

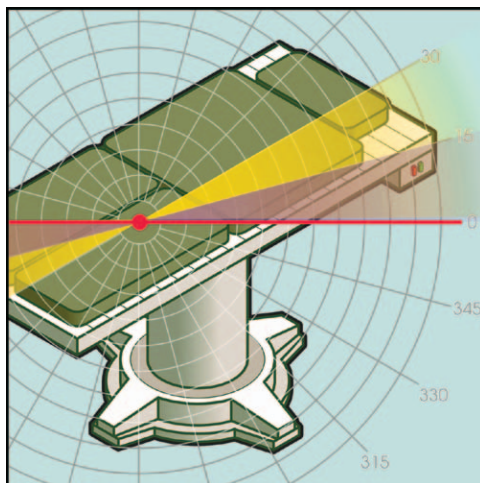
Tilting at Aortocaval Compression

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HOW do you position your patients for cesarean delivery? Simple question, right? Even if I put the question to the junior residents in our training program who have completed their obstetric anesthesia rotation, I am sure that almost all (there are always outliers!) would answer “Supine, with left uterine displacement.” Left uterine displacement is generally accepted to be a 15-degree tilt of the parturient’s hips when she is in an otherwise supine position on the operating room table or laboring in a delivery room.¹ This 15-degree “gospel” has become ubiquitous in our labor and delivery suite, but a study by Higuchi *et al.*² in this issue challenges the utility of this simple, pervasive practice. To understand how and why, we need to recall exactly what the basis is for this mystical 15-degree tilt.

The description of the “supine-hypotension” syndrome goes back at least as far as 1953 when Howard *et al.*³ described a significant decrease in blood pressure in 18 of 160 term parturients placed in a supine position; they ascribed the syndrome to occlusion of the inferior vena cava (IVC) by the gravid uterus. Bieniarz *et al.*⁴ published a series of articles in the mid-1960s using angiography and differential blood pressure measurements in upper and lower extremities which purported to show that the abdominal aorta could also be occluded in the supine position, potentially decreasing uterine artery blood flow. Thus, “aortocaval compression” entered our lexicon and the lore of obstetric anesthesia.

It was not until 1972, however, that the 15-degree rule became institutionalized in our practice. Crawford *et al.*⁵ compared Apgar scores and blood gas measurements between two groups of parturients at cesarean delivery and found that those who had been tilted with a “sorbo rubber” wedge of “approximately 15 degrees” had better scores and less severe



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“birth asphyxia” than those who had been delivered supine (especially when the incision to delivery interval was lengthened). He ascribed these results to relief of compression of the IVC by the positioning. We have been tilting our pregnant patients 15 degrees ever since, believing we were avoiding compression of the IVC and aorta, but did Crawford’s conclusions truly warrant the wide application to our current practice that they have received? A careful reading makes one wonder whether *any* of the findings are relevant today—among the confounders, all the patients were under general anesthesia, mechanically ventilated with supplemental oxygen (33% O₂/67% N₂O), and the tilt applied was either to the left *or* right!

In the study published in this issue of ANESTHESIOLOGY, Higuchi *et al.*² used magnetic resonance imaging to determine the volume of both the IVC and aorta in 10 term parturients in positions ranging from supine to 45 degrees of left lateral tilt and compared them to a cohort of nonpregnant women. In short, they found no evidence of decreased aortic volume (aortic compression) in *any* of the pregnant subjects in *any* position, supine or tilted; calculated aortic volumes were not different from the nonpregnant subjects. In the nonpregnant women, position (supine or tilted) had no effect on calculated IVC volume. In the pregnant subjects however, IVC volume was greatly reduced in the supine position, indicating almost complete compression but even with lateral tilt to 15 degrees applied, this near-complete compression remained! Not until the lateral tilt reached 30 degrees, did IVC volume increase *somewhat* (indicating relief of compression), but even at 45-degrees lateral tilt, IVC volume was still reduced compared with the nonpregnant controls. We might have predicted that this IVC compression would affect maternal

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hemodynamics, but surprisingly, Higuchi *et al.* found no alterations in cardiac output, heart rate, or mean arterial pressure related to the degree of lateral tilt.

Certainly, the study has its shortcomings—the number of subjects studied is small (only 10 subjects in each group, 20 in all), and it should be noted, by current American standards, even the pregnant subjects were quite small (their body mass index ranged from 17.8 to 26.2...I can go weeks it seems without seeing a pregnant patient in that range!). Furthermore, none of the pregnant women were laboring, and none had received a regional anesthetic; it is unclear how these variables might have impacted the findings.

Despite these drawbacks, there is at least one important lesson we should take away from this study. With all due respect to Dr. Crawford, who remains an icon in the obstetric anesthesia community, the study exposes the application of a 15-degree tilt as the anesthesia equivalent of the emperor's new clothes: "Yes, see how the patient is tilted 15 degrees? Surely, her IVC cannot be compressed!" It seems we have only been deceiving ourselves, but apparently, most women tolerate this IVC compression pretty well. Yes, maternal blood pressure usually does fall, more often than not, after placing a subarachnoid block, but rarely so far or so rapidly as to cause significant problems. Recent reports have even questioned whether the use of pelvic tilt has any effect on the incidence of hypotension after subarachnoid block.⁶ This is not to condone complacency however—if a parturient under our care becomes hypotensive, or develops a nonreassuring fetal heart trace after a regional block, placing her in a more extreme lateral position, 45-degrees or even full lateral tilt, may be the most appropriate intervention.

As far as aortic compression goes, virtually all the previous studies that addressed the issue relied upon indirect evidence to document compression—differential blood pressures and the like. Magnetic resonance imaging in the current study allowed actual visualization of the abdominal aorta, and so short of directly monitoring blood flow through the vessel, this is likely as accurate an indication of aortic compression, or lack thereof, that we could ask for. As such, aortic compression by the gravid uterus would seem to be quite infrequent; it may be time to revise our terminology to drop the "aorto-" from "aortocaval compression."

Although it would be great to be able to conclude by saying all our patients should be placed in at least 30-degrees left lateral tilt after a regional anesthetic, I have serious

doubts that our obstetric colleagues would find it a reasonable position for cesarean delivery, particularly in obese or heavy patients. Is surgery even possible with a 30-degree tilt? Certainly, there are those who would dismiss the idea out-of-hand; at the least, it would require a vastly different approach to the procedure, for a benefit that has not yet been defined.

Finally, the question remains "Should we continue to position our cesarean patients in left uterine displacement?" Personally, I do not feel ready to abandon it altogether based on a small study like this one. There quite probably are patients for whom the modest tilt we apply has a salutary effect. I will have to be less dogmatic about the practice however.

Sometimes practices become so ingrained in our routines that we forget why we began doing them in the first place... and whether our original rationale is still valid. Kudos to Higuchi *et al.* for revisiting an "ancient" practice, applying current technology to the matter, and shedding new light on an old routine.

Competing Interests

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References

1. Cheek TG, Gutsche BB: Maternal physiologic alterations during pregnancy, *Anesthesia for Obstetrics*, 4th edition. Edited by Hughes SC, Levinson G, Rosen MA. Philadelphia, Lippincott Williams and Wilkins, 2002, pp 10
2. Higuchi H, Takagi S, Zhang K, Furui I, Ozaki M: Effect of lateral tilt angle on the volume of the abdominal aorta and inferior vena cava in pregnant and nonpregnant women as determined based on magnetic resonance imaging. *ANESTHESIOLOGY* 2015; 122:286–93
3. Howard BK, Goodson JH, Mengert WF: Supine hypotensive syndrome in late pregnancy. *Obstet Gynecol* 1953; 1:371–7
4. Bieniarz J, Maqueda E, Caldeyro-Barcia R: Compression of aorta by the uterus in late human pregnancy. I. Variations between femoral and brachial artery pressure with changes from hypertension to hypotension. *Am J Obstet Gynecol* 1966; 95:795–808
5. Crawford JS, Burton M, Davies P: Time and lateral tilt at Caesarean section. *Br J Anaesth* 1972; 44:477–84
6. Calvache JA, Muñoz MF, Baron FJ: Hemodynamic effects of a right lumbar-pelvic wedge during spinal anesthesia for cesarean section. *Int J Obstet Anesth* 2011; 20:307–11