

suspect many clinicians would be uncomfortable with use of SpHb readings in this manner. Our finding of larger bias and wider limits of agreement at lower hemoglobin values suggests an area for further algorithm or device refinement. Perhaps a user-selectable “low hemoglobin range” setting could be developed to provide tighter limits of agreement in this lower range.

Comparison of our results to others is important. We found larger bias and wider limits of agreement in patients with larger blood loss or lower hemoglobin. As pointed out, the limits of agreement we found (-2.3 to $+3.3$ g/dl) are similar to those reported by Miller *et al.*³ (-3.2 to $+3.7$ g/dl) and Lamhaut *et al.*⁴ (-2.7 to $+2.75$ g/dl); slightly larger than that reported by Berkow *et al.*⁵ (-2.0 to $+1.8$ g/dl); but larger than that reported by Frasca *et al.*⁶ (-1 to $+1$ g/dl). Of note in the study by Frasca *et al.*, sample pairs from patients who were treated with norepinephrine infusion more than 0.2 mcg/kg/min or obtained when the perfusion index was less than 0.5 had greater bias and wider limits of agreement (-1.4 to $+1.4$ g/dl). Miller *et al.*⁷ reported that digital nerve block performed on the finger to which the sensor was applied improved accuracy of pulse hemoglobin compared with standard laboratory cooximetry. This finding suggests that differences between intensive care and intraoperative blood loss could induce changes in peripheral circulation that affect the accuracy of pulse cooximetry. We believe this is an important area of future research.

We are impressed by the innovations Masimo has brought to patient care. The company has demonstrated sincere commitment to improving their devices. We are convinced that pulse cooximetry could be used to inform clinical transfusion decisions. We also believe that differences in clinical situations in which blood loss occurs may have important effects on peripheral circulation, and thus potentially influence the accuracy of pulse cooximetry. Dr. O'Reilly noted that Ehrenfeld *et al.*⁸ reported less transfused blood was given to patients monitored with pulse cooximetry in comparison with standard care. However, transfusion was expected in only 4.5% of patients they studied, whereas 55% of our patients received ≥ 1 unit of transfused erythrocytes during surgery. We do not have access to all information about patients in the abstract from Ehrenfeld *et al.*, but the average blood loss they reported was nearly 600 ml less than in our study. The larger amounts of blood loss and transfusion in our patients could be associated with changes in peripheral circulation affecting pulse cooximetry accuracy and thus would seem to make patients similar to those we studied more appropriate for determining the effect of pulse cooximetry on transfusion decisions.

Further research is warranted to delineate which patient or intraoperative factors contribute to larger differences between pulse cooximetry and invasive hemoglobin measurements. We believe this will lead to studies that verify a posi-

tive effect of SpHb[®] on patient care and perioperative outcome.

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Perioperative Ischemic Optic Neuropathy and Spine Surgery: Are We Asking the Right Questions?

To the Editor:

The recent article and editorial regarding intraoperative vision loss in the prone position continue to promote real advances in understanding and reducing the occurrence of this devastating complication.^{1,2} The importance of prone positioning, obesity, gender, and use of the Wilson frame clearly invite the conclusion of perioptic venous back pressure and edema formation as causative mechanisms. However, the commonality for all four factors is perhaps, at least partially, one of simple geometry. The gender factor may not

These letters were sent to the author of the mentioned Editorial View, who felt that a reply was not necessary.—James C. Eisenach, M.D., Editor-in-Chief.

be hormonal differences. Women typically are shorter than men. Fixation on body mass index as the index of obesity obscures the gender difference in absolute height, also imparting a different absolute “thickness.” The combination of increased thickness and length together may contribute to significant differences in periocular congestion and edema. The Wilson frame’s absolute height may be fixed, but measurements of “thicker” and longer males will result in a greater total prone body height as measured from base (eyes) to apex (skin incision site) geometrically (Pythagorus). This is minimized by Jackson style frames, where the shoulders and hips are preferentially supported in a level position. The shortest female’s face may never reach to the base of the Wilson’s arch.

Geometry has been implicated as a significant factor in vision loss in prolonged *supine* surgical positioning: robotic prostatectomy.^{3,4} Certainly the prone and head-down positions impart increased ventilation pressures to increase central venous pressure and venous pressure in the optic area, with prolonged surgery promoting intensification of edema accumulation. If we accept the geometry theory of this process, the rational conclusion to eliminate ischemic optic neuropathy is clear: Perform prolonged spinal surgery only in the left lateral position! The head is now uniformly placed above the heart, facilitating minimal venous back pressure from gravity and ventilation, while maximizing the filling pressure of the now “dependent” heart. Can geometric considerations drive a change in “routine standard neurosurgical practice?” Is the prone position primarily used for obsolete “historical reasons?” Geometry considerations have reduced sitting craniotomy numbers to an unparalleled historical minimum only by exposing the dangers of air embolism, which was also a “rare event.” Is ischemic optic neuropathy any less devastating? Can the authors examine the geometry factors in their available data because the published material is inadequate in this regard? Can surgeons be led to use the lateral position, especially for prolonged surgical procedures? What problems would be introduced or need solutions? Is it time to reexamine the premise and study this theory prospectively as optimal preventive strategy?

The suggestion that staging procedures may represent a preventative strategy deserves consideration here. Staging recently has been demonstrated to impart increased morbidity and possibly mortality in major spinal surgery.⁵ The multicenter retrospective data indicate, but do not prove, that increased morbidity and mortality, prolonged hospital stay, increased costs, and infections are to be expected. It is also possible that nonarteritic ischemic optic neuropathy occurring during prone surgeries simply reflects coincidental occurrences found in the general nonsurgical population, given the relatively similar frequency of occurrence.⁶ Vasopressors commonly used during these surgeries or delayed detection in the intensive care unit with causative association to surgery may also play a role.⁷ Clearly, comparing prone to lateral surgery in a prospective fashion may be the single most effective

means to improve patient outcome and clarify cause *versus* effect in this devastating surgical complex.

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Could the Open Door Crack on Perioperative Visual Loss Be Even Bigger?

To the Editor:

The recent study of postoperative visual loss after spinal surgery identified long duration anesthesia, male gender, obesity, and the need for larger blood transfusion as risk factors for postoperative visual loss.¹ The authors believe the core mechanism for visual loss is a vascular one causing optic nerve ischemia. The accompanying editorial emphasized the possible role anesthesia-associated inflammation may play in visual loss and referenced the article of Staff *et al.*, who first described postoperative inflammatory neuropathy.^{2,3} The inflammatory neuropathy cases described by Staff *et al.* all involved peripheral nerves. Perhaps there is a common risk factor in perioperative visual loss and postoperative inflammatory peripheral neuropathy. That factor could be the use of nitrous oxide. It would be interesting if information on the use of nitrous oxide were available from these two reports’ databases.

Nitrous oxide anesthesia increases plasma homocysteine.⁴ Nitrous oxide does this by disrupting a metabolic chain involving folate, vitamin B6, and vitamin B12. Speculatively, the nitrous-oxide-induced increase in homocysteine effects could be greater in individuals who have a preexisting deficiency of these vitamins or a subclinical or undiagnosed