LOW CONCENTRATION LIDOCAINE (0.5%) BOLUS EPIDURALLY CAN INITIATE FAST-ONSET, EFFECTIVE AND SAFE ANALGESIA FOR EARLY STAGE LABOR

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Abstract

There is no consensus on the optimal local anesthetic agent to initiate labor analgesia for patients in active labor. Currently used local anesthetic agents for initiating labor analgesia include 0.25% bupivacaine, 0.5% bupivacaine, 0.2% ropivacaine without or with various types and doses of opioids. All these agents are administered in incremental doses and are relatively "slow onset" in initiation of labor analgesia. We used 0.5% lidocaine 10ml as the loading dose given as an epidural bolus to initiate epidural analgesia for patients in early stages of labor. We included 32 cases (16 in Lidocaine group and 16 in Bupivacaine group). We found that 0.5% lidocaine is fast-onset, very effective and safe in initiating epidural analgesia for early stage labor.

Introduction

There is no consensus on the optimal local anesthetic agent to initiate labor analgesia[1,2,3,4,5]. The commonly used agents include 0.25% bupivacaine, 0.5% bupivacaine, and 0.2% ropivacaine with or without various types and doses of opioids and other adjuncts[3,4,5,6,7]. However all these analgesia-inducing local anesthetic agents/techniques are believed to be slow in initiating labor analgesia, which has led to the gaining popularity of combined spinal and epidural (CSE) analgesia in recent decades[7,8,9]. Nevertheless CSE has its intrinsic drawbacks: the potentially increased risk of postdural puncture headache[10], fetal heart rate changes[8,11], pruritus related to intrathecal opioids[12], untested epidural catheter if local anesthetic agent is used intrathecally, undetermined amount of local anesthetic agent migrating into intrathecal space after epidural bolus or infusion and other potential problems[13,14,15]. There is an additional concern for those who use intrathecal opioid for their CSE: opioids are controlled substances with controlled access, certain amount of time is needed to sign out opioids, so the faster onset after intrathecal injection could be offset by the additional time needed to obtain opioids. And the time for the onset of analgesia in laboring parturients should be the total time from anesthesia team is consulted/requested for labor analgesia to the time the patient experiences analgesia and reasonable pain relieve. Since anesthesiologist needs to go to drug-dispensing machine to get opioid, the time spent in the process will be counted to the total time. It won't be unusual if the total time for dispensing opioids, the insertion of

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CSE, and injection of opioid is longer than regular epidural catheter placement and bolus dose of local anesthetic agent and achieving reasonable analgesia. In 2006 Nafisi found that 1% lidocaine is effective for labor analgesia[16]. It is well documented that lidocaine is faster in onset of analgesia than bupivacaine[17], and bolus of the loading dose at once will achieve even faster analgesia than giving incrementally, as we noticed from our practice. However 10ml loading dose of 1% lidocaine cannot be given with single injection, because 100mg total lidocaine dose is not safe if given intrathecally by accident. It may cause high or total spinal anesthesia. We hypothesized that labor analgesia can be safely induced with bolus loading dose of 10ml 0.5% lidocaine (total 50mg lidocaine), which should be relatively safe even if it is accidentally injected intrathecally. So we conducted this small sample-sized pilot study to investigate the efficacy and safety of 10ml 0.5% lidocaine as a bolus dose to induce labor analgesia, and we found that this strategy was effective and safe in initiating labor analgesia. In this pilot study of prospective nature we compared 10ml bolus of 0.5% lidocaine to 10ml of 0.25% bupivacaine in initiating labor analgesia.

Methods

We randomized 32 parturients who are in active labor into two groups: Lidocaine group and Bupivacaine group. This study was approved by our Institutional Review Board. Written consents were obtained from all patients prior to inclusion in the study. Patients in Lidocaine group received 10 ml of 0.5% lidocaine as the bolus loading dose (n = 16), and the Bupivacaine group received 0.25% bupivacaine 10 ml as the bolus loading dose for their labor epidural (n = 16). A pre-epidural intravenous fluid loading was given to both groups. All patients were in sitting position when epidural catheters were placed by the same anesthesiologist. After sterile preparation of the skin and local anesthetic infiltration of skin wheals at L3, L4 level, #17G Tuohy needle was inserted into epidural space with the technique of "loss of resistance" with 2ml air. The epidural catheter was threaded 4 cm into the epidural space. Then 10ml of 0.5% lidocaine or 10ml of 0.25% bupivacaine was epidurally injected respectively in Lidocaine group or Bupivacaine group. A continuous infusion of 0.2% ropivacaine at 14 ml per hour was used for both groups and started as soon as patient lays down from sitting position. After the injection of the loading dose of local anesthetic agents, a senior anesthesiologist examined the patients to get the following parameters: sensory blockade is assessed with pinprick technique; motor blockade is graded according to Bromage Scores (I = free movement of legs and feet, II = free movement of feet, only flex knees, III = free movement of feet, unable to flex knees, IV = unable to move legs and feet)[18]; pain relieve is assessed by asking patient "do you feel better now or net yet?", the time was documented when patient reported "feeling better".

We documented patients' age, height, and body weight; the total volume of pre-epidural intravenous fluid loading; the cervical dilatation status indicating the stage of laboring process; the time from skin preparation to epidural loading dose injection to reflect the technical difficulties of the epidural placement; the time patient started feeling better or achieving pain relieve; and the time the sensory blockade level to reach stable levels.

For the comparison of age, height, body weight, pre-epidural fluid loading volume, the time from skin preparation to epidural loading dose injection, and cervical dilatation (in centimeters), we used Student T test for statistical analysis. For the comparison of the time to start feeling analgesia, and the time to achieve stable levels, we used Wilcoxon method for statistical analysis. For the analysis of delivery methods, total top-off doses and the incidence of motor blockade, we used Chi-Square Test. For all the statistical analyses, $P < 0.05$ is considered significant.

Results

Pre-epidural intravenous fluid loading was given to both groups, Lidocaine group received 1537 ± 144.6 ml on average and the Bupivacaine group received 1418 ± 187.8 ml on average (P = 0.62). The cervical dilatation when epidural catheter was placed was 3.44 ± 1.9 cm for Lidocaine group and 3.38 ± 1.15 cm for Bupivacaine group (P = 0.99).There were no statistically significant differences in age, height or

Table 1

Patients' demographic data, hematocrit and platelet counts (Mean ± SD)

	Age (years)	Height (cm)	Weight (kg)	Hematocrit	Platelet
Lidocaine	24.9 ± 5.3	161.6 ± 7.8	85.9 ± 21	33.58 ± 3.92	211 ± 43.8
Bupivacaine	23 ± 4.9	161.3 ± 6.1	82.5 ± 20	34.6 ± 3.16	232 ± 43.1
P value	0.33	0.9	0.64	0.4	0.19

weight between the two groups (Table 1). The time from skin preparation to epidural loading dose injection were 4 ± 1.21 minutes in Lidocaine group and 4.81 ± 2.56 minutes in Bupivacaine group(P = 0.26). We did not experience significant technical difficulties in placing the epidural catheters in both groups.

The number of top-up doses, the onset time of pain relieve, the time of sensory blockade to reach stable level, and the rate of cesarean section between the two groups were listed in Table 2. There were statistically significant differences in the onset time of pain relief, 2.88 ± 0.89 minutes in Lidocaine group and 4.81 ± 1.56 minutes (P <0.0001) and incidence of motor blockade between the two groups, Lidocaine group zero while Bupivacaine group had 6/16 (P <0.01). All motor blockades observed in the Bupivacaine group were Grade II on the Bromage Score. Other documented parameters included hematocrit (33.58 ± 3.9 in Lidocaine group, 34.69 ± 3.16 in Bupivacaine group, P = 0.4) and platelet count (211.69 ± 43.78 in Lidocaine group and 232.06 ± 43.06 in Bupivacaine group, P = 0.19), no significant differences between the two groups.

Discussion

The ultimate goal in obstetric anesthesia is to achieve safe and fast relieve of labor pain. The onset time to achieve analgesia should not only be the time from injection of anesthetic agents (opioids and/or local anesthetic agent) to pain relieve. Obstetric anesthesia service should target the shortest time between anesthesia team is consulted/requested for epidural placement to the time patient achieves reasonable analgesia. The agents used via traditional epidural catheter are believed not fast enough to initiate labor analgesia, thus CSE is designed to achieve faster onset by injecting local anesthetic agent or opioids into intrathecal space. However, CSE does have its intrinsic drawbacks: if local anesthetic agent is used intrathecally, it is very difficult to test the epidural catheter placement, because the intrathecally injected local anesthetic agent will produce sensory and/or motor blockade; the potentially increased risk of postdural puncture headache, though this has not been confirmed by meta-analyses[12,19] if opioids is used intrathecally, patient may complain pruritus, fetal heart

Table 2

Cervical dilatation, pain relieve times, motor blockade and Cesarean section from both Lidocaine group and Bupivacaine group (Mean ± SD)

	Cervix dilation (cm)	Time to pain relieve (min)	Motor blockade	Top-up injection	C-section rate
Lidocaine	3.44 ± 1.93	2.9 ± 0.9	0/16	4/16	8/16
Bupivacaine	3.38 ± 1.81	4.8 ± 1.6	6/16	3/16	5/16
P value	0.99	0.00017	0.01	0.67	0.28

rate changes and other symptoms; if opioids is used, anesthesia provider(s) needs to spend some time to obtain opioids from a dispensing machine/storage. This process will take some time and delay the combined spinal and epidural placement in some hospitals; there will be some local anesthetic migration into intrathecal space after initiation of continuous epidural infusion, the rate and total amount of this migration will be very difficult to assess[13,14,15], this may necessitate the dose adjustment of continuous epidural infusion. The dose adjustment can be very difficult because it is extremely difficult to quantify how much local anesthetic agent will diffuse into the intrathecal space via the dural puncture. Currently epidural analgesia in many medical centers is usually initiated with a loading dose of 10-12 ml 0.25% bupivacaine, 0.2% ropivacaine, less popularly with 0.5% bupivacaine, or 1% lidocaine with or without opioids, in 3-5ml incremental boluses. The problems with this traditional epidural technique are its slow onset of analgesia and potential motor blockade. As we notice from our practice, bolus of the whole loading dose will induce analgesia faster than incremental boluses, especially when we inject with slightly higher pressure. Unfortunately the above-mentioned commonly-used loading dose agents are not safe to be injected epidurally as a bolus because if the catheter is accidentally placed intrathecally, the loading dose will induce high or total spinal anesthesia, which can be detrimental to the parturients. This led us to test 0.5% lidocaine 10ml bolus injection to initiate labor analgesia. Injection of 0.5%lidocaine 10ml as an epidural loading dose can be relatively safely because even if the total 50mg lidocaine loading dose is accidentally given intrathecally, patient will likely develop spinal anesthesia, but the risk of high spinal or total spinal anesthesia will be significantly minimized. However, bolus injection of 0.25% bupivacaine 10ml as the loading dose is not within the scope of standard practice, though some anesthesiologists do give bolus of 0.25% bupivacaine 10ml epidurally. We used 0.25% bupivacaine as control group so we could compare the onset time of analgesia and incidence of complications. The epidural catheter placement in this study was executed by one senior experienced obstetric anesthesiologist, and if the anesthesiologist encountered any technically difficult or felt possible misplacement, 0.25% bupivacaine wouldn't be given as bolus, and the case would be excluded from the study, but this did not happen during this pilot study.

This study showed that 0.5% lidocaine caused significantly less motor blockade than 0.25% bupivacaine. Lidocaine group did not have any motor blockade (0/16) while 0.25% bupivacaine group had 37.5% (6/16) Grade II motor blockade. We are not sure whether bolus dose of 10ml 0.25% bupivacaine increased the incidence of motor blockade or not comparing with incremental doses of 0.25% bupivacaine with a total volume 10ml. Our result indicated that lidocaine group achieved significantly faster onset than 0.25% bupivacaine group (2.9min versus 4.8min, $P < 0.001$). With an onset time of analgesia reported by patients as quick as 2.9 min on average, 10ml 0.5% lidocaine loading dose given as a bolus will be indicated for those patients in early stage of labor, if this technique can be validated by larger scale clinical trials for its efficacy and safety. However, 0.5% lidocaine 10ml loading dose given as a bolus epidurally may or may not be adequate for more severe pain experienced by patients in later stage of labor. This needs to be elucidated by further investigations. The rate of cesarean section can be related to different techniques of epidural analgesia, but it can also be dependent upon the tradition of the obstetric team.

Conclusion

The result of this small pilot study indicated that loading dose of 0.5% lidocaine 10ml given epidurally as a bolus injection can induce fast onset of labor analgesia. This technique can be used effectively and safely in initiating epidural analgesia in early stage labor.

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