

## AANS Position Statement On Recent Literature Correlating Volume to Outcome

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An inverse relationship between hospital and/or surgeon case volume and morbidity and mortality has been documented in the literature for a number of complex medical and surgical conditions. [1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17]. Because of the complexity and heterogeneity of neurosurgical care, such analysis has not been done until recently for specific neurosurgical conditions. Carotid endarterectomy has been analyzed in this manner for a number of years; however, only a minority of operations in these studies were performed by neurosurgeons [8,18,19].

Several articles have appeared recently in the neurosurgical literature relating hospital and/or surgeon volume (number of cases of that particular condition treated per year) to outcome. Generally mortality rate and in some cases, either length of stay or discharge destination (home vs. extended care facility) have been used as the only outcome measures. The specific neurosurgical conditions analyzed so far are craniotomy for brain tumors [20,21], overall care of patients with subarachnoid hemorrhage [22,23], surgical treatment of intracranial aneurysms [24,25,26,27,28], and surgical treatment specifically for unruptured intracranial aneurysms [29]. In general, these studies have found that mortality and morbidity appear to be lower in high volume centers and/or when the surgeon that performs the operation does a high volume of such operations per year.

Two recent editorials have pointed out the limitations of these specific neurosurgical studies [30,31]. In addition to the retrospective uncontrolled nature of these studies, their authors have used state, regional or national databases that, although offering some data on co-morbidities, do not offer specific data on the initial (on admission or pre-operative) neurological condition; for example, admission grade of patients with subarachnoid hemorrhage and the severity or complexity of the condition to be treated (severity of the subarachnoid hemorrhage, size or location of the tumor or size or location of the aneurysm). Additionally, although mortality is a clear end point in these databases, morbidity cannot be analyzed except by using indirect measures such as length of stay and/or destination of the patient after discharge from the initial hospital, as indicated before.

To balance these studies, at least one careful, though smaller, study has documented that excellent results can be achieved in aneurysm surgery by well trained neurosurgeons who perform a relatively small number of such operations in relatively "small volume" community hospitals [32].

The AANS Executive Committee and Board of Directors have carefully analyzed this issue and reviewed the studies alluded to above. We do not dispute the validity of the statistical analysis used in these studies and we accept the fact that it is possible that indeed, their conclusions are correct. **However, given the limitations imposed on these studies by the databases used, we conclude that at this time, a mandate for regionalization of neurosurgical care would be premature and potentially harmful to some patients whose definitive neurosurgical care is delayed pending transfer. In addition, we conclude that the evidence available so far does not justify holding a hospital or a neurosurgeon legally liable simply because a patient with a bad outcome was treated at a hospital where only a low volume of such cases are treated yearly and/or by a neurosurgeon who treats only a limited number of such patients a year. It is clear that well-trained neurosurgeons can achieve excellent results in a "low volume" hospital even if they treat a limited number of patients with a particular condition [32]. Likewise, it is a fact that high volume is not always associated with superior outcomes.**

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