

Programmed Intermittent Epidural Boluses (PIEB) for Maintenance of Labor Analgesia: An Incremental Step Before the Next Paradigm Shift?

Brendan Carvalho, Edward T. Riley

Department of Anesthesia, Stanford University School of Medicine, Stanford, CA, USA

We agree with the evidence comparing programmed intermittent epidural boluses (PIEB) to conventional continuous epidural infusions (CEI) for maintaining epidural labor analgesia presented by Munro and George, (1) showing advantages with PIEB for both the patient (with less local anesthetic consumption, improved maternal satisfaction, potentially shorter duration of labor) and the anesthesia team (with decreased workload requirements) (2). However we disagree with their interpretation of the data, specifically the effect size of the demonstrated improvements (3). As we previously stated, the observed differences are modest and of limited clinical impact (4). The epidural analgesic technique of PIEB therefore needs to be considered only an incremental improvement over CEI for the maintenance of epidural labor analgesia. As such rather than focusing on the limited improvement of PIEB, perhaps we need to shift our overall perspective.

A paradigm shift is a fundamental change in the basic concepts and practices of a discipline (5). In our opinion, there have only been a few paradigm shifts for labor pain management, for example, the discovery of local anesthetics and their utilization to provide spinal and/or epidural analgesia; and the finding of opioid receptors in the spinal cord that has facilitated the use of neuraxial opioids. These changes moved labor pain control from practices involving inhalational anesthesia, twilight sleep or relying on systemic opioids (6), to epidural labor analgesic techniques that many laboring women request and receive during childbirth (7). However within these paradigm shifts, there have been many significant improvements in the analgesia and safe care that we provide laboring women. Examples of such improvements would include the use of epidural catheters instead of a single-shot spinal, epidural or caudal techniques, utilization of dilute local anesthetic opioid-containing solutions, smart volumetric epidural pumps, patient-controlled epidural analgesia (PCEA), combined spinal-epidural (CSE) analgesia, and flexible wire-reinforced epidural catheters. Some of these changes were major improvements and others incremental, but cumulatively these changes are substantive and have fundamentally improved our practices.

So where does PIEB fit into these paradigms shifts and stepwise improvements? We agree with Munro and George, (1) that PIEB is superior to CEI for delivering local anesthetics to the epidural space and maintaining epidural labor analgesia. However, the improvement

Address for Correspondence:

Brendan Carvalho

E-mail: bcarvalho@stanford.edu

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is what one expects from the refinement within a paradigm versus a shift in the paradigm, and more specifically within a paradigm refinement, PIEB likely offers only incremental improvement.

There are changes that have been major improvements within the paradigm. For instance catheter-based neuraxial techniques compared to single-shot spinals or epidurals that provide patients and providers a fundamentally different experience, whereas an example of an incremental improvement would include wire-reinforced epidural catheters that reduce insertion paresthesias, intravascular cannulation and one-side blocks (8). Cumulatively, these stepwise improvements (both major and incremental) have progressively improved the provision of labor analgesia. Modern compared to historical epidural techniques have significantly decreased maternal and fetal side effects, and most importantly, have minimal impact on obstetric outcomes.

We appreciate that it is difficult to unravel whether a technique refinement has been a major or an incremental improvement. The impact and adoption of some refinements may also be augmented by other concurrent changes. For example, the utilization of opioid-containing dilute local anesthetic solutions have been shown to significantly reduce local anesthetic consumption, motor block, assisted delivery and duration of labor (9). However, without the introduction of high capacity volumetric epidural pumps, the use of dilute local anesthetic solutions for labor analgesia would not be a viable option. Similarly if epidural pumps with the ability to provide PCEA boluses were not developed, patient-controlled labor analgesic techniques would not be possible.

Although refinements of techniques do not affect our practices as much as paradigm shifts, if anesthesia providers do not adopt individual technique refinements as they are developed, there will eventually be a cumulative fundamental difference in the quality of the labor analgesia they deliver, with more associate complications and less efficient workflow. In isolation many of these refinements may be incremental improvements, but collectively these epidural drug and delivery improvements result in a near paradigm shift. Many of these epidural labor analgesia refinements (for example high volume dilute local anesthetics, PCEA, PIEB and wire-reinforced catheters) are a part of our clinical practice. Adoption of each change did not make a major clinical impact on our practice, however if all of these were discontinued simultaneously, the quality of labor analgesia we deliver to our patients would be fundamentally impacted. Our patients would suffer (women would experience more pain, greater motor block, longer labors, more assisted deliveries

and lower satisfaction) and our workload would increase (we would need to replace many more epidural catheters, provide more manual supplementary epidural boluses during labor, and more frequently pause epidural pumps for problematic motor block or maternal inability to push).

Continually refining one's practice between paradigm shifts is vital. However, Munro and George (1) do not seem to appreciate that early adoption of techniques can be challenging during the period when optimal use of the technique is still being determined. For example, early adopters of the CSE technique for labor analgesia used only opioids in the intrathecal injection, and used in this manner, the CSE technique did not offer much advantage over the standard epidural technique for advanced labor pain management (10). Once it was determined that adding local anesthetic to the intrathecal injection of opioid was effective in late labor (11), the CSE technique become widely adopted (7). For those considering the change to PIEB, there is a price to pay beyond the cost of pump capable of delivering PIEB. The optimal PIEB settings for maintenance of labor analgesia have not been fully elucidated, and early adopters will have to refine their PIEB settings after implementation.

When epidural catheters were first introduced for labor analgesia, local anesthetic were given in boluses. These boluses were administered manually by anesthesiologists or midwives, and rather than given at timed intervals like PIEB, they were bolused on maternal request when pain returned. Pumps that delivered CEI were more convenient, produced more stable analgesia and could be supervised by midwives and nurses (12), and consequently CEI were rapidly adopted when introduced. With the introduction of PIEB, we have returned to an intermittent bolus technique, however this time without requiring ongoing manually boluses of the epidural catheter. The advantages inherent in bolus-based techniques of PCEA and PIEB over CEI are clear, and fortuitously pump technology has allowed us to return to a bolus-base technique and provide this optimal drug delivery method.

In conclusion, the evidence that PIEB is better than CEI when used as a background infusion with PCEA is well-presented by Munro and George (1), however we disagree with their interpretation, (4) and feel that the improvements are incremental and of subtle clinical benefit. However, adopting these incremental epidural drug and delivery technique refinements are important rather than just waiting for the next paradigm shift. Therefore despite the incremental improvements with PIEB compared to CEI, we believe that PIEB for labor analgesia maintenance is worth considering incorporating into your clinical practice.

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