IMAGING Management

Promoting Management and Leadership in Medical Imaging

Volume 9 Issue 1
2009

ISSN = 1377-7629

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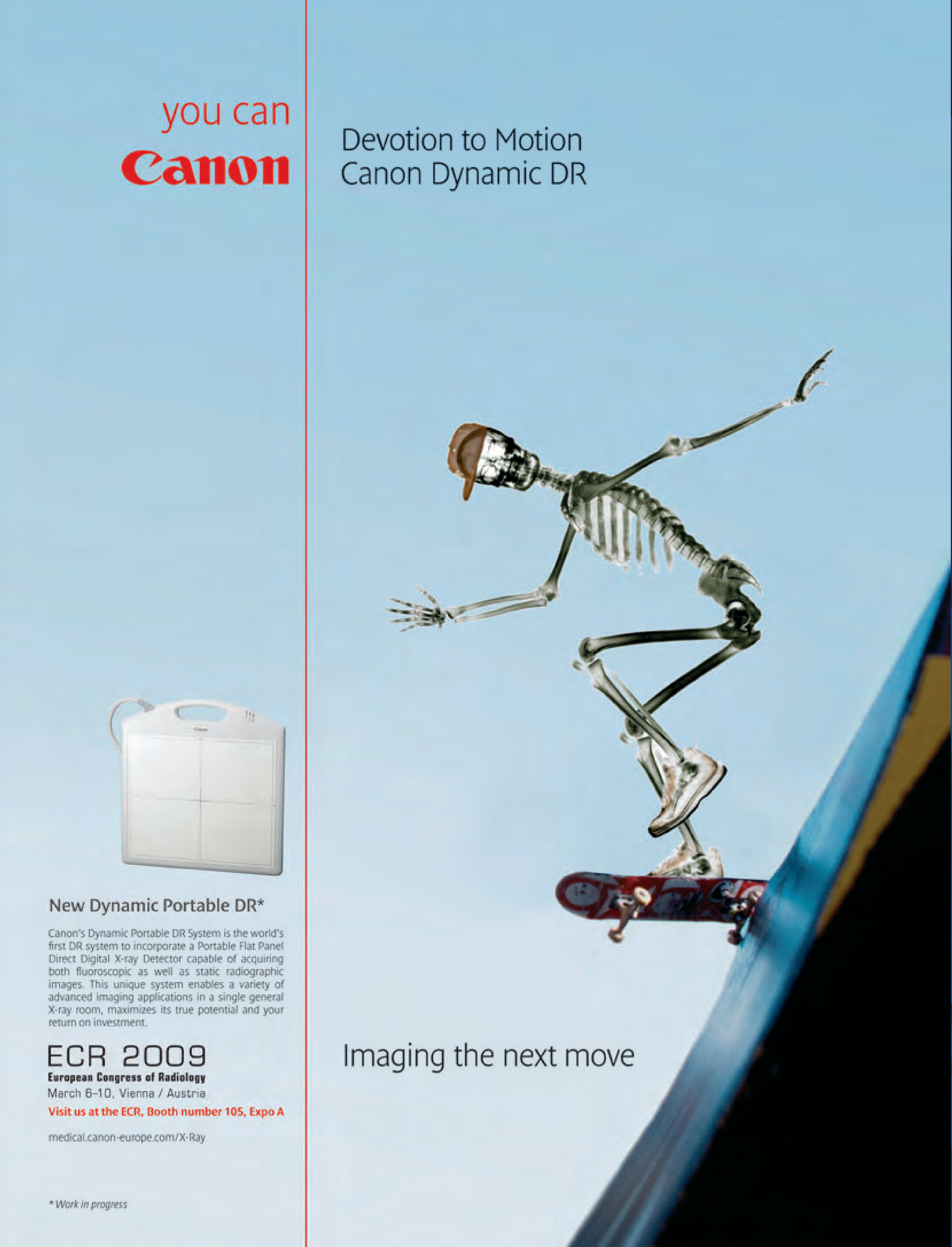
MIR Leads Radiology Into 2009

TOP MANAGEMENT TRENDS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Imaging the next move
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Prof. Iain McCall

Editor-in-Chief

editorial@imagingmanagement.org

Dear readers,

In this issue of IMAGING Management, we cover the top three papers presented at 2008's Management in Radiology (MIR) congress. Included is a focus on the explosion in the demand for ultrasound (US) exams, and the impact it is having on managers in imaging departments. Also, the selection includes a paper on the techniques used by private imaging practices in running their facilities: their common aim is to share and explore the need for better management practices through discussing the evolving challenges and the guidelines that we can take away from those.

President-Elect of the World Federation of Ultrasound in Medicine and Biology (WFUMB) Prof. Michel Claudon, gamely speaks out as a pioneer and luminary in the field of US. His presentation notes that US's range of uses has constantly expanded over the years from the initial focus of obstetrics and gynaecology to include the abdomen, musculoskeletal and vascular system and the heart. Endoscopic US has further increased its range of uses and has proven a valuable means of real-time guidance for biopsies and injections. Radiologists are urged to take notice of this growing trend and to think of ways for the profession to capitalise on it.

Initially, US equipment was expensive and the resolution limited, but developments have resulted in a wide range of scanners, some of which are inexpensive but limited in their use while others are much more complex multipurpose, high-resolution and expensive. As a result of this growth, US is now used by a number of clinical specialties and has become in certain situations, the equivalent of the stethoscope to some clinicians, especially as there are no radiation hazards.

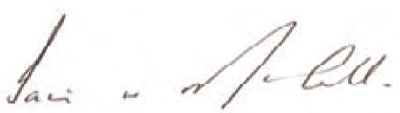
Healthcare managers face challenges such as the proliferation of equipment, the staffing requirements to use it, the training of users and ultimately the clinical effectiveness and diagnostic accuracy for the patient. There have also been differing views regarding the use of US across Europe where in some areas radiologists are not officially recompensed for undertaking US, whereas in other areas they are the main providers.

It is therefore wise to review the provision of US based on the type, frequency and cost of the task to be undertaken, the availability of properly trained staff and what that training should entail. It is also important to weigh up the alternative imaging options and to ensure that the operator appreciates the full extent of information revealed on an exam.

Present experience indicates that obstetric and cardiac departments are heavy US users and require dedicated and good quality equipment while anaesthesia often requires relatively simple equipment for the placement of central venous pressure lines. There is greater debate in terms of gastroenterologists and orthopaedic medicine and surgery, heavy but less consistent users whose requirements vary, resulting in difficult choices of equipment and focus.

In order to avoid the proliferation of expensive and underutilised US scanners operated by either inexperienced or infrequent personnel, it seems managerially wise to centralise the sophisticated and expensive equipment in the imaging department performed and managed by professionals who are widely trained in its use to maximise clinical- and cost-effectiveness. This allows developments to be assimilated and organised in a safe way so that standards are maintained and the resources that are committed to the new techniques, particularly contrast agents, are controlled and effectiveness maximised.

However, the importance of rapid access for diagnosis and treatment must be recognised and built into operational pathways with the emphasis on one-stop clinics and primary care. Radiologists must also be prepared to take on and explore the challenges of the modality while continuing to provide primarily a system-based service.



Prof. Iain McCall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How long was the report turnaround time last week?
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What's the difference
between imaging and
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Booth 22

Management In Radiology (MIR)

Update From MIR Winter Course

Management in Radiology (MIR), a subcommittee of the European Society of Radiology (ESR), recently held a challenging management workshop in La Thuile, Italy, from January 15 – 17, 2009 that aimed at sharing the effective management techniques used by top industry managers with leaders in a healthcare setting.

Organised and led by Dr. Nicola Strickland, Chairman of MIR, the programme, with both educational and interactive elements, revealed the secrets of the following three management methodologies:
- The DISC Inventory, which teaches managers how to better understand what motivates employees and how to effectively deal with them;
- The Change Acceleration Process (CAP), GE's proprietary Change Acceleration Process. CAP is a Model, Process and Tool/Skill-Set for increasing acceptance and commitment to changes, and
- LEAN, a methodology aimed at reducing waste, eliminating bottlenecks and improving quality.

Teaching Sessions Prove a Success

The Thursday morning session was an analysis of DiSC, which classifies individuals into four primary behavioural styles: Dominance, Influence, Steadiness and Conscientiousness. Delegates were asked to submit an electronic personal DiSC analysis in advance of the course, which revealed their natural and adaptive DiSC profiles. These were used to discuss what motivates their colleagues, and themselves and based on this to recognise how best to conduct themselves and how to deal with colleagues most effectively.

The next sessions concentrated upon CAP and LEAN methodology. The delegates chose various medical workplace scenarios and problems in which to apply and work through these concepts. The last session addressed the issue of the five dysfunctions of a team and how to avoid and overcome these. The requirements for building up a good team within healthcare were explored.

Management in Radiology (MIR) Preliminary Programme

"Making Imaging Relevant"

MIR have announced the line-up of topics for their forthcoming conference to take place in Riga, Latvia, from September 30, to October 2, 2009. Abstracts will go online March 27, 2009 and further details will be forthcoming on www.mir-online.org.

Wednesday, September 30

Session 1 – Imaging in the Baltic States: Latvia, Lithuania & Estonia
Session 2 – How to manage low budget imaging: Investment strategy; Departmental financial management; Hospital and countrywide healthcare management

Thursday, October 1

Session 1 – SCARD: North American imaging management; Current concerns.
Session 2 – Managing the public face of Imaging: Medical professionalism in imaging; Ethics and imaging; The role of the professional radiographer; How hospital managers assess imaging; How to interface with clinical colleagues.
Session 3 – Making tele-imaging relevant: Virtual imaging – the case in favour; Virtual imaging – the case against; Pitfalls.
Session 4 – Making imaging IT relevant: Integration of digital teaching files into PACS; Audit trails: what we need; Patient consent/opt out: what we need; Balancing governance (quality) and service delivery (quantity); IT for the MDTM (multidisciplinary team meeting).

Friday, October 2

Session 1 – "An imaging decicion, which has made a difference to imaging management": Six five-minute presentations from presenters; followed by a one-hour floor discussion.
Session 2 – Managing imaging equipment: Bringing an idea to market; How to choose equipment: radiological perspective; How to choose equipment: industry perspective; Single vendor-managed service: industry perspective.

www.mir-online.org

Integrating the Healthcare Enterprise (IHE) Europe

IHE Connectathon Update

The IHE-Europe Executive Board is pleased to announce that the Ninth Annual European Connectathon will be held in Vienna, Austria from April 20 - 24, 2009. Hosting the Connectathon will support the Austrian IHE initiative in further developing their presence in the healthcare interoperability community, according to IHE co-chairs Peter Kuenecke and Karima Bourquard.

The Connectathon is a connectivity marathon during which systems exchange information with complementary systems from multiple vendors, performing all of the transactions required for the roles they are implementing. At the IHE Connectathon, all companies that have implemented IHE's Technical Framework specifications in their products, have the chance to test them with many other companies' products in a real interoperability environment.

The results of the Connectathon will be published in the connectathon results table on the IHE-Europe website. Vendors may use the IHE integration statements to show the compliance of their products with the IHE integration profiles.

Parallel Workshops

Parallel to Connectathon 2009, IHE Austria and the University of Applied Sciences Technikum Vienna will offer a series of workshops entitled "Sharing Clinical Documents and Integrating Workflow: Practical Solutions from Integrating the Healthcare Enterprise (IHE)". The workshops are organised in two tracks, one for users of health IT and another for vendors of such systems. The User Track is categorised as follows:

- Clinical Content User Track: Designed to show healthcare professionals the benefits of using content profiles in clinical work and will be of interest to suppliers and those involved in planning the implementation of healthcare IT systems.
- Management User Track: Designed to inform CEOs, CIOs, Financial Directors, Clinical Directors, IT/ICT Directors and Managers, of the benefits of this efficient and cost-effective implementation of technology for the enhancement of communication within healthcare in Austria and Europe and will be of interest to suppliers and those involved in planning the implementation of healthcare IT systems.

For vendors, the Vendor Track is designed to inform vendors about the IHE development process and how they can stay at the cutting edge by being part of it. It will be of interest to software suppliers and those involved in planning the implementation of healthcare IT systems.

www.ihe-europe.net

FUJIFILM MEDICAL IMAGING

Enhancing the Quality of Life of People world-wide

Innovative Medical Systems:

In medical imaging systems of the company such equipment and materials as computed radiography (CR) and digital radiography (DR) are strongly developed. Amid the steadily growing use of IT, related to medical facilities, SYNAPSE, the medical-use picture archiving and communication systems are very successful. Additionally the company is advancing with moves to create comprehensive healthcare functions by supplementing the field of diagnosis to prevention and pharmaceutical treatment. Highlight in DR is the new MAMMO System AMULET, a completely new innovative x-ray detector in mammography.

The new mammo DR system

Fujifilm has developed a completely new kind of x-ray detector that represents a breakthrough for upcoming applications in digital mammography.

■ World's best resolution for detectors of its kind

The detector uses two substrate layers of amorphous selenium and, at 50 µm pixels, offers the world's best resolution in detectors of its kind. A sharper picture and improved signal/noise ratio result, making for significantly enhanced imaging quality in breast cancer diagnostics.

■ High pixel density and improved signal/noise ratio

The x-rays are converted into electric signals in the first layer, and are then detected in the second layer with the help of an optical switch and presented as an image. The procedure reduces the amount of time needed for erasing and re-exposing the detector, accelerating the overall exam workflow

AMULET

■ Optical Switch – as new development

New procedure for selenium vacuum storage generates extremely pure selenium layers with an even thickness across each layer. Light is used as a switch for detecting electric signals. The data is thus read out from the detector directly, without first being converted. It enables the operator to lower the radiation dose while improving diagnostics and the efficiency of the examination.

■ Specifications

- High DQE, high MTF
- Optimised compression feature
- More convenience and safety for the patient
- Detector method: a-Se with optical switch
- Exposure interval: approx. 20 s
- Pixel size: 50 µm
- Grey scale: 14 bit
- Image display after: approx. 10 s
- Availability: end of 2008

www.fujifilm.eu

FUJIFILM

Association News

Cardiovascular and Interventional Radiological Society of Europe (CIRSE)

2009 Congress: Lisbon, Portugal

The CIRSE Annual Scientific and Postgraduate Educational Meeting is a unique forum where medical professionals will meet colleagues from all around the world to exchange ideas and information in the field of minimally invasive, image-guided therapies. The best recent scientific developments and novel research will be presented in more than 100 hours of sessions and workshops.

The annual CIRSE congress is the European showcase of this medical specialty. It has developed significantly over the last four years, both in size and quality. According to CIRSE President, Prof. Jim Reekers, "It is what shows us that there is a plus ultra, a further beyond which we must always strive for, just as the explorers before us. Uniting interventional radiology around the world is another key element for the success of our congress. It is also one of the main aims of our association". He adds: "I am therefore particularly happy to announce that Brazil recently decided to become a CIRSE Group Member, thus adding the biggest South American nation to our global network. At CIRSE 2009 we will welcome Brazil to our "CIRSE meets…" sessions and I very much look forward to meeting our Brazilian colleagues in the land of their ancestors".

A second "CIRSE meets…" session unites representatives of the European Association for the Study of Diabetes (EASD) who will present topics of interest to interventional radiologists, dealing with peripheral vascular disease. Last year's successfully launched patient awareness exhibition, which was complemented by a press conference for patient awareness groups and a programme to present interventional radiology to young residents will become a permanent feature of the scientific programme.

www.cirse.org

Computer Assisted Radiology & Surgery (CARS)

Preliminary Programme Details

The CARS congress with its associated journal, the International Journal of Computer Assisted Radiology and Surgery, is focused on research and development for computer assisted systems and their applications in radiology and surgery.

The main themes emphasised in the CARS programme are established by an interdisciplinary and international group of experts from healthcare institutions, academia and industry, world-renowned for their work on innovative methods and technologies in medicine. These are members from the ISCAS, EuroPACS, CAR, CAD, CMI and CURAC societies, who are active in the various committees of CARS, and in particular, who have successfully presented novel approaches at CARS congresses.

The CARS Congress Organising Committee invites you to join them in Berlin in June 2009, if you work in the fields of radiology, surgery, engineering, informatics and/or healthcare management, and have an interest in topics such as image guided interventions, medical imaging, molecular imaging, image processing and display, computer aided diagnosis, surgical simulation, surgical navigation and robotics, as well as new PACS applications, including infrastructures adapted for surgery. Clinical specialties represented at CARS include:

- Image Guided Tumour Ablation Therapies
- Cardiovascular Imaging
- Computed Maxillofacial Imaging
- Computer Assisted Radiation Therapy
- Computer Assisted Orthopaedic and Spinal Surgery
- Computer Assisted Head and Neck, and ENT Surgery
- Image Guided Neurosurgery
- Minimally Invasive Cardiovascular and Thoracoabdominal Surgery

www.cars-int.org

ECRI Institute

Devices Sourcebook Now Available

ECRI Institute has announced the publication of its 2009 Health Devices Sourcebook and updated Health Devices International Sourcebase Online. Both resources help healthcare professionals locate medical device manufacturers, suppliers, and service companies as well as medical products.

ECRI Institute's 2009 Health Devices Sourcebook lists complete contact information for more than 6,800 US and Canadian manufacturers, distributors, and service companies. Data is indexed by categories such as product listings, trade names, manufacturers' product lines, equipment services, service company profiles, and a master company list. Executive contacts are also included.

Sourcebase, an online database updated twice a month, indexes 15,000 worldwide manufacturers and distributors of medical devices—from surgery equipment to healthcare information technology. Through the searchable database, users can view typical price ranges and cross-reference terms, commonly used names for each device, and device descriptions. The database's supplier profiles contain general company information, including their history, annual sales, and financial information as well as executive contacts with direct email links, where available.

www.ecri.org

EUROPE'S HEALTH DATA EXCHANGE PILOT

PROJECT ENABLES SECURE ACCESS TO PATIENT HEALTH INFORMATION

The EU Member States still have their own systems of storing healthcare information; yet these systems often cannot communicate or exchange information between each other. According to the epSOS team, this situation should come to an end. The project is set to run for three years and in the end, anyone who falls ill in one country should have access to his or her health information in other European countries.

European Commission an Active Supporter

In support of this idea, Fabio Colasanti, European Commission Director General in charge of Information Society and Media confirmed that the challenge of increasing mobility of European citizens in the context of healthcare has already been addressed by the European Commission. He states that *"together with the launch of its proposal for a directive on the application of patients' rights in cross-border healthcare, the issue of its July recommendation on the cross-border interoperability of electronic health record systems and the start of the epSOS pilot, the European Commission is laying the groundwork for improved healthcare options for travelling EU citizens."*

Therefore, the key issue addressed by the epSOS project is that of interoperability. Seeing that some countries still struggle with interoperability within their own national boundaries, the large-scale pilot is trying to identify, and later to test "the relevant tools to make things happen." Within this context, two key cases for cross-border communication have been identified.

Patient Summary

Analysing two situations (on the one hand, the case of an occasional visitor in a foreign EU country, and on the other, a regular patient using medical services of a country other than that of his/her origin), the benefits of epSOS can be easily identified. In the first case, the occasional visitor is a person on holiday or attending a business meeting, for example. The key characteristic is that this type of visit is irregular, infrequent, and may not be repeated. Under the circumstances of an incidental encounter with the healthcare professional, one of the major problems arising is the lack of a previous medical record of the person seeking care.

A routine case can, however, be best exemplified by someone who lives in one country but works in another. The distinguishing characteristic is that this type of visit is regular, frequent, and the person seeking care may be accustomed to using services in the country where he/she works as a matter of personal convenience. This is a type of situation where the healthcare professional may have some information available from previous encounters. However, in both cases, epSOS aims to provide European citizens with the possibility to travel safely all around Europe and have optimum care in case of emergencies.

ePrescription

Within the cross-border prescription area, there are two basic use cases. The first one concerns patients who need medicine that has already been prescribed at home when they are abroad. In this case, the pharmacist should be able to electronically access the prescription from the same e-Health interface used for prescriptions ordered in the local country. When medicine is provided to the patient, the system should notify the home country node of the foreign patient about the dispensed drugs.

The second use case is aimed at the medical professional who decides to prescribe medicine to a visiting patient from another country. In order to help the medical professional make the best decision on the pharmaceutical strategy to be used, the patient's medical and pharmaceutical history from his/her home country will be available through the patient summary. When the electronic prescription is finalised, a copy of the prescription should also be sent to the patient's national node for inclusion in the national medication summary.

Based on these two key cases for cross-border communication, the methodology will strive to build a common architecture and core services for the identification of users and institutions, security and confidentiality aspects, and aim to enhance various semantic aspects of the systems. These technical activities will be prefaced by an indepth analysis of the need for the creation of an appropriate legal and regulatory framework to enable field-testing.

Conclusion

epSOS is the first European eHealth project clustering such a large number and variety of countries in practical cooperation. The countries involved in the epSOS project are Austria, the Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, Slovakia, Spain, Sweden and the UK. Connecting what already exists, this pilot project represents a great incentive for the Member States, as they have to turn their heads towards their electronic health records systems and see what can be shared.

For more information, please visit:
www.epsos.eu

What is epSOS?

epSOS (Smart Open Services for European Patients), previously known as S.O.S. – "Smart Open Services - open eHealth initiative for a European large scale pilot of patient summary and electronic prescription" - is a Europe-wide project organised by 27 beneficiaries from twelve EU Member States that includes ministries of health, national competence centres and industry. It will run for 36 months from July 2008. The key goal of epSOS, developed under the Competitiveness and Innovation Framework Programme is to build a practical e-Health framework and ICT infrastructure that will permit secure access to patient health information, especially on a basic patient summary and ePrescription, between European healthcare systems. From this perspective, epSOS's parallels the nationwide health information network (NHIN) already underway in the US.

Acies

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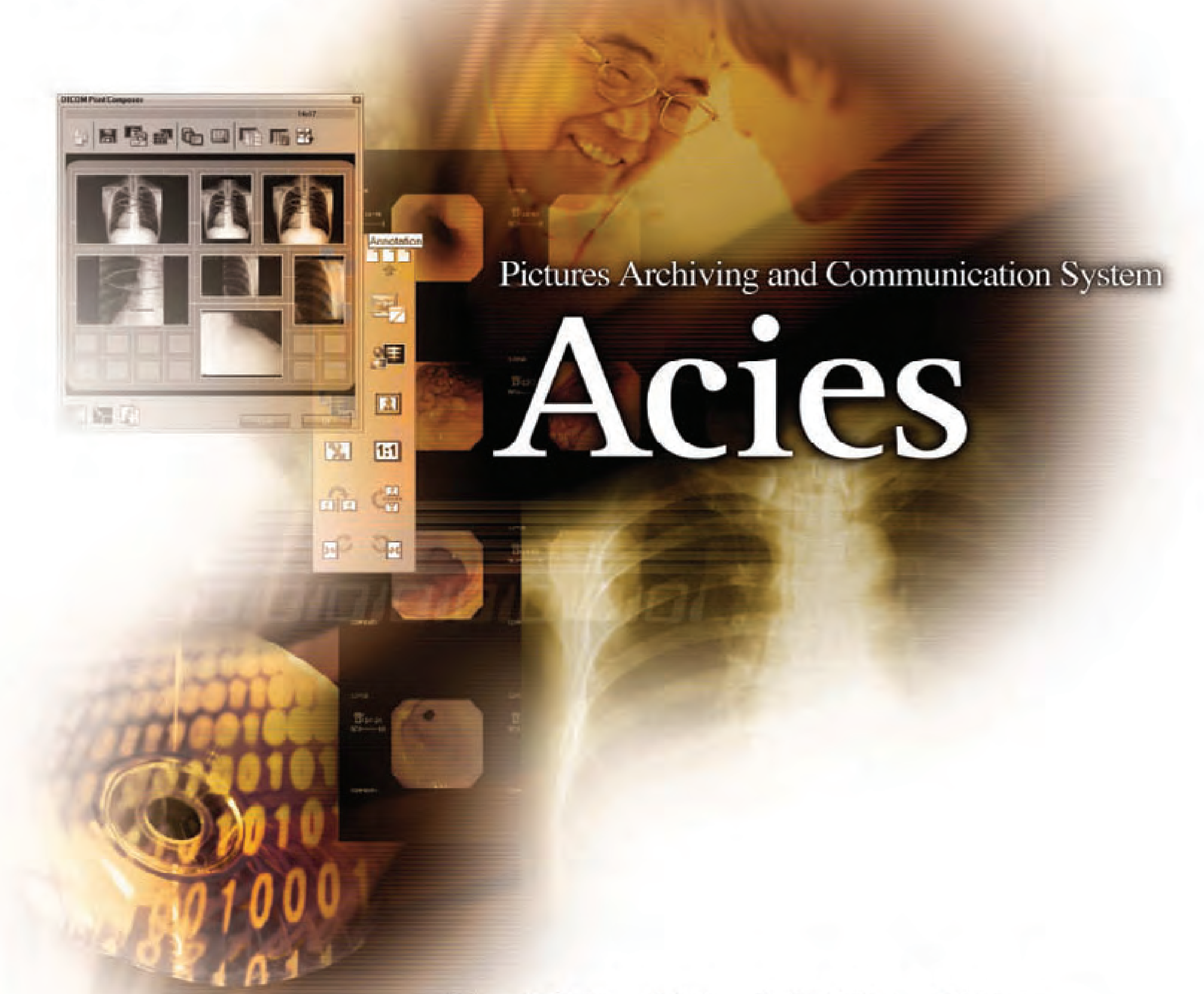

Pictures Archiving and Communication System

Acies

Picture Archiving and Communication System -- Acies is a Server/Viewer system with high functionality. Medical images generated from all modalities are unified and stored on to a RAID server that can manage data at Terabyte levels while ensuring consistency of information. Helps high capacity image diagnostic imaging relying on simple, high-performance viewer functionality. Web transfer of stored images inside hospital, and also offline link between hospital and clinic. Has selected NAS for backup or storage capacity extension. The simple but high-performance system -- Acies.

KONICA MINOLTA MEDICAL & GRAPHIC IMAGING EUROPE BV.
Frankfurtstraat 40 - 1175 RH Lijnden, The Netherlands

The essentials of imaging

A NEW CLINICAL SPECTRUM IN ULTRASOUND

Opportunities Expand for Radiology

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Ultrasound (US) has a long history within medicine since 1798, when Spallanzani suggested that bats move using their ears. With a mean annual growth rate of 8% in recent years, it has since metamorphosed into lucrative business. For example, a 2007 survey conducted in France, showed that US is the second greatest of imaging expenses for private radiology with a rate of 31.8%, just behind CR/DR (38.8%) but far ahead of CT (12.2%), MRI (9.4%) and nuclear medicine (4.5%) for a total of 2,986 million euros. Furthermore, the global US market represented an income level for industry of approximately 4.5 billion dollars in 2006. In this article, I will provide an overview of the latest advances and explain why radiologists should capitalise on this expanded market.

The global ultrasound market is roughly twice that of CT (in dollars). The reasons are clear: US machines, although much less expensive than CT, MRI and PET machines, enjoy much greater diffusion. There are, in most countries, no restrictions on equipment purchase, and every physician may have access, with little need for sharing equipment. In addition, patients enjoy similarly rapid access to machines, real-time imaging and close contact and cooperation between the operator and the patient. This explains why, apart from radiologists, many clinicians consider ultrasound to be a useful evaluation in a wide spectrum of pathological conditions. For some, the US machine is expected to become the "new stethoscope".

Advances in Image Quality

Image quality improvements have come about from factors like the sophisticated architecture of probes and ceramics, a fully-digital acquisition chain, wideband transducers, complex pulse generation, and the introduction of compound and harmonic modes. For a given case, the total examination time remains approximately similar, but provides a better image quality and more confident diagnosis. Investment costs are stable for high-end machines (100 – 200,000 euros), and have decreased for middle-range machines (50 - 80,000 euros). Revolutionary portable units are characterised by low weight, electrical autonomy and image storage capabilities, and good image quality. Available for a reasonable price (10 – 60, 000 euros), this new segment represents approximately 10% of the global US market.

Improvements in Flow Imaging

Improvements in flow imaging are due mainly to the increase in doppler sensitivity to slow flow, allowing demonstration of flow in small and/or deep vessels. The main question with doppler is the "human cost" of the US exam, which usually lasts long and requires expertise. This cost has be balanced with the cost of a CT or MRI exam, which is more expensive but appears less operator-dependent and unhampered by obesity, bones or gas. In that regard, doppler modes would be used as a complement for the evaluation of haemodynamics of a lesion detected on CT or MRI. This management should be considered by radiologists, though only presently emerging.

> **"The ultrasound world market is roughly twice the CT market"**

3D Imaging

3D imaging is a well-assessed modality for foetal imaging since a few years, providing striking images of prenatal anomalies. More recently, Beryl Benaceraf from Boston showed that this new mode would improve both efficiency and confidence. She found that "The standard foetal anatomic sur-

vey can be performed in less than two minutes with 3D volume US, and the volumes can be interpreted in six - seven minutes, compared with a mean of 19.6 minutes to perform standard 2D US".

This opens the door for a tremendous change in daily practice and workflow, being associated with a short acquisition time and a delayed post-treatment and reporting phase. This allows more convenient comparison between successive exams and improves patient follow-up. 3D techniques are slowly moving to general radiology, with increasing applications in the urinary and biliary tracts, the heart, etc. Some papers have already reported a lower interobserver variability using 3D versus 2D traditional techniques.

Contrast-Enhanced Ultrasound

Contrast-enhanced ultrasound (CEUS) is based on the intravenous administration of microbubbles, which increase the backscattered signal. Despite important disparities between countries, this technique is slowly maturing with the increasing use of second-generation agents, allowing real-time imaging of organs at very low output levels. Using specific non-linear sequences, it is possible to display macro and micro-vascularisation with a high frame rate.

> **"Each radiologist has to promote the increased quality and visibility of radiological US in his/her environment"**

Primary clinical applications include focal liver lesions' characterisation and detection, renal parenchyma lesions, pancreatic tumours, vesico-ureteral reflux, abdominal blunt trauma and transcranial doppler. The market for the main agent labeled in Europe for general imaging and cardiology (Sonovue® from Bracco, Italy) shows a current annual growth rate of approximately 17%.

The consequences on patient management are significant and need an adaptation of the workflow in imaging departments: e.g., placement of an IV line, assistance of a nurse or a technician for injection, longer examination time, need for long clips storage (total exam often > 1 Go), and time for the radiologist for the post-treatment phase. Unfortunately, there is no economic model covering all the expenses in most European countries, and generally only the cost for the contrast agent (~ 90 euros per vial) is reimbursed. Multicentre medico-economic studies are ongoing in several countries, and should justify an appropriate reimbursement price for the CEUS examination itself.

Where Will These Advances Lead?

Each of these advances potentially lead to new turf battles between radiologists and clinical specialists. An example is musculoskeletal ultrasound, which is increasingly used by rheumatologists. Also, US is now widely recommended as a control method for IV line placement. Therefore, there is recent pressure from anaesthesiologists and ICU physicians to acquire machines, with potential competition with the radiology department. Portable units are used increasingly outside the traditional hospital circuit, including emergency cases, with the expectation of better management of many patients in the most critical situations, as recently supported by emergency specialists.

What Do Radiologists Need to Do?

In this competitive world, the contribution of radiologists should be firmly assessed. For radiologists, ultrasound is and should stay as an imaging technique. Radiologists often have the best technical expertise, and are in the best position to propose the most appropriate diagnostic imaging method in a given case, without any interest in self-referral. As a result of subspecialisation, they offer expertise in all clinical fields, and are highly trained in post-treatment in different imaging modalities.

Most radiology departments as well as private radiologists offer a 24/24h service. However, the increasing clinical demand for ultrasound as well as new technical capabilities should be taken into consideration. Department organisation should be adapted, and resources optimised. Radiologists should be ready to more widely delegate some tasks to close staff members, e.g, in some countries sonographers have been introduced. Communication is also essential, with the objective to show the fiability of ultrasound data, often demonstrated but ignored by referring physicians! This can easily be achieved by circulating selected information through the institution or regional networks.

Win-win solutions with corresponding clinical teams are often more productive than turf battles, but radiology needs to stay a strong actor in the ultrasound field. Each radiologist has to promote the increased quality and visibility of radiological US in his/her environment.

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- Complete this form and fax it to +32 2 286 8508.

In order to qualify please fill in the questions below:

Medical Doctors (respond below)

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

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

1b. 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)

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

PRIVATE PRACTICE TRENDS IN THE UNITED STATES

Will Increasing Competitiveness Weaken the Profession?

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Certain trends are notable in private practice radiology in the United States (US), including a shift toward larger practice sizes, greater use of teleradiology, and a move toward commoditisation. In this article, many important elements of private practice radiology in the US will be reviewed with the goal of allowing comparison with other practice models elsewhere in the world.

An estimated 26,800 post-training radiologists were active in the US in 2003 (Cohen 2005). An ACR (American College of Radiology) survey shows that they are working in a variety of practice types: the most common is private single specialty practices (57%), followed by private multi-specialty (20%) and academic (18%). At the present time, the common radiology practice types in the US include:

- Private single-specialty practices employing one or more radiologists;
- Private multi-specialty practices consisting of several different types of physicians including radiologists working together, often in a clinic setting, near or attached to a hospital. Academic practices are a form of multi-specialty group practice associated with teaching institutions;
- Government practices, associated with Veterans Affairs or Military Hospitals;
- In some settings, radiologists have been hired directly by hospitals to provide care to patients, and
- Finally, radiologic services can be provided through locum tenens and other independent contracting arrangements.

Trends in Practice Settings

Different types of practice settings include single regional hospitals or tertiary care facilities, smaller suburban hospitals, rural hospitals, single or multispecialty clinics, free-standing imaging centres, teleradiology, or a combination of settings. The same ACR survey examined practice location with the most common setting being the main city of a small metropolitan area (33%) followed by the main city of a large metropolitan area (30%) and suburb of a large metropolitan area (21%).

Practice size has been changing over the past several years, with trends toward larger-sized practices increasing, especially during the period from 1990 - 2000. While practices with one - four radiologists are not extinct there has been a slight decrease to 29% from 22% from 1990 to 2007, while practices with greater than 30 radiologists have increased from 5% to 19% over the same period.

Groups with greater than 60 members have seen the largest growth since 2000. This may be because larger practices have advantages, including greater economies of scale, allowing better deals on capital purchases and greater access to quality marketing and management services. Also, the leverage to negotiate with providers increases with size, allowing larger groups greater flexibility when contracting with hospitals and insurers. Larger groups are able to subspecialise and adapt to practice changes more easily. Since one radiologist can still cover a night on-call in most groups, call coverage is potentially less frequent in larger groups although this has become less of an issue with the growth of teleradiology.

> **“The greater time required for management is often under-valued by radiology group members”**

Disadvantages of Larger Practice Settings

Increased group size has the disadvantages of increased management complexity, especially with making group decisions, and with communication of issues to group members. Larger groups may foster less personal identity and lead to decreased tolerance of risk or sacrifice on the part of the individual members. The greater time required for management is often undervalued by radiology group members, even leading to resentment of group leaders who may be required to spend time away from the daily group activities. These management activities can have critical importance to the financial prosperity of the group. Many groups, therefore, employ non-physician managers.

How are Radiology Services Paid For?

There are several options for payment for radiologic services in the US including private insurance, Medicare, Medicaid, self-pay, or no-payment (indigent care or charity care). The process of image acquisition to actual payment for services can be complex but some important points can be made regarding certain steps in the process. In our practice, the patient's financial information is collected from the patient at the point of service and shared between the facility and our billing office.

The type of procedure performed is recorded using the Current Procedural Terminology (CPT) code set and the diagnosis is recorded using the International Classification of Diseases 9th revision (ICD-9) code set. The procedure and diagnosis codes and the patient's personal information are submitted on a standard form to the insurance provider.

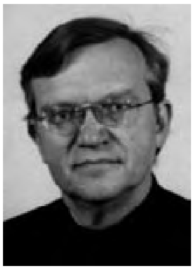
Typically, two claims are submitted, one by the radiology billing office for the professional component of the services and one separately by the hospital or imaging facility for the technical component of the service. The technical component compromises the majority of the total fee (often 75 - 80%). Compensation for the exam is based on the CPT code with Medicare/Medicaid rates determined by the federal government. Private insurance companies typically contract with radiology groups to reimburse at a negotiated percentage greater than Medicare rates. Claims are then carefully reviewed. Insurance companies employ powerful software filters and medical directors who evaluate patient eligibility, provider credentials, and medical necessity.

Accepted claims are reimbursed for a percentage of the billed service and rejected claims are sent back for review. The rejected claim must be corrected and resubmitted and this process may have to be repeated many times. Submitting claims quickly and accurately is therefore very important to avoid rejections. Payment is typically due by 30 days but often can take 45 - 60 days. Periodic audits are very important for groups to maintain quality control and assure payments are appropriate and timely.

>*Continues on page 20*

PROS AND CONS **OF PRIVATE VERSUS PUBLIC IMAGING**

The Case in France



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Around 2,000 radiologists in France work in public hospitals, while there are about 5,000 radiologists in private practice. This national bias towards a private radiology system has given us much opportunity to discern the advantages of a competitive structure for the delivery of imaging services, and to comment on the jungle of administrative burdens and various healthcare policies that hamper it.

In France, healthcare governance is very complicated, socialised and heavily centralised. There are two main sectors, ambulatory care, mainly private, and hospitals, mainly public. There are multiple actors. The state is in charge of parts of the system such as health, social affairs, finance and agriculture. The parliament votes every year on the "Healthcare Financing Law" (LFSS: Loi de Financement de la Sécurité Sociale) covering budgets and the growth index. The "Alert Committee" (Comité d'Alerte) watches spending and sounds the alarm if trouble appears. It is empowered to ask the parliament to take financial measures if required.

Another contributor to this complexity is that "paritarisme", a cooperative and equal system between unions and the state, is used to control the social security system. This is the financing body redistributing the money collected through taxes and premiums to the different actors in the healthcare field. Medical bodies are tied to social security by the cooperative agreement, which is a contract negotiated by the ever-divided unions. Lastly, there are quite a number of agencies dealing with healthcare: Haute Autorité en Santé (High Authority in Healthcare), regional agencies and so on.

Healthcare Spending in France

A total of 206 billion euros were spent in 2007 (10.9% of GNP) with 163.8 billion euros (8.7%) on care and medical goods, leading France to the third in rank in the OECD in terms of expenditure.

Both public and private actors share common tariffs through the CCAM (Classification Commune des Actes Médicaux) system, a list of prices and codes for about 7,200 items. In hospitals, billing relies upon CCAM and the T2A system (Tarification à l'Activité), analoguous to the DRG system. Social security covers up to 76.6% of health expenditure. Households cover a further 8.5%, and others funds 14.9%, (including mutual insurance, insurance companies, providing societies, forms of welfare).

Paris-Nord Imaging & Cancer Centre

The Paris-Nord Centre in Sarcelles is organised around the twin poles of cancer treatment and imaging. It is associated functionally but not financially, with a 250-bed private clinic, which belongs to a family group. The centre is equipped with:

- Digital x-ray department including an angio- and interventional suite;
- 2 ultrasound departments;
- 2 MDCT (16 GE Brightspeed and 64 GE LightSpeed HSA);
- 2 1.5 T MRI (GE Signa HDxT);
- Breast disease department with 2 GE FFDM, US, Vacuum biopsy system (Fischer Breast Care);
- 1 PET-CT (Siemens) and 2 NM cameras (Siemens/GE);
- 2 cyclotrons (joint venture with CIS-BIO/Schering, now sold to these partners);
- Full scale PACS (GE Centricity) with EDL-Xplore RIS;
- 3 linear accelerators (Varian), and
- 12 ambulatory chemotherapy beds.

There are seven full time radiologists, three part-time radiologists, five full-time nuclear medicine specialists, three full time obstetricians and six full-time cancer specialists with some part-time consultants. We now share more than 70 employees.

Strong Administrative Organisation is Key

Over the years, we built up a strong and transparent administration with a dedicated finance and administration department with in-house directors of finance and development, which are employees of the overall group. Accountants and lawyers are outsourced. There is a human resources chief of staff along with delegates within every department. Technical maintenance is mainly outsourced, including IT, but there is an on-site agent.

Power remains in medical hands. There is one CEO for each group but the two groups share the same administration. In the imaging department, peers elect the CEO. New rules are still to be defined for the cancer centre due to partnership changes.

There are regular meetings within and between both groups on an annually planned schedule. Strong relationships had to be developed with the various administrations and the local politicians.

Our Main Management Challenges

Managing human resources is one of our main management challenges, as a small community staff require frequent Q & A sessions and assurance about our future direction. Demographics are another major problem: a high turnover of technicians, coupled with ever increasing salaries (now over 3000 euros/p/m net); a lack of qualified board certified radiologists in front; a lack of task forces to introduce new techniques; the younger generation's different way of life to older established radiologists; locum tenens cherry picking the best jobs and asking for higher and higher fees which means they have higher incomes than full-time radiologists; retirement limitations, and last but not least, the identification of future leaders.

From the economic point of view, the different locations for each centre are generating higher costs than a single, united one, and labour as well as administrative costs are rising in the face of reduced tariffs. Outsourcing some clerical tasks (appointments, transcription) has proven useful but with limited effects.

Increased Productivity a Limited Solution

Solutions are quite limited: the increase in productivity has limited effects because of the national "dynamic management" of tariffs by the system – here in France, the more you do for the same budget, the less you get next time. New techniques and new services e.g, teleradiology, can be offered and we are also treating some foreign patients, coming from the UK and the Middle East to generate other revenue streams. In the long run, ISO certification may help negotiation with third party payers and a larger group may have to be built. Some changes in the cancer centre organisation have also brought "non medical" investors into our partnership: a big departure for us. Our by-laws insist upon some protection against purely financial management. We also have to cope with the increasingly negative working environment, with declining social and medical relationships, the rise of malpractice claims and insurance costs, long working hours, including medical meetings (multidisciplinary), burn-out, and many unwanted "non medical" tasks.

Advantages of Private Practice

One of the key advantages of operating a private system for imaging is the resultant freedom of decision in terms of medical equipment and strategy choices. Our medical income is right on the average according to the present standards. We therefore anticipate resisting any negative economic impact for the time being and forward planning should facilitate survival of the financial crisis, despite no short-term visibility. Finally, there is some satisfaction in the delivery of a high quality of care and service to our patients. Our centre thereby maintains its attractiveness to clients.

Private radiologists in France lost 120 million euros (4% of turnover) last year in national fee reductions, and we are now asked to sacrifice 100 million euros more this year. A new reform is on its way, called HPST or Hôpital, Patient, Santé et Territoires, without any negotiation with the healthcare workers, MDs or others… The new financing law for 2009 (LFSS 2009) has been voted by the parliament with some measures added concerning various forms of punishment aimed at professionals (no mention of the gallows, but…). Investment is clearly at risk in both sectors and French society still has to decide about healthcare policy: friend or foe???

This paper is dedicated to Dr. Marc Kandelman, who passed away in October 2008. A renowned radiologist and a specialist in healthcare economics, he provided some information used in this article.

>*Continued from page 17*

Future Challenges

Commoditisation

Image interpretation services are at risk of becoming a commodity. Recently, a reverse auction model for image interpretation has been implemented to have radiologists compete on price alone for interpretation contracts (Moan 2008). This is a growing trend. Potential risks of commoditisation are diminished quality control, decreased personal service, and a threat to local radiology practices when imaging services can be outsourced to the lowest bidder.

The rapid technological advancement of teleradiology and the growth of imaging centres owned by non-radiologist physicians have contributed to commoditisation. Proposed solutions include raising awareness of imaging as an integrated service, to add value beyond just image interpretation. Additional roles of radiologists include the determination of appropriateness of the study, quality control, adherence to safety and accreditation standards, and consultation with the referring clinician and sometimes patient.

Reimbursement

Diagnostic imaging is the fastest growing physician service in the US. Medicare spending on imaging increased from 6.4 billion dollars in 2000 to 12 billion dollars in 2005 (Medpac 2008). The government has had an increasing role in attempting to control costs including limits imposed on the reimbursement of the technical component of imaging services with the Deficit Reduction Act of 2005. Laws have been implemented to decrease over-utilisation, self-referral, and illegal kickbacks. There will be an increased role for accreditation and pay-for-performance requiring radiology practices to adapt accordingly.

Leadership

There is growing competition from non-radiologists wanting an increased role in the field of diagnostic imaging. The need for increasing the recognition of radiology as a distinct medical specialty has never been greater in the US. National societies such as the American College of Radiology have recognised this issue and are promoting both national and local marketing and branding campaigns. Radiologists should strive to add value to the services they provide to make themselves indispensable.

Summary

Challenges for the future include greater competition with a need for improved brand identity and declining reimbursement with increased focus on accreditation and pay for performance. Greater attention to the business matters of the field and increased training of our future leaders is critical. Quality training of future leaders and increased education regarding the business aspects of radiology is essential. Providing greater leadership opportunities earlier in the career of radiologists is important as is greater local and national involvement by radiologists.

PUBLIC-PRIVATE PARTNERSHIPS **IN HEALTHCARE**

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Public private partnership (PPP) refers to an arrangement between the government and the private sector, with the principal objective of providing public infrastructure, community facilities and other related services. Such long-term partnerships are characterised by a sharing of investments, risks, rewards and responsibilities for the mutual benefit of both parties involved.

A survey in 2001 showed benefits of PPPs to include high quality facilities and infrastructure, with construction completed as planned, on time and within budget; staff and user satisfaction; responsiveness of the private sector; efficient development of output specifications, economies of scale, innovative technologies, more flexible procurement and compensation arrangements and reduced overheads.

Different types of public-private partnerships include:
1. The introduction of private-sector ownership to state-owned businesses, using the full range of possible structures and with the sale of either a majority or minority stake;
2. Private finance initiatives and other arrangements, where the public sector contracts to purchase quality services on a long-term basis so as to take advantage of private sector management skills incentivised by having private finance at risk, and
3. Selling government services to wider markets and other partnership arrangements where private sector expertise and finance are used to exploit the commercial potential of government assets, for example, through the various types of PPPs.

Adopting PPP

Whilst the public sector is seen as representing a pool of potentials and resources central to the delivery of key public services, the private sector is regarded for its ability to harness its expertise in realising substantial incremental values of those resources. The public sector's potential will not be fully realised without the private sector, whose participation can expand opportunities through the following disciplines and skills: commercial incentives; a focus on customer requirements; new and innovative approaches and better business and management expertise.
PPPs are about more than just privatisation. The prime drivers behind improved efficiency in a privatisation project are freedom to invest, management skills and the profit motive. There are three main factors that draw a line between our current partnership practices (privatisation) and those of PPP:
- Adoption of the Public Sector Comparators (PSC) to determine whether PPPs offer good value for money to the public sector;
- The definition - by the public sector - of services to be provided by the private sector and freedom for the private sector to undertake these services, and
- Optimal allocation of risks between the public and private sector.

"Despite their proven benefits, the development of PPPs worldwide has been patchy"

Development of PPPs

Despite their proven benefits, the development of PPPs worldwide has been patchy, not least because of poor understanding of how best to engage private sector skills in traditional public sector activities, and political antipathy. However, the UK, some parts of Europe and Japan have embraced the concept and recent trends suggest that these partnerships have borne fruitful results.

In these models, the private sector was responsible for designing, building, operating and maintaining the hospital, while the public took charge of the core medical services such as provision of patient care, recruitment of doctors and nurses, and so on. Apart from considering the stability of the business plan of the private partners and certainty of funding in selecting the private sector partner, the following key factors underlie the success of the partnership:

- **Risk allocation:** Risk is allocated to the parties best able to manage it, that is, the government has experience and expertise in providing clinical services and ensuring that the welfare of patients, doctors and nurses is well taken care of, while non-critical services are handled by the private sector. This clear separation of risks enables the hospital to respond quickly and effectively to patient requirements.
- **Scale of project:** Despite the benefits of PPPs, the process involved could be complex and require the input of advisors. As such, a large investment is necessary to absorb additional costs such as legal and financial advisory fees.
- **Evaluation process:** This is largely driven by the concept of "value for money," which takes into account "whole life cost optimisation." In the long run, the private sector alternative provides better value for money compared with the public sector, as it takes into consideration capital costs as well as maintenance costs.

Five Key Principles

The enhancement of partnerships between the public and private sectors is one of the elements that needs to be addressed in ensuring sustainable economic growth. There are five key principles:

1. Drawing on past experience

Privatisation has served to define the relationship between the public and private sectors, where it has created thousands of employment opportunities and generated multiplier effects to spur the overall economy. Nonetheless, it is still viewed with suspicion and scepticism. The government needs to identify the reasons for these shortcomings and address the key deficiencies in these programmes.

2. Becoming a better partner

The lessons learnt need to be applied for the government to become a better partner, so as to secure better public services and value for money for the taxpayer. This can be achieved by the government taking a more long-term view as shareholder, by increasing the value of the businesses and drawing on practices in the private sector and in other countries.

3. Safeguarding public interest

The success of PPPs lies in whether the added value generated benefits for users of public services, and the wider community. The government must protect public interest by enforcing a structured tender process to assess the benefits of the private sector's proposed services vis-à-vis the total costs to be borne; delivering better value for money and better management of capital spent; putting effective regulation in place to ensure all public services are accountable to customers and communities that rely on them; and maintaining continuous government involvement in those elements of PPP where a strong public interest remains.

4. Recognising the contribution of staff

As dedicated and committed staffs are central to the long-term success of partnerships, it is vital that their contribution is recognised and entitlements protected.

5. Developing innovative partnerships

PPPs are about changing the way in which the government does business and interacts with the private sector; to introduce the private sectors' expansive skills, experience and finance into the wide range of public sector activities for new and innovative solutions.

Conclusions

Having outlined the approaches, it is opportune to re-examine the way these partnerships have been undertaken, with the principal objective of delivering partnerships that are appropriate, imaginative, holistic and beneficial. A deep appreciation of the mechanisms within PPPs could serve as a starting point for this exercise.

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Footnotes

<1> These recommendations are the opinions of ECRI Institute's technology experts. ECRI Institute assumes no liability for decisions made based on this data.

<2> Input/Output: modem, J1 (USB-A); ethernet RJ45 (10BaseT/100BaseT); composite video (BNC-type, 1 input, 1 output); Y/C video (S-terminal), (1 input, 1 output); 2 channel audio (right/left), RCA-type (1 input, 1 output)
• Output: RS-232 port for printer/PC communication (COM1), (9-pin D-sub miniature); remote printer connector, J5B, J5A, (USB-A); parallel port (printer), (25-pin D-sub miniature); composite video (BNC-type)
• Input: ECG trigger (BNC-out)
• Video standard
- VGA (15 pin D-sub miniature) 1280x1024, 60 Hz
- NTSC/EIA: 525 lines, 60 Hz
- PAL/CCIR: 625 lines, 50 Hz
• Stereo headphone jack. Meets requirements of ANSI/AAMI ES1, HHS, DICOM, NFPA 99, OSHA 1910.399, and UL 2601.

<3> MISA beam-formation technology; precision upsampling; GigaProcessing technology; high-density active aperture; channel-to-signal architecture; ErgoDynamic design; syngo software; color SieScape panoramic imaging; patented phase inversion technology; Cadence contrast pulse sequencing technology option; 3-Scape real-time 3-D imaging; Advanced SieClear compounding with dynamic tissue contrast enhancement technology; TEQ technology for 2-D and spectral Doppler; extend technology, fourSight 4-D imaging; fourSight EV9F4 4-D endovaginal transducer; fourSight ViewTool offline analysis; Clarify vascular enhancement technology; ECG; arterial health package with IMT; velocity vector imaging technology; Hanafy lens and Multi-D array transducer technology. Meets requirements of ANSI/AAMI ES1, HHS, DICOM, NFPA 99, OSHA 1910.399, and UL 2601.

	ECRI INSTITUTE'S RECOMMENDED SPECIFICATIONS<1>	TOSHIBA Leading Innovation
MODEL	General-purpose ultrasonic scanners with small-parts capabilities	Aplio XG
WHERE MARKETED		Worldwide
FDA CLEARANCE		Yes
CE MARK (MDD)		Yes
CLINICAL APPLICATION	General-purpose, small parts	General-purpose, abdominal, OB/GYN, vascular, cardiology, small parts, urology, interventional, musculoskeletal
PROBE TYPES, MHz		
Mechanical sector		No
Annular array		No
Linear array	2.5-5 (abdomen), 5-10 (small parts)	10-4 (vascular), 11-5 (carotid), 12-5 (small parts), 18-7 (small parts, MSK), 6-3 (abdominal biopsy)
Convex array	2.5-5 (abdomen), 5-10 (small parts)	10-3 (pediatric), 6-2 (abdomen), 6-1 (abdomen)
Phased array	2.5-5 (abdomen)	3-2 (TCD), 4-2 (adult heart), 5-2 (adult heart), 6-3 (pediatric heart), 6-2 (abdomen), 9-4 (neonatal head)
Multifrequency		All multifrequency
Endovaginal		3-9
Endorectal	5-7.5 (prostate)	10-5 (biplane)
Others		Dynamic microslice 1.5 D array (6-2), multiplane TEE (7-3), 4D Convex (2-7), 4D EC (3-9), 4D Lin (7-14)
FRAME RATE, fps		Up to 500
GRAYSCALE LEVELS	64	256
PREPROCESSING		Yes
POSTPROCESSING		Yes
MAXIMUM DISPLAY DEPTH, cm		28
IMAGING MODES		
M-mode display		Yes
M-mode and 2-D		Yes
3-D (freehand)		Yes
3-D (automatic)		No
4-D (live 3-D)		Yes
Harmonic imaging	Yes	Yes
DOPPLER		
Type	CFM	PW, CW, pencil CW, steerable CW, CDI, power, advanced dynamic flow, TDI
FUNCTIONALITY		
Digital calipers	Yes	Yes
Selectable dynamic range		Yes
Adjustable transmit focus	Yes	Yes
Dynamic receive focus		Yes
Measurements on VCR replay		Yes
PAN/ZOOM		
Real-time image	Yes	Yes
Frozen image		Yes
IMAGE STORAGE		MO, HD, CD ,USB-stick
Capacity, number of stored images		Up to 2,000,000 images (HD)
Cine		Up to 4,095
DICOM 3.0 COMPLIANT	Yes	Yes
ANALYSIS PACKAGES		
Cardiac scanning		Yes
Vascular scanning		Yes
OB/GYN scanning		Yes
Others		Gallbladder, common bile duct, liver, pancreas, kidney, spleen, prostate, user-programmable calculations
NUMBER OF USER-PROGRAMMABLE PROTOCOLS		168
OTHER SPECIFICATIONS	Digital and TV video outputs; full-screen annotation.	Dynamic Micro Slice, Differential-THI, pulse subtraction THI, ApliPure, trapezoid scan, Quick Scan, IASSIST, advanced dynamic flow, panoramic view, fusion 3-D, flash-echo imaging, microflow imaging, 1.5 harmonic imaging, rate subtraction, TDI, tissue study, 4-D, MicroPure, Elastography, Precision Imaging* *Available soon
LAST UPDATED		Jan-09

TOSHIBA Leading Innovation	TOSHIBA Leading Innovation	TOSHIBA Leading Innovation	TOSHIBA Leading Innovation	GE Healthcare
Xario XG	Xario	Nemio XG	Famio XG	Vivid E9
Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
General-purpose, abdominal, OB/GYN, vascular, cardiology, small parts, urology, interventional, musculoskeletal	General-purpose, abdominal, OB/GYN, vascular, cardiology, small parts, urology, interventional, musculoskeletal	General-purpose, abdominal, OB/GYN, vascular, cardiology, small parts, urology, intraoperative, musculoskeletal	General-purpose, abdominal, OB/GYN, vascular, cardiology, small parts, urology, intraoperative, musculoskeletal	Cardiology,vascular, transcranial, pediatric, small parts, abdominal
No	No	No	No	
No	No	No	No	No
10-4 (vascular), 11-5 (carotid), 12-5 (small parts), 18-7 (small parts, MSK), 6-3 (abdominal biopsy)	10-4 (vascular), 11-5 (carotid), 12-5 (small parts), 14-7 (small parts, MSK), 6-3 (abdominal biopsy)	9-6.(vascular), 11-6 (carotid), 12-6 (small parts), 14-8 (small parts, MSK), 5-3 (abdominal biopsy)	11-6 (carotid), 12-6 (small parts), 14-8 (small parts, MSK), 5-3 (abdominal biopsy)	SP4-10, SP6-12, SP10-16, RSP6-16
10-3 (pediatric), 6-2 (abdomen), 6-1 (abdomen)	10-3 (pediatric), 6-1(abdomen)	6-3 (abdomen), 7-4 (pediatric), 8-6 (neonatal head)	6-3 (abdomen), 5-3 (heart), 7-5 (pediatric, neonatal head), 8-5 (pediatric)	SP4-10, SP6-12, SP10-16, RSP6-16
3-2 (TCD), 4-2 (adult heart), 5-2 (adult heart), 6-3 (pediatric heart), 6-2 (abdomen), 9-4 (neonatal head)	3-2 (TCD), 4-2 (adult heart), 5-2 (adult heart), 6-3 (pediatric heart), 6-2 (abdomen), 9-4 (neonatal head)	2-3.7, 2.5-5, 3.7-6, 5-10, 3.2-5, 2-3	No	1.3-4, 4-9.8
All multifrequency	All triple frequency	All multifrequency	All multifrequency	Yes
3-9	3-9	7.5-5	7.5-5	No
10-5 (biplane)	10-5 (biplane)	8-4 (single plane), 10-5 (convex/convex), 12-6/10-5 (linear/convex)	12-6/10-5 (linear/convex)	No
Multiplane TEE (7-3), 4D Convex (2-7), 4D EC (3-9), 4D Lin (7-14)	Multiplane TEE (7-3), 4D Convex (2-7), 4D EC (3-9)	Multiplane TEE (6-4, 7-4), Intraoperative (10-5), laparoscopic (10-5), pencil (1.9), pencil (5), mechanical 4-D (6-3)	Intraoperative (10-5)	Complete set of 4D transducers for Cardiac investigations
Up to 500	Up to 500	Up to 394	Up to 172	Variable to 300
256	256	256	256	
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
28	28	24	24	24
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	No	No	
No	No	No	No	Not specified
Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes
PW, CW, pencil CW, steerable CW, CDI, power, advanced dynamic flow, TDI	PW, CW, pencil CW, steerable CW, CDI, power, advanced dynamic flow, TDI	PW, CW, steerable CW, pencil CW, CDI, power (directional), advanced dynamic flow, TDI	NA	Color, tissue, PD, CW, PW with HPRF
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
MO, HD, CD ,USB-stick	MO, HD, CD, USB-stick	MO, HD, CDR, DVD, USB	HD, CD	Hard disk, MOD, CD-RW, DVD
Up to 2,000,000 images (HD)	Up to 2,000,000 images (HD)	Up to 6,000 (MO), 30,000 (HD), 4,500 (DVD)	Up to 50,000 (HD)	80 GB hard disk (~40,000 images)
Up to 4,095	Up to 4,095	Up to 512	Up to 256	Up to 256 MB, up to 3,000 2-D images
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	No
Gallbladder, common bile duct, liver, pancreas, kidney, spleen, prostate, user-programmable calculations	Gall bladder, common bile duct, liver, pancreas, kidney, spleen, prostate, user-programmable calculations	Prostate, user-programmable calculations	Prostate, user-programmable calculations	M-mode, B-mode, Doppler calculations
168	168	16	12	Extensive
Differential-THI, pulse subtraction THI, ApliPure, trapezoid scan, Quick Scan, IASSIST, advanced dynamic flow, panoramic view, fusion 3-D, flash-echo imaging, microflow imaging, 1.5 harmonic imaging, rate subtraction, TDI, tissue study, 4-D, Precision Imaging* *Available soon	Pulse-subtraction THI, ApliPure, trapezoid scan, QuickScan, IASSIST, advanced dynamic flow, panoramic view, fusion 3-D, flash-echo imaging, stress echo, automated contour tracking, programmable panel, touch-command screen, 4-D, Presision Imaging* *Available soon	THI, Advanced Dynamic flow, stress echo, panoramic view, programmable panel, Quick Scan, Free Cursor, Sono Set, ApliPure, DVI, USB, CD/DVD-writer.	THI, DirectCine, programmable panel, One-button image optimizer, CD-writer.	Full 4 Dcapabilities, Dedicated platform for quantitative 4D cardiac assesment
Jan-09	Jan-09	Jan-09	Jan-09	Feb-09

	SIEMENS	SIEMENS	SIEMENS
MODEL	ACUSON S2000 Ultrasound Platform	ACUSON Antares Ultrasound Platform	ACUSON X300 Ultrasound Platform
WHERE MARKETED	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes	Yes	Yes
CE MARK (MDD)	Yes	Yes	Yes
CLINICAL APPLICATION	Abdominal, Renal, Obstetrics, Fetal Echo, Gynecology, Neonatal, Pediatric, Cerebrovascular, Peripheral Vascular (arterial, venous), Transcranial, Cardiac (adult, pediatric and neonatal), Musculoskeletal, Small Parts (breast, testicle, thyroid, digital), Urology (pelvis, penile, prostate)	Abdominal, Renal, Obstetrics, Breast, Fetal Echo, Gynecology, Neonatal, Pediatric, Cerebrovascular, Peripheral Vascular (arterial, venous, digital), Small Parts (breast, testicle, thyroid), Musculoskeletal & Superficial Musculoskeletal, Transcranial, Urology (penile, pelvis, prostate), Intra-operative (vascular), Cardiac (adult, pediatric and neonatal)	Abdominal, Renal, Obstetrics, Gynecology, Early Obstetrics, Adult Cardiac (Transthoracic), Pediatric Cardiac (Transthoracic), TEE Adult, ICE (Adult and Pediatric Intracardiac Echocardiography), Vascular (C-Vas, P-Vas, Venous), Small Parts (Breast, Testicle, Thyroid), Orthopedics, Musculoskeletal, Urology (Prostate), Cranial (TCI), Emergency Medicine (EM), Penile
PROBE TYPES, MHz			
Mechanical sector	No	No	No
Annular array	No	No	No
Linear array	7.0 -16.0, 6.0 -14.0, 4.0 -9.0	2.9 -8.9, 3.3 -7.3, 3.6 -10, 5.3 -11.4	5.0 -11.4, 4.0 -10.0, 2. 7 -10.0
Convex array	2.5 -6.0, 2.0 -4.5,	2.0 -6.67, 1.54 -4.0,	3.1 - 7.3, 2.0 - 5.0, 1.5 - 5.0
Phased array	1.75 -4.5, 4.0 -10.0, 4.0 -7.0	1.67 -4.21, 1.54 -4.0, 2.5 -10.0. 4.0 -11.4, 2.86 -8.89, 3.64 -10.0, 2.2 -7.2	1.3 - 3.6, 1.5 - 4.0, 2.7 -6.7,
Multifrequency	All transducers	All transducers	All transducers
Endovaginal	4.0 -9.0	2.86 -8.9	2.9 -8.0, 2.9 -7.3
Endorectal	4.0 -8.0	2.5 -8.0	2.9 -8.0
Others	3.0-7.0, 4.0-9.0 fourSight 4-D transducers; 2 × CW Doppler pencils; multiplane TEE; intraoperative	1.5 -4.7; 2.0 -6.1; fourSight 4-D transducers; 2 × CW Doppler pencil; multiplane TEE; intraoperative	2.0 - 5.0 fourSight 4-D transducers; 2 × CW Doppler pencil; multiplane TEE; intraoperative
FRAME RATE, fps	up to 1000	Up to 500	up to 1001
GRAYSCALE LEVELS			
PREPROCESSING	Yes	Yes	Yes
POSTPROCESSING	Yes	Yes	Yes
MAXIMUM DISPLAY DEPTH, cm	30	30	30
IMAGING MODES			
M-mode display	Yes	Yes	Yes
M-mode and 2-D	Yes	Yes	Yes
3-D (freehand)	Yes	Yes	Yes
3-D (automatic)	Yes	Yes	Yes
4-D (live 3-D)	Yes	Yes	Yes
Harmonic imaging	Yes all transducers	Yes all transducers	Yes
DOPPLER			
Type	PW, CW, HPRF, color Doppler, power Doppler, M-mode, color Doppler M-mode, DTI	PW, CW, HPRF, color Doppler, power Doppler, M-mode, color Doppler M-mode, DTI	PW, color Doppler, power Doppler, directional power Doppler, CW, DTI, 2-D, M-mode
FUNCTIONALITY			
Digital calipers	Yes	Yes	Yes
Selectable dynamic range	Yes	Yes	Yes
Adjustable transmit focus	Yes	Yes	Yes
Dynamic receive focus	Yes	Yes	Yes
Measurements on VCR replay		Yes	Yes
PAN/ZOOM			
Real-time image	Yes	Yes	Yes
Frozen image	Yes	Yes	Yes
IMAGE STORAGE		DIMAQ-IP workstation CD-R/DVD-R, S-VHS VCR, DICOM, syngo Dynamics	DIMAQ-IP workstation CD-R/RW, DVD-R/RW, DICOM, syngo Dynamics
Capacity, number of stored images	160GB; > 35,000	89GB; Up to 35,000	100GB; Up to 150,000
Cine	30 seconds, 201megabytes and 400 frames (dependent on frame rate and other parameters)	Standard cine memory: 30 seconds, 201 megabytes, estimated storage of at least 400 image frames	2,729 frames
DICOM 3.0 COMPLIANT	Yes	Yes	Yes
ANALYSIS PACKAGES			
Cardiac scanning	Yes - plus DICOM Structured reporting	Yes - plus DICOM Structured reporting	Yes - plus DICOM Structured reporting
Vascular scanning	Yes - plus DICOM Structured reporting	Yes - plus DICOM Structured reporting	Yes - plus DICOM Structured reporting
OB/GYN scanning	Yes - plus DICOM Structured reporting - automatic OB measurements (Auto OB)	Yes - plus DICOM Structured reporting - automatic OB measurements (Auto OB)	Yes - plus DICOM Structured reporting
Others	Urology, renal, transcranial, breast, testes, thyroid, auto Doppler trace and calculations	Urology, renal, transcranial, breast, testes, thyroid, auto Doppler trace and calculations	Urology, breast, testes, thyroid, orthopedic, optional stress echo imaging
NUMBER OF USER-PROGRAMMABLE PROTOCOLS	>100	>100	Up to 32
OTHER SPECIFICATIONS	<2>	<3>	All-digital architecture; TGO system optimization technology; Clarify vascular enhancement technology; SieClear multiview spatial compounding; SynAps synthetic aperture technology; Hanafy lens technology; arterial health package with IMT; Axius edge assisted ejection fraction.
LAST UPDATED	Feb-09	Feb-09	Feb-09

MEDISON	MEDISON	MEDISON	MEDISON	PHILIPS
ACCUVIX V20	ACCUVIX V10	SONOACE X8	SONOACE X6	iU22
Worldwide	Worldwide	Worldwide	Worldwide	Worldwide
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
General, internal medicine, surgery, breast, renal, abdominal, cardiology, neonatal, Abdominal, OB/GYN, vascular, small parts, endovaginal, endorectal, urology, cardiology, 3D, volume 3-D, live 3-D, 4D	General, internal medicine, surgery, breast, renal, abdominal, cardiology, neonatal, Abdominal, OB/GYN, vascular, small parts, endovaginal, endorectal, urology, cardiology, 3D, volume 3-D, live 3-D, 4D	General, internal medicine, surgery, breast, renal, abdominal, cardiology, neonatal, Abdominal, OB/GYN, vascular, small parts, endovaginal, endorectal, urology, cardiology, 3D, volume 3-D, live 3-D, 4D	General, internal medicine, surgery, breast, renal, abdominal, cardiology, neonatal, Abdominal, OB/GYN, vascular, small parts, endovaginal, endorectal, urology, cardiology, 3D	Abdominal, OB/GYN, vascular, breast, small parts, musculoskeletal, pediatric, endocavity, adult cardiology, surgical, prostate, TCD
No	No	No	No	No
No	No	No	No	No
L5-13IS, L7-16IS, L4-7EL, L5-12/50EP	L6-12IS, L8-15IS, L5-12/50EP, L4-7EL, L5-13IS, L7-16IS	L5-12EC, HL5-12ED, L5-12/50EP, L5-13EC, L4-7EL	HL5-12ED, L5-12/50EP	L17-5, L15-7io, L12-5, L9-3, L8-4
C2-6IC, C2-5EL, C3-7IM, EC4-9IS	C2-6IC, C2-5EL, C3-7IM, C4-9/10ED	C2-5EL, C3-7EP, C2-5EP	C3-7ED, C4-9/10ED-N	C9-4, C9-5ec, C8-5, C8-4v, C5-2, V6-2, 3D9-3v
P2-4AC, P3-5AC	P2-4AC, P3-5AC, P2-4BA, P3-8CA,	P2-4AA, P3-7AC, P2-4AH, P3-5AC	P2-4AH	S7-2omni, S5-1 PureWave, S4-1
All probes	All probes	All probes	All probes	Broadband, 2D Opt
EC4-9IS	NEV4-9ES, C4-9/10ED, EC4-9IS,EV4-9ED	NEV4-9ES	NEV4-9ES	C8-4v, 3D9-3v
EC4-9IS	NER4-9ES, ER4-9ED	NER4-9ES,	NER4-9ES,	C9-5sec
Pencil CW2.0, CW4.0 Volume probe:3D4-9ES, 3D2-6ET, 3D4-8ET, 3D5-9EK	Pencil CW2.0, CW4.0 Volume probe:3D2-6ET, 3D4-8ET, EC5-9EK	Pencil CW2.0, CW4.0 Volume probe:3D2-6ET, 3D4-8ET, 3D4-8EK, 3D5-9EK, 3D4-9ES	Pencil CW2.0, CW4.0	Static CW Doppler and PW Doppler, xMATRIX 3-1 and 7-2
Up to 700 maximum	Up to 700 maximum	Up to 700 maximum	Up to 169 maximum	>500
256	256	256	256	256
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
30	30	30	30	35
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	No,	Yes, 4D and Live Volume
Yes	Yes	Yes	No	Yes-Multivariate
Yes	Yes	Yes	Yes	
Color Doppler imaging with quad-beam receiving, Power Doppler imaging with quad-beam recieving, directional Power Doppler, Pulse Wave Doppler (PWD) and Continuous Wave Doppler (CWD) Tissue Doppler imaging.	Color Doppler imaging with quad-beam receiving, Power Doppler imaging with quad-beam recieving, directional Power Doppler, Pulse Wave Doppler (PWD) and Continuous Wave Doppler (CWD) Tissue Doppler imaging.	Color Doppler imaging with quad-beam receiving, Power Doppler imaging with quad-beam recieving, directional Power Doppler, Pulse Wave Doppler (PWD) and Continuous Wave Doppler (CWD) Tissue Doppler imaging.	Power/angio Doppler mode, pulsed-wave Doppler, color Doppler, tissue Doppler imaging, steered CW Doppler	PW, steerable CW, CFM, color power angio
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes, Automatic iFOCUS
Yes	Yes	Yes	Yes	Yes
Yes	No	No	No	No
Yes	Yes	Yes	Yes	Yes, HD Zoom
Yes	Yes	Yes	Yes	Yes
Cine, DVD, DVD/RW, CD-RW, MOD, SonoView, Memory Stick	Cine, DVD, DVD/RW, CD-RW, MOD, SonoView, Memory Stick	Cine, DVD, DVD/RW, CD-RW, MOD, SonoView, Memory Stick	Cine, DVD, DVD/RW, CD-RW, MOD, SonoView, Memory Stick	HD, DVD, CD
35 000	35 000	35 000	30 000	160 GB for data storage
10000	10000	10000	256	1000 frames
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes, Stress Echo
Yes	Yes	Yes	Yes	Yes, IMT
Yes	Yes	Yes	Yes	Yes
Urology	Urology	Urology	Urology	QLAB, 3DQ, 2DQ, ROI, MVIRadiology, urology
5 per application per transducer	5 per application per transducer	5 per application per transducer	Not specified	45 per transducer
Trapezoid scanning, Spatial Compound ImagingTM (SCI), Pulse Inversion Harmonic Imaging, Full Spectrum ImagingTM, Color Edge Processing, Vocal, Oblique view, Volume CT, ECG moduletrapezoidal mode; 5 probe ports.	Elastoscan, Trapezoid scanning, Spatial Compound ImagingTM (SCI), Pulse Inversion Harmonic Imaging, Full Spectrum ImagingTM, Color Edge Processing, Vocal, Oblique view, Volume CT, ECG module	Trapezoid scanning, Spatial Compound ImagingTM (SCI), Pulse Inversion Harmonic Imaging, Full Spectrum ImagingTM, ECG module, PC printer	Trapezoid scanning, ECG module	iCOMMAND voice control; SonoCT real-time compound imaging; XRES processing; adjustable monitor and control panel; one-control image optimization; 2-D; 3-D; 4-D, MPR, STIC, iSlice, Live Volume, and xPlane; Workflow Protocols
Feb-09	Feb-09	Feb-09	Feb-09	March-07

	HITACHI Inspire the Next	HITACHI Inspire the Next	HITACHI Inspire the Next	HITACHI Inspire the Next
MODEL	HV-900	Preirus	EUB-7500	EUB-7000HV
WHERE MARKETED	Worldwide	Worldwide	Worldwide	Worldwide
FDA CLEARANCE	Yes			
CE MARK (MDD)	Yes	Yes	Yes	Yes
CLINICAL APPLICATION	Cardiology, OB/GYN, urology, pediatric, breast, neonatal, vascular, intraoperative, endorectal, endovaginal, laparoscopic	Cardiology, OB/GYN, urology, pediatric, breast, neonatal, vascular, intraoperative, endorectal, endovaginal, laparoscopic	Cardiology, OB/GYN, urology, pediatric, breast, neonatal, vascular, intraoperative, endorectal, endovaginal, laparoscopic	Cardiology, OB/GYN, urology, pediatric, breast, neonatal, vascular, intraoperative, endorectal, endovaginal, laparoscopic
PROBE TYPES, MHz				
Mechanical sector	No	No	No	No
Annular array	No	No	No	No
Linear array	2.5-5 (abdomen), 5-9 (small parts)	2.5-5 (abdomen), 5-10 (small parts)	2.5-5 (abdomen), 5-9 (small parts)	2.5-5 (abdomen), 5-9 (small parts)
Convex array	2.5-5 (abdomen), 5-13 (small parts)	2.5-5 (abdomen), 5-13 (small parts)	2.5-5 (abdomen), 5-13 (small parts)	2.5-5 (abdomen), 5-13 (small parts)
Phased array	2-7.5	2-7.5	2-7.5	2-7.5
Multifrequency	Yes	Yes	Yes	Yes
Endovaginal	Yes	Yes	Yes	Yes
Endorectal	Yes	Yes	Yes	Yes
Others	Fingertip Interventional, Intraoperative, EUS, mini probes, thru-crystal, laparoscopic	Intraoperative, EUS, mini probes, biopsy, thru-crystal, laparoscopic	Fingertip Interventional, Intraoperative, EUS, mini probes, thru-crystal, laparoscopic	Fingertip Interventional, Intraoperative, EUS, mini probes, thru-crystal, laparoscopic
FRAME RATE, fps	400 maximum	410 maximum	410 maximum	410 maximum
GRAYSCALE LEVELS	256	256	256	256
PREPROCESSING	Yes	Yes	Yes	Yes
POSTPROCESSING	Yes	Yes	Yes	Yes
MAXIMUM DISPLAY DEPTH, cm	36	36	36	36
IMAGING MODES				
M-mode display	Yes	Yes	Yes	Yes
M-mode and 2-D	Yes	Yes	Yes	Yes
3-D (freehand)	Optional	Optional	Optional	Optional
3-D (automatic)	Not specified	Not specified	Not specified	Not specified
4-D (live 3-D)	Yes	Yes	Yes	Yes
Harmonic imaging	Yes	Yes	Yes	Yes
DOPPLER				
Type	CW, PW, CFM	CW, PW, CFM, tissue Doppler, Fine Flow	CW, PW, CFM , tissue Doppler	CW, PW, CFM
FUNCTIONALITY				
Digital calipers	Yes	Yes	Yes	Yes
Selectable dynamic range	Yes	Yes	Yes	Yes
Adjustable transmit focus	Yes	Yes	Yes	Yes
Dynamic receive focus	Yes	Yes	Yes	Yes
Measurements on VCR replay	Yes	Yes	Yes	Yes
PAN/ZOOM				
Real-time image	Yes	Yes	Yes	Yes
Frozen image	Yes	Yes	Yes	Yes
IMAGE STORAGE	DVD+RW, DVD-RAM, USB, CD-R, HDD	DVD+R, DVD-RAM, HDD, USB	DVD+RW, DVD-RAM, USB, CD-R, HDD	DVD+RW, DVD-RAM, USB, CD-R, HDD
Capacity, number of stored images	69,000 max	44,600 max	44,600 max	44,600 max
Cine	4,000 frames	2,977 frames	2,977 frames	4,000 frames
DICOM 3.0 COMPLIANT	Yes	Yes	Yes	Yes
ANALYSIS PACKAGES				
Cardiac scanning	Yes	Yes	Yes	Yes
Vascular scanning	Yes	Yes	Yes	Yes
OB/GYN scanning	Yes	Yes	Yes	Yes
Others	General, urology	General, urology	General, urology	General, urology
NUMBER OF USER-PROGRAMMABLE PROTOCOLS	32	22 per probe	10 per probe	10 per probe
OTHER SPECIFICATIONS	HI COMPOUND multiangle compound imaging; high resolution adaptive imaging; raw data freeze; Sono IQ one-touch optimization; 4 modes of harmonic imaging; pulse inversion harmonics; High definition Tissue Harmonic Imaging; real-time Doppler measurements; baseline shift in freeze; optional contrast harmonics, stress echo, wideview, and omnidirectional M-mode. SonoElastography (HI-RTE-mode), RVS Fusion Imaging and real-time archiving.	HI COMPOUND multiangle compound imaging; high resolution adaptive imaging; raw data freeze; Sono IQ one-touch optimization; 4 modes of harmonic imaging; wideband pulse inversion imaging; real-time Doppler measurements; baseline shift in freeze; optional contrast harmonics, SonoElastography (HI-RTE-mode), stress echo, wideview, omnidirectional M-mode, and real-time archiving. RVS Fusion imaging	HI COMPOUND multiangle compound imaging; high resolution adaptive imaging; raw data freeze; Sono IQ one-touch optimization; 4 modes of harmonic imaging; wideband pulse inversion imaging; real-time Doppler measurements; baseline shift in freeze; optional contrast harmonics, SonoElastography (HI-RTE-mode), stress echo, wideview, omnidirectional M-mode, and real-time archiving. RVS Fusion imaging	high resolution adaptive imaging; raw data freeze; Sono IQ one-touch optimization; 4 modes of harmonic imaging; wideband pulse inversion imaging; SonoElastography (HI-RTE-mode)
LAST UPDATED	Jan-09	Jan-09	Jan-09	Jan-09

SHOULD YOU INVEST IN **AN ONCOLOGY MANAGEMENT SYSTEM?**

A Mini-HIS for Oncology

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The selection and integration of appropriate information systems is one of the challenges facing department managers in their quest to offer a high level of clinical care, coupled with efficiency, and good financial and clinical governance. The issues become particularly difficult when 'top down' systems, such as EHR, HIS and PACS come into contention with established departmental systems. This article considers Oncology Management Systems (OMS), where issues of integration between departmental systems and corporate systems currently engender debate.

OMS offerings have developed from the real-time computer systems used in radiotherapy (RT) departments, mainly with linear accelerators, to control treatment delivery. Complex daily treatment fractionation is tracked through Record and Verify (R&V) modules that maintain a complete record of each radiation beam's contribution to the overall dose.

OMS Components

R&V modules and machine verification aspects are specialist and unique RT features, now incorporated into OMS systems. These encompass other modules from medical history, to record tumour diagnosis and staging, scheduling, not only for patient preparation and therapy attendances, but also for activities in treatment preparation that do not involve patient attendance. Additionally, with modules for the organisation and delivery of chemotherapy regimes and RT protocols, concurrent treatments can be tracked. Clearly this OMS functionality now overlaps with some features found in 'top-down' Hospital Information Systems (HIS).

RT Processes Aid Planning

Patient pathways through oncology are complex, involving input from various professionals. Developments within OMS introduce the possibility of actively tracking 'back-office' tasks such as tumour delineation on planning images and the subsequent RT planning processes. Careful mapping of preparation processes and available staff skills makes it possible to devise ways in which the scheduling capabilities of an OMS can be used to more clearly define and allocate the associated tasks within the processes.

This precise definition and allocation of tasks can also improve the sense of ownership, accountability and control that staff feels. Such techniques also enable the audit of pathways. This kind of audit highlights areas of resource bottlenecks, enabling managers at all levels to address such issues by training or physical resource provision. The need to meet stringent waiting time targets requires the overall process to be intelligently controlled.

Other Advantages

Integration
To achieve good integration, OMS providers should be encouraged to provide solutions that both embrace newly developing technologies and integrate with HIS and other systems. This is most likely to be achieved by ensuring that systems support developing standards, for example, HL7 for general message passing, and the maturing RT components of the DICOM standard, for PACS integration, both encouraged by the Integrating the Healthcare Enterprise (IHE) initiatives for exchanging data between systems using agreed definitions.

Time and space management
Oncology management falls at the complex end of the spectrum of hospital activities. Work is largely outpatient oriented and both RT and chemo are likely to involve many treatment sessions. Scheduling is complex because slots in treatment bays and rooms are used so intensively. The treatment pathways are many; their modification as treatments, regimes and protocols progress, is quite common. When using an OMS database, a distinction between activities concerned with the provision of patient treatment and those intended to provide management statistics needs to be appreciated.

For costing/billing and process/revenue, allocation managers must choose between collecting large volumes of daily data from incomplete prescriptions, or lower volumes of summary data, which has been through more quality screening and deals with finished prescriptions. For monitoring the use of treatment rooms, the various waiting times and the techniques in use, the OMS is also a rich resource.

Dissemination of information

A challenge for the oncology community is to make local data appropriately available across a broader spectrum in a manner that is not open to misinterpretation; uses could include audit and resource planning. Unfortunately the terminology used in oncology and OMS is not standardised and comparisons between centres are therefore difficult. The wide availability of PACS systems, themselves based on the DICOM standard and in some countries becoming integrated across the nation, make them a potential platform for achieving this wider dissemination of information.

The operational differences between radiology and oncology departments make it difficult to envisage a real-time integration with OMS, but the retrospective uploading of a completed RT episode summary DICOM data object into PACS is a potential way in which this data may be "protected" for the benefit of the patient across a broader geographical spectrum.

Data security

Data protection is often viewed as ensuring that data does not fall into the wrong hands. Another important aspect is to ensure that the data held remains available for continued use, in the context of both current and future treatments. The centralised storage of data in local OMS facilitates this process. Note that statutory oncology data storage periods are usually greater than many OMS software life cycles, implying that evolutionary planning must include archive data.

Conclusion

An OMS is now a critical component in the day-to-day operation of oncology facilities and a potentially rich data resource for management to meet larger goals. Currently, the level of integration, for example, for the assimilation of OMS elements beyond R&V into HIS and/or PACS, is not completely developed. The standards for the definitions required for national and international data exchange have also not yet been agreed. It is necessary to consider these issues when purchasing an OMS solution and essential to engage in an active debate about future relationships between OMS, HIS and PACS.

CARDIAC **CT**

What Lies Ahead?

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The primary reason for the development of cardiac CT was the expectation that CT could replace diagnostic cardiac catheterisation procedures, an expensive study that, due to the need for arterial catheterisation, has a relatively high complication rate. But where will this relatively new technology go, and how will it improve imaging techniques for cardiologists? This article explores the issues involved.

4-slice CT systems enabled calcium scoring, which is used in cardiac risk assessment, and gave a glimpse of the potential for assessing the coronary arteries using CT angiography (CTA). 16-slice systems delivered negative predictive values comparable to conventional cardiac catheterisation (i.e., ability to safely rule out the disease), though the selection criteria for patients were exacting. A number of studies have compared 64-slice CT to the gold standard of cardiac catheterisation, including those summarised in table 1 (see below).

When the data is combined, the sensitivity of 64-slice CT is about 92% and specificity 96%. Most importantly, the negative predictive value is 98%. In other words, if a patient has a negative scan, there is a high degree of certainty that the patient can be safely discharged.

Radiation Dose for Cardiac Studies a Concern

However, radiation dose for cardiac studies is a significant concern. CT is well recognised as delivering a high radiation dose to patients and cardiac CT is one of the highest dose CT exams, due to the need to overlap slices to ensure sufficient raw data is acquired. Cardiac catheterisation also incurs a high radiation dose. The issue is that CT will be used with patients with a lower pre-scan probability of coronary artery disease. As a result, the justifiable dose is lower. All CT manufacturers have made significant progress in lowering the radiation dose by reducing the amount of wasted x-ray exposure. For example, using axial image acquisition instead of spiral acquisition or applying more aggressive ECG gating techniques can significantly reduce the dose.

New Developments

CT technology has not stopped with 64-slice systems. In 2005, Siemens Medical Solutions introduced the dual source CT system (Somatom Definition) that halved the temporal resolution. Temporal resolution is the key factor in cardiac imaging since it determines the heart rates that can be effectively imaged without resorting to heart rate control medication.

In a normal CT system, the highest possible temporal resolution is half the gantry rotation time. By adding a second source and detector the temporal resolution is reduced to one quarter the rotation time. Testing with dynamic phantoms shown by ECRI Institute (May 2008) show that heart rates up to 85 bpm and variable heart rates can be successfully imaged. For comparison, normal 64-slice systems are typically limited to 65 bpm and stable heart rates. By removing the need for medication, patient scheduling becomes easier and the need to monitor patients before and after the scan is reduced.

Reference	Number of Patients	True Positives (TP)	False Positives (FP)	True Negatives (TN)	False Negatives (FN)
Ehara et al., 2006	69	275	35	545	29
Leschka et al., 2005	67	165	25	804	11
Pugliese et al., 2006	35	66	19	408	1
Raff et al., 2005	70	79	41	802	13

Table 1. *Selection of studies comparing 64-slice CT and cardiac catheterisation for the detection of coronary artery stenosis.*

Other developments are also now becoming commercial realities. Most notably is a 320-slice system (Aquilion One, Toshiba Medical), which acquires 16cm long volumes in each rotation. So, the whole heart can be acquired in a single rotation. In any other CT scanner it is necessary to make multiple rotations and select the best data after the scan. A necessary assumption is that the heart returns to exactly the same position for each cycle. With the 320-slice system, this is no longer a problem. So, smaller vessels should be better visualised. Other manufacturers are also working on extending the coverage.

There is more to cardiac imaging than the coronary arteries. CT is also now being used for myocardial perfusion imaging, quantitative assessment of the ventricular output, and plaque characterisation. It is early days but early results are promising. It may be that CT will become a one-stop shop tool for cardiac risk assessment. However, dose concerns and over utilisation of the technology are issues that must be addressed.

Patient Demand and Utilisation

The common early expectation was that demand for coronary CTA would be overwhelming and cardiac CT would rapidly become a major source of patients and revenue. However, anecdotally it appears that the number of exams remains low (e.g., Dowie, 2007).

Why the slower than expected utilisation? There are probably many reasons, including physician competence and credentialing requirements, staff training, referral practices, appropriate indications, and reimbursement.

The appropriate indications and reimbursement issues are closely linked and subject to considerable debate and confusion. In 2006, a multidisciplinary clinical committee in the US published a report that summarised their conclusions regarding the appropriate indications for coronary CTA that are supported by evidence (Hendel et al. 2006). A number of indications were found to be appropriate, including the evaluation of some intermediate risk patients with acute chest pain, such as would present to emergency rooms.

Will Coronary CTA Replace Nuclear Stress Test?

A significant related question is whether a coronary CTA is a suitable replacement for a nuclear stress test. The 2006 appropriateness criteria (Hendel et al., 2006) specify that only patients with equivocal stress tests or those unable to exercise (i.e., can't complete a stress test), are suitable candidates for coronary CTA. The nuclear stress test is routinely performed on low and intermediate risk patients that present with chest pain by the cardiologist. A nuclear stress test is a physiological study that identifies regions of the myocardium that receive inadequate blood flow during exercise, usually caused by significant arterial stenosis.

> **"CT may become a one-stop shop tool for cardiac risk assessment"**

In contrast, coronary CTA detects arterial stenosis that may or may not be significant. Supporters of the stress test point out that the physiological nature of the stress test provides more relevant diagnostic information. Despite this difference, a recently published direct comparison of the imaging techniques shows similar diagnostic accuracy (Gallagher et al., 2007). So, for the time being, the nuclear stress test remains the primary option. However, coronary CTA may replace nuclear stress test in the future.

Insurance Companies Reluctant to Expand Indications

There is considerable pressure, particularly from radiologists, to expand the indications for coronary CTA. However, insurance companies are reluctant to change their policies despite coronary CTA being about the same cost as a nuclear stress test. Possible reasons for not changing the referral policies include the concern that utilisation may be less controllable and the high number of incidental findings may increase costs of follow-up diagnostic tests. So overall, costs would increase. In addition, cardiologists would lose patients undergoing stress studies, which they usually conduct and are reimbursed for. The bottom line is that economic and political issues are likely to be important factors in this debate and uncertainty over reimbursement remains controversial.

References and further recommended reading lists are available upon request to the Editor at ***editorial@imagingmanagement.org.***

MANAGING DIAGNOSIS AND TREATMENT PATHS

The Case for Adrenal Tumour Imaging

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In adrenal tumour imaging, there are several imaging techniques that may be used to manage the patient, depending on their clinical scenario. But which one is best for patient safety as well as for cost-effectiveness? This article explores each relevant imaging modality and their use in different clinical cases.

Unlike in patients with hypersecreting adrenal lesions, where tumour diagnosis is easily made on the basis of clinical and laboratory data, patients with non-hypersecreting adrenal tumours and normal laboratory data, are challenging to diagnose and treat. Particularly in some complicated cases, the need for complementary imaging techniques still remains; for this purpose, functional diagnostic information provided by nuclear radionuclide modalities are helpful and are explained here.

Radionuclide Imaging

Radionuclide imaging using specific tracers such as nor-cholesterol, MIBG, SAs, FDG or carbon-11 (C-11) metomidate may provide in-vivo tissue characterisation of adrenal tumours that differentiate between benign and malignant abnormalities. In particular, radiolabeled nor-cholesterol scintigraphy allows the diagnosis of benign adrenocortical adenomas, both in hyper- and non-hypersecreting lesions; in particular, for these latter disorders nor-cholesterol is able to offer specific information for lesion characterisation. Similarly, MIBG imaging has been demonstrated to be useful to identify chromaffin tissue tumours. Preliminary and limited data suggest a role of SAs to detect the presence of somatostatin receptors in malignant adrenal masses. Fluoro-18 FDG using PET scanning has been shown to be able to recognise malignant adrenal tumours on the basis of increased glucose metabolism. High C-11 metomidate uptake has been reported both in normal adrenal cortex as well as in benign and malignant cortical adrenal tumours, but differential diagnosis between these adrenal lesions may be not performed with this agent.

MIBG Imaging

Previous studies have clearly demonstrated the usefulness of radioactive MIBG imaging in the diagnostic evaluation of patients with pheochromocytoma as well as extra-adrenal paragangliomas. However, in these experiences MIBG scintigraphy was used to localise and detect tumour sites only in patients with hypersecreting lesions and, particularly, no data regarding non-hypersecreting pheochromocytoma have been reported. We specifically investigated the role of MIBG imaging to identify non-hypersecreting pheochromocytoma in a subgroup of patients with indeterminate adrenal masses; in such patients, the clinical diagnosis of pheochromocytoma using laboratory tests was not possible, while the integrated imaging results of MIBG with those of CT and/or MR were clinically relevant for this purpose.

MIBG uptake in a non-hypersecreting adrenal mass characterises the lesion as a pheochromocytoma. In this regard, whereas this tumour-type specifically concentrates MIBG into its catecholamine storage granules, other adrenal space-occupying abnormalities do not accumulate this agent. Thus, MIBG scintigraphy may be diagnostically useful to identify or rule out non-functional tumours of medullary chromaffin tissue.

FDG PET-CT Imaging

Although there are CT and MR imaging patterns to suggest the diagnosis of malignancy such as large tumour size, high contrast or gadolinium enhancement as well as increased signal intensity on T2-weighted MR images or

no signal change on chemical-shift MR sequence, these criteria are suggestive but not diagnostic of malignancy. In the absence of specific endocrine hyper-secretion, no individual finding can absolutely resolve this issue.

FDG uptake has been reported to reflect high tumour metabolism. Its concentration in malignancies has been associated with proliferative tissue activity and to the amount of viable cells, thus, being an accurate indicator of tissue viability in malignant adrenal lesions.

Therefore, presumptive specific metabolic criteria may be included in radionuclide adrenal imaging to evaluate patients with radiographically indeterminate adrenal masses in which there is a high risk of malignancy. In this regard, the possibility to make a differential diagnosis between benign and malignant adrenal masses using FDG PET imaging shows a relevant clinical impact, and this application has been widely demonstrated.

> **“On the basis of our experience, radionuclide imaging may have a significant role to non-invasively characterise adrenal tumours”**

This diagnostic information allows one to plan appropriate treatment in such patients, avoiding unuseful surgical interventions in cases of benign tumours or metastatic malignant lesions; in this regard, a significant advantage in terms of cost-effectiveness is reached since surgical procedures are clearly associated with greatest cost (20,000 – 30,000 dollars for laparotomy, probably somewhat less for laparoscopy because of shorter hospital stays). Conversely, the accurate characterisation of an adrenal mass as a malignant tumour with localised increased FDG activity suggests the need of immediate surgical resection.

Moreover, in patients with proven malignant adrenal tumours, the evaluation of regional and distant spread by whole-body PET FDG realises accurate disease staging for a complete work-up before any treatment strategy, using a single technique instead of several conventional imaging techniques.

In the last years the combined imaging technique represented by PET-CT offers unique diagnostic informations in patients with malignant adrenal tumours. In fact, PET-CT combines the attenuation and morphologic details of CT with the metabolic information from PET FDG to allow accurate coregistration of anatomic and functional data and, thus, leading to more assured anatomic localisation of areas of increased metabolic activity. Though its relatively high cost limits the availability of PET-CT centres, its wide-spread applications to image malignant tumours is currently a reality.

Conclusions

On the basis of our experience, radionuclide imaging may have a significant role to noninvasively characterise adrenal tumours particularly in patients with non-hypersecreting lesions and, hence, it should be inserted in the diagnostic algorithm of such patients to supplement CT and/or MR findings when these are uncertain as well as inconclusive for lesion characterisation. This latter approach could avoid the need to perform fine-needle biopsy, which is invasive and uncomfortable for the patient.

In this setting, the selection of the appropriate radiotracer for adrenal scintigraphy depends on clinical patient history and department availability of radiocompounds and equipments. Since benign adenomas are the most common cause of adrenal tumours, labeled nor-cholesterol could be useful as a first choice for patients with no history of cancer disease; in case of normal nor-cholesterol scan, MIBG could be used to confirm or rule out the presence of pheochromocytoma; if MIBG is also normal, FDG PET-CT may be considered when the clinical suspicion of malignancy is high.

Conversely, when neoplastic patients are evaluated, FDG PET-CT should initially be performed followed, if normal, by nor-cholesterol and, in sequence, MIBG studies. In particular, combined FDG PET-CT reflects the diagnostic significance of morpho-functional integrated imaging which simultaneously offers information regarding the anatomic characteristics and metabolic features of malignant adrenal tumours.

Finally, clinical applications for labeled somatostatin analogues in adrenal lesions are still uncertain since limited experience has been obtained; however, the potential role of these radiocompounds consists of somatostatin receptors' identification on adrenal tumours for possible somatostatin therapy when conventional treatments are not effective. Therefore, adrenal scintigraphy with different radiophamaceuticals plays a clinically relevant role in the evaluation of adrenal masses and, hence, this imaging technique should be inserted in diagnostic algorithms for managing such patients integrating CT and/or MR scans.

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THE CHANGING FACE OF EUROPEAN RADIOLOGICAL EDUCATION

The Perspective of the Radiology Trainees Forum

Tell us about your roles in the Sunderland Royal Hospital (SRH), and the Radiology Trainees Forum (RTF).

I was appointed as consultant radiologist at the SRH in October 2007. My main interests are cross-sectional imaging and ultrasound. I am also honorary clinical senior lecturer of the Newcastle University with weekly radiology teaching commitments for 3rd and 5th year medical students. In addition I am a member of the Royal College of Radiologists (RCR) European subcommittee.

From 2003 – 2007, I was the UK national representative in the Radiology Trainees Forum (RTF). I was elected RTF vice-chair in 2005 and I have been chairing the RTF since 2007. In this role I, and other executive members, coordinate the activities of the RTF such as sample surveys, short RTF exchanges and activities during the ECR, in particular the RTF Highlighted Lectures. I also attend other ESR committee meetings as junior representative.

Please tell us about the origins and achievements of the RTF.

The RTF was established during the 1991 edition of the European Congress of Radiology in Vienna, Austria to improve training, career development and research for junior radiologists. We also aimed to develop exchange programmes and promote the creation of national junior radiologists' organisations.

Over the years we increased the number of active national representatives in the RTF to 36 countries. There are regular communications with national delegates who participate in data collection for RTF sample surveys and voice their concerns and suggestions for future activities. I also ask for the views of national representatives and take discussion points forward to represent junior views in the main ESR committees.

European radiological education is inherently fragmented – can this be remedied?

Every European country has a different hospital system, including training of junior doctors. Radiology training also varies. The ESR Training Curriculum offers excellent guidance working towards homogeneity and many training schemes across Europe are already adapting their programmes. This process will take many more years and since legally this is guidance rather than law, changes cannot be implemented 100%.

However, exchange programmes such as ERASMUS, are key to harmonising education in Europe. I took part in an ERASMUS exchange as a 4th year medical student and enjoyed studying with French students in Dijon. It showed me at an early stage how beneficial exchanges are to broaden one's horizon.

ESOR's (European School of Radiology) visiting fellowships are a great success and I have spoken to a few trainees personally who were very impressed. Other ESOR courses are also well attended and easily affordable as they are heavily sponsored. On a smaller scale, the RTF organises short exchanges on a personal level and if anybody is interested, please do not hesitate to contact us!

What deficiencies in the education system impact European radiological residents?

General working pressures are increasing and managers are pushing for ever-greater efficiency and cost-savings to cope with the rising demand on radiology departments, often without an increase in staffing or funding. As a consequence, stress levels worsen and there is less time for direct supervision for trainees. Training of junior radiologists is not always seen as a priority, in particular when they are inexperienced and not able to contribute significantly to work output. This is worrying as no book or internet-based training course can replace the daily teaching offered by an experienced radiologist.

Are residents keen to learn more about management topics? Are facilities and courses widely available to them?

RTF data from a sample survey amongst national representatives from 2005/6 shows that 23% replied that management course were obligatory, and 30% stated that no management courses were available to them. I think that many trainees probably have little access to "hands-on" management tasks and see it as a rather dry topic. Raising interest amongst trainees is important, as management vitally needs competent clinical input to be successful in balancing the books as well as offering the best service for patients.

Dr Strickland, Chairman of Management in Radiology (MIR), and a supporter of management training amongst trainees, aims to provide a platform for this to allow more trainees to get involved in management and to improve their CV.

What is the impact of the rapid advances in technology on residents' educational programmes?

There are considerable training resources freely available on the internet and most trainees I know use them on a daily basis, with equal access for trainees whether in a well-equipped university hospital or a small district general hospital.

On the other hand, teleradiology will change the way we work significantly in the future. This technology can be used very effectively to get a second opinion from a specialist centre (such as for example neuroradiology), which will improve training. Teleradiology can however also be used for outsourcing and may as a consequence limit the type and number of examinations which can be reported by trainees under supervision of an experienced radiologist in their base hospital. Offering training in outsourcing centres could prevent training from suffering, but this may not be cost-effective for a private company.

Many state that there is considerable difficulty in attracting women to radiology –what do you think women find off-putting about radiology?

I personally always liked radiology very much and found the variety of the job (patients from all specialties and age groups as well as the different modalities) fascinating. The interaction with clinicians and the opportunities to make the final diagnosis are also appealing.

In the UK, there are a lot of female radiology trainees and I personally think it is a job, which allows flexible working times better than many other jobs (such as medicine or surgery). With advances in technology, reporting of images from home may also become easier, contributing further to flexibility, which is an important fact for women who are planning to start a family. I am personally very happy with my career choice and can only recommend radiology to other women!

Please tell us about your favourite memory from your own time as a radiology resident.

One very happy memory was travelling down to London for the admittance ceremony as "Fellow of the Royal College of Radiologists". We had a very good time and celebrated the fact that there were no more exams after years of studying. This was a good feeling!

What is your key advice for radiology residents, to make them more attractive to potential employers?

Showing initiative and doing something over and above the required standard in radiology training should attract the attention of potential employers. Good audits and research projects are also likely to impress, in particular published works of research, as everybody will know how much effort this takes. On a smaller scale, case submissions, for example to EuroRAD or national case collections will be recognised and look good on a CV.

AN OVERVIEW OF THE HEALTHCARE SYSTEM IN AUSTRALIA

Strengths & Weaknesses

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To understand the Australian healthcare system requires a consideration of core problems facing every healthcare system. Australia is a large, federated country of nine jurisdictions with 20 million inhabitants and a developed economy with a gross domestic product (GDP) per capita of 34,660 US dollars in 2006. This places Australia in the world's wealthiest fifteen countries (World Bank 2006).

Australia's healthcare system is a mixed public-private model, lying somewhere between the largely monolithic public systems exemplified by the National Health Service (NHS) of England on the one hand and the more privatised arrangements characterising healthcare in the US on the other.

Financing and Structural Arrangements

Expenditure on healthcare in Australia, at 9.7% of GDP, is above the Organisation for Economic Co-operation and Development (OECD) average. Health expenditure has tended to rise in recent decades in OECD countries, including Australia, driven primarily by the costs of population ageing and of advancing, and increasingly expensive, medical technology.

Around two-thirds (68%) of the GDP consumed by Australian healthcare is public expenditure, and the remainder (32%) is non-government, private expenditure. The Australian government contributes 45% of total funding, principally through taxation, and directly funds pharmaceuticals, general practitioners and medical services. States and territories provide funding in conjunction with the Australian government and directly manage public hospital services and various community, prevention, public health, health education and promotion programmes. Local governments have responsibility for environmental issues such as garbage disposal, health inspections and some home care and preventive services.

The generic term for the main policy instrument to achieve these service arrangements is Medicare. The vehicle used to contract the jurisdictions to their part of the bargain in sharing federal, state and territory responsibilities for public hospitals are called the Australian Health Care Agreements (Department of Health and Ageing 2006). The states and territories manage services via area, district or regional health service arrangements, which are geographically-based administrative units responsible for the health of a population of perhaps half a million people. Medicare enshrines the principle that all resident Australians are entitled to free public hospital care if they exercise the choice to be public patients.

Private patients meet their costs via private health insurance or personal contributions. The Australian government has recently encouraged increased membership in private health insurance funds. About half the population is covered by elective, government-subsidised private health insurance. Most out-of-hospital medical services are provided by private doctors, and, alongside salaried medical practitioners, these doctors perform a considerable proportion of hospital services.

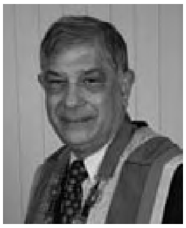
> **"Overall, life expectancy of Aboriginal people is 17 years below that of other Australians."**

Strengths & Weaknesses

Commentators have bemoaned the poor integration between general practice and hospitals and the apparent administrative and policy duplication attributed to the split responsibilities between the federal government and the states and territories. A bigger issue is whether we can call the health industry a system at all, given the various levels of divided responsibilities, fragmentation and its pluralist nature. Australian consumers and providers have considerable discretion and autonomy, and there is a complex mix of public-private concerns, state-federal politics and other intermittently strained, dichotomous interests, such as those representing clinicians and managers, the acute and community sectors, and medicine and nursing.

The other major weakness is the deplorable state of indigenous health, with extremely high prevalence of diabetes, obesity, alcohol abuse and drug problems amongst the Aboriginal population. Overall, life expectancy of Aboriginal people is 17 years below that of other Australians.

The strengths of the system are considerable: the Australian population, measured by the usual morbidity and mortality indicators, is relatively healthy and enjoys good life expectancy. Healthcare in Australia is well funded; clinicians, managers and policymakers are suitably trained; and equipment, buildings and technology are modern and well-resourced. The health policy settings are underpinned by effective research and are internationally well regarded, despite the fragmentation and difficulties in promoting integration at some points in the system. Plurality and diversity, though contributing to system fragmentation, can also bring strengths, particularly when they offer a wide range of different types of services, thereby creating choice for consumers.



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THE ROYAL AUSTRALIAN AND **NEW ZEALAND COLLEGE OF RADIOLOGISTS**

Investing in Health

The Australian and New Zealand Association of Radiologists was formed in 1935, leading to the foundation of the College of Radiologists in 1949. Today, the Royal Australian and New Zealand College of Radiologists (RANZCR) represents the professions of radiology and radiation oncology and is recognised as the body responsible for standards of practice, training and continuing professional development in both countries.

RANZCR is a not-for-profit company owned and governed by its members. Although financially and legally independent of government, it undertakes funded projects for government on a contract basis.

Australia is a federation of eight states and territories. Each state/territory has a separate government as well as the Australian or federal government. There is one government in New Zealand. New Zealand and each of the Australian states/territories has a college branch to assist in coordinating training and continuing professional development and interacting with government in their region. The college head office is in Sydney and there is an office in Wellington, the capital of New Zealand.

Membership

The college has approximately 2,900 members in Australia, New Zealand and throughout the world. Members comprise fellows, educational affiliates (who are practising but who have qualifications from overseas and not completed the requirements for fellowship), student members (or trainees) and a small number of associate members.

There are approximately 1,600 fully qualified radiologists in Australia and 315 in New Zealand; and approximately 250 fully qualified radiation oncologists in Australia and 40 in New Zealand.

Focusing on radiology, there are around 1,700 fellows or educational affiliates in active practice in the two countries. With a population of 21 million in Australia and 4.2 million in New Zealand, this represents approximately 67 radiologists per 1 million or 1 per 15,000 population. 20% of the Australian and 30% of the New Zealand radiology workforce are female. Of the current radiology trainees 34% are female. 20% of fully qualified radiologists are over age 60 and about 25% are under age 40.

Training

RANZCR is responsible for the training of radiologists and radiation oncologists and conducts five-year 'apprenticeship' model training programmes, regularly reviewed and accredited by the Australian Medical Council and the Medical Council of New Zealand. 540 trainees are undertaking five-year training programmes in radiology or radiation oncology.

The college is concerned that the current number of training positions is inadequate to produce the required number of radiologists based on estimated likely retirements in the next five - 10 years and increasing demand. There is no shortage of young doctors seeking to be trained but there are insufficient funded training positions.

Continuing Professional Development

RANZCR conducts a continuing professional development (CPD) programme in which members of the college are expected to participate. It involves accruing CPD points over a triennium with minimum sub-requirements for different kinds of educational activities, including audit. In New Zealand and some Australian states, participation in CPD is a legal requirement for medical registration.

RANZCR runs a major annual scientific meeting each year as well as smaller meetings in the branches. For rural and provincial centres the college has various CPD sessions delivered by videoconference and through the web.

Strategic Planning

In 2005, the college established strategic plans to address current and future challenges and to refocus radiologists as clinical consultants in diagnosis with direct involvement in patient care and clinical problem solving.

A number of challenges and trends in the environment in which radiology operates were identified, including:

- Increasing demand for imaging as clinicians seek to have as much diagnostic information available as possible;
- Greater consumer awareness of and access to imaging technologies;
- Continuing shortage of radiologists and insufficient funding of training positions;
- Increasing workload pressures with a risk of diminishing quality and safety;
- Radiologists and other medical practitioners wanting to control their workloads and to work flexibly and part-time;
- Sub-specialisation of the radiology workforce in response to increasing sophistication of technologies and practice in multidisciplinary teams;
- Increased training in ‘appropriateness of imaging’ in medical schools;
- The need for academic radiology positions in universities to help shape teaching and research;
- The tendency for the health system to treat radiology as a commodity rather than a consultative clinical service;
- More widespread use of imaging in screening and prevention programmes;
- New opportunities and challenges from molecular imaging, and
- Other clinical disciplines continuing to claim ownership of imaging within their spheres of practice.

Within this environment, the college’s strategic priorities include:

- Redeveloping the curriculum for radiology training to reflect modern imaging, best practice education and including a research component;
- Lobbying governments and private sector practices to fund more training positions;
- Developing standards of practice, which promote safe and quality care, including acceptable workloads for radiologists and technical staff;
- Lobbying universities and governments to support academic positions;
- Engaging with key stakeholders to establish structures, a culture and funding mechanisms to promote and support quality services, and
- Improving communications with members and fostering a greater sense of members’ ownership of their professional body.

Quality Use of Diagnostic Imaging Programme

With workforce shortages and rapidly expanding demand for imaging, the pressures to treat imaging as a commodity and to compromise quality services are great.

Key to achieving a vision for quality is the college’s Quality Use of Diagnostic Imaging Programme (QUDI). QUDI is a research and development programme providing an evidence base for diagnostic imaging in Australia and New Zealand. The QUDI programme has commissioned a wide range of projects addressing quality issues from the perspectives of consumers, referrers and radiology providers as well as considering economic issues in the delivery of services.

The programme commenced in 2005 with funding provided by the Australian government and managed by RANZCR. Its current annual budget is one million Australian dollars. It promotes safe, effective, efficient and sustainable imaging services that lead to optimal diagnosis and treatment, support consumer choice and empowerment, are delivered by accredited practitioners using evidence-based guidelines, and are sustainable within the national health system ‘budget’.

Other Activities

In addition, RANZCR:

- Has quality assurance programmes in mammography, MRI and CT;
- Offers a voluntary accreditation of practices programme in conjunction with the National Association of Testing Authorities in Australia;
- Works in collaboration with International Accreditation New Zealand in practice accreditation in New Zealand, and
- Supported the foundation of the International Radiology Quality Network (IRQN) to promote quality in radiology through international collaboration, experience sharing and mutual assistance.

RADIOLOGY SERVICES IN AUSTRALIA

The Director's Highlights

What led you to a career in medical imaging?

I chose medicine because it is ethical, innovative and one can help a lot of people. I started as a resident in neurosurgery in Paris in 1979, but on returning to Australia, found there were no training positions available. I entered general practice for a few years but decided that specialisation was more interesting. A friend had done radiology and passed the exams, and, having been fascinated by images studied during medical school, I thought it might be a suitable avenue. I commenced my training at the age of 37. These days, on selection panels, I have sympathy for doctors looking for a radiology career having tried other streams. It is a brave choice as committees often frown upon candidates moving between specialties.

What is your role within the RANZCR?

I am chairman of three committees:

- The South Pacific Radiology Liaison Committee provides education and support for some of the 17 South Pacific Island nations. Radiologists and radiographers visit centres to provide training, give advice, and provide some service work.
- The Committee of the Directors of Academic Departments is a forum for ideas about management, common problems, and the challenges of working in a complex environment such as a teaching hospital.
- The Committee of Academic Radiologists brings together radiologists who wish to share ideas and learn about research, teaching, quality, innovation, and management.

How are most national radiology services financed?

Australian citizens have free medical cover for almost all conditions. Funding is by a 1.5% tax surcharge on most taxpayers with an additional 9% of the GDP spent on healthcare. The difference is made up by money from general revenue in the federal budget. 35% of Australians also pay for private health insurance that covers private hospital charges and extra services such as dental, physiotherapy, drugs, and prostheses. By law, private health insurers cannot discriminate between the healthy and the unwell customers. Contributions are the same, and chronic conditions are covered from 12 months after joining.

Interviewee:
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The industry here help with education and research as best they can but there are not many local companies who can compete with the large manufacturers and providers in Europe and the US. Academic research is funded by the government, industry, universities, and foundations. Radiology often finds it difficult to compete with general medicine and surgery departments for a share of the research funds. We now cooperate more with them.

Up to 60% of the radiology services in Australia are performed by the private sector and we are closer in practice to the European approach to imaging rather than the US, in that ultrasound is used more, and we are more, can I say, 'discerning' in selecting imaging.

How is education structured?

Training is a five-year course in the combined New Zealand and Australia programme. In the first year there is an exam in physics and anatomy. Pass rate on the first attempt is around 80%. The first year training is mostly in ultrasound and CT so that the registrar can be on call, often after six months training and a test of basic trauma imaging. In our hospital, one registrar stays until 9pm and then the night registrar starts. He or she does seven straight nights of 11.5 hours until 8.30am when the overnight work is checked. That makes 80 hours, and the registrar has the remainder of the fortnight off duty.

The final exam is in the fourth year. It is a multiple choice exam in radiodiagnosis, a multiple choice exam in pathology, a simulated reporting session, and seven oral exams of 25 minute each, in neuroradiology and head and neck, women's imaging, chest, musculoskeletal, gastrointestinal and genitourinary, paediatrics, and pathology. Because the requirement is that all 10 parts of the exam need to be satisfactorily completed, the pass rate on the first attempt for the exam is around 40%. Only the parts that were failed need to be re-examined six months later.

> **"Radiology has to compete with general medicine and surgery departments for a share of the research funds."**

The fifth year can be spent in an advanced training position in Australia, or often in North America or Europe.

The College of Radiologists has just completed a curriculum for the training programme and it is soon to be introduced. It has some common features with the Canadian system, CanMED, which encourages doctors to be medical experts, collaborators, heath advocates, communicators, scholars, professionals, educators, and managers.

The Royal Australian and New Zealand College of Radiologists is trialling the British NHS internet eLearning system for training in the first three years: the Radiology – Integrated Training Initiative R-ITI. It looks promising.

Does geographic spread hamper access to services for patients in Australia and New Zealand?

Geographic spread is a particular problem. Australia is 14 times the size of France in area and 80% of the population live within 50km of the coast. The people living away from the coastline have restricted access to services caused by distances to travel and access to sophisticated imaging modalities. Radiologists prefer to live in the larger urban centres and this exacerbates the problem. PACS and RIS systems can help with this. One of the private radiology practices has established an Australia-wide network with the server located in Sydney. It works without significant delays, even though Sydney on the east coast is 4,000km from Perth out west.

Is academic radiology well-structured and well-funded?

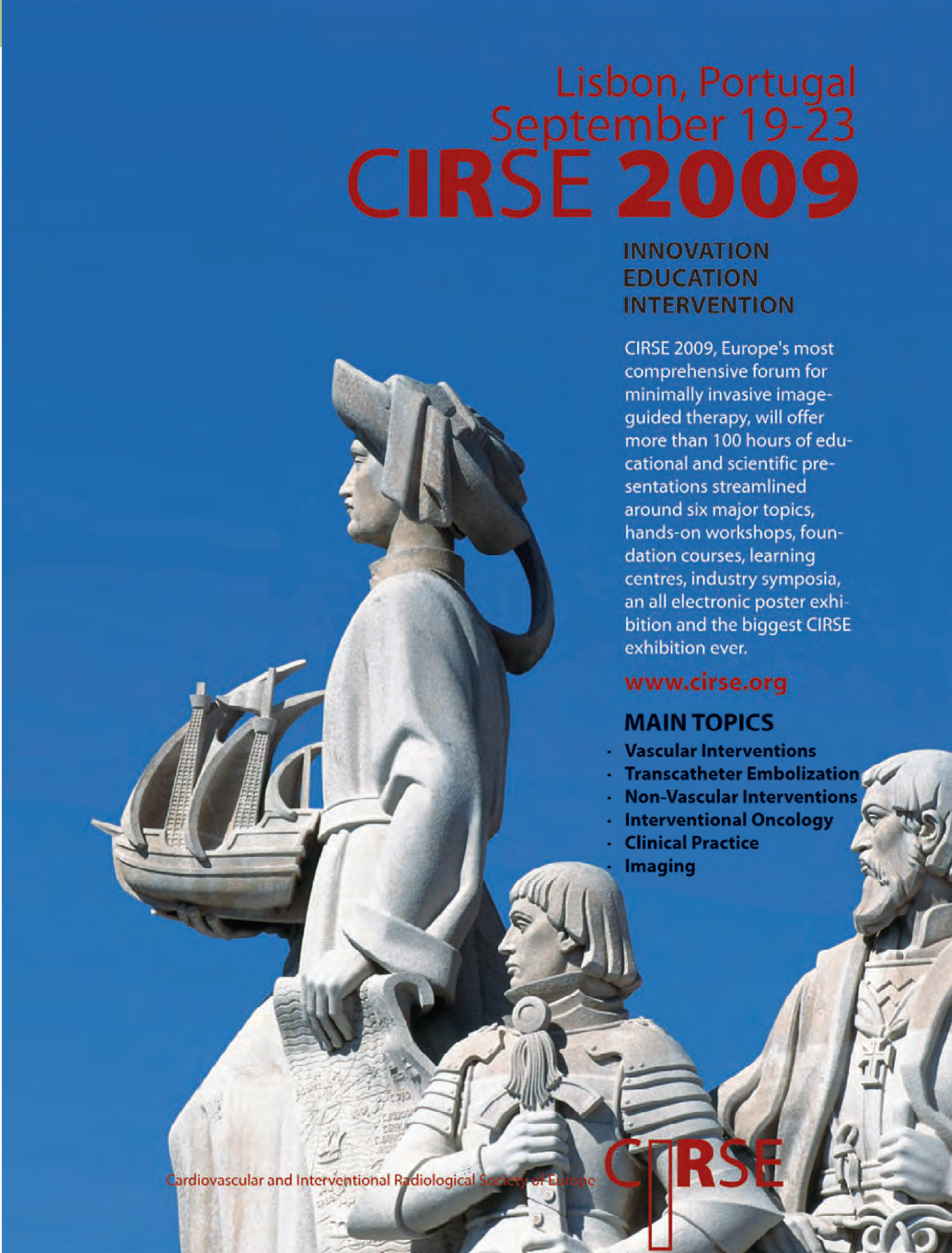
Academic radiology is not well-structured or -funded. Traditionally it has been a service-oriented specialty with fee-for-service government funding expanding the private sector, and the public sector constrained by budgets and bureaucratic management.

Fortunately, that is changing. Radiation oncology in Australia and New Zealand is something of a model of how to get organised with research and resources. Diagnostic radiology is following. Several centres have reasonable research bases. Most of the work concerns clinical research, less on translational research, and basic research is almost only at the universities. Some leading research projects focus on MRI and new radiopharmaceuticals.

Please tell us about the most interesting case you experienced in your medical career so far.

One of my "hobbies' relates to the case of a man convicted of homicide when his 28-year-old lawyer fiancée was found dead in the bath. The prosecution said it was homicidal drowning. There was a similar case in New Zealand where the radiologist made the diagnosis of an epileptic seizure because of the bilateral posterior dislocation of the shoulders on the CXR. Not so easy though in the case where I am giving advice to the defence, no CXR, the body was cremated.

It seems likely that the death was due to sudden adult death syndrome, but the forensic evidence, a poorly performed autopsy, hidden evidence, media reporting, and unprofessional conduct led to conviction for 25 years. I have spent hundreds of hours on this case over the last nine years with a small but growing band of supporters. Medicine sometimes seems to move slowly, the law is something else.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Imaging Agent to Enhance Scans of Blood Flow

The FDA has approved Vasovist Injection (gadofosveset trisodium), the first contrast imaging agent for use in patients undergoing MRA, a minimally invasive test for examining blood vessels. The agent is said to provide a clearer image in patients suspected of having blockages or blood vessel problems therefore cutting out the need for the lengthy process of x-rays for this purpose.

St. Jude Medical Buys Israeli Imaging Firm

St. Jude Medical has bought the Haifa, Israel-based MediGuide for 300 million dollars. MediGuide develops the Medical Positioning System (gMPS), that uses proprietary technology for real-time tracking of sub-millimetre sized sensors, which can be mounted on needles, guidewires, catheters, or other medical devices used for minimally-invasive intra-body navigation.

Alliance Imaging Acquires Shared PET Imaging

Alliance Imaging, a provider of outpatient diagnostic imaging services and radiation therapy services has acquired Shared PET Imaging, a mobile and fixed-site provider of positron emission tomography/computed tomography (PET/CT).

Carestream Wins Top Prize for Molecular Imaging

Carestream Molecular Imaging's KODAK Multispectral Imaging System has earned the "Top 10 Innovations of 2008" award from The Scientist magazine. The KODAK In-Vivo Multispectral Imaging System FX is designed to enable researchers to precisely locate and monitor changes in molecular activity of specific areas of interest long before morphological changes can be detected and therefore expediting the development of effective therapeutics for disease treatment.

Ziosoft Receives FDA Clearance for CT Brain Perfusion Application

Ziosoft has received FDA clearance for its CT brain perfusion application. The application is an analysis tool used with the Ziostation thin-client system that aids radiologists in stroke assessment by providing a colour map of cerebral blood flow and other perfusion-related parameters from CT images of the brain. The application includes image manipulation tools and measurement tools such as cerebral blood volume, blood flow and mean transit time.

NextRay Defraction Enhanced Imaging Technology for UNC

The University of North Carolina (UNC) has granted NextRay exclusive license to develop and commercialise DEI technology that creates x-ray images through defraction instead of absorption of x-ray beams. The technology is said to provide clearer and more detailed images than conventional x-rays while also decreasing the radiation dose for patients.

Pegasus Acquires AccuSoft's Imaging Business

The deal includes ImageGear® and NetVue® product lines. According to the company this acquisition will enable them to confirm their position as one of the most stable providers of digital imaging software.

Philips and Hansen Medical Sign Cooperation Agreement

Philips and Hansen Medical have signed an agreement to co-develop integrated products to diagnose and treat arrhythmias. By combining Philips' Allura Xper X-Ray system with Hansen Medical's Sensei® Robotic Catheter System the companies hope to enable electrophysiologists to perform complex procedures confidently and efficiently.

Siemens to Provide Al Razi Healthcare With Diagnostic Facilities

The contract will provide Al Razi Healthcare with diagnostic imaging services including the MAGNETOM Avanto MRI, the SOMATOM Definition CT and the AXIOM Multi M with mobile flat detector reported to be the first radiography system in Pakistan to cover the full spectrum of general purpose radiographic applications from skeletal to thorax, paediatric to orthopaedic exposures. A mammography system, multiple Digital Colour Doppler machines and Digital Radiography/Fluoroscopy unit AXIOM Iconos R200 are also included in the deal.

FUJIFILM Acquires Russian Distributor

FUJIFILM Corporation has acquired all shares in Fujifilm Russia, a Russian independent distributor of its medical and imaging products, from Marubeni Corporation. Through this deal, FUJIFILM hopes to accelerate its business expansion in the Russian market, which is set to expand in the coming years.

Philips Announce New Ultrasound System for Women's Health

Launched at Arab Health 2009, the HD9 ultrasound system combines advanced imaging technology, including 3D and 4D capabilities for use in obstetrics, gynecology and breast imaging. The HD9 system is reported to be durable enough to withstand rigorous use, to increase workflow efficiency and designed for new as well as experienced users. As well as women's health, the HD9 is also able to cater for applications including general imaging, adult and paediatric cardiology, general paediatrics and urology.

European Congress of Radiology: Product Preview

Carestream Health to Showcase Latest Innovations

These innovations include latest generation RIS/PACS available worldwide in the second quarter of 2009. The new web-based CARESTREAM RIS employs a Microsoft® .NET architecture allowing flexibility and secure remote access for physicians. The new CARESTREAM PACS claims to facilitate increased productivity with a virtual desktop allowing the faster reading of CT, MR and PET/CT exams through automatic registration.

Carestream's first ever SuperPACS™ Architecture will also be showcased. This architecture is designed to integrate multi-vendor, multi-site PACS into an efficient enterprise solution.

Sectra

At this year's ECR Sectra will highlight its PACS solution featuring RapidConnect technology™, optimised for effective cross-enterprise workflow. Sectra PACS is said to enable efficient workflow whether radiologists work locally or across department or hospital boundaries.

Konica Minolta

Konica Minolta is showcasing its new DR system - FlexDR C30 at the ECR 2009 in Vienna. The company has remarked that the FlexDR C30 offers a complete digital radiography solution by combining a cassette-less upright receptor combined with a cassette-based system that is cost-effective, easy-to-use and reliable.

PACSGEAR

At this year's ECR Annual Meeting, PACSGEAR™ will demonstrate enhancements to its document and multimedia connectivity solutions. MediaWriter™, a DICOM CD/DVD burning system, now integrates reports from DICOM Structured Report and HL7 feeds. Featuring the highly reliable Epson® Discproducer™, MediaWriter D200 includes an embedded DICOM viewer to create complete and portable medical records. MediaWriter solutions scale from desktop to film room and give hospitals, outlying departments, and imaging facilities DICOM distribution systems that are easy to configure, deploy and maintain.

Hologic

During ECR 2009 Hologic are presenting their new breast imaging technologies and also holding an ECR satellite symposium "Integrating Emerging Breast Cancer Detection & Diagnosis Technologies into Clinical Practice".

New technologies showcased include the Hologic Selenia Dimensions breast tomosynthesis system, Selenia digital mammography system, StereoLoc II upright biopsy system and SecurView diagnostic workstation. Hologic will also highlight their R2 CAD family of products, MammoPad radiolucent breast cushion, MultiCare Platinum prone biopsy table, MammoSite targeted radiation therapy, their line of breast biopsy solutions, Discovery bone densitometer as well as the InSight mini C-arm.

PLANILUX/Gerätebau Felix Schulte at ECR 2009

At this year's ECR Planilux will present their radiology working environment for soft copy reading and teleradiology users. Features of the new ELTRONO model 2009 include a touchscreen panel for comfortable handling, two separate flexible, and adjustable light sources. It also includes a preset option allowing individual working positions to be saved by the user and established again automatically through a memory function.

AGENDA

Key Seminars & Conferences

April 2009

4 – 7 **Charing Cross International Symposium**
London, UK
www.cxsymposium.com

15 – 18 **GEST 2009 Meeting Europe**
Paris, France
www.gest2009.eu

16 – 19 **68th Annual Meeting of the Japan Radiological Society**
Yokohama, Japan
www.radiology.jp

21 – 24 **2nd Pan-Arab Radiology Congress**
Alexandria, Egypt
www.parcalex.com

22 – 24 **6th Vienna Interdisciplinary Symposium on Aortic Radiology**
Vienna, Austria
www.visar.at

26 – 29 **Reaching Out: The Breast Course™ 2009**
Nice, France
www.thebreastpractices.com

28 – 1 **25th Iranian Congress of Radiology**
Tehran, Iran
www.icr2009.ir

May 2009

7 – 9 **ERASMUS COURSE Abdominal MRI**
Verona, Italy
www.emricourse.org

19 – 22 **11th Annual International Symposium on Multidetector-Row CT**
San Francisco, US
www.radiologycme.stanford.edu/dest

20 – 23 **Deutscher Roentgenkongress (DRK)**
Berlin, Germany
www.roentgenkongress.de

21 – 21 **New Frontiers in Interventional Oncology**
London, UK
www.bir.org.uk

27 – 29 **II Congreso Cubano de Imagenologia**
Havana, Cuba
www.sld.cu/sitios/imagenologia

28 – 29 **Interventional Fellows Conference**
San Francisco, US
radiologycme.stanford.edu/dest

31 – 2 **2nd World Congress of Thoracic Imaging and Diagnosis in Chest Disease**
Valencia, Spain
www.2wcti.org

31 – 4 **32nd Postgraduate Course and 46th Annual Meeting of ESPR**
Istanbul, Turkey
www.espr.org

June 2009

1 – 5 **ERASMUS COURSE Breast and Female Imaging**
Wroclaw, Poland
www.emricourse.org

12 – 13 **ESSR Annual Meeting**
Genova, Italy
www.essr-sirm2009.it

15 – 19 **ERASMUS COURSE Central Nervous System I**
Amsterdam, Netherlands
www.emricourse.org

23 – 26 **ESGAR 20th Annual Meeting and Postgraduate Course**
Valencia, Spain
www.esgar.org

23 – 27 **CARS 2009 Computer Assisted Radiology and Surgery 23rd International Congress and Exhibition**
Berlin, Germany
www.cars-int.org

July 2009

16 – 18 **International Symposium on State-of-the-Art Imaging**
Taormina, Italy
www.isi2009.org

27 – 30 **3rd Annual LAVA (Latest Advances in Inteventional Techniques)**
Maui, US
www.radiologycme.stanford.edu/dest

August 2009

3 – 8 **NYU Radiology in Banff**
Banff, Canada
www.med.nyu.edu/courses/cme/banff09

28 – 2 **ERASMUS COURSE Central Nervous System II**
Antwerp, Belgium
www.emricourse.org

Coming in issue two:

> *Cover Story: The Economic Crisis & Radiology*
> *Cardiologists & Portable Ultrasound: A Growing Trend*
> *Quality Standards in Paediatric Echocardiography*
> *Cost-Effectiveness & Cardiac Imaging*

IMAGING Management is published by
EMC Consulting Group
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B-1040 Bruxelles, Belgium
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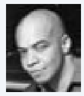

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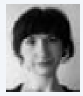

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Subscription Rates (5 Issues / Year)

One year	Europe	85 euros
	Overseas	105 euros
Two years	Europe	150 euros
	Overseas	180 euros

Production and Printing
Print run: 14,000
ISSN = 1377-7629