

Phenylephrine Infusion

Driving a Wedge in Our Practice of Left Uterine Displacement?

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THE avoidance of maternal hypotension during spinal anesthesia for cesarean delivery is of paramount importance to maintain placental blood flow before delivery and to avoid maternal nausea, vomiting, and dizziness. In this issue of ANESTHESIOLOGY, Lee *et al.*¹ demonstrate that maintaining maternal systolic blood pressure with phenylephrine infusion prevents neonatal acid–base impairment in healthy women undergoing cesarean delivery under spinal anesthesia, whether the mother is positioned supine or in a traditional 15° left lateral tilt to prevent aortocaval compression.

Maternal hypotension after spinal anesthesia during cesarean delivery in the absence of prophylactic therapy is a predictable event, reported as high as 95% in healthy women.² This hypotension can be a result of the neurophysiologic effect of the spinal anesthetic, including arterial and venous dilation after sympathetic blockade of the thoracic spine, as well as from impairment of aortocaval blood flow and decreased preload. Therefore, the recommended practice after the placement of a neuraxial anesthetic is currently to use both mechanical prophylaxis—tilting or wedging the patient—and pharmacologic prophylaxis with vasopressor therapy to prevent maternal hypotension.

Left uterine displacement has been ingrained in practice to avoid aortocaval compression–related hypotension during cesarean delivery under spinal anesthesia since its description in the 1970s.^{3,4} It is typically achieved by either using a pelvic wedge or lateral table adjustment. Studies comparing these two approaches report that they are equally effective in achieving some degree of pelvic tilt,⁵ although



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the actual angle achieved is widely variable and often overestimated.⁶ Investigation of how the degree of tilt impacts hemodynamics demonstrates that hypotension from aortocaval compression is progressively eliminated by moving from full supine to full lateral position, albeit with significant interindividual variability in both the susceptibility to hypotension and to impact of the tilting maneuvers.⁷

The study by Lee *et al.*¹ calls into question whether the routine practice of left uterine displacement is necessary. The investigators point out that the 15° left lateral tilt recommended to relieve aortocaval compression is rarely achieved in routine practice. Further, they note that, in contrast to the 1970s, when the practice of uterine displacement was developed, vasopressors are now routinely used during cesarean delivery and may readily overcome

any hemodynamic impact of aortocaval compression.

No previous study has directly compared the impact of tilt *versus* a level supine position in the setting of contemporary anesthetic practice. It is clearly important to critically evaluate aspects of our practice that may be perpetuated based on tradition more than a firm evidence base. Lee *et al.* should therefore be congratulated for performing this carefully designed and executed study that tests the need for this standard clinical practice.

In the trial, 100 healthy women were randomized to either a supine horizontal position or 15° left lateral tilt. Maternal systolic blood pressure was maintained through the use of a titrated phenylephrine infusion and boluses. The primary outcome was appropriately a measure of the adequacy of *in utero* fetal perfusion, umbilical artery base excess. The trial

Image: F. Hage.

Corresponding article on page 241.

Accepted for publication April 4, 2017. From the Division of Obstetric Anesthesia, Department of Anesthesiology, Perioperative and Pain Medicine (M.K.F. and B.T.B.), and the Division of Pharmacoepidemiology and Pharmacoeconomics, Department of Medicine (B.T.B.), Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts.

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showed that there was no difference in umbilical artery base excess between the supine and tilt groups.

An important implication of this investigation is that providers can have peace of mind if the full supine position is desired or required, whether for better surgical exposure or for enhancing rapidity of block onset during an emergency. In these situations, at least for healthy women with uncomplicated pregnancies, the study shows that fetal acid base status need not be compromised as long as systolic blood pressure is maintained with a phenylephrine infusion.

However, should we go so far on the basis of these data to abandon the routine practice of tilting all patients having a cesarean delivery? We'd suggest that this change is probably not yet warranted. First, the trial by Lee *et al.* was performed in a highly selected group of pregnant women. The study population was restricted to nonlaboring, term, nonobese, women with singleton pregnancies. Women with pregnancies complicated by intrauterine growth restriction, hypertension, preeclampsia, smoking, and a range of other comorbidities were excluded. It is unclear whether these results will generalize to the many cesarean delivery patients with these conditions who would have been excluded from the trial and who may be more vulnerable to the effects of aortocaval compression. Despite careful, protocol-based administration of phenylephrine, systolic blood pressures were significantly lower in the supine group, as was cardiac output. At the time point of 15 min after spinal anesthesia, the average cardiac output was nearly 20% lower in the supine group. Although these differences in maternal hemodynamic measures did not affect neonatal acid–base status in the healthy pregnant women included in the trial, it is very plausible that the higher blood pressure and cardiac output achieved with tilting may be clinically important in maintaining fetal well-being in many clinical circumstances, particularly conditions when placental perfusion is impaired (*e.g.*, preeclampsia, intrauterine growth restriction).

Second, patients in the supine position required considerably more phenylephrine. Although high-quality research over the past decade has demonstrated that phenylephrine infusion is more effective than ephedrine for either prophylaxis or treatment of maternal hypotension during elective cesarean delivery and is generally considered to be safe,⁸ the avoidance of unnecessary pharmacologic treatment will always be appealing if there is a simple mechanical maneuver (patient positioning) that may achieve the same hemodynamic goals. Further, the need for additional phenylephrine to compensate for the lack of tilt will require a heightened level of attention to blood pressure by practitioners that may be hard to maintain in the context of routine practice.

Finally, we currently lack the sophistication to predict individual response to flat positioning at term gestation. The supine hypotensive syndrome occurs in approximately

10% of women at term and has been attributed to mechanical aortocaval compression, exaggerated autonomic response, or both.⁹ Cardiac output monitoring in pregnant patients who develop the supine hypotensive syndrome reveals a marked reduction in stroke volume and cardiac output in all, followed by a rapid fall in heart rate and mean arterial pressure in those who become symptomatic.¹⁰ Although asking patients whether they are able to lie flat may be useful, the question as a screening tool for this condition has yet to be validated. Until we can better predict patients susceptible to the supine hypotensive syndrome, practitioners will need to be extremely vigilant with patients for whom they decide to forego uterine displacement to recognize this syndrome early and then correct it by tilting or wedging the patient.

This trial provides an important step forward for the field of obstetrical anesthesia by showing that not all patients having a cesarean delivery need to be tilted or wedged to maintain normal blood pressure after spinal anesthesia. For healthy women with uncomplicated pregnancies, it may be reasonable to forego this practice if there is a good reason to do so, including patient comfort or obstetrician preference, provided the anesthesiologist remains attentive to maintaining the patient's blood pressure through the use of vasopressor therapy. The work that lies ahead is to further define for whom this routine practice can be safely omitted.

Competing Interests

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.

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ANESTHESIOLOGY REFLECTIONS FROM THE WOOD LIBRARY-MUSEUM

Stramonium for Extending the Anesthetic Duration of Nitrous Oxide



In 1676, English colonists observed the sedative and hallucinogenic effects of *Datura stramonium* on soldiers at Jamestown, Virginia, who had ingested what was later popularized as Jamestown Weed or Jimsonweed (*left*). Other nicknames followed based on this nightshade's night-blooming ("Moon Flower"), funnel-shaped flowers ("Hell's Bells" or "Devil's Trumpet"), each of which, once moth pollinated, are replaced by a spiny ovoid fruit ("Thornapple," "Pricklyburr," or "Devil's Cucumber"). Frustrated in the mid-1880s with nitrous oxide's brief anesthetic duration, some clinicians supplemented laughing gas anesthesia with herbal sedatives, such as *D. stramonium*. As enthusiasm waned for herially supplemented nitrous oxide, physicians continued prescribing stramonium leaves (*right*)—a perilous anticholinergic slurry of scopolamine, hyoscyamine, and atropine—as an anodyne and an antispasmodic, especially for asthmatic patients. (Copyright © the American Society of Anesthesiologists' Wood Library-Museum of Anesthesiology.)

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