Medicine for Managers

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Can I have a scan, doctor?

Before the 1960s, X-rays were one of the few forms of non-invasive internal examination available to medical clinicians and they had many limitations. Then along came scans of various types and their use has increased exponentially during the last thirty or forty years. Commonly now, during medical consultations, patients will ask if they can have a scan.

Scans are of different types and fulfil different roles. Their use is now very widespread but they do not provide a total answer to any diagnostic conundrum. Like all other tests they are an aid to diagnosis, albeit an extremely valuable one.

Ultrasound Scanning.

Ultrasound was first applied to medical use in the late 1940s in America and developments in the USA and Sweden and in Scotland by Professor Donald and Dr Willcocks at Glasgow resulted in the recognition of ultrasound as a safe technique with a variety of different applications during the 1950s.

Ultrasound can now be undertaken in different ways according to the part of the body being scanned. The scanning probe may be applied externally, internally or as part of an endoscopy. Scans are now very versatile.

External ultrasound is commonly used in a variety of situations:

- Obstetrics to assess the health and gestational age of the developing infant.
- To assist in the diagnosis of disease associated with abdominal organs (liver, gallbladder, uterus and ovaries, kidneys, adrenal glands and bladder)
- Evaluation of testes and thyroid gland

Internal ultrasound enables some structures within the body to be examined more closely.

- The prostate gland in men by inserting the probe into the rectum
- The ovaries and uterus by inserting the probe into the vagina.

Such examinations are uncomfortable and may cause embarrassment but do allow more detailed examination of the structures *Endoscopic ultrasound*. It is possible to fit a very small ultrasound probe to the end of an endoscope for examination of the oesophagus, stomach, bowel, mediastinal

(chest) lymph nodes and other specific areas.

Endoscopy may be carried out in hospital or in the community and machines vary in design from large fixed machines,

to small portable devices

Other specific uses for ultrasound include breast assessment, identification of aneurysms and blockages in blood vessels, and examination of the heart (*echocardiogram)*.

Echocardiography is used to make a detailed assessment of the heart; size, shape, movements of the heart valves and contraction of the chambers. The technique will enable structural and functional abnormalities to be identified in adults and children, even before they are born.

CT Scans (also called CAT scans)

CAT (computerised axial tomography) scans are specialised X-ray investigations. They produce very detailed, almost text-book, pictures of parts of the body and their introduction resulted in a leap forward in diagnosis.

The concept of X-ray tomograms was developed in the early years of the twentieth century by the Italian Vallebona who devised a technique for obtaining X-ray slices through tissue. The first commercially viable body scanner was developed by Sir Godfrey Hounsfield at EMI in London in the late 1960s and the first scan (of a brain) was done in 1971. Since then the technique has been refined to the effective diagnostic tool it is now.

The scan involves lying on a couch with the part to be scanned surrounded by a circular ring (doughnut-shaped) within which is an X-ray tube. The tube rotates round the body and the X-rays are collected by detectors which transfer the information to a

computer. Tissues of different densities appear as different colours. The computer creates a picture of a thin slice of the body.

The CT scan can demonstrate structures which standard X-rays cannot show.

The investigation is used to demonstrate the brain (in cases of head injury, suspected stroke or tumour) and can display muscles, internal organs, blood vessels and nerves. It can also visualise tumours, abscesses and other abnormalities.

For clinicians the scan will assist in planning for surgery, identify the exact position of particular structures and provide a way of monitoring changes with treatment.

The scan can be done following consumption of a dye (contrast) which highlights a particular structure.

The CT scanner uses X-rays and therefore the usual precautions of screening and monitoring are essential. The risk to the patient of the radiation is low but is much more than for a single radiograph. There is a small risk of developing a tumour or leukaemia over years following a CT scan.

However, the benefits of the scan greatly outweigh the risks in appropriate circumstances although radiological advice states that the scans should not be used in circumstances where an alternative to X-rays is available or as a screening tool where the patient has no symptoms.

They are not recommended in pregnancy and are used with caution in small children.

MRI scans

Magnetic Resonance Imaging (MRI) techniques are used to display and investigate body tissues using strong magnetic fields and radio waves to create images of parts of the body. It is now used widely for structural visualisation, diagnosis, staging of disease and follow-up after treatment without the need for exposure to radiation.

MRI techniques were discovered in the 1940s and 50s but the first scanner was produced in America in the early 1970s. Further development occurred in the USA and in the UK. In 1980 a team headed by Professor John Mallard at Aberdeen launched a full body MRI scanner capable of 3-D imaging of internal tissues.

Since then further developments have made the equipment even more effective.

In some ways the technique is similar to CT but differs in that there is no X-ray exposure making the investigation inherently safer. However, unlike the ring design of the CT scanner, the MRI scanner requires patients to be placed in a tube (about 1.5 metres long) and this can be very difficult and upsetting for people who feel claustrophobic.

The distress in such patients can often be reduced by distraction techniques or sedation. The scan can take

up to 45 minutes to complete. The scanner is noisy and patients will often use headphones which reduce the noise and through which music is played.

There is no evidence to suggest that it is harmful to place a body in an intense magnetic field. Therefore the MRI scan is a safe investigation. However, the magnetic effects of the scanner must be completely shielded because the magnetism would disrupt anything from a computer to a credit card if exposed.

MRI scans may be used for most patients including pregnant women but may not be used for those people with implants such as pacemakers or those with any metal in the body (e.g. metal clips, implants, electrical devices or artificial joints). As with CT scans some MRIs involve the use of a contrast dye to highlight particular structures.

In conclusion

In the last forty years, the various scanners available have allowed huge improvements in diagnosis, treatment and monitoring of outcomes. In recent years more specialist types of scanner, such as the PET (positron emission tomography) have become available. This sort of scanner uses a radio-active chemical which is linked to a simple body chemical and is administered before the scan is undertaken.

No doubt further improvements will continue to occur to reduce the necessity to open the body to 'see' what is happening inside. Scans will go down as one of the huge leaps in medical technology.

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