") is supposed to be signed by physicians' unions to set regulatory frameworks and remuneration. In 1980 and 1990 changes in the ability to charge other than the regular rates were recognised and in 1993, official medical practice guidelines ("RMO") were implemented. Since 1998 negotiations between doctors' unions and the funds failed and mean that only the union of GPs and not specialists sign the convention. Private practitioners are strongly opposed to any control on outpatient expenditures, as it effects how they practice and prescribe, despite that the main part of their income is paid by public funds.

Many problems remain regarding areas such as the following:

- inequality remains among the regions, as there are twice as many specialists in the south of France or in the greater Paris area, than in the north of France
- a great lack of coordination and cooperation exists between the various healthcare actors due to competition between private and public sectors, between out-patient facilities and hospitals, and also between some healthcare professionals themselves.

Recently, incentives have been created to spur the development of managed-care networks ("DNDR"), to build these "missing links", but economical equilibrium has to be found in order to facilitate the process. An Electronic Health Record ("DMP") system is planned to start in 2007, to network and integrate information technology, and would greatly aid modernisation.

Financial Management

As deficits in the healthcare system have been accumulating for the last 30 years, many measures have been progressively introduced to limit health expenditure by regulating the quantity of available care: limiting the number of physicians and number of hospital beds, negotiating prices for ambulatory procedures and regulating prescription drug prices, etc. Since 1990, yearly expenditure caps have been set for some sectors, and prices vary depending on whether or not objectives have been met.

Since 1996, Parliament has determined the national health insurance system's annual budget, and then the amount is distributed to the various sectors (e.g., public, private, ambulatory). Public hospital funds are allocated to the regions to better distribute available care to the needs of the population. Once caps are set, the health insurance funds (private sector) or the government (public sector) are responsible to enforce them, but ineffective financial regulation is worsening the relationship between healthcare providers and authorities.

Future Challenges

Progressively the Bismarckian model of funding is tending to be replaced by a Beveridgian one, and social funding is moving to become less an arbitration between contribution and tax, and more a combination of different taxes (e.g., income tax, corporation tax, VAT, social contributions, etc.). Arbitration in the repartition of these taxes would then become likely and probably animate future political debates in France as in other EU countries.

FRENCH SOCIETY OF RADIOLOGY

PROMOTING THE PROFESSION OF RADIOLOGY IN FRANCE

The French Society of Radiology (SFR), founded in 1909, is a non-profit scientific organisation, actively promoting and safeguarding the highest standards of practice in radiology and the related sciences. It achieves this not only through the promotion of education and research activities in these fields in France, but also through the elaboration and harmonisation of good practices. Current figures reveal that membership levels of the SFR number more than 6,000 professionals in the field of imaging, an increase of 7 per cent over the previous year's level. Overall membership of the SFR has doubled over the past 10 years. The SFR is mainly financed through membership fees, although grants given to young radiologists are financed by the SFR's private-sector partners. The SFR is administered by an Executive Board composed of leading national radiologists from both the private and public sectors, led by Professor Guy Frija, General Secretary of the Board. There are ten employees on the SFR's administrative staff, administered by an Executive Director, Catherine Prop.

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Leading Annual Congress

Among the many achievements of the Society in its efforts to promote the profession of the radiologist and related sciences in France, the SFR holds a yearly congress, the Journées Françaises de Radiologie (JFR), which takes place in Paris every October. The JFR congress is one of the largest of its kind in the world, only second in size after the RSNA congress in the U.S. In 2005, attendance levels reached over 15,900 people, including 2,066 visitors coming from abroad (notably from Belgium, Switzerland, Maghreb, Africa, etc.).

The main scientific focuses of the congress are the enhancement of imaging practices, the distribution of clinical guidelines and to present the latest medical and scientific advancements. In addition, best practice in computer science applications, cost-effective diagnoses, management of radiological departments, and radiation protection are also highlighted during the congress.

This congress also provides an ideal platform in which to hold educational sessions and activities which are CME-accredited and which have a high attendance level. The 2005 JFR Congress included 218 hours of CME-accredited educational sessions, more than 450 electronic posters in all subspecialties, with the ultimate mission of promoting innovation and quality in healthcare. The JFR's technical exhibition, also one of the largest in the world, was spread over 15,000 square metres, with 150 exhibiting stands, including an international societies section.

Publishing and Educational Activities

The SFR publishes its own review, 'Le Journal de Radiologie', of which there are twelve issues per year, along with five medical textbook series. The abstracts of featured articles are available free, and in English, on the SFR website. The SFR also publishes educational materials on focused subjects, such as "Breast Imaging", "MRI Imaging" and "Radiation Oncology", and creates a number of multimedia educational supports through CD-roms and the SFR website. For the past two years, more than 1,000 electronic posters as well as taped conferences shown during the JFR congress have also been made available through the SFR website. Currently there are twenty-seven online lectures on the site on the following subjects: 'Sports-related Imaging', 'Prostate Imaging' and 'Breast Imaging'.

Among its main objectives, the SFR provides radiologists, technicians and other health professionals with CME-accredited educational programmes and materials, whose contents are constantly updated and improved upon. On an international level, the SFR is also deeply involved in providing educational programmes and teaching materials in French-speaking countries with which the SFR has developed a close

cooperation over many years (these include the following: Africa, Algeria, Argentina, Brazil, Canada, Morocco, Israel, Lebanon, Lybia, Romania, Syria and Tunisia). Approximately fifteen young radiologists from these countries are invited and sponsored in full by the SFR to attend the JFR congress in Paris, while others are granted a three-month internship in a French Academic Hospital for specific educational purposes.

Since 2001, the SFR has been involved in the IHE (Integrating the Healthcare Enterprise). The IHE improves patient care by harmonising healthcare information exchanges and provides a common standards-based framework for seamlessly passing health information among care providers. One of the results of this cooperation, has been the French government's agreement to include radiological images in the soon-to-be implemented Electronic Health Record system in France.

Finally, the SFR is strongly supporting the establishment and the development of the European Society of Radiology, of which Professor Guy Frija is the current General Secretary.

Best Practices and Procedures

Regarding the development of good practices and standards, the SFR has given priority to the introduction of important components arising from the EU Directive 97/43 Euratom. In order to achieve this, the SFR has published two essential technical guidebooks, one on best practices and the other on procedures. At this time, the SFR is ambitiously aiming to develop and extend these aspects to the whole of cross-sectional imaging.

The SFR is also engaged in other majors fields within radiology, such as championing an increase in the installation of MRI and CT scans in France; the promotion of new nomenclature; and the drive to include the use of images in the Electronic Health Record system that the French government plans to put into place during 2007.

The SFR, in association with private and public French radiological unions, along with the College of Academic Radiologists, has contributed to the founding of a professional organisation called the G4. The aims of this cooperation are to harmonise strategies for the protection of radiology and medical imaging in France, as well as to present common positions in negotiations with national institutions and other health organisations.

PROCESS MANAGEMENT
IN A RADIOLOGICAL DEPARTMENT

IMPROVING THE QUALITY SYSTEM

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This article focuses on the efforts of the The Department of Diagnostic Radiology of the Hôpital Sud in Rennes, France, in upgrading their ISO 9001 Quality System. The transformation of the department's internal processes allowed workflow optimisation, better identification of processes and a more holistic vision of the department. This approach is essential in today's competitive healthcare climate, which demands quality patient care at the lowest cost possible.

The Department of Radiology and Medical Imagery at the "Hôpital Sud" is part of the hospital of Rennes which services approximately 55,000 patients per year performing about 76,000 interventions. In the previous process management system, patient care was more of a priority than education and research. The department documentation system was structured according to ISO 9000 standards, divided into twenty chapters based on these.
Subsequently, two external auditors were asked to evaluate

the new quality system using major quality standards, the French Movement for Quality (MFQ) and the National Agency for Accreditation and Evaluation of Health (ANAES). Finally, the department documentation system was evaluated by means of two questionnaires: a qualitative one dealing with staff acceptability and a quantitative one on research effectiveness.

Evaluating Process Management

The "process Approach" considers the organisation in terms of flows and successions of transformations adding value to the ISO 9001/2000 certification model which imposes process management and integrates both management and quality assurance. In order to visualise relationships among processes a Data Flow Diagram (DFD) was made, representing the organisation in terms of inputs and outputs.

As a management tool the "process approach" favours results, in the form of products supplied to the hospital's clients: patients, correspondents and students. A process is a transformation that adds value, and takes place between inputs and outputs of the process. The DFD, based on clients' needs, is the systemic representation of these processes. It permits the realisation of the mission of the organisation and requires breaking down each level of transformation into several major processes. These processes are chosen according to their direct link with the organisation's activities. At each step it is recommended to ensure that processes do not generate superfluous data regarding client needs.

In order to effectuate this evaluation MFQ and ANAES standards were translated into tables stating their requirements. Then, the following question was asked: "Does the quality system allow us to know...?" Five possible answers were chosen: no, partially, mostly, completely, and non-applicable (N/A). These answers corresponded respectively to the five columns of the tables annotated 0, 1, 2, 3, and N/A. By listing non-applicable criteria and answering applicable questions we determined the system's percentage of non-applicability as well as its accordance with each requirement.

The DFD was then compiled into a table of contents outlining processes. The major processes became the plan's primary titles and from sub-headings a table of contents was generated. This table of contents constituted the basis for the re-classification of existing procedures and working instructions previously filed into the twenty chapters of the previous ISO 9001 standard. After the introduction of the DFD General Plan into the department intranet, a qualitative evaluation was made by means of a survey of user satisfaction. Quantitative evaluation of the system was made by means of a poll: one week after the launch of the new intranet, a representative sample of the staff was timed in order to evaluate how fast they were in researching their documents.

Benefits of a Data Flow Diagram

The DFD allowed us to better identify the department mission. Its division into four major processes was carried out according to the four chapters of the new ISO 9001 standard, further sub-divided into the following headings:

- "Leading", based on "The Department as a Project", behind the realisation of primary, or leading processes
- "Managing", looking at interaction between management processes
- "Patient Care", based on 'non-conformities' that occur when the patient is under the responsibility of the department, resulting in preventative actions
- "Measuring, Analysing and Improving", based on "preventive and corrective actions" that can be applied in each process

Evaluating the New System

Evaluation according to the ISO 9004 standard showed 2.5% of non-applicability and 95.8% of accordance with standard requirements. Weaknesses related to regular identification of the needs and expectations of clients. Evaluation according to the MFQ standard revealed that the new standard's criteria were all applicable and that the system reached 83.9% of requirements. Weaknesses related to the efforts of staff members, as well as the quality of services offered by suppliers and outsourcers. Finally, evaluation according to the ANAES standard revealed that 64.63% of the standard's criteria were not applicable and that the system reached 93.93% of requirements. Weaknesses related to the management of the patient's registration form as well as that of human resources.

Comments were positive concerning all areas of improvement. A major benefit of process management is that it underlines the real mission of the department of radiology and permits checking suitability between supplied services and the real needs of users. It also eliminates useless processes and data generated by some processes. Involvement of staff was found to be essential, reducing isolation between departments by allowing a better understanding throughout the medical facility.

For the last twenty years, major technological advances have transformed radiology and diagnostic and therapeutic imaging. X-rays no longer constitute the main workload of the radiologist; ultrasound, magnetic resonance and computer assisted devices are some of the many examples that make up a significant part of their diversified daily workload. As well as considering the needs of the patient, the radiologist responds to questions asked by the referrring physician. In constant re-evaluation and transformation, the profession of the radiologist is both dynamic and firmly focused on the future. With a foundation in the diagnostic arena, it is evolving to focus on therapeutic services and the complete management of the patient via interventional imaging. The demands on the modern healthcare professional have magnified the role of technology so that efficiency is one of the major markers of the quality of care provided. Since 1907, the National Federation of Medical Radiologists (FNMR) is confronting these major changes in role and pursuing its various goals as described below.

PROFILE OF THE NATIONAL FEDERATION OF IMAGING PROFESSIONALS

PROTECTING THE INTERESTS OF IMAGING IN FRANCE

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Role of the FNMR

The FNMR's mission is the promotion of liberal radiology, and to represent and defend the interests of medical imaging specialists. Led by President Jacques Niney, and a group of foremost experts in the field, the FNMR is a medical federation which unifies 70% of French medical professionals active in the field of imaging, and counts over 3,800 supporters. Backed by this support, the FNMR guarantees the representation and defence of medical imaging professionals on a world stage of health bodies and public powers.

The FNMR also includes a range of other activities in the form of information provision and services, advice and interventions on behalf of its members. It defends the interests of the profession within the framework of its policy of bringing together and addressing the needs of both general and specialised doctors. As part of its collaboration with the SFR (French Society of Radiology), CERF (French Radiology Resident Advisory Service), and the SHR (Syndicate of Hospital Radiologists), which come together under the umbrella of the 'G4' organisation, the FNMR provides an essential platform for the professional identity of the French radiological community.

Permanent Role and Missions

The FNMR represents and defends the interests of medical radiologists before other world health actors and public powers. In ensuring an efficient imaging service that is accessible by all, the FNMR also represents the interests of patients. It ensures they have access to the best diagnostic and therapeutic imaging techniques, and therefore to a more efficient medical service. The FNMR also works with medical radiologists in the management of their enterprise. It informs its members about the evolution of the profession including IT, legal and administrative issues. In this way the FNMR is paving the future for imaging and healthcare. It has put into place a continued training structure for medical radiologists and their staff members. It contributes along with the SRF, CERF and the SRH, to the application of the Euratom Directives, in particular in the area of radioprotection and justication of acts.

Current Activities

- Development of propositions for coherent and equitable standards for recognition of best practice
- Imaging Observatory
- Senology Observatory
- Quality Mark in Radiology Services
- Promotion of organised activities for breast cancer in partnership with other actors
- Training of medical professionals and personnel from imaging offices under the framework of FORCOMED and the FMC addressing areas such as the management of breast cancer, radioprotection, quality assurance and department management
- Working on behalf of patients to develop access to new imaging technology such as multi-slice CT
- Training of medical professionals in good practices in imaging, working with the guide developed by the SFR with reference to applying European Directives
- Official recognition of entrepreneur status for those in charge of radiology departments
- Recognition of the central importance of imaging to centralised networks in providing healthcare services for patients

More information on the activities of the FNMR can be found at www.fnmr.org

INTERVIEW WITH PROF. DAVIDE CARAMELLA

INTERVIEWEE

Prof. Davide Caramella

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Tell us about your professional background.

I am an Academic Radiologist at the University of Pisa. My main clinical role is in the area of imaging and intervention in oncology. Since several years ago, I have also been involved in research projects concerning information technology applications in radiology. This gave me the opportunity to explore various issues about teleradiology, PACS systems, advanced image processing and internet applications for radiology. Throughout my fifteen years of activity in this field, I occupied different responsibilities at both a national and international level; in particular I was President of EuroPACS and am presently the Scientific Director of Eurorad.

How did you come to be involved with e-Learning initiatives?

When we first wanted to publish scientific content on our university website, it became clear that the hypermedia capabilities of the internet can be ideally exploited for preparing teaching materials for radiology. We therefore initially prepared a resource devoted to the diagnosis and interventions of liver lesions, and we had considerable positive feedback from both physicians and patients. I was therefore encouraged to participate in the European Project 'EURORAD' that started in 1997 by Prof. Robert Sigal, with the aim of establishing the first peer-reviewed pan-European database of teaching files.

How can PACS improve the quality of and access to teaching files?

PACS provides a complete clinical archive of our patients. Those who have clinical histories of imaging findings that are unusual or rare can be easily converted into electronic teaching files. In fact, the images are already in digital format, multimodality examinations are often available and in all cases the radiological report contains the relevant information. Such a multimedia teaching file can be kept within the local system to be used as reference by the local radiologists or can be shared with others via the network.

What sorts of informatics are necessary to support an e-Learning system, and what are the costs involved?

As a matter of fact, PACS providers might add e-learning tools at virtually no additional costs to themselves, and consequently for the users. The issue is that the vendors must realise that we radiologists are getting more and more impatient with systems that do not allow radiologists to access the PACS archive by search criteria different from just the name of the patients, and do not provide functions such as "personal scientific archive". It looks like in the future, these aspects will have a relevant impact on the selection of the PACS vendor.

What do you envisage for the future of PACS, and related teleradiology and e-Learning?

PACS are more and more regarded as a regional facility as opposed to the traditional view of PACS being a resource for distributing images and reports within the hospital. This is due to many factors; hospitals are merging on a regional basis to decrease costs, patients are often seen in different facilities in their region, and subspecialty competence is not homogeneously distributed, etc. As a consequence in future, where regional PACS systems are concerned, teleradiology will be just another PACS function and will progressively be used not only for telereporting but also for e-Learning.

What future developments are envisaged for the continued growth of EURORAD?

EURORAD recently obtained a grant from pharmaceutical company Bracco, in recognition of the educational value of our teaching files, that are published only after having gone through rigorous peer-review implemented by the EURORAD Editorial Board. In the future EURORAD should be integrated in the general process of continuing medical education in radiology. There is no doubt that publishing a EURORAD case, or accessing to a certain number of published cases, allows the radiologist to focus on specific topics and to hone his or her radiological skills.

What are the real benefits for users of e-Learning tools such as EURORAD?

The main advantage is that e-Learning resources have no limitation in terms of number and size of image. In an article published on a printed journal you can have up to a dozen images which usually have "jpeg quality". On the other hand, our department has made available on the web (http://62.101.69.100:8080/archive/index.jsp), an educational resource which contains hundreds of entire diagnostic examinations (up to more than 100 images) in full DICOM format. They can be downloaded and even added to the local archive as reference cases. Limitations of e-Learning are non-existent, when the comparison is made with printed teaching material. On the other hand there are possible limitations if we compare e-Learning with traditional "oral" interactive teaching. The importance of the physical presence of the teacher cannot be underestimated, and this presence will be less frequent as e-Learning applications will have widespread availability.

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HOW TO
TUTOR A PHD STUDENT

BEST PRACTICE IN EDUCATION AND TRAINING OF RESIDENTS

In this article, I will detail how the education and training of postdoctoral students in Hungary is executed, in order to highlight how we are raising standards to ensure the best possible levels of medical excellence and healthcare provision in our country.

How is Education Structured?

Residents in the first and second year of education participate in their internship year with medicine, surgery, emergency medicine and transfusion as the primary focus areas. During this time, the main goal is to teach residents how to understand and participate in the planning of diagnostic strategies, diagnostic algorithms and of course management of patient care. Clinico-radiological and clinico-pathological meetings are also attended by residents.

"The objective of regular training is to have a level of general radiologists with fairly similar core knowledge and skills"

This provides an excellent basis for the second year, which is rotated; it starts with classroom-based education about radiation physics, instruments and radiological techniques, as well as radiation biology, hygiene and protection. Imaging modalities based on analogue and digital (indirect and direct) techniques are extended to cover areas such as PACS, RIS, HIS, intranet, internet, teleradiology and teleconsultation, e-medicine and e-health systems.

Other aspects of education cover topics such as radiological conventional and cross-sectional anatomy, pathology and functional- pathophysiological refresher courses and are practice oriented. The pharmacological refresher course starts with sessions about good practice in contrast media administration, focused on management of high-risk patients, kidney function, hydration, oral antidiabetic medication, etc. Contrast media related reactions and complications and management of drug administration are widely discussed and practical point-of-view lists are prepared.

Special Focus Lectures

One way of highlighting the importance of certain areas to our residents is by offering special lectures focusing e.g., on clinico-radiological aspects of the physics of ultrasonography, including colour Doppler and power Doppler. Management questions related to problem-oriented technical system requirements are extensively discussed. Other highlighted topics are technical details of CT and the relationship between image quality and radiation doses. The success of these lectures means that new topics like MDCT, contrast timing, PET-CT and SPECT-CT have been added. However, only 16-detector raw MDCT equipment is available in Hungary, and though new private PET-CT centres have recently begun here, they are unfortunately independent of universities.

Education in MRI is undergoing rapid changes, while equipment ranges from 0,2T up to 3T at Semmelweis University – although this is

unfortunately independent of the Department of Radiology here. Management questions of patient care and optimal diagnostic algorithms are covered both in a theoretical and practical sense. In the case of USPIO or manganese contrast media and MRI-guided interventions, only a theoretical educational approach is available yet, though we recognise the need for a practical education for our residents.

Educating Future Managers

Explicit management issues are included at this level of education. There are many fundamental areas any good management course needs to address, and in order to do so we offer basic issues like cost-effectiveness and financial/reimbursement topics, relative value units, technical quality control, reporting, medical quality control and auditing. Special focus is given to the relationship with senior colleagues and junior partners on one hand, and collaborations between radiologists and other clinicians.

Amongst the specific issues that result from these collaborations, we delve into the issues surrounding how to achieve successful partnerships with radiographers, technologists and technicians, engineers, physicists, chemists, pharmacists, administrative and supportive workers. Finally, we focus on the relationship with patients and relatives, especially with elderly patients and children, and their relatives. Some education in law is part of the training we offer as well including special topics like work-law, teleradiology and human rights.

We also enable residents to get involved in workflow management questions, such as their future involvement in general radiology and subspecialities without losing long-term professional skills. They receive education on how to use conventional and electronic libraries, how to read books and articles, how to select and evaluate the increasing flow of new information. Scientific research is not obligatory during their training, but most young radiologists prepare small case reports and related overviews of literature at the annual meeting of young radiologists, providing a good basis for future activities in this area. In the short-term, though basic education in scientific research is part of the foundation course, the long-term aim of training in scientific research is to promote young doctors to get interested in a scientific way of thinking, in the follow-up of their cases and in a scientific evaluation of their experiences.

The Next Educational Steps

During the following eleven months of their education, residents focus on learning about other various imaging modalities, such as conventional radiology, ultrasonography, CT, MRI, nuclear medicine, neuro- and paediatric radiology, mammography, interventional and radiation therapy.

The next three years consists of the registrar's period. During this period doctors work under the control of different tutors and consultant radiologists in different subdisciplines. They have regular meetings with their personal mentors. They participate in clinico-radiological and clinico-pathological meetings and regular meetings in smaller groups and once a year a national meeting for all trainees is held. These occasions offer refresher courses held by senior consultant radiologists, and young doctors get the opportunity to make short presentations. Biannual national meetings organised by the Hungarian Society of Radiologists support participation of residents and registrars, similar to the ESR.

A Comprehensive Education

Registrars must cover all subdisciplines: general radiology, head and neck, neuro, paediatric, breast, chest, musculoskeletal, gastrointestinal and abdominal, uro-genital-obstetric and pelvic, cardiovascular, etc. Interventional procedures are divided into two groups depending on core knowledge or core skills. Four more classroom-based one week courses are obligatory during the registrar's period. These courses also cover related issues of management.

There we explain that management in radiology is no longer the business of managers only. Management pervades the daily activity of all radiologists. For example, individual radiologists, who may run just one imaging modality with some radiographers and technologists, are responsible not only for patient transfer, patient care, patient comfort and optimal imaging parameters, but also for reliable workflow. Other important management areas include visual perception using digital or analogue methods, cognitive evaluation and correct interpretation, the clear presentation of findings, consultation and cooperation with clinical partners and pathologists and self education and training of young colleagues. Mistakes and errors in radiology are part of education in management as well.

The objective of regular training is to have a level of general radiologists with fairly similar core knowledge and skills. No additional subspeciality oriented formal training year is offered, but registrars working in special institutions get of course an informal level of deeper training in some subdisciplines.

Board Examinations

Board examinations are general radiology-oriented as well and don't cover subdiscipline orientation. Board examinations in subdisciplines for neuroradiology and of paediatric radiology are organised for either radiologists with special additional training in these fields or for neurologists and paediatricians after they have trained in general radiology. Scientific activity is not an obligatory part of training, but it is popular to give presentations at local and national junior radiologist's meetings. In this way, we have structured the education of PhD students in Hungary to optimise the potential of our pool of upcoming young talent, and to ensure that the future of the profession of the radiologist in Hungary is safeguarded by a foundation in good management practices as well as scientific education.

EUROPEAN CONGRESS OF RADIOLOGY, VIENNA, 3 – 7 MARCH, 2006

With a record number of 16,000 participants, the number of attendees at ECR 2006 exceeded all previous year's levels. This year's congress also saw the highest ever number of attendance in lecture rooms, thirteen percent higher than 2005. Due to high demand, the Foundation Course on Musculoskeletal Radiology had to be repeated. "One of the foundations of ECR's success is the high quality of its scientific programme, which is made possible by the dedication of committee members and speakers," states ECR President Andy Adam.

ECR 2006 Celebrates

Record Participant Levels

Innovation at the Congress

ECR 2006 offered the new service of a digital preview system (EDiPS). EDiPS enables speakers to prepare their presentations, to upload them in advance into the congress venue's computer system, and to test their functionality right away. In addition, it offers the possibility to supplement to the presentations, check their status, and place them on CD-ROM as well as have them included in eECR – ECR's electronic congress. The new system immediately became extremely popular among the lecturers. "This year's congress was a tremendous success", states ECR President Andy Adam. "I'm very proud that we've reached an all time high in participation figures. I would like to thank everybody involved in the preparation of ECR 2006 and the attendees from all over the world. I look forward to seeing you all again in Vienna next year".

The highly popular technical exhibition also extended its success from 2005 and called thousands of visitors from five continents. More than 200 exhibitors showed the latest developments on approximately 25,000 square metres.

ECR 2007 President Announced

Starting from March 8, Professor Christian Herold will take over the ECR presidency from Professor Andy Adam. Professor Herold is the Head of the Medical Diagnostic Division at the General Hospital, Vienna University of Medicine. Professor Herold will be the first Austrian president since Vienna was chosen as a permanent congress venue in 1991. "It's a great honour to be ECR president and it's very exciting to shape the educational and scientific programme for such a great meeting," states Professor Herold, "Preparation for the ECR starts two years in advance so a significant part of the programme – especially the educational programme – has already been developed. With regards to the scientific programme we are ready to send out the request for input of abstracts and next year's social programme will definitely contain some surprises. I'm very excited about the entire programme because we've already received such great input from the members of the programme planning committee and from everybody involved in ECR. I'm sure ECR 2007 will attract huge crowds."

ECR 2007 will also continue its efforts on introducing new innovative features. In 2007 there will be an e-learning initiative where most innovative features of e-learning will be made available for the attendees of ECR.

The 'ECR Meets' countries 2007 will be China, the Czech Republic and Austria. 2007's ECR will take place from March 9 –13, at the Austria Centre in Vienna.

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Medical Doctors (respond below)

1. What is your occupation? (check only one)
   - ❑ Diagnostic Radiologist
   - ❑ Other Physician (please specify)

1a. What is your radiology sub-specialty? (check only one)
   - ❑ General Radiology
   - ❑ Neuroradiology
   - ❑ Nuclear Medicine
   - ❑ Vascular & Interventional
   - ❑ Nuclear Radiology
   - ❑ Cardiovascular Diseases
   - ❑ Paediatric Radiology
   - ❑ Other (please specify)

1b. I am Chief of my Department
   - ❑ Yes
   - ❑ No

Non-physician professionals (respond below)

1c. What is your occupation? (check only one)

Administrator/Manager:
- ❑ Radiology Administrator
- ❑ Radiology Business Manager
- ❑ PACS Administrator

Executive
- ❑ Chief Information Officer / IT Manager
- ❑ Chairman / Managing Director / Executive Director
- ❑ Chief Financial Officer / other executive titles

Other
- ❑ Medical Physicist
- ❑ Academic
- ❑ Chief Technologist / Senior Radiographer
- ❑ Manufacturer
- ❑ Business Consultant
- ❑ Distributor / Dealer

All respondents reply to the questions below

2. In what type of facility do you work? (check only one)
   - ❑ Private clinic
   - ❑ Hospital (check number of beds)
   - ❑ More than 500 beds
   - ❑ 400-499 beds
   - ❑ 300-399 beds

3. With what technologies or disciplines do you work? (check all that apply)
   - ❑ Diagnostic X-ray
   - ❑ Nuclear Imaging
   - ❑ Interventional Radiology
   - ❑ CT
   - ❑ Ultrasound
   - ❑ MRI
   - ❑ Mammography
   - ❑ Bone Densitometry
   - ❑ PACS/Teleradiology
   - ❑ Cardiac Imaging
   - ❑ PET
   - ❑ Echography
   - ❑ Angio/Fluoroscopy

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Key Seminars & Conferences

MAY 2006

15-17 UK RADIOLOGICAL CONGRESS (UKRC)
BIRMINGHAM, UK
www.ukrc.org.uk

24-27 GERMAN RADIOLOGY CONGRESS
BERLIN, GERMANY
www.roentgenkongress.de

JUNE 2006

9 – 10 13TH ANNUAL MEETING OF THE EUROPEAN SOCIETY FOR MUSCULO-SKELETAL RADIOLOGY (ESSR)
BRUGES, BELGIUM
www.essr.org

14-17 15TH WORLD CONGRESS IN CARDIAC ELECTROPHYSIOLOGY AND CARDIAC TECHNIQUES (CARDIOSTIM)
NICE, FRANCE
www.cardiostim.fr

12 – 16 1ST WORLD CONFERENCE ON INTERVENTIONAL ONCOLOGY
CERNOBBIO, ITALY
www.wcio2006.com

14 – 17 EUROPACS 2006
24TH INTERNATIONAL EUROPACS CONFERENCE
TRONDHEIM, NORWAY
www.europacs.net

19-23 EUROPEAN SOCIETY OF GASTROINTESTINAL AND ABDOMINAL RADIOLOGY ANNUAL MEETING (ESGAR)
CRETE, GREECE
www.esgar.org

28 – 1 20TH INTERNATIONAL COMPUTER ASSISTED RADIOLOGY AND SURGERY (CARS) CONGRESS
OSAKA, JAPAN
www.cars-int.org

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.euroson2006.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

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CONGRESS 2006
MIR
MANAGEMENT IN RADIOLOGY

MANAGEMENT IN RADIOLOGY CONFERENCE 2006

9TH ANNUAL MEETING

October 5 – 7, 2006
Budapest, Hungary
Venue: Hotel Sofitel****
Local Organiser:
Prof. Andras Palko, HU
Prof. Adam Mester, HU
Organising Secretariat:
Antonio Santoro, IT

Submission of abstracts invited before August 20, 2006

Visit www.ewgmr.org

Registration fee waived for participants with accepted abstracts.
Junior Radiologists (under 35): no fee required.

MIR represents a dedicated arena for the discussion of service delivery and management issues specifically tailored to the needs of radiologists in Europe.

This annual meeting is a crucial date in the schedule of any radiologist, in charge of running a department and interested in management issues.

Organized by Subcommittee on Management of the European Society of Radiology.
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Topics include:

- Radiology Department Organisation
- Teleradiology, RIS-PACS Interaction
- Electronic Management of Radiological Data
- Academic Radiology: Teaching & Research
- Leadership
- Turf Battles & Partnership Strategies
- Emergency Radiology
- Standards
- Medico Legal
- Quality Issues
- Change Management
- General Management: Teaching & Reflection