RSNA Congress

held in the Mc Cormick Conference Centre, Chicago from 25 November to 1 December1995

A report back by
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The congress was extremely well organised despite being the largest medical congress of any type with over 20 000 professional delegates. Most delegates were able to pre-register, avoiding any queuing, and a number of restaurants and stalls shared the load of catering. The effective computerised electronic messaging system for delegates was a popular and effective way of meeting colleagues. A number of workstations with direct and rapid Internet access were provided and were always in demand. The speed of access compared to that in South Africa was probably ten times better, e.g. 2 seconds vs. 20 seconds to download an average page.

The congress catered for many special interest groups with multiple concurrent lectures, categorical courses, scientific sessions, workshops and seminars. The congress also celebrated the centennial of the discovery of X-rays with special presentations and events, including a live link-up to Wurzburg, Germany, the town in which the original discovery was made.

Commercial section

The commercial section was spread over two equally vast halls in the two wings of the congress centre, with all the latest products from the imaging technology and support industries on display. A new south wing for the McCormick conference centre is being built and scheduled for completion in 1996.

One item of note amongst the commercial exhibits was a computerised "intelligent" viewing box which was able to automatically sense the size of the X-ray film or films placed on the viewing surface and then blank off any extraneous viewing box light peripheral to film. The importance of adequate exclusion of nonessential light on a viewing box is well known to every radiologist. Here, at the press of a button a dark blue surrounding collimating screen is turned on in what appeared to be a liquid crystal display, blanking out all the unneeded and interfering light. A dramatic demonstration using an overexposed mammogram revealed an impressive amount of additional detail after adequate blanking. No price was available as the product is still being developed, but it appears to be close to commercial viability.

The poster section was also extensive, being divided chiefly by body systems, and generally polished and professional. A few exhibits covered 3D ultrasound displays, while others demonstrated reconstructed holographic films of the skull and other skeletal structures, which to me were not worth the effort that must have been required to produce them. A separate "Inforad" area highlighted computer applications, itself subdivided into a number of specific sections.

General

In an address entitled "Radiology 2000" a look at the future of radiology was offered. It was predicted that the hospital will probably be replaced as the centre of health care by a more diffuse health management system. Speakers emphasised the concept that the diagnostic radiologist is essentially an information vendor who deals with people, processes and technology. Joint ownership of equipment with the suppliers was felt likely owing to the enormous costs entailed. One speaker predicted that the ownership of a specific piece of equipment would be replaced by the purchase or hire of functionality, e.g. buying the ability to perform magnetic resonance angiography from a contractor rather than a specific model of machine.

The American College of Radiology has spent a good deal of time developing "appropriateness criteria" along the lines of the Royal College and Australian College of Radiology's clinical radiology guidelines. An interesting presentation detailed the way in which the various categories of clinical conditions were decided upon and assigned to expert groups in sub-committees for detailed evaluation. Of importance was the inclusion of non-radiologists such as orthopaedic surgeons in the groups. A number of meetings were held after extensive literature searches had been completed, and much fax correspondence between group members ensued. In the spirit of evidence-based medicine the statistical soundness of each recommendation was stated in the publication which was released at the congress. A CD-ROM version is also available, although a number of clinical scenarios have yet to be completed. The publication was sent to all members of the ACR free of charge, and is now available for purchase by interested parties.

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Computer applications

Future of radiology

The entry to this area was via an ingenious multimedia tent which included a "floating head" of Röntgen addressing the audience on the history and likely future of radiology. Multiple, initially unseen, screens and a mock-up of the original laboratory in which the discovery was made were hidden behind a veil-like netting which made for a dramatic effect when these were illuminated.

A number of adjacent exhibits portraying radiology in the future had sections depicting a disaster scene illustrating the potential medical contributions from the US Military, home medical management via a TV link, neuroradiology and mammography.

Of interest in the disaster scenario was the new version of the US Military dog tag which although similar in shape to the old standard issue, now contains an integrated electronic chip able to store 20 megabytes of information. A newer version to be released next year is able to store 200 megabytes, which will include all the patient's medical records as well as pertinent imaging. The dog tag is apparently indestructible, being also acid and fire resistant.

The home radiology section included the re-creation of a complete family lounge where communication through a TV set allowed the radiologist and physician to consult directly with the patient. Teleradiology was also used in the scenario, demonstrating the consultation of a general radiologist with a super-specialist on the imaging details of the case, in this example a lung lesion. Teleradiology also featured strongly in the other two scenarios, one a mobile mammography clinic, and the other a neuroradiology - pathology laboratory link up.

Computer aided diagnosis, digital imaging, workstations, computerised literature searching, virtual reality and future technology were all represented in different sections, most work being performed on high end Silicon Graphics or Sun workstations. An impressive presentation demonstrated a prototype example of so-called "Telepresence surgery" or "Telemedicine" which involved a doctor performing surgery on a pig's stomach using a remote control system with scissor-handle grips, incorporating tactile feedback, from a few metres away. Another example was a computerised simulator of balloon-catheter angioplasty. This apparatus provides sensory and visual feedback from a dummy catheter which can be pushed, pulled or rotated as a conventional catheter would. Increased resistance is felt when "advancing" the catheter through a narrowing in the vessel, and the system is able to sense whether the balloon on the catheter is overinflated or left inflated for too long during the angioplasty.

The proposal is that such devices could be invaluable both for training as well as for allowing imaging guided procedures to be performed "over the wire" in remote sites at distances of many kilometres. It may someday be feasible to perform emergency after-hours procedures from home using this type of technology, perhaps without even getting out of bed!

Teleradiology

Teleradiology was one topic that featured repeatedly in different presentations. Already widely used in the USA for the transmission of emergency after-hours and peripheral clinic images, sending images for remote expert opinion appears less commonly utilised.

Concern was expressed that the close interaction between clinician and radiologist may suffer as a result of the removal of the to-and-fro interchanges that normally occur in regular consultations. Also, lack of clinical information, most especially as a result of not having the option of seeing, speaking to or examining the patient is a significant disadvantage. This is especially so when the referring person may be a nurse or equivalent.

A number of technological problems were also addressed, most notably the amount of information that needs to be conveyed. In practical terms this translates into compression of images and speed of transmission, both of which are subject to a good deal of research. In particular mammography with its high spatial resolution demands of 4000-by-4000 pixels, and CT and MRI which may require 3D methods, is especially problematic. Wavelet compression has evoked a good deal of interest and is currently capable of providing compression ratios ranging from 10:1 up to 60:1 at times.

Of interest, despite all the technical challenges, human error remains a major cause of transmission errors in the experience of one of the larger centres.

Computed radiography

Presentations addressed the three essential aspects of any form of imaging, namely:

a) Capture

b) Storage, and

c) Display, all of which present their own problems with computerisation.

Capture

There was a fair deal of discussion on the three types of receptor material available for computed radiography, namely:

1. Photostimulable phosphors
2. Caesium iodide, and
3. Amorphous selenium (with an applied charge gradient). A newer modification incorporating an active matrix similar to that of a laptop computer display shows promise.

Storage - (PACS)

The practical difficulties of a Picture Archival and Communication System (PACS) are now better recognised, although information storage has become less problematic over the last year or so with new high capacity storage technology.

Display

The high cost of dedicated 2000-by-2000 matrix, flicker-free, high luminance diagnostic monitors limits their widespread use, especially as four to six monitors are ideally needed for a reporting station. This expense is in part due to the relatively small volume in the radiology field as opposed to the high turnover in the personal computer field. The use of flat panel displays was recommended by one speaker as this reduces reflections. Some feel that touch-screen displays are the best form of interface, but practical difficulties such as smudgy fingerprints on the screen after a day's reporting still remain.

The overall state of computed radiography at present was summarised by one speaker who felt that the best analogue image is better than the best digital image, but that the average digital image is better than the average analogue image.

Computer aided teaching

In keeping with the overall educational shift from instructionist to constructivist methods, the educational software presented in a session on computer-aided teaching also demonstrated a shift in emphasis from tutor-like programs to intelligent tools for use by the student. Instructor, student, author and domain modules formed the functional components in one overall application package. Authoring tools allow the instructor or tester to write their own applications, while the student module provides the ability to structure the session individually. The domain module contains all the relevant factual knowledge.

Interaction

Following on the theory that cognition can either be experiential or reflective, and quoting an interesting point made in a study undertaken by

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the US Parks Department showing that the average time spent looking at the Grand Canyon is 90 seconds, the inference was that visual spectaculars are not sufficient on their own to sustain interest for long periods of time. This they felt was reflected in the "channel surfing" of the typical television addict, and argued strongly for an interactive model to sustain interest. The format employed in one such interactive project was to present a case, discuss findings, ask for the diagnosis and emphasise the visual concept in the case, together with creating a personal "bug library" of misdiagnoses.

Authenticated learning with credentialling and CME credits were felt to be potential benefits of computer aided training, with the Internet a likely avenue for dissemination. Recently legal questions concerning ownership of software content and design have risen, and have yet to be clarified. Fear, uncertainty and doubt ("FUD") were felt to often mitigate against further developments in a field where such threats were present.

A proposal in principle to develop a "Radiology interlingua" - a controlled vocabulary in a unified medical language system to allow intercommunication between the various current disease coding and classification systems such as ICD 9, SNOMED, the ACR anatomical and pathological codes and the BIRADS system in mammography with different levels of granularity was interesting but is as yet undeveloped.

Virtual Human project

A highlight in the Inforad area was a huge projected display of the Virtual Human project, funded by the National Library of Medicine, which entailed taking photographs of cross sections of cadavers at 1mm (in a male subject) or 1/3mm (in a female) intervals. Layer by layer these now famous bodies can be displayed in full colour in any desired plane. The male display allowed for more rapid progression through the fewer slices, creating a dramatic display of continuously flowing sectional anatomy. Individual organs, muscles, bones and vessels can also be selected and displayed, and simulated surgical incisions can be made revealing the underlying tissue. One of the problems is the preservation artefact in the bodies with distorted viscera not simulating exactly what would be encountered at surgery.

Functional MRI

One of the keynote addresses concerned functional cardiac and cerebral MRI. Echoplanar imaging (EPI) is essential for these techniques, requiring in turn high field strength magnets. Detection of myocardial perfusion by this still experimental technique reportedly gives better detail than Nuclear Medicine perfusion scans, with microstructural elements and myocardial contraction patterns identifiable.

Magnetic resonance diffusion and perfusion imaging of the brain promises detection of cerebrovascular accidents as they occur. Portrayal of areas of regional haemoglobin desaturation as an indicator of cerebral cortical activity allows accurate mapping of eloquent areas in the brain, but there is still no direct method of mapping neural activity.

Recent work on 4 Tesla MRIs has shown that contrary to popular belief, these high strength magnets can produce good quality clinical images, including EPI. Work is currently underway on an experimental 9.4 Tesla MRI.

Interventional

Angioplasty and stenting

Much of the recent research has gone into the prevention of restenosis after angioplasty and/or stenting. Radiation has previously been used in the attempted prevention of neointimal hyperplasia. One presentation dealing with the coronary arteries suggested that beta radiation may be the best form of radiation for this purpose as it appears to be more effective, to have quicker onset of action and to cause less radiation to the surrounding tissues due to its poor penetration. Drug delivery was also topical with, for example, a heparin-hydrogel coated PTA balloon releasing dexamethasone into the angioplasty site. Eluting stents impregnated with chemical agents such as Taxol, an anti-angioneogenesis factor appear to be beneficial in preventing tissue overgrowth in stented porcine biliary systems although proximal and distal overgrowth remain problematic.

The cost effectiveness of primary arterial stenting versus angioplasty was also addressed, suggesting that primary stenting may be cheaper in the long term.

New applications of vascular intervention in aortic dissection were discussed by the Stanford group. Transoesophageal echocardiography is felt best for emergency imaging, while magnetic resonance angiography is best suited to elective imaging. However angiography remains important before any interventional procedure. Even then, angiography is really only a "lumenogram" which does not always give a complete picture of the pathology. It is therefore felt important to opacify both true and false lumens independently during arteriography.

Interventions in aortic dissection are indicated for the treatment or prevention of rupture, aneurysm or ischaemia. The false lumen may produce a windsock or "sausage-casing" obstruction in the aorta or branch vessels. Techniques include use of metal stents to open up vessels occluded by flaps and balloon fenestration of dissection flaps.

The same group have also successfully placed a few covered metal stents for traumatic aortic arch injuries.

Embolisation

Hepatic artery embolisation in the face of biliary obstruction was reported to occasionally cause biliary necrosis, possibly due to the blood supply to bile ducts being end arteries or because of pre-existing periductal ischaemia. Another group reported that chemical cholecystitis following inadvertent cystic artery chemoembolisation seldom necessitates surgery, although prolonged analgesia may be needed.

Vascular

A carotid Doppler workshop presented a simplified approach to carotid artery stenosis - a flow velocity of 120cm/s implies a 60% stenosis, while 230 cm/s equates to a stenosis of 70% or more. Technical points regarding flow measurement in eccentric stenoses and the use of the temporal tap to identify the external carotid were emphasised. A simple aide memoire to recall the low resistance circulation in the internal carotid was to remember that the brain is more important than the face, hence needing diastolic flow as well as systolic flow.

CT and MRI lymphography using subcutaneously injected experimental contrast agents which are subsequently taken up by the lymphatic system were discussed. These agents could also be used to guide biopsies of nodes in the future.

TIPS

In most cases the mid right portal vein lies between half and one and a half vertebral body widths lateral to the right vertebral margin, and between the tenth and twelfth ribs. This is the ideal target for puncture during TIPS procedures.

Prior renal function was shown to predict the likely outcome of TIPS for ascites in one group's experience. The presence of portosystemic collaterals was also commented on, and it was felt that these were potentially dangerous with the risk of gastrointestinal

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haemorrhage if they ran close to the stomach and should therefore be embolised at the time of, or following, TIPS.

A paper from a group using 12mm diameter Wallstents as opposed to the usual 10mm variety felt that these larger stents may not be as effective as the 10mm size, possibly due to poor hoop strength. However this was controversial with others in the audience reporting better results with the larger Wallstent.

Flow velocity in the shunt below 100cm/s at follow up Doppler suggested future problems. Splenic size does not seem to reduce after successful TIPS in one group's experience.

Gastrointestinal tract

Percutaneous cholecystostomy was promoted as a useful technique. It was suggested that one divide the cases into calculous vs. acalculous types. In the latter it may be appropriate to allow removal of the drainage catheter, albeit after 6 to 12 weeks, whereas the former should require subsequent cholecystectomy or stone removal.

Stenting in the GIT was the subject of a number of presentations. Oesophageal, gastric, duodenal and colonic stents were placed for both benign and malignant conditions. The 15mm diameter Wallstents were often found to be too short, while the 25mm diameter Wallstent appeared to work well even for relieving acute colonic obstruction (to allow subsequent one stage surgical repair).

Endoluminal appendectomy

An innovative technique has been devised to perform a transluminal appendectomy. At this stage it has only been performed on appendices in colonic specimens, but has the potential for application in colonic and other resections as well. The appendix is inverted (i.e. intussuscepted) into the caecal lumen by traction on either a transcolonic angioplasty balloon introduced per rectum and inflated in the lumen of the appendix, or by elongated grasping forceps pulling on the base of the appendix. Thereafter the appendix is amputated and stapled with a modified stapling gun. The finer technical details were not clear, but the concept has interesting potential.

Imaging of blunt abdominal trauma

The point was made that the two causes of acute death in the trauma setting were neurological damage and haemorrhage. A plea was made during this discussion to remember that angiography was the one imaging modality which could be lifesaving in the severely traumatised patient, and that delaying this in favour of more detailed examinations such as CT or MRI could be disastrous.

Conclusion

In all the congress was of an excellent standard and most enjoyable, although potentially overwhelming. It is the ideal venue for anyone contemplating the purchase of imaging or related equipment as the vendors are represented as nowhere else. Personal highlights were the keynote address on functional MRI, the developing use of vascular metal stents in aortic dissections and traumatic aortic rupture and the intriguing new method of endoluminal GIT intervention.

Multimedia in Radiology Education

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and effects of parameter modification in action at molecular level. Admittedly the creation of a slick multimedia production takes an enormous amount of time and effort, much of the content of which may soon be out of date - we all know that there is nothing as stale as yesterday's newspaper wrapping your fish and chips. The threat of software piracy must also be a strong disincentive in a limited market such as radiology.

Having used a few radiology software applications on CD-ROM, disk or the Internet there are certainly advantages to the new media, but to me these only hint at the future promise rather than revolutionising the way we learn our radiology now. The overall impact of computerised learning so far is less than predicted by McLuhan - Gutenberg can rest easy for a while longer! Just as digital radiology paradoxically increases one's appreciation of the quality of analogue X-rays, so the same applies in educational media - the continued popularity of book shops attest to this - books are difficult friends to desert. None of the newer alternatives seriously competes with the convenience, immediacy and image quality of reading a text book or journal while lounging at the poolside sipping your pina colada. The current state of digital multimedia compared to textbooks and journals reminds me of the comparison between an early chunky digital subtraction angiogram and one of Lennie Handler's exquisite analogue subtraction angiograms, but the digital promise remains enticing. The gap between digital and analogue is narrowing and may eventually reverse, with us all perhaps one day carrying digital videobooks linked by satellite to gigabytes of information in carefully reviewed and nurtured global repositories of information covering all known diseases, imaging features, techniques and equipment.

It is worth remembering, however, that all forms of transmitted education are of necessity simplifications and distillations of the ultimate teacher - experience, lending weight to Thoreau's warning that education "makes a straight-cut ditch of a free, meandering brook".