is difficult to document until loss of brain bulk can be documented on delayed CT or MRI scans.

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- 1 Leininger BE, Gramling SE, Farrell ED, Kreutzer JS, Peek EA. Neuropsychological deficits in symptomatic minor head injury patients after concussion and mild concussion. *J Neurol Neurosurg Psychiatry* 1990;53:293-6.

The paper by Leininger, *et al*¹ reported that the pursuit of litigation had no effect on neuropsychological status after cerebral concussion, and that the cognitive deficits were attributable to cerebral dysfunction. These conclusions, drawn from a clinical series of symptomatic patients, warrant scrutiny.

The authors provide no information as to how they classified their patients into groups "pursuing claims for compensation" or "pursuing litigation". Merely asking patients if they have filed a lawsuit does not provide the information necessary to classify their claim status. Some of the patients may have been injured in work-related accidents, and in the United States, been unable to sue their employers, regardless of fault. In nonwork-related motor vehicle accidents, claims for damages may have been made against insurers without any litigation. Furthermore, the patients studied could have filed lawsuits after their neuropsychological evaluations; all of them were seen within 22 months of their injury. These results are contrary to our own.

In a recent paper Binder and Willis² reported a very strong relationship between the pursuit of a claim and performance on a measure specifically designed to assess motivation to remember, the Portland Digit Recognition Test. Our study compared minor head trauma patients to patients with well-documented cerebral dysfunction who were not seeking financial compensation. Our minor head trauma patients were much more chronic, seen an average of two years after their trauma, than the patients studied by Leininger *et al*, a factor which may have affected the results.

Leininger *et al* equated the cognitive deficits of the concussed patients with cerebral dysfunction. The possible existence of comorbidities in the minor head injured patients make this relationship tenuous, however. The majority of the minor head injury patients were injured in motor vehicle accidents. Consequently, they may have had orthopaedic injuries and been treated with analgesic medications. Some of them may have developed anxiety disorders or depression as a result of their accidents and may have been treated with psychotropic medications. The authors provided no information on chronic pain, psychiatric status, or medication use. These variables are also associated with cognitive abilities^{3,4} and may have accounted for the differences between the concussed and control subjects. Controlled studies of consecutive acutely injured patients followed prospectively⁵ have shown normalisation of cognition within a few weeks of minor head trauma, using measures no less sensitive than those employed in the study of symptomatic patients by Leininger *et al*.

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Low plasma iron status and akathisia

Barton *et al*¹ reported a significant inverse correlation between plasma iron levels and akathisia rating. Their findings are important. However, three of their akathisia group had low plasma iron levels (about 50 µg/100 ml). Since the association between restless legs syndrome and low plasma iron is generally accepted,² their three patients might not have akathisia but the restless legs syndrome.

Although akathisia and restless legs syndrome are clinically similar (floor pacing, marching on the spot, and body rocking occur in both conditions),³ the symptoms of akathisia are prominent throughout the waking hours. Conversely, the symptoms of restless legs are more prominent at night.⁴ It suggests that the circadian rise of possibly some hormone could be related to the symptoms of restless legs syndrome, but not to those of akathisia. Sandyk *et al*,⁵ pointed out that one of the possibilities may be melanocyte stimulating hormone (MSH).

Further research is required to differentiate between akathisia and restless legs syndrome, and measuring MSH may be helpful.

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- 1 Barton A, Bowie J, Ebmeier K. Low plasma concentration and akathisia. *J Neurol Neurosurg Psychiatry* 1990;53:671-4.
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- 5 Sandyk R. Melatonin stimulating hormone (MSH) in the restless-legs syndrome. *Intern J Neuroscience* 1989;46:197-9.

Bowie and Ebmeier reply:

We are pleased to answer Terao's and Yoshimura's comments relating to the differential diagnosis of our akathisia patients, particularly the patients with plasma iron

levels about 50 µg/100 ml. Using Walters' summary of the clinical characteristics of restless leg syndrome, the three patients in question: 1) did not suffer parasthesias; 2) motor restlessness was in evidence during the day, but not during the night; 3) periodic movements in sleep had not been observed, although no systematic observation during sleep had taken place; 4) there was some dyskinesia lying still, or sitting quietly, as evidenced by patients' akathisia scores; 5) none of the patients was suffering from sleep disturbance; 6) there was no family history of restless leg syndrome, and finally, 7) symptoms and signs occurred during waking hours and not at night.

We would therefore maintain that these patients had neuroleptic induced akathisia rather than restless leg syndrome. This, of course, leaves open the possibility of a "common pathway" of both syndromes evidenced by the association with lower iron levels. Terao and Yoshimura state that "the association between restless leg syndrome and low plasma iron is generally accepted" referring to Ekbom's seminal paper.² In fact, Ekbom found iron deficiency in only 19 of 77 unselected patients. On the other hand, he states that in patients with iron deficiency of less than 60 µg/100 ml, the incidence of restless legs was 24%. This suggests to us that iron deficiency is neither a necessary nor a sufficient cause of restless leg syndrome, or indeed (drug-induced) akathisia.

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Pupillary disturbances in migraine: what is the relation to autonomic dysfunction?

The proposal that decreased cervical sympathetic outflow (and an increase in facial blood flow) follows trigeminal nerve activity during migraine¹ is not consistent with greater eyelid separation and meiosis on the side of the headache and the poor correlation between meiosis and ptosis during and between migraine attacks. Although the pupillary reflex to darkness is regarded primarily as a sympathetic reflex, pupillary dilatation in darkness occurs in the human sympathetomised eye but is less complete. In the analysis of pupillary light reflexes it is important to remember that a well-defined degree of central sympathetic tone is necessary for the full development of the constrictor action.

Electrical stimulation of the infratrochlear nerve causes unilateral meiosis in normal volunteers² thus raising the possibility of a contribution of iris trigeminal fibres towards the development of meiosis during migraine headache through antidromic discharge. In contrast to electrical stimulation of the ophthalmic division of the trigeminal nerve (which was found to be relatively ineffective), mechanical stimulation of the nerve, both with and without stellate ganglionectomy,

was found to be highly effective in inducing changes in the intraocular pressure (IOP) and vasodilatation in the uvea in the rabbit; the reaction seems to have much in common with an axon reflex mediated by the peripheral branches of the nerve, at the endings of which some active histamine-like substance is liberated, causing pupillary contraction and intense intraocular vasodilatation.³

Can mechanical activation of iris trigeminal nerve terminals develop naturally and contribute to meiosis seen during and between migraine attacks? Acute elevations in the IOP have been shown to discharge impulses in iris nerve fibres (and whole nerve and corneo-scleral fibres) probably due to mechanical distortion of the iris and the chamber angle⁴ which suggests the production of painful impulses described in experimental animals.^{3,4} An association between migraine and low-tension glaucoma (LTG) has been suggested recently;⁵ the differential diagnosis of LTG should include wide diurnal fluctuations in which high pressures are occurring at times when they are not being recorded. Given the central importance of autonomic effects on aqueous dynamics, autonomic hypofunction in those with migraine during headache-free intervals⁶ allow development of a relatively higher IOP in response to a variety of stimuli and situations, thereby resulting in exaggerated fluctuations in the pressure that possibly contributes both to visual field loss and mechanical activation of iris nerve fibres.

The results of studies of autonomic nervous system dysfunction in migraine have been contradictory.⁶ Besides wide normal inter- and intra-individual variations in the reactions of the autonomic nervous system, it may be useful (and not necessarily simplistic) to view autonomic hyperfunction during migraine attacks as an adaptive (secondary stress) response liable to "fatigue" variably in the later stages of severe headache, one function of which may serve to limit the effects of vasodilatation (of intraocular and cranial blood vessels) resulting from antidromic discharge from trigeminal nerve fibres.

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- 1 Drummond PD. Disturbances in ocular sympathetic function and facial blood flow in unilateral migraine headache. *J Neurol Neurosurg Psychiatry* 1990;53:121-5.
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Drummond replies:

I thank Dr Gupta for his comments and for the opportunity to clarify a point which may not be clear in my paper.¹ In 62 patients with headache on the usually-affected side the pupil was smaller, on average, and eyelid separation greater, on the symptomatic side.

These autonomic disturbances, however, were not normally observed in the same

patients. In fact, miosis was usually associated with ptosis on the symptomatic side during attacks of migraine (in darkness, $r = 0.38$, $p < 0.001$, see table 4). Since miosis persisted during the headache-free interval^{1,2} it seems likely that, in some cases, permanent ocular sympathetic deficit prevented greater eyelid separation on the affected side during attacks of migraine.

Discharge of the trigeminal nerve could have contributed to miosis during migraine, but this is unlikely to be the mechanism of miosis during the headache-free interval.^{1,2} On the other hand, thermoregulatory flushing is reduced on the usual side of migraine headache,³ consistent with a decrease in cervical sympathetic outflow.^{4,5} Intraocular pressure does not increase on the symptomatic side during attacks of migraine,⁶ which argues against the idea that autonomic disturbances are due solely to trigeminal discharge.

Thirty years ago, Walsh and O'Doherty⁷ suggested that swelling of the internal carotid artery during migraine could cause ophthalmoplegia, either by direct pressure on nerves in the cavernous sinus, or by interfering with the local circulation of the involved nerves. Narrowing of the internal carotid artery, presumably due to oedema, was demonstrated by arteriography in two of three selected cases. This same process could cause cervical sympathetic deficit in migraine, because sympathetic fibres supplying the eye and skin of the forehead form a plexus around the internal carotid artery.

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- 1 Drummond PD. Disturbances in ocular sympathetic function and facial blood flow in unilateral migraine headache. *J Neurol Neurosurg Psychiatry* 1990;53:121-5.
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Increased risk of multiple sclerosis among nurses and doctors

A recent study concluded that the multiple sclerosis (MS) death rates in British nurses and qualified medical practitioners was not greater than expected.¹ However, as part of a population-based prevalence study of MS in North East Scotland,² the occupation of all economically-active patients over 15 years of age was classified at the time of onset of the disease³ and compared with the distribution of economically-active males and females in North East Scotland based on the 1961 Census.⁴ Fifteen female nurses (occupational

group 282) had MS (expected 6.2) and four male medical practitioners (occupational group 280) were affected whilst 0.8 were expected (both $p < 0.001$).⁵

Whilst the actual numbers involved were small, particularly for medical practitioners, an analysis of occupation at the time of onset of MS will nevertheless, produce a less biased assessment than analysis of occupation at the time of death, given the well-recognised downward occupational drift in chronic disabling diseases such as MS and accepted by Dean and Gray.¹ I conclude that, at least in North East Scotland in 1970, there was an excess risk of MS among female nurses and possibly among male doctors.

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- 1 Dean D, Gray R. Do nurses or doctors have an increased risk of developing multiple sclerosis? *J Neurol Neurosurg Psychiatry* 1990;53:899-902.
- 2 Shepherd DI, Downie AW. Prevalence of multiple sclerosis in north-east Scotland. *BMJ* 1978;2:314-16.
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- 5 Shepherd DI. *Multiple sclerosis in North-East Scotland*. (MD Thesis). University of Aberdeen 1976.

Gray and Dean reply:

We are grateful for Dr Shepherd's comments on our study of mortality from multiple sclerosis (MS) among doctors and nurses¹ and for his interesting data suggesting an excess incidence of MS among doctors and nurses in North East Scotland.

Dr Shepherd suggests that downward occupational drift by the time of death could explain the lack of any excess of MS deaths among doctors and nurses in our study. However, we believe this to be unlikely—particularly for medical practitioners. The British doctors study was a prospective study and the occupation of medical practitioner was (by definition!) the necessary prerequisite to be included. Occupation was determined from the 1951 British Medical Register and not from the death certificates.

There may be three explanations for the excess incidence seen among doctors and nurses in Dr Shepherd's study. First, the methods of identifying patients² are likely to have resulted in over-representation of doctors and nurses. To supplement the original register of patients with MS further patients were identified by visits to local hospitals and extensive surveillance of their records. A further 73 cases in this study were then identified by asking the region's GPs to note any additional cases that they knew of. As a result, nurses and doctors with MS seem more likely to be identified than those in non-medical professions.

Second, using the 1961 census data to estimate the proportion of economically active males and females who are doctors or nurses in 1970 may have introduced some bias if the proportion who were doctors and nurses had increased over the intervening period.

Finally, doctors and nurses may have MS diagnosed earlier in the disease than other MS sufferers. Again, this "lead time" bias is likely to suggest—artefactually—that there is