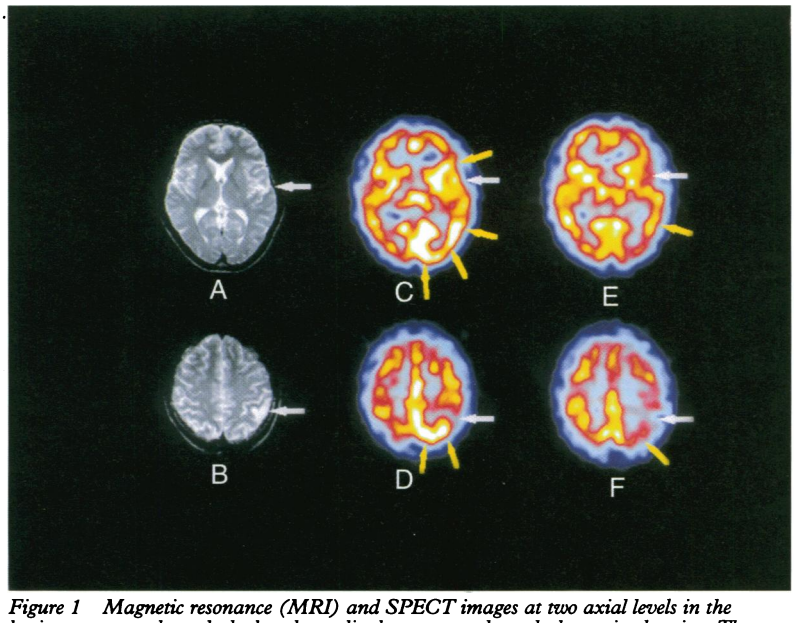

Figure 1 Magnetic resonance (MRI) and SPECT images at two axial levels in the brain— top row through the basal ganglia, bottom row through the parietal region. The SPECT images were taken on day 2 (C and D) and day 60 (E and F). MRI demonstrates small areas of infarction (white arrows), which are also seen on the SPECT images. Areas of hyperperfusion seen on day 2 on the SPECT scan (yellow arrows) become slightly hypoperfused at day 60, confirming that damage has occurred.

findings strongly suggest, however, that the emboli arose from endothelial disruption and local thrombosis in the left carotid artery.

Despite its well defined role in the detection of haemorrhage the sensitivity of CT to acute ischaemic lesions is poor. CT usually does not show significant changes in parenchymal density until 24 hours after the event, although subtle changes can be seen in some large infarctions earlier than that. In some ischaemic events the CT images never become abnormal. In contrast, SPECT is able to demonstrate the primary perfusion defect from the moment it happens, provided it affects a large enough region (> 1 cm) to be detected by this lower resolution technique.[6] The appearance of the SPECT abnormality may change with time, as in our patient. After a period of ischaemia "luxury perfusion" may develop,[7] where the perfusion may be much higher than the surrounding normal brain (fig 1C and 1D). This phenomenon is indicative of reperfused but damaged tissue. Later, the hyperperfusion subsides and may leave either a considerably hypoperfused area that correlates with the structural changes and relates to gross infarction or a slightly hypoperfused area that indicates only partial neuronal loss, at a level not readily seen by MRI.

Awareness of the potential consequences of neck injury is vital to encourage prevention and to highlight the need for rapid and accurate diagnosis as well as appropriate treatment. With the emergence of powerful new thrombolytic and possibly neuroprotective treatments the role of imaging will increase.

Thrombolysis with tissue plasminogen activator, is effective in ischaemic stroke provided the treatment is started within the first three hours and in the absence of intracranial haemorrhage.[8] SPECT may contribute to the treatment of the patient by confirming the ischaemia, indicating patients with a profound perfusion deficit who are at high risk of haemorrhagic transformation[9] and demonstrating when thrombolysis is unnecessary because spontaneous reperfusion has already occurred (as in this patient). It is important to exclude cervical carotid or vertebral artery dissection because in this condition current recommended treatment entails early anticoagulation (despite the lack of formal trials) in an attempt to prevent further neurological deficit.[10]

The incidence of carotid artery damage in the form of dissection, thrombosis, and embolisation could be reduced in sport by increasing awareness of the vessel's vulnerability. Advice and supervision to avoid prolonged or vigorous neck holds are important. In conclusion this report has highlighted an important danger of stroke from neck trauma in the martial arts and emphasised some of the associated clinical features as well as current management issues.

Dr M O McCarron is supported by a Patrick Berthoud Fellowship.

1 Thomas P, Lowitt NR. A traumatic experience. *N Engl J Med* 1995;**333**:307–10.
2 Li MS, Smith BM, Espinosa J, Brown RA, Richardson P, Ford R. Nonpenetrating trauma to the carotid artery: seven cases and a literature review. *J Trauma* 1994;**36**:265–72.
3 Cantu RC. Head injuries in sport. *Br J Sports Med* 1996;**30**: 289–96.
4 McLatchie GR, Davies JE, Caulley JH. Injuries in karate: a case for medical control. *J Trauma* 1980;**20**:956–8.
5 Mourad JJ, Girerd X, Safar M. Carotid-artery dissection after a prolonged telephone call. *N Engl J Med* 1997;**336**: 516.
6 Alexandrov AV, Black SE, Ehrlich LE, Bladin CF, Smurawska LT, Pirisi A, *et al*. Simple visual analysis of brain perfusion on HMPAO SPECT predicts early outcome in acute stroke. *Stroke* 1996;**27**:1537–42.
7 Shimosegawa E, Hatazawa J, Inugami A. Cerebral infarction within six hours of onset: prediction of completed infarction with technetium-99m-HMPAO SPECT. *J Nucl Med* 1994;**35**:1097–103.
8 The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischaemic stroke. *N Engl J Med* 1995;**333**:1581–7.
9 Ueda T, Hatakeyama T, Kumon Y, Sakaki S, Uraoka T. Evaluation of risk of haemorrhage transformation in local intra-arterial thrombolysis in acute ischaemic stroke by initial SPECT. *Stroke* 1994;**25**:298–303.
10 Blunt SB, Galton C. Cervical carotid or vertebral artery dissection—an underdiagnosed cause of stroke in the young. *BMJ* 1997;**314**:243.

Commentary

This report highlights a potentially devastating "near miss" from a neck holding manoeuvre in a martial arts class. These clinical and neuroimaging findings fit well with their hypothesis that compression of the neck in an arm grip was to blame. Highlighting the case with the supervising authorities would seem the minimum sensible response to the event described. This case report should help to do this. Awareness in the sport of the vulnerability of the brain to carotid occlusion clearly needs to be highlighted. The authors hope that in future cases computed tomography and SPECT might all be sorted out within a three hour time window before a decision on thrombolysis. This seems a little optimistic, particularly in a UK context.

ROGER SHINTON