example, cerebral autoregulation and intracranial dynamics, characterized by the involvement and superimposition of many different parameters).

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References


Response: We appreciate the thoughtful comments made by Drs. Giulioni and Ursino on our manuscript. Their comments correctly point out that the effect of the transient drop in blood pressure on ICP could potentially confound the determination of dynamic pressure autoregulation.

The transcranial Doppler software that was used for our study allows either the blood pressure or the CPP tracing to be used in calculating the ARI. Although CPP might have been preferable, we chose to use blood pressure because we knew that the patients would not have an ICP monitor for the entire time that we were planning to monitor pressure autoregulation. Although we cannot exclude the possibility that this decision influenced the reliability of the measurements, we do not think that it is likely because of the methodology used to calculate the ARI.

Only information from the first 10 seconds of the flow velocity and blood pressure (or CPP) response to cuff deflation is used in the calculation of the ARI.1 During this initial period of time, the blood pressure and CPP are almost always similar in the ways that they change after cuff deflation. Later, as shown in Fig. 1 of Giulioni’s and Ursino’s letter, the blood pressure and CPP may diverge significantly. This later response to the cuff deflation is not used in the calculation of ARI, but as pointed out by Drs. Giulioni and Ursino, may contain information about the compliance of the brain. For these reasons, we believe that the ARI in our study does accurately reflect dynamic pressure autoregulation after severe TBI.

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Reference


Grade IV and V Arteriovenous Malformations

To THE EDITOR: I congratulate Han, et al., for their excellent article (Han PP, Fonse FA, Spetzler RF: Intention-

Abstract

Object. In this study the authors quantified a subgroup of patients with Spetzler–Martin Grades IV and V arteriovenous malformations (AVMs) recommended for complete, partial, or no treatment, and calculated the retrospective hemorrhage rate for these lesions.

Methods. Between July 1997 and May 2000, 73 consecutive patients with Grades IV and V AVMs were evaluated prospective-ly by the cerebrovascular team at Barrow Neurological Institute. Treatment recommendations given to the patients or referring physi-cians were classified as complete treatment, partial treatment, and no treatment. Retrospectively, the hemorrhage rates associated with these treatment groups were also calculated.

In the prospective portion of the study (the intention-to-treat analysis), no treatment of the AVM, was recommended for 55 patients (75%) and partial treatment was recommended for seven patients (10%). Aneurysms associated with an AVM were obliterated by sur-gical or endovascular treatment in seven patients (10%), and com-plete surgical removal was recommended for four patients (5%). The overall hemorrhage rate for Grades IV and V AVMs was 1.5% per year. The annual risk of hemorrhage was 10.4% among patients who previously had received incomplete treatment, compared with patients without previous treatment.

Conclusions. The hemorrhage risk of 1.5% per year, which was associated with Grades IV and V AVMs appears to be lower than that reported for Grades I through III AVMs. The authors recommend that no treatment be given for most Grades IV and V AVMs. No evidence indicates that partial treatment of an AVM reduces a patient’s risk of hemorrhage. In fact, partial treatment may worsen the natural history of an AVM. The authors do not support palliative treatment of AVMs, except in the specific circumstances of arterial or intranidal aneurysms or progressive neurological deficits related to vascular steal. Complete treatment is warranted for patients with progressive neurological deficits caused by hemorrhage of the AVM. This selection process plays a significant role in the relative-
ly low combined morbidity and mortality rates for Grade IV and Grade V AVMs (17 and 22%, respectively) reported by the cerebrovascular group in both retrospective and prospective studies.

I want to comment on certain aspects of their study. First, the authors imply that higher-grade (IV and V) AVMs are those in patients with nonhemorrhagic presentations.3,5 This factor could have contributed to the low overall risk of rebleeding. I hope that all of these confounding variables will be controlled in future studies.

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References

RESPONSE: We appreciate Dr. Dhandapani’s comments about our intention-to-treat analysis of Grades IV and V AVMs.
First, he noted that the size of an AVM and its pattern of venous drainage influence the risk of hemorrhage in opposite directions and that intervention should be based on individual factors rather than AVM grade. We agree that intervention should be based on particular factors of a given AVM and not just its grade. In the conclusion of our article, we supported definitive treatment of Grades IV and V AVMs when hemorrhage causes significant or progressive neurological deficits. Furthermore, we recommended palliative treatment when specific risk factors (for example, arterial aneurysms associated with the AVM) were associated with individual AVMs to reduce the risk of future hem-orrhage. Because the study was an intention-to-treat analysis, we reviewed the individual factors associated with each AVM. We placed the greatest importance on a history of hemorrhage, the patient’s current neurological status, and angioarchitectural risk factors that may predispose to hemorrhage (for instance, arterial aneurysms).
Second, Dr. Dhandapani commented that AVMs that initially become symptomatic with hemorrhage are likely to be associated with a higher risk of further hemorrhage than AVMs in patients with a nonhemorrhagic presentation. We clearly agree with this statement. In our article, we noted that patients who present with hemorrhage are the most likely to qualify for definitive treatment to eliminate their future risk of hemorrhage from the AVM.
We determined the rate of hemorrhage in AVMs that became symptomatic with hemorrhage as follows. We calculated the total number of hemorrhages experienced by patients after their first bleed. These 15 patients experienced a