

Enhancing Patient Satisfaction during Labor and Delivery with Programmed Intermittent Epidural Bolus (PIEB) Analgesia

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Introduction

The first documented use of epidural anesthesia for labor analgesia occurred in 1909 when Walter Stoeckel, MD, published his study on the use of caudal epidural analgesia.¹ Today, epidural analgesia is used around the world with a clinical focus on maximizing labor outcomes, while enhancing maternal satisfaction and minimizing side effects.

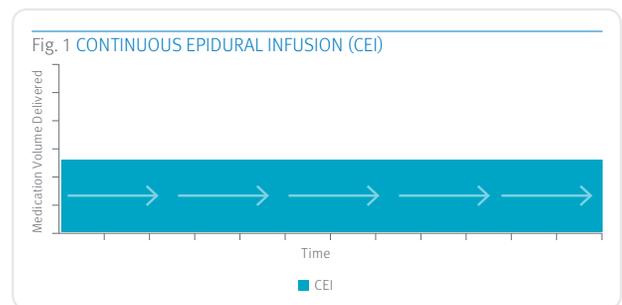
There are three common delivery modes for epidural analgesia: continuous epidural infusion (CEI), patient-controlled epidural analgesia (PCEA), and programmed intermittent epidural bolus (PIEB).

During CEI, the patient receives epidural medication at a continuous infusion rate (i.e., mL/h) of analgesia (Fig. 1).

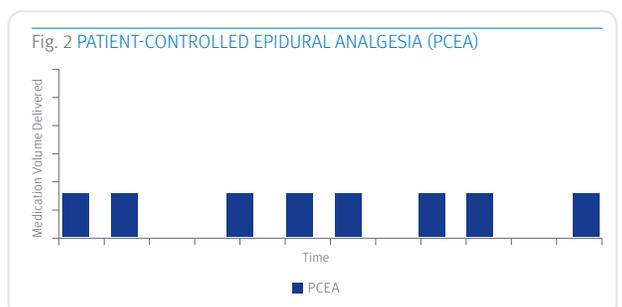
Alternatively, PCEA enables patients to self-administer their pain medication, as needed, through an infusion pump (Fig. 2). This enables patients to manage their labor pain while potentially reducing side effects such as excessive motor block that may accompany CEI alone.^{2,3}

PIEB is a newer mode of administration that delivers identical volume doses of epidural medication intermittently at scheduled periods of time (Fig. 3). This delivery method has demonstrated more extensive spreading of local anesthetic in the epidural space compared to continuous administration.⁴ In laboring patients, PIEB has also been shown to result in lower anesthetic consumption⁵ and higher patient satisfaction scores.⁶

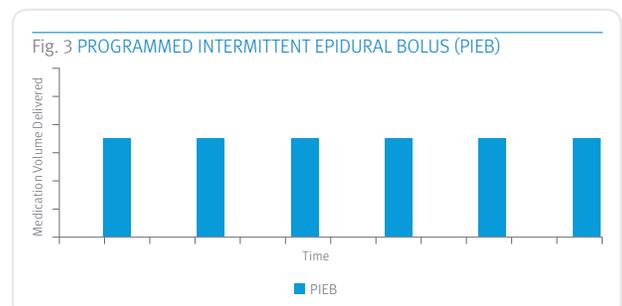
PIEB has been shown to demonstrate a more extensive spreading of local anesthetic in the epidural space.



Patient receives a continuous infusion of analgesia.



Patient self-administers pain medication through a programmed infusion pump.



Patient receives identical programmed intermittent doses.

Improving Epidural Efficacy by Combining Delivery Modes

Randomized clinical trials have compared epidural infusion delivery methods, assessing endpoints of labor outcomes, pain relief, side effects, and maternal satisfaction.

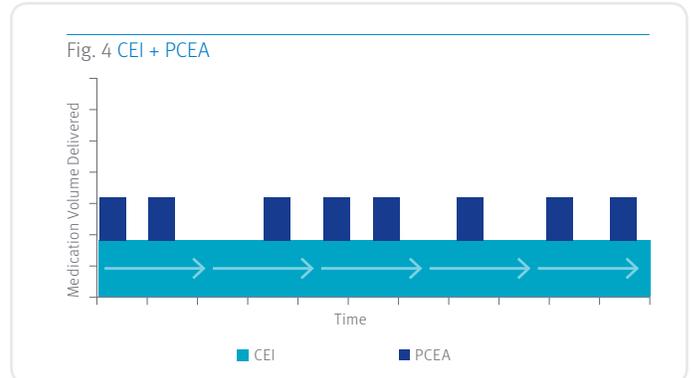
The combination of PCEA with CEI (background infusion) has greater analgesic efficacy when compared to PCEA without a background infusion (Fig 4).⁷

Maternal satisfaction is influenced by multiple factors. Pain relief and side effects both influence a patient's labor experience.⁸ The minimization of motor block to enable patient participation during delivery, along with minimization of opioid-induced pruritus, may also enhance maternal satisfaction with childbirth.⁹

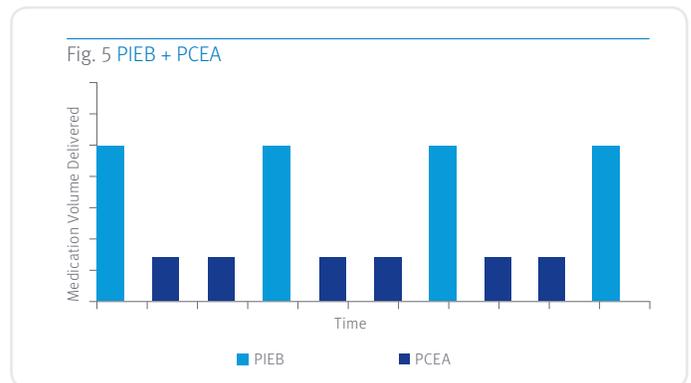
In 2006, Wong and colleagues published a study on the effects of combining PIEB with PCEA (Fig 5) compared to CEI with PCEA. The results indicate that the combination of PIEB with PCEA is associated with improved maternal satisfaction, a reduced total anesthetic dose, and less need for PCEA and manual clinician rescue dose administration. An explanation for the results may lie in the PIEB mechanism of action, as studies have demonstrated more extensive spreading of local anesthetic in the epidural space with bolus administration compared to continuous administration.^{4,6,10,11,12} In addition, the potential dose-sparing effect of the intermittent bolus may be clinically relevant in reducing the potential for motor block and minimizing or eliminating pruritus.¹

The Wong, et al. study has been instrumental in the development and adoption of PIEB delivery. Due to the technologic limitations of the then available epidural pumps, the Wong, et al. study required the researchers to use two separate epidural pumps for each subject, in which one pump administered either the PIEB or CEI while the second pump administered the PCEA.⁹

Since the publication of Wong, et al, infusion pumps have received FDA 510(k) clearance for software enhancements that incorporate PIEB plus PCEA functionality into a single program. These select epidural pumps (i.e., Q Core Sapphire™ Epidural and Multi-Therapy pumps and Smiths Medical CADD®-Solis ambulatory infusion pump) also provide time-based lockout periods, which minimize the potential for overmedication. The prioritizing of PIEB versus PCEA doses may differ by software package and may have a potential clinical impact.



Patient receives a continuous epidural infusion and has the ability to self-administer.



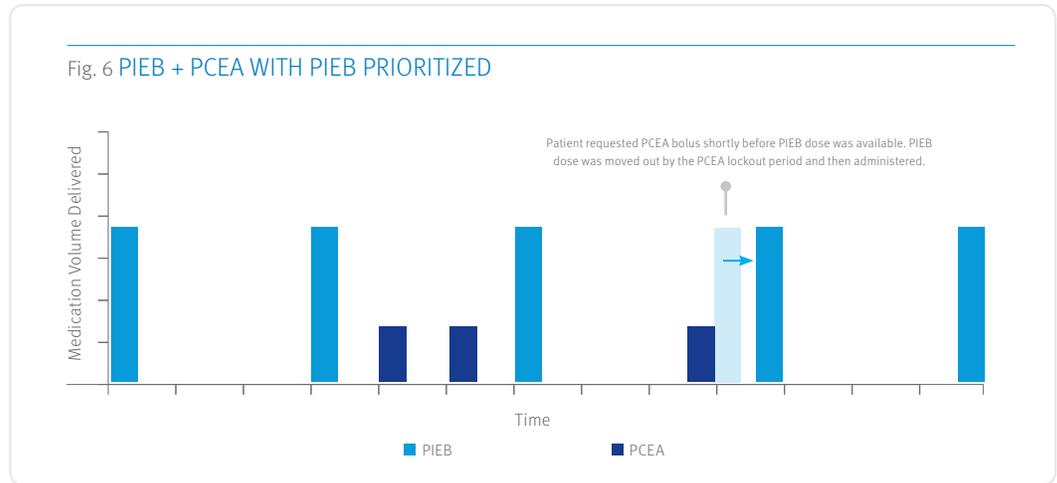
Patient receives a programmed intermittent infusion and has the ability to self-administer.

The combination of PIEB with PCEA provides a method for improved maternal satisfaction, reduced total anesthetic dose, and less need for PCEA and manual clinician rescue dose.

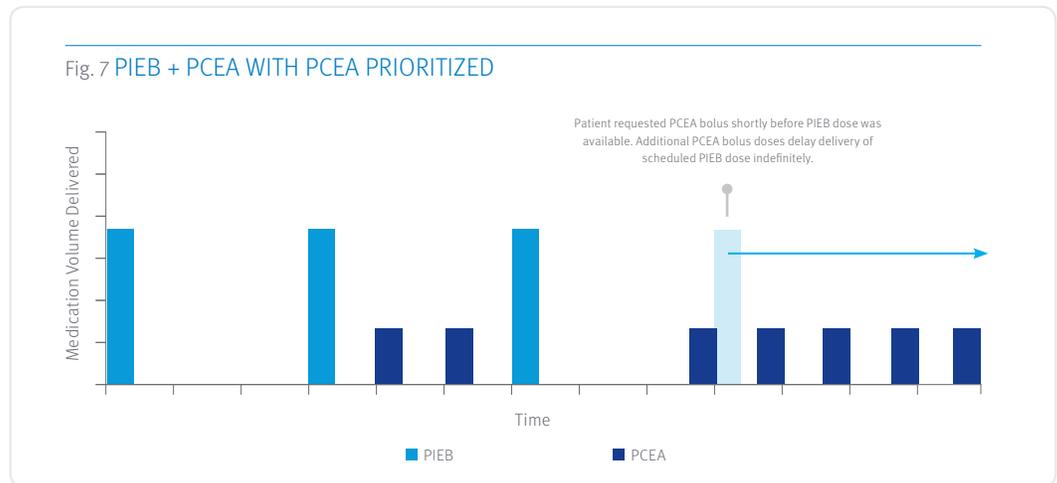
Prioritizing the PIEB Dose over the PCEA Bolus

The Wong, et al. study demonstrates that a larger intermittent epidural dose reduced the need for a PCEA bolus.⁶ Fewer PCEA doses indicates improved analgesia observed as fewer patients initiated demand boluses. From this result, it is intuitive that when selecting an epidural pump, the clinician should ensure that the lockout protocol prioritizes the delivery of the intermittent PIEB dose over the PCEA bolus to ensure the patient receives the scheduled PIEB dose (Fig. 6). Conversely, if a patient-demanded PCEA dose resulted in a lockout period that delayed a PIEB dose, a patient may require multiple small PCEA doses, which delayed delivery of the larger and more impactful scheduled PIEB dose (Fig. 7).

Patient requires fewer PCEA doses for breakthrough pain due to prioritization of PIEB



Patient requires frequent PCEA doses for breakthrough pain due to prioritization of PCEA



Conclusions

Effective pain relief during labor has been demonstrated with both CEI and PIEB regimens with or without PCEA. A review of the literature in this report suggests that PIEB with PCEA is associated with a reduced epidural medication requirement, fewer side effects, and improved maternal satisfaction. When selecting an infusion pump to administer epidural analgesia for labor and delivery, state-of-the-art devices considered should contain CEI - PCEA - PIEB delivery modes, and the PIEB mode should provide a lockout protocol that prioritizes the delivery of the intermittent dose over the PCEA bolus. As of the publication date of this white paper (December, 2017), the Sapphire™ Epidural and Multi-Therapy pumps are the only infusion devices that provide the optimal level of infusion modalities and PIEB prioritization.

References

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