

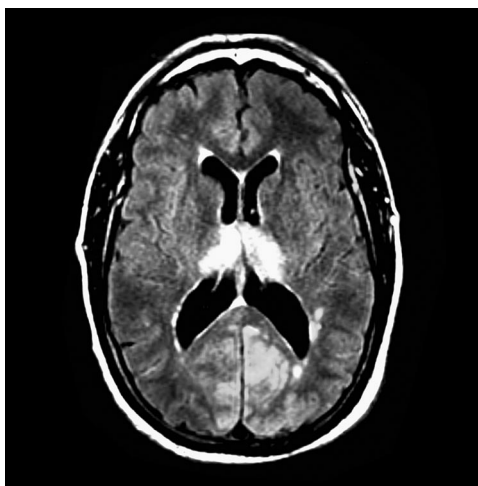
# What Matters during Endovascular Therapy for Acute Stroke

## Anesthesia Technique or Blood Pressure Management?

**P**ATIENTS who experience acute ischemic stroke increasingly are undergoing treatment with endovascular revascularization procedures. Davis *et al.* present a retrospective review encompassing their 6 yr experience treating 96 stroke patients with endovascular arterial revascularization, half receiving local anesthesia or sedation, and the remainder receiving general anesthesia.<sup>1</sup> A number of recently published studies have implicated general anesthesia as a factor in poor outcome.<sup>2–5</sup>

All these studies have a common problem. The patients receiving general anesthesia had the confounding factor of being “sicker” at baseline than patients receiving local anesthesia and/or sedation: they had higher baseline values on their neurologic stroke scale, which would lead one to expect a higher postprocedure stroke volume, morbidity, and mortality. For example, in Davis *et al.*, patients who received general anesthesia presented with higher baseline National Institutes of Health Stroke Scale scores (worse strokes), lower levels of consciousness, and higher rates of preprocedural aspiration. In this and other studies, general anesthesia was administered because of a lack of patient cooperation.

Davis *et al.* postulated that “... [d]espite the likelihood that these patients are sicker ... there may be additional factors that contribute to poor outcome .... Specifically ... that peri-procedural blood pressures may have been influenced by anesthetic management and could plausibly have contributed to the observed differences in neurologic outcome.”<sup>1</sup> In addition, the correlation analysis identified the possibility that general anesthesia and blood pressure were colinear variables. The authors present two models to examine the effect of either the type of anesthesia or the blood pressure nadir; they found both to correlate with poor outcome.



***“It is the first study to find that systolic blood pressures less than 140 mmHg significantly contributed to poor outcome.”***

This study underlines the importance of blood pressure management during anesthetic management in patients experiencing acute stroke. It is the first study to find that systolic blood pressures less than 140 mmHg significantly contributed to poor outcome. In our opinion, this is the most important result of this study.

Induction of general anesthesia frequently causes a decrease in blood pressure. Intraoperative hypotension has been shown to affect cognitive outcome in patients undergoing cardiac surgery, and it may have effects on cognitive functioning that can be seen immediately after spine surgery in patients with a history of hypertension.<sup>6</sup> In the studies published on the outcomes of anesthesia type in patients experiencing acute ischemic stroke, a decrease in blood pressure may have exaggerated consequences because

of the loss of cerebral autoregulation and reliance on collateral circulation.

Seventy percent (70%) of patients experiencing acute thromboembolic stroke present with hypertension, some without a history of hypertension, which gradually decreases during the next 24 h to various degrees depending on the type of stroke<sup>7</sup>; a smaller percentage present with hypotension, which has a significantly worse prognosis.<sup>8</sup> Data from the International Stroke Trial demonstrates a U-shaped relationship between baseline systolic blood pressure and death or dependency: “... early death increased by [18%] for every 10 mmHg below 150 mmHg (*P* less than 0.0001) and by [4%] for every 10 mmHg above 150 mmHg (*P* = 0.023).”<sup>9</sup> As Davis *et al.* discuss, the hemodynamic goals for the care of patients experiencing acute stroke are controversial.<sup>10</sup> Although hypotension during the acute phase of ischemic stroke is associated with poor neurologic outcome,<sup>8</sup> induced hypertension is clearly not the remedy for every patient.<sup>11</sup> There probably is a subgroup of

Image: J. P. Rathmell.

Accepted for publication November 7, 2011. The authors are not supported by, nor maintain any financial interest in, any commercial activity that may be associated with the topic of this article.

Copyright © 2012, the American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins. Anesthesiology 2012; 116:244–5

◆ This Editorial View accompanies the following article: Davis MJ, Menon BK, Baghirzada LB, Campos-Herrera CR, Goyal M, Hill MD, Archer DP; the Calgary Stroke Program: Anesthetic management and outcome in patients during endovascular therapy for acute stroke. ANESTHESIOLOGY 2012; 116:396–405.

patients with acute stroke who would benefit from induced hypertension. American Heart Association guidelines state that “[d]rug-induced hypertension, outside the setting of clinical trials, is not recommended for treatment of most patients with acute ischemic stroke.”<sup>12</sup> In addition, high blood pressures (a systolic blood pressure greater than 185 mmHg or a diastolic pressure greater than 110 mmHg) are a contraindication to IV recombinant tissue plasminogen activator, the first-line treatment for acute stroke.<sup>12</sup>

Therefore, with a patient experiencing acute ischemic stroke, one walks a delicate balance among competing urgencies. For some patients, decreasing the blood pressure because of a hypertensive baseline (as experienced by 40% of the patients in the study by Davis *et al.*) may be indicated. However, some of these patients may have impaired cerebral autoregulation and may depend on a higher blood pressure for collateral blood flow, despite recommendations to decrease blood pressure for interventional techniques, including the administration of recombinant tissue plasminogen activator.

The blood pressure requirements and outcomes of patients receiving endovascular therapy who have failed to have response to IV recombinant tissue plasminogen activator or are ineligible for IV fibrinolysis are not clearly defined in the literature. Davis *et al.* have demonstrated that in patients receiving general anesthesia, an independent predictor of good neurologic outcome is a lowest systolic blood pressure of more than 140 mmHg.<sup>1</sup> Although the study stated that the goals of blood pressure management are to maintain blood pressures within 10% the patient’s baseline values, it is highly probable that this goal was not met during the induction of general anesthesia. These results underline the importance of avoiding hypotension in these patients.

The actual ranges at which the blood pressure of the individual patient should be kept during endovascular therapy probably are specific to the patient’s baseline blood pressure and the characteristics of the patient’s stroke and cerebral vasculature. These issues are the subject of ongoing investigation.<sup>13–15</sup> Questions raised by these results include how far can one deviate from the patient’s baseline blood pressure and acute presenting blood pressure, and how long of a deviation makes a clinical difference. Davis *et al.* recorded blood pressure changes at 5-min intervals and discuss the nadirs of the blood pressures. The importance of avoiding hypotension brings into importance the choice in hemodynamic monitoring. Early placement of a radial arterial line is especially important for patients experiencing acute stroke because blood pressure may decrease when medications are administered for the induction of anesthesia.

The ideal time of placement of the radial arterial line is during the initial stabilization and assessment periods. The placement of the radial arterial line should never delay the onset of the procedure because measurement of arterial pressures can always be performed *via* the femoral sheath should there be a problem in obtaining the radial arterial line.

**Eric J. Heyer, M.D., Ph.D.,\* Zirka H. Anastasian, M.D.,† Philip M. Meyers, M.D., F.A.H.A.‡** \*Departments of Anesthesiology and Neurology, Columbia University, College of Physicians and Surgeons, New York, New York. ejh3@columbia.edu. †Department of Anesthesiology, ‡Departments of Radiology and Neurological Surgery, Columbia University, College of Physicians and Surgeons.

## References

1. Davis MJ, Menon BK, Baghirzada LB, Campos-Herrera CR, Goyal M, Hill MD, Archer DP; the Calgary Stroke Program: Anesthetic management and outcome in patients during endovascular therapy for acute stroke. *ANESTHESIOLOGY* 2012; 116:396–405
2. Brekenfeld C, Mattle HP, Schroth G: General is better than local anesthesia during endovascular procedures. *Stroke* 2010; 41:2716–7
3. Gupta R: Local is better than general anesthesia during endovascular acute stroke interventions. *Stroke* 2010; 41:2718–9
4. Molina CA, Selim MH: General or local anesthesia during endovascular procedures: Sailing quiet in the darkness or fast under a daylight storm. *Stroke* 2010; 41:2720–1
5. Nichols C, Carrozzella J, Yeatts S, Tomsick T, Broderick J, Khatri P: Is periprocedural sedation during acute stroke therapy associated with poorer functional outcomes? *J Neurointerv Surg* 2010; 2:67–70
6. Yocum GT, Gaudet JG, Teverbaugh LA, Quest DO, McCormick PC, Connolly ES Jr, Heyer EJ: Neurocognitive performance in hypertensive patients after spine surgery. *ANESTHESIOLOGY* 2009; 110:254–61
7. Vemmos KN, Tsivgoulis G, Spengos K, Synetos A, Manios E, Vassilopoulou S, Zis V, Zakopoulos N: Blood pressure course in acute ischaemic stroke in relation to stroke subtype. *Blood Press Monit* 2004; 9:107–14
8. Ritter MA, Kimmeyer P, Heuschmann PU, Dziewas R, Dittrich R, Nabavi DG, Ringelstein EB: Blood pressure threshold violations in the first 24 hours after admission for acute stroke: Frequency, timing, predictors, and impact on clinical outcome. *Stroke* 2009; 40:462–8
9. Leonardi-Bee J, Bath PM, Phillips SJ, Sandercock PA, IST Collaborative Group: Blood pressure and clinical outcomes in the International Stroke Trial. *Stroke* 2002; 33:1315–20
10. Mullen MT, McKinney JS, Kasner SE: Blood pressure management in acute stroke. *J Hum Hypertens* 2009; 23:559–69
11. Wityk RJ: Blood pressure augmentation in acute ischemic stroke. *J Neurol Sci* 2007; 261:63–73
12. Adams HP Jr, del Zoppo G, Alberts MJ, Bhatt DL, Brass L, Furlan A, Grubb RL, Higashida RT, Jauch EC, Kidwell C, Lyden PD, Morgenstern LB, Qureshi AI, Rosenwasser RH, Scott PA, Wijdicks EF, American Heart Association, American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: Guidelines for the early management of adults with ischemic stroke: A guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups: The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists. *Stroke* 2007; 38:1655–711
13. Martin-Schild S: Blood pressure in acute stroke: Lower it or let the CHHIPS fall where they will. *Lancet Neurol* 2009; 8:23–4
14. Potter JF, Robinson TG, Ford GA, Mistri A, James M, Chernova J, Jagger C: Controlling hypertension and hypotension immediately post-stroke (CHHIPS): A randomised, placebo-controlled, double-blind pilot trial. *Lancet Neurol* 2009; 8:48–56
15. Sare GM, Geeganage C, Bath PM: High blood pressure in acute ischaemic stroke—broadening therapeutic horizons. *Cerebrovasc Dis* 2009; 27:156–61