critical analysis of the venous drainage system and its pathological changes.

Our studies specifically focused attention on the venous drainage system alone and we undertook a statistical analysis of the influence of the venous drainage system on the risk of hemorrhage. Many authors, including Dr. Höllerhage, have noted that a small AVM is associated with a higher risk of bleeding; however, the pathophysiology of this finding is not elucidated. We would like to know the relationship between the size of the lesion and the number of draining veins. The significant difference in hemorrhagic rate according to the size of the lesion may be related to the number of draining veins. Is it not possible that a small AVM has a higher risk of bleeding because of a low number of draining veins?

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Mild Closed Head Injury and Seizures

To The Editor: The article by Lee and Lui (Lee ST, Lui TN: Early seizures after mild closed head injury. *J Neurosurg 76*:435–439, March, 1992) contributes much valuable information. Because of the relevance of their conclusions to ongoing controversies, I would appreciate clarification of two points. The first concerns the penultimate sentence in their abstract. Would not this sentence reflect their results if it read as follows: "This review suggests that patients with early posttraumatic seizures after mild closed head injury have a high incidence (53%) of normal CT scan findings."?

A second point arises from their finding of 47 *abnormal* studies in only 100 computerized tomography (CT) scans from over 4000 patients. Does this not suggest that scanning in more cases would have resulted in more than 47 abnormal studies? If so, their experience seems to support the suggestion by Williams, *et al.*,[1] that the diagnosis of "mild head injury" might well include an intracranially negative CT scan as well as clinical criteria.

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Reference

1. Williams DH, Levin HS, Eisenberg HM: Mild head injury classification. **Neurosurgery 27**:422–428, 1990

Response: We thank Dr. Bogen for his clarification of our study. In our protocol, there is no routine computerized tomography (CT) scanning for mild head-injured patients unless they develop focal neurological deficit, exhibit signs of increased intracranial pressure, display further deterioration, or develop early posttraumatic seizures. Among the 100 CT scans obtained from the patients with mild head injury and early seizures, 47 showed abnormal findings. This result would not be influenced by obtaining more scans performed for mildly head-injured patients without the above indications. We included patients with documented mild head injury (Glasgow Coma Scale scores of 13 to 15) if they had one of the following: a blow to the head, loss of consciousness, or posttraumatic amnesia less than 30 minutes in duration. Patients with these criteria and a normal CT scan were included in our study.

We hope this response will clarify the questions raised by Dr. Bogen.

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Sympathectomy and Spinal Cord Blood Flow

To The Editor: I read with considerable interest the recent article by Iwai and Monafo (Iwai A, Monafo WW: The effects of lumbar sympathectomy on regional spinal cord blood flow in rats during acute hemorrhagic hypotension. *J Neurosurg 76*:687–691, April, 1992). The article concluded that "sympathectomy has no major effect on regional spinal cord blood flow in rats stressed by either moderate or severe arterial hemorrhage."

The article did not point out an important factor that may have a bearing on their interpretation of the results. The blood flow measurements by Iwai and Monafo were based on ^{14}C-butanol tracer in whole spinal cord segments. This tracer method unfortunately does not distinguish between gray- and white-matter blood flow. The flow values obtained thus represent a mixture of widely discrepant white- and gray-matter flows and are dominated by the latter. Spinal gray-matter blood flow is largely supplied by the anterior spinal artery which may not receive any innervation from paravertebral sympathetic ganglia, particularly the lumbar sympathetic ganglia.

In our earlier study in cats,[1] we measured blood flow in lateral column white matter, which is supplied mainly by vessels from intercostal arteries known to be innervated by paravertebral sympathetic nerve endings. Given the differences in methods of blood flow measurement, the results reported by Iwai and Monafo are not necessarily in conflict with our conclusion that white-matter blood flow autoregulation is influenced by paravertebral sympathectomy.

Iwai and Monafo did find a significant effect of lumbar sympathectomy on the S1–4 segments in normotensive rats. Their statement that these segments contain little or no gray matter, although reasonable, is