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Who needs a CT brain scan?

Computed tomography (CT) has led to a reorientation in neurological practice.[1 2] The procedure is well tolerated and has almost completely replaced air encephalography—but the equipment and its maintenance are expensive, and the radiologist needs considerable skill. With these limitations on material and human resources careful selection of patients is vital. The indications may now be defined more clearly, but difficulties remain, and much still depends on the clinical judgment of the doctor who asks for the investigation.

Firstly, a good case may be made for CT in many acute conditions: raised intracranial pressure, abscess, subarachnoid haemorrhage, severe head injury, encephalitis, unexplained coma, and some cases of stroke and meningitis.

When an intracranial tumour is suspected a clinical search for a primary neoplasm outside the nervous system should be followed by chest radiography.[3] A negative scan will exclude a mass lesion but does not completely rule out an infiltrating tumour. CT has brought to light cases of latent hydrocephalus. Enhancement of the image by intravenous injection of contrast increases the sensitivity of detection. The radiologist should be told of the expected location of the lesion—especially if a lesion of the visual pathway or posterior fossa is suspected, since a high definition scan may then be appropriate.

In suspected subarachnoid haemorrhage a CT scan is the best first investigation.[4 5] It distinguishes the haemorrhage in many cases and may indicate the area of origin, but when doubt remains it is essential to examine the spinal fluid. Aneurysms are not displayed unless they are large. When the patient is far from the scanner and the diagnosis is uncertain a lumbar puncture may be appropriate.

The CT scan is of great value in patients with head injury who are unconscious or show focal signs. Scanning may not be possible with an irritable and restless person unless he is anaesthetised. The scan will show a haematoma or intracranial shift and indicate the extent of cerebral oedema as well as displaying the ventricular system. In encephalitis the scan will give information on the state of the ventricular system and the degree of cerebral oedema, and in meningitis exudate may be shown in the ventricles.

The distinction between stroke and tumour may be difficult, particularly when there is progression. A CT study of 325 patients with clinically definite stroke showed that the scan was useful in about a quarter—including some in whom the diagnosis was in doubt (sometimes because no clinical history was available), in cerebellar haemorrhage, and in some with an atypical clinical course. It was also helpful in excluding haemorrhage within the cranium when some other investigation was planned. Two subdural haematomas and three tumours were discovered in this study.[6] The CT scan is a reliable means of distinguishing cerebral infarction from haemorrhage.

Secondly, in more chronic disorders unexplained signs or symptoms of intracranial disease may justify scanning. In migraine and non-specific headache without signs the scan is seldom of diagnostic value. It is in this group that pressure may be brought by medical friends, acquaintances, and other well meaning people who are not familiar with the uses and limitations of radiology. By contrast, in epilepsy of late onset about one fifth of patients are shown to have a tumour. The dilemma here is that while early recognition of a meningioma may lead to effective surgery the more common glioma is not amenable to treatment. In the absence of localising signs and when epilepsy is the only feature it may be wiser to defer scanning.

A scan will often show cerebral atrophy in patients with dementia.[7] The limits of normal are difficult to define in the elderly, however, and the degree of atrophy does not correlate closely with the severity of the loss of memory.[8] A tumour is sometimes discovered in these patients. A further problem arises in relation to ventricular size. Dilated ventricles may be due to cerebral atrophy, but this must be distinguished from hydrocephalus associated with raised intraventricular pressure. Monitoring of the intracranial pressure may be required to decide whether a shunt is needed.

Scans are unrewarding in patients with trivial symptoms who sometimes demand, and are prepared to pay for, the investigation. The same is often true of scans performed "for exclusion" in the absence of clinical indications. Scans are being requested more frequently in patients with psychiatric disorders, but in general they are of little diagnostic value. Indiscriminate scanning sometimes detects symptomless lesions and raises difficult decisions in investigation and management. I am

reminded of the dictum "never have anything investigated until you know what it is."[9] Finally, a false negative scan may be due to poor technique, movement artefact, or low resolution.

Scanning is an important advance, but it has not removed the need for clinical assessment. Of course mistakes will be made if clinical or indeed any other judgment is the basis of decision—but that is hardly a justification for universal scanning.

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Stones, lithotripters, trials, and arguments

Two papers on extracorporeal shock wave lithotripsy for renal and ureteric calculi (pp 877 and 880) sketch out the now classic scenarios for introducing new techniques in either diagnosis or treatment. On the one hand are the innovators, seized with what they see as the relentless logic of their proposal but perhaps blinded by their closeness to the problem. On the other hand are the analysers, who wish anything new to be subject to what they regard as the only satisfactory form of assessment—a prospective randomised controlled clinical trial.

The two views are polarised. Inevitably mine are also biased. It was William James who said: "Neither the whole truth nor the whole of good is revealed to any single observer although each . . . gains a partial superiority of insight from the peculiar position in which he stands."[1] Is it possible to acquire a corporate insight so as to reconcile the opposing views and perhaps find a vantage point of consensus? I believe so, though it requires hard thinking as well as compromise.

The champions of new technology may well urge innovation for many of the insufficient reasons discussed by Challah and Mays, though not all of those proposed are necessarily relevant to the present case. We may perhaps distinguish, however, within what these authors regard as insufficient grounds, the two circumstances of unbridled speculation and of rational inference from established premises. It is indeed speculative to say that because I can cool the mucosa of the stomach to freezing point I will then permanently ablate the power of parietal cells to secrete acid while at the same time doing the patient no harm. It is considerably more removed from speculation and therefore closer to rationality to believe that if I can bring to bear a disintegrating force on a ureteric stone and so fragment it then the stone debris will pass and the patient's present problem be relieved. The one is a new and unsubstantiated venture in the physiology of gastric secretions, the other merely an alternative technique of stone removal.

Clearly the current side effects and long term outcome of an alternative technique cannot be examined by a study which does not make contemporaneous and preferably random comparison. The innovators would counter this by saying that there are a priori grounds for belief that side effects will be small and that there are no rational grounds for believing that the long term results would be different from those of operative extraction. They might also go on to say that those who use historical examples of florid disaster from failing to carry out controlled trials neglect the distinction I have drawn between speculation and rationality; trialists also conveniently ignore counterexamples such as antisepsis and asepsis, rabies vaccine, penicillin, and appendicectomy for acute appendicitis, all of which have gained the high ground of therapeutic acceptance without the benefit of a clinical trial. If we wished to make a frontal attack on Challah and Mays we might ask them if they would care to have an operation performed on themselves using the kitchen as the operating environment, a dirty knife wielded by a gentleman in a filthy frock coat as the instrument, and without benefit of anaesthesia—because neither antisepsis nor anaesthesia has been subject to clinical trial. But this would be to win a debating point and not to resolve the issue—which is in 1986 whether any new, complex, and expensive treatment should be introduced without prior assessment by a prospective controlled trial.

One feature which helps in deciding if a new treatment is on the face of it a rational substitute for an old is asymmetry in relation to complications or the disturbance it produces in the patient. If by the nature of things something deleterious cannot happen with one treatment and is a potential or actual happening with another then asymmetry is apparent. A simple example in the present case is leakage of urine and wound infection—possible for open or percutaneous nephrolithotomy but both out of the question for extracorporeal shock wave lithotripsy. One version of Occam's razor is then satisfied: it is vain to do with more what can be done with less.

Proponents of controlled trials would argue, however, that the central question is the direct comparison of the two treatments and that this can be done with full intellectual satisfaction only if these are applied at random to a sample believed to be representative of the population with the disease. Clearly this is the case, but in each instance a question and a condition remain: firstly, is the precision of the direct comparison of more or less importance than the asymmetry factors to which I have referred? and, secondly, as Challah and Mays agree, there must be stability in the therapeutic process where the change is proposed rather than a rapid evolution. (I find their argument about the "danger"—an emotive word—of using historical controls in such circumstances a difficult one to follow).

If we are to use history as a guide (and, as I have argued elsewhere, we must do so because all experience gained by whatever method becomes history[2]) we must also be prepared to organise our data and to limit our comparisons. Though