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Intracranial Hemorrhage and Cerebral Hyperperfusion Syndrome after Extracranial Carotid Artery Angioplasty and Stent Placement

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Intracranial Hemorrhage and Cerebral Hyperperfusion Syndrome after Extracranial Carotid Artery Angioplasty and Stent Placement

Morrish et al (1) incorrectly state there has been no report to date in the literature regarding the incidence of postprocedural intracerebral hemorrhage after extracranial carotid artery angioplasty and stent placement. Authors working at the University of California, San Francisco, were the first to publish a series report examining the incidence of intracranial hemorrhage and cerebral hyperperfusion syndrome after craniocervical stent placement (2). In our series of 140 patients, the incidence of intracranial hemorrhage was only 1.4% compared with 4.4% in the current report. Moreover, we encountered 0% mortality, whereas the current authors report a rate of 3.3%. We also reported on patients with clinical or radiologic manifestations of cerebral hyperperfusion syndrome without intracerebral hemorrhage, something the current authors did not attempt. Indeed, we observed the major contribution to the 5% incidence of cerebral hyperperfusion syndrome were these cases.

Although it is true that the incidence of intracranial hemorrhage after surgical carotid endarterectomy is approximately 0.6%, Morrish and colleagues fail to indicate that reports examining the incidence of cerebral hyperperfusion syndrome by means of perioperative transcranial Doppler studies have reported rates of up to 9% (3, 4). Because the clinical findings in cerebral hyperperfusion syndrome may be subtle, and ancillary investigations examining postprocedural cerebral blood flow such as brain perfusion CT, nuclear medicine single-photon emission CT, xenon CT, and transcranial Doppler sonography are not often performed, one may expect a significant reporting bias that can skew the published data. We would be interested to know if any of these patients had postprocedural headaches before their hemorrhage, particularly if severe and unilateral; something the authors have not mentioned. Furthermore, what was the preprocedural status of the collateral flow pathways in the patients with intracranial hemorrhage? Although the authors mention in their Discussion that this represents a risk factor for the development of cerebral hyperperfusion syndrome, they have only provided data on the patency of the contralateral carotid artery.

Finally, in any such report, it should be clearly elucidated if the technique in any of these procedures involved placing a guidewire either deliberately or inadvertently intracranially, particularly as multiple centers were involved. The authors have stated this in the legend accompanying the Figure illustrating findings in patient 4, but they have not done so for the other three patients.

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Reply

We retrospectively reviewed the incidence of intracranial hemorrhage after stent placement and angioplasty of extracranial carotid stenosis in a series of 104 consecutive patients (1). When we submitted this for peer review, we were unaware of any published series addressing this issue. Although our data were published approximately 3 months after a similar series from the University of California at San Francisco (UCSF) (2), the articles were accepted for publication by their respective journals within 6 days of each other; on April 20, 2000, and April 26, 2000, respectively. Thus, we were unaware of the existence of this pending publication at the time our article was accepted. One case report was published between the time our data were received, in June 1999, and the accepted date for our revision in April 2000, and the case was cited in the accepted version of our series (3). We note our original article was actually submitted 5 months before the UCSF series.

In our series of 104 carotid arteries, intracranial hemorrhage occurred in 4.4%. The UCSF series had an incidence of 1.4%. However, our series and that of UCSF are not directly comparable. In the UCSF

series, only 76 of 140 angioplasty procedures involved the carotid artery. Fifty-seven of the angioplasty procedures involved the posterior circulation, including 18 subclavian angioplasty procedures. We are unaware of any data implicating hyperperfusion syndrome after surgical or endovascular treatment of subclavian stenosis.

In our series, a mortality rate of 3.3% occurred because of intracranial hemorrhage. In the UCSF series, no mortality occurred. Mortality related to intracranial hemorrhage secondary to hyperperfusion syndrome is clearly recognized (4, 5). In the single case report in the literature, intracranial hemorrhage that occurred after carotid angioplasty and stent placement (3) was fatal.

Unlike the UCSF series, headache was not a major presenting factor in our four patients. Of our four patients, one had signs of an acute stroke approximately 10 hours postoperatively; the second was found collapsed at home 2 days postoperatively; the third had two grand mal seizures but no neurologic deficit 6 days postoperatively; and the fourth had headache followed by collapse approximately 15 minutes postoperatively.

In two of our four patients, atherosclerotic disease was present in the contralateral carotid artery, and one of the four patients had an occluded contralateral carotid artery. Contralateral stenosis is probably a risk factor for hyperperfusion injury. Unfortunately, I have not been able to retrieve complete data with respect to anterior communicating artery patency at this time. The posterior circulation was not routinely assessed.

Careful and diligent technique is required when performing endovascular procedures, and carotid stent placement is no exception. In no case was a guidewire either deliberately or inadvertently positioned intracranially. This was specifically mentioned with respect to patient 4, as the hemorrhage occurred immediately after the procedure. In the other cases, we think it is extremely unlikely that vessel perforation by a guidewire occurred because of the significant time delay between the procedure and the development of symptoms and the parenchymal nature of the hemorrhages. Thus, we did not directly address this in our article.

I hope this addresses any concerns raised with respect to our data. Carotid artery angioplasty and stent placement is a new and exciting procedure, and we look forward to future advances in this field.

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