

When first asked to talk on this subject, I had visions of covering all the exciting developments in the field, which have turned Radiology into a dynamic and vibrating speciality, bringing so many new modalities to the Radiologist and allowing him to revel in the information he needs to help towards the diagnosis and management of conditions which were previously only possible by means of potentially dangerous invasive techniques, or frequently by means of surgery.

I considered talking about CT scanning, ultrasound, thermography and radio-isotope studies, but, due to the remarkable advances in technology and in particular the use of the microchip in medicine, these diagnostic tools are actually almost out of date in the context of the term "Update Radiology".

I will therefore limit this discussion to three fields of action, which are or will soon become available to Radiologists and which will add further to our diagnostic armamentarium.

The three techniques which I will discuss briefly are: (i) Nuclear Magnetic Resonance; (ii) Interventional Radiology; (iii) Digital Vascular Imaging.

Nuclear Magnetic Resonance

Many of the medical imaging techniques in use today depend on reconstruction of an image from a set of measurements, rather than direct recording of the image on film.

Such techniques include ultrasound, radio-isotope examinations and CT scanning. A recently developed technique of this type is tomography based on Nuclear Magnetic Resonance. NMR has been used for some years in the analysis of samples *in vitro*, but its application to imaging the structures of the living body is relatively new.

The NMR images are derived from radio signals emitted by the nuclei of Hydrogen atoms in the water molecules of cell contents or naturally occurring body fluids. The resulting images show the distribution of water within the body and additional information can be obtained on chemical structure and flow rates. No adverse biological effects from the applied magnetic fields have been found, or are anticipated.

Consequently NMR has aroused considerable interest as a potentially safe technique for visualizing internal structures and determining their cellular chemistry and metabolism *in vivo* without the use of ionizing radiation. NMR has been used on a limited scale in patients in the USA and Britain and encouraging results have been obtained in the detection of such pathological processes as cerebral tumour, cerebral oedema and disseminated sclerosis.

The technical aspects of NMR are highly complex and even the terminology

used by physicists creates confusion so I will explain the system as I understand it.

NMR is a phenomenon exhibited by the nuclei of certain elements. The most important of these for medical purposes is Hydrogen as it occurs as a constituent of the water molecules present in the majority of living tissues.

If these nuclei are placed in a magnetic field, they will align themselves with the field like miniature compass needles. If a radio-signal is applied at right angles to the magnetic field, the axes of the nuclei will be tipped at an angle and the degree of tilt depends on the strength of the radio wave.

If the radio wave suddenly stops, the nuclei will begin to realign themselves with the magnetic field and they will also wobble like a top that has been tipped off the vertical. As they return to their previous position in line with the magnetic field, they release energy in the form of a weak radio-signal.

The strength and duration of the signal indicates the quantity and physical state of the nuclei.

NMR imaging depends not only on demonstrating the presence of water-molecules, but also on determining their location in the body. NMR is only of practical value in water at the present time as the nuclei in body proteins do not produce a measurable signal.

Radiology Update

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Three fields of action are discussed which are, or will soon become available to the Radiologist and which will add further to his diagnostic armamentarium.

Interventional Radiology

For the past ten years, Dotter has been routinely performing trans-luminal angioplasty, but it is only in the past five years that interventional radiology has undergone widespread development.

This is mainly as the result of the fine gauge needle for biopsy, the development of the art of cytopathology, the refinement of angiographic techniques, the enormous technological improvements in medical imaging and, most importantly, a willingness on the part of the Radiologist to play a "front line" role in the management and therapy of patients.

For the patient, interventional radiology usually results in less morbidity and mortality and less financial burden than does conventional treatment.

For the radiologists, however, it represents an increased responsibility both for the effects of his treatment and for any complications that may arise. I believe that these responsibilities are amply rewarded by the central role of the radiologist in patient management.

Interventional procedures may involve virtually any area in the body and I have grouped them arbitrarily into two main groups - the vascular and the non-vascular procedures. Many of these have very little in common except that they are performed by the interventional (or if you prefer, the interfering) radiologist.

Most of these procedures are alternatives to surgery and in several US hospitals, there are interventional radiological beds in the wards where ward rounds are performed by the radiologist and the referring surgeon.

No patient is accepted for Interventional Radiology without prior discussion and consultation with the surgeon. The surgeon must be aware of potential complications because he may have to deal with them.

Non-Vascular

Biliary tract

- Drainage
- Endoprosthesis placement
- Stone removal
- Replacement of T tubes
- Dilatation of strictures
- Catheter placement for dissolution of stones
- Disimpaction of T tubes

GIT

- Dilatation of oesophageal strictures
- Reduction of intussusception

Renal

Nephrostomy

Ureter

- Endoprosthesis placement for strictures
- Stone removal
- Dilatation of benign strictures
- Catheter placement for dissolution of stones

General

- Drainage of intra abdominal abscesses
- Fine needle biopsy techniques

The complication rate varies with the skill and experience of the radiologist who is advised not to "dabble" in interventional techniques, but rather to do a lot of them

or none at all.

Already an invasion of interventional radiologists has caused some suspicion and resentment in some parts of the surgical community, but interventional techniques have survived as have other new forms of treatment in the past.

The radiological community is convinced that this new subspecialty is here to stay and will form an increasingly significant portion of the work load of the future radiologist.

Digital Vascular Imaging

There is one aspect of a radiologists life which creates enormous stress and which results in an outpouring of adrenalin equivalent to that of a surgeon in his most stressful moments. I refer to the arteriogram performed in a high risk patient. 15 years ago, when I performed my first arteriogram, a patient needed to be reasonably fit to cope with major vascular surgery.

Today, with improvements in surgical and anaesthetic techniques, many of the patients previously considered too ill for these procedures are having successful reconstructive vascular surgery. As a result, there are now requests from surgeons for angiography on patients with extensive vascular disease.

Most arteriograms are performed using catheterization techniques via the femoral or axillary arteries or, in limited examinations by direct puncture of the abdominal aorta - the translumbar aortogram.

Imagine the patient who has had a number of myocardial infarcts and occasional transient cerebral ischaemic attacks. His aorta is occluded at the level of the renal arteries and his renal function is poor due to renal artery stenosis. His one subclavian artery is occluded and a bruit is audible over the other subclavian artery

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Vascular

Embolization

- C.C. Fistulae
- Intracranial aneurysms
- Facial A-V malformations
- Extracranial vascular tumours
- Parathyroid tumours
- Epistaxis
- Pulmonary AVM
- Haemoptysis
- PDA
- GIT bleeding

- Splenic infarction
- Hepatic tumours
- Oesophageal varices
- Adrenal infarction
- Renal infarction of tumours A-V-F and haemorrhage
- Bladder tumours
- Varriceles
- Int. Iliac arteries for priapism

T.L. Angioplasty

- Aorta, iliac and femoral

- Renal
- Coronary
- Carotid
- Coeliac and SMA
- Int. iliac arteries for impotence
- Subclavian

Infusion of drugs

- Chemotherapeutic agents
- Streptokinase in coronary and pulmonary
 - Pitressin for bleeding

IVC filters