higher. This point we had not made before but find most significant.

We mentioned that tuberculosis lesions in lungs and elsewhere did disappear without antitubercular therapy and the primary complex also does. We accept that we erred originally in our thinking that as the lesion disappeared with anti-tuberculosis treatment it was due to tuberculosis. By the time we wrote the paper we had realised our mistake and did not claim that all lesions that disappeared were tubercular. We only wished to point out a similar error may be made by those who assume that just because a lesion disappears without antitubercular treatment it cannot be tubercular. The human body has an immune system which is able to look after diseases be they in the lungs or brain.

The authors mention managing some of these cases without anti tuberculosis drugs. We discussed this and since the paper was submitted we too have treated some this way and in some cases the lesion has disappeared. The number so far is below 12. (Three of these have failed to clear). But the control trial mentioned has not to our knowledge been attempted anywhere as yet.

That this lesion may at times represent a postictal change was discussed but the reason for this is not described in western literature remains unclear. Whether this lesion is due to focal encephalitis has been discussed. The chronicity of the illness would mean that subacute or chronic encephalitis is much commoner than any other slow virus CNS infection in this country. Of course the focal encephalitis may not be viral, but then in our context a tuberculoma would be an important candidate for "focal encephalitis". That it is focal it is obvious. That it is inflammatory is also an assumption: therefore our non committal use of the term ring/disc lesion.

That a biopsy would be helpful is agreed. We would certainly not agree to biopsy without an adequate antitubercular trial either immediately or after 3 months. We are virtually sure this would be the feeling of most neurologists in India. Drs Diwate and Apte also speak of arbitrary anti tuberculosis trial as their present plan.

Our policy of giving antitubercular therapy to all cases has changed since the reported series was closed in 1985. At mentioned, we too in 1988 are using anti tuberculosis treatment much less often.

Our paper was an attempt to highlight the problem of ring/disc lesion in India, to assess its incidence and clinical characteristics and to discuss its aetiology with special reference to the proportion which are tubercular. In these respects we found no prior published work from this subcontinent and we felt the problem needed to be highlighted.

References

Regional cerebral blood flow in epilepsy studied with xenon enhanced CT

Sir: We would like to comment on the article by Fish et al., on the use of xenon enhanced CT brain scanning (XeCT) to determine regional cerebral blood flow in focal epilepsy.

In the introduction, the authors imply that the difficulty of computing absolute flow values constitutes a disadvantage of single photon emission computed tomography (SPECT) versus XeCT. The end product of the processing of their data, however, is a percentage difference in flow between one side and the other. SPECT is eminently capable of producing such figures, if indeed they are required; positron emission tomography (PET) studies have cast doubt on whether the use of numbers rather than simple visual inspection confers advantage in any case.2 3

In setting a level of significance for side to side differences the authors make no reference to relevant PET literature. A previous study (from the same institution) found a mean side to side difference in flow in temporal lobe epilepsy of 7.6%, with the low flow on the side of the focus.4 The control group used by Fish et al. had a mean side to side difference of 14% (in one case 23%), and they adopt 30% as their level of significance. A technique with a natural variation of 30% hardly seems the method of choice to detect a 7.6% side to side difference.

We are a little puzzled regarding the authors’ choice of controls. The inclusion of controls was presumably for the purpose of establishing what side to side variation one might expect in a group of normal individuals. How does the inclusion of two such scans performed in one subject contribute to this? Assuming the parameter you are measuring is constant, the performance of repeated tests in a single subject tells you nothing about the repeatability of the test, not about normal inter-individual variation. The fifth control subject has bilateral dysfunction of two (presumably temporal lobe) on psychometry. Although we are also told that he had generalised spiking on an interictal EEG and no focal discharge during sphenoidal recording, one would not be happy that he did not have secondary generalised seizures (assuming that is the sort of seizure from which he has suffered) from bilateral temporal foci. It may be that the insensitivity of the technique partly reflects the composition of the control group.

The control values are used, as expected, to interpret the results found in patients (tables 2 and 3). The patients’ results show that the flow on the affected side is similar to control values, while that on the unaffected side is substantially higher. Surprisingly, this is interpreted as an absolute reduction in blood flow on the affected side. The authors may claim that you would expect the control values to be lower than normal because these were obtained from patients with primary generalised epilepsy. Evidence from PET studies, however, shows no interictal reduction in metabolism (and hence most likely cerebral blood flow) in such patients.5

One of the patients (patient 7) with a normal CT scan, has a very low blood flow indeed at 9 ml/min/100g. Although there is some disagreement as to the exact level of critical cerebral blood flow,6 this value is at least low enough to put tissue viability in doubt. Its significance should have been discussed.

The conclusion of the study, that XeCT can be a useful adjunct in the assessment of patients with intractable partial epilepsy, can hardly be justified on the basis of the data presented. The results show that the technique has a poor sensitivity compared with PET; abnormalities were detected in 50% of the patient group, whereas PET detects abnormalities in 60–70% of patients.4 XeCT requires highly motivated and cooperative patients. Image quality is poor compared with SPECT,7 partly owing to the low signal to noise ratio inherent in the technique. It is tempting to use XeCT simply because it is immediately available, but the technique involves time, effort and money. Unless PET systems become practicable for routine clinical use, SPECT should surely be considered.

Matters arising
Matters arising
the method of choice for functional imaging of patients with temporal lobe epilepsy.

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References

Fish replies:
1. Although we discussed previous PET and SPECT studies in epilepsy in our introduction, our study did not compare these techniques with XeCT. While we stated that SPECT cannot measure CBF quantitatively, at no time did we imply that SPECT was not a useful technique for imaging patients with focal epilepsy.
2. It is difficult to compare studies using different methods of functional imaging unless they use a similar patient population. The patients we studied were a highly selected group with intractable focal epilepsy who had unequivocal unilateral EEG abnormalities on repeat studies, usually including a sphenoidal, ictal recording. The PET study by Bernardi et al. quoted by Duncan and Patterson involved a population of 10 patients, four of whom had evidence of bilateral EEG abnormalities, and eight of whom also had generalised seizures. Engel et al. studied 50 patients with focal epilepsy using PET and found a side to side difference in glucose metabolism of 8-56% (mean 24%).1 Franks et al. reported CBF PET studies using 13O on 25 patients with focal epilepsy. The CBF on the side of the focus was reduced by a mean of 22-5% in the 21 cases with normal CT (and by 68-5% in four cases with abnormal CT). The results of these larger PET studies on patients with focal epilepsy correspond well with our mean side to side rCBF difference of 25%.
3. Our choice of controls is appropriate because xenon CT is to be used to look for a focal abnormality in patients known to have intractable epilepsy, and not to differentiate patients with focal epilepsy from normal subjects. The mean 14% side to side CBF differences found for our controls probably reflects background noise rather than a true CBF variation. We agree with Duncan and Patterson that the scatter in our control data means that only xenon CT scans with greater than 50% side to side differences provide useful information. 50% of our patients with focal seizures had positive xenon CT scans using this criterion. In all these patients xenon CT correctly localised the epileptogenic side. The use of normal subjects as controls in studies involving x-rays raises important ethical questions and, after discussion with the Chairman of our Ethics Committee, this was felt to be inappropriate.
4. Paragraph 5 of Duncan and Patterson's letter is difficult to interpret because the reference which they quote by Theodore et al. does not include any quantitative data in patients with primary generalised epilepsy. Six out of our 12 patients with focal seizures had clear side to side differences in CBF and in all six cases the side of the epileptic focus had lower CBF than the contralateral (presumed normal) side. We would agree that CBF asymmetry is more important than absolute flow values.
5. We agree that the medial temporal strip on the epileptogenic side of patient 7 yielded a very low CBF value. In general we found that medial strip CBF values showed great variability, probably reflecting tissue heterogeneity. As discussed in the paper we suggest in practice attention is focused on lateral strip CBF data.
6. It is apparent from the quality of our images that PET is a superior technique in terms of signal to noise ratio.

Unfortunately it is not widely available. We were surprised that Duncan and Patterson should state that SPECT is surely the method of choice for functional imaging of patients with temporal lobe epilepsy without giving any supporting data or references. We are not aware of a published comparison between xenon CT and SPECT in patients with focal epilepsy. Helman et al. have studied nine patients with cerebral vascular disease using both techniques and found both approaches useful.3 They reported that the main advantages of xenon CT were its greater resolution and potential for non-invasive quantitation of rCBF, while the major advantage of SPECT was visualisation of the entire brain on transverse coronal and sagittal section. Xenon CT is a far cheaper technique if a CT scanner is available.

References

Book reviews

Like the other volumes in this beautifully presented series this is primarily a treatise on technical neurosurgery. The book reviews the management of 500 cases of arteriovenous malformations handled by Yasargil over a 19 year period, of which 414 were operated upon.

Professor Yasargil has categorised AVMs into two groups; convexity and deep central.