

Continuous spinal labor analgesia for two deliveries in a parturient with severe subvalvular aortic stenosis

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Abstract Various degrees of left ventricular outflow tract (LVOT) obstruction have been seen in patients with subvalvular aortic stenosis (SAS). Regional analgesia during labor for parturients with SAS is relatively contraindicated because it has a potential risk for hemodynamic instability due to sympathetic blockade as a result of vasodilation by local anesthetics. We thought continuous spinal analgesia (CSA) using an opioid and minimal doses of local anesthetic could provide more stable hemodynamic status. We demonstrate the management of a 28-year-old pregnant patient with SAS who received CSA for her two deliveries. For her first delivery (peak pressure gradient (ΔP) between LV and aorta was approximately 55 mmHg), intrathecal fentanyl was used as a basal infusion, but we needed a small amount of bupivacaine to provide supplemental intrathecal analgesia as labor progressed. Although there were mild fluctuations in hemodynamics, she was asymptomatic. For her second delivery (ΔP between LV and aorta was approximately 90 mmHg), minimal doses of continuous bupivacaine were used as a basal infusion. For her additional analgesic requests, bolus co-administration of fentanyl was effective. There were no fluctuations in her hemodynamics. Although her SAS in her second pregnancy was more severe than in the first, her hemodynamics exhibited less fluctuation during the second delivery with this method. In conclusion, CSA using fentanyl combined with minimal doses of bupivacaine provided satisfactory analgesia and stable hemodynamics in parturient with severe SAS.

Keywords Continuous spinal analgesia · Labor analgesia · Subvalvular aortic stenosis

Introduction

Regional analgesia for labor pain in a patient with subvalvular aortic stenosis (SAS) may present hemodynamic instability from vasodilation by local anesthetics and resultant sympathetic block. Continuous spinal analgesia (CSA) using opioids as a sole analgesic agent could provide more stable hemodynamic status. We demonstrate management of a parturient with SAS who received CSA using an opioid combined with a minimal dose of a local anesthetic for her two deliveries.

Case report

The first labor and delivery

A 28-year-old pregnant patient (height, 154 cm; weight, 55 kg) with a history of SAS, diagnosed during infancy, was transferred to our hospital at 24 weeks of gestation. Her SAS had been annually examined at another hospital until the age of 22. At the initial examination in our hospital, she remained asymptomatic if she limited her physical exercise, consistent with the New York Heart Association Class II. Her electrocardiogram (ECG) showed sinus rhythm and heart rate of 68 bpm. Echocardiogram revealed grade II mitral valve regurgitation with mild hypertrophy of left ventricular (LV) posterior wall (PW; 9 mm) and interventricular septum (IVS; 7 mm). Peak pressure gradient (ΔP) between LV and aorta was approximately 55 mmHg. Similar results were obtained at 30 and 36 weeks of

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gestation. The shortest distance of subvalvular aortic outlet was 6 mm.

At 38 weeks of her gestation, an induced delivery under regional analgesia was planned. Arterial blood pressure (ABP) and heart rate (HR) were 118/65 mmHg and 78 bpm, respectively, with no remarkable change in the cardiac echocardiogram. Maternal ECG, pulse oximetry, continuous ABP with radial artery catheter, and central venous pressure (CVP) using a right jugular vein catheter were monitored. CVP prior to analgesia was 6 cm H₂O. A continuous spinal catheter (22-gauge Spinocath; B. Braun, Melsungen, Germany) was placed using an over-the-needle (27-gauge) technique through her L3–4 intervertebral space. Thirty minutes after commencement of labor induction with oxytocin infusion, maternal ABP and HR remained 121/74 mmHg and 84 bpm, respectively. CVP remained between 4 and 10 H₂O with intravenous fluid administration of acetated Ringer's solution at 1–2 ml/kg/h during labor and delivery. Because she requested labor analgesia 90 min after initiation of labor induction with oxytocin infusion, intrathecal fentanyl (25 µg) diluted with 5 % dextrose in water (total volume: 2 ml) was administered as an initial dose, followed by infusion of the same dose of fentanyl (25 µg/5 ml) at 5 ml/h. During the first stage of labor (8 h, 48 min), she requested additional analgesia three times with the maximum ABP rise of 162/78 mmHg. Because all visual analogue scale of pain (VASP) scales at these requests were >50 mm, 0.5 % isobaric bupivacaine (1 mg) was additionally administered each time through the spinal catheter. When the cervix had fully dilated, VASP was 40 mm, and the patient requested an analgesic again. Then, isobaric bupivacaine (1 mg) and morphine (150 µg) were administered through the spinal catheter, resulting in satisfactory analgesia with a VASP of 0 mm. ABP and HR remained between 140–120/70–80 mmHg and 60–90 bpm, respectively. Each time interval of four bupivacaine administrations was 40–60 min. Hypoesthesia to cold was T6 bilaterally 10 min after the drug administration. No motor blockade of lower extremities was noted (Bromage scale: 0). Eighty minutes later from the fourth additional analgesia, a neonate weighing 2,864 g with Apgar scores of 8 and 9 at 1 min and 5 min, respectively, was delivered using forceps. Expulsive force remained satisfactory. There were no complications, such as respiratory depression, nausea, and vomiting, due to fentanyl continuous infusion in mother and neonate. Maternal cardiac status remained stable.

On postpartum day 1, the patient noted very mild headache when in the upright position, which resolved without any treatments. She was encouraged to undergo surgery for SAS, but refused.

The second labor and delivery

Seven years after the first delivery, the same patient (35 years old; height, 154 cm; weight, 58 kg) was referred

to our institution at 11 weeks of gestation. She strongly declined termination of pregnancy. She had continued to limit her physical exercise. ECG showed sinus rhythm without ST depression. Echocardiogram demonstrated grade II–III aortic and mitral valve regurgitation and severe hypertrophy of the LV-PW (12 mm) and IVS (12 mm). ΔP between the LV and aorta was approximately 78 mmHg. The shortest distance of subvalvular aortic outlet was 3 mm. Her echographic finding at 35 weeks of gestation further deteriorated, and her checkup demonstrated grade III regurgitation and ΔP of 90 mmHg between the LV and aorta. No systolic anterior movement of the mitral valve was noted, but the findings indicated mid-systolic semi-closure of the aortic valve. Although she was asymptomatic up to 4 METs movement, two short periods of ventricular tachycardia were noted; bisoprolol (0.625 mg/day) was prescribed.

At 37 weeks of gestation, an elective induced delivery was planned under regional analgesia. Her ABP and HR were 132/78 mmHg and 86 bpm, respectively, with no remarkable change in cardiac function. Initial CVP was 3 cmH₂O and remained between 3 and 7 cmH₂O using acetated Ringer's solution at 1–2 ml/kg/h. The same continuous spinal catheter was placed as before. Maternal ABP and HR were 121/74 mmHg and 84 bpm, respectively. Ninety minutes after initiation of labor induction with oxytocin infusion, labor analgesia was started with intrathecal fentanyl (25 µg) plus epinephrine (50 µg) diluted with 5 % dextrose (total volume: 1.5 ml) through the intrathecal catheter. Thirty minutes later, hourly infusion of isobaric bupivacaine (0.2 mg/ml) plus epinephrine (10 µg/ml) diluted with 5 % dextrose was started at 5 ml/h. During the first stage of labor (7 h), she requested an additional analgesic twice, and 0.5 % isobaric bupivacaine (0.6 or 1 mg) plus fentanyl (25 µg) were administered each time through the spinal catheter. Before and after these administrations, ABP and HR remained between 140–120/70–80 mmHg and 70–90 bpm, respectively. Hypoesthesia to cold was Th6/7 and complete loss of cold sensation was Th8/9. No motor blockade of lower extremities was noted (Bromage scale: 0). Thirty minutes after full dilation of the cervix, she delivered a neonate weighing 2864 g with Apgar scores of 8 and 9 at 1 min and 5 min, respectively. Her cardiac status remained stable throughout. Her intrapartum and postpartum courses were uneventful. The patient noted no headache postpartum.

Discussion

Previous reports have described safe management of pregnant hypertrophic cardiomyopathy (HOCM) [1] or aortic stenosis (AS) patients [2] using CSA. However, consecutive successful anesthesia management of labor in the same

patient with severe SAS has not been reported. We believe that more insightful strategies of CSA using minimal dose of local anesthetics for serial two deliveries resulted in stable hemodynamics.

Cardiovascular disease during pregnancy is one of the most common causes of nonobstetric maternal deaths [3]. During pregnancy, substantial hemodynamic changes, such as increases in cardiac output (45 %) and blood volume (usually close to 45 %) occur, whereas systemic peripheral resistance and arterial pressure decrease [4]. Furthermore, the increment in cardiac output during uterine contractions during labor becomes progressively greater as labor advances [5]. In addition, labor pain may worsen LV outflow tract obstruction in patients with HOCM or AS [6], because labor pain activates the sympathetic activity, increases the afterload. In order to avoid labor pain, Cesarean section (CS) is often chosen as the mode of delivery. Furthermore, CS under general anesthesia is specifically chosen because conventional spinal anesthesia leads to more hemodynamic deterioration in patients with HOCM or AS. However, there is a risk of more blood loss, infection, and thromboembolic complications in a CS than in vaginal delivery. After we explained the risks and benefits of both CS and vaginal delivery with anesthetics, our patient would rather choose the labor analgesia for her first and second deliveries.

Minimizing the ventricular outflow obstruction is important during delivery in patients with HOCM [6] or AS [7]. Regional analgesia for labor and delivery is controversial and is relatively contraindicated in these patients because of the detrimental effects of vasodilation, resulting from sympathetic blockade induced by local anesthetics. Despite the potential drawbacks, conventional epidural analgesia [8] and combined spinal epidural analgesia [9] have been used successfully in HOCM patients during labor and vaginal delivery. However, pressure gradient was more severe in our patient than those reported previously.

Therefore, we chose CSA with fentanyl combined with minimal doses of bupivacaine rather than conventional epidural technique in this patient. Intrathecal opioids may be the best choice for hemodynamic stability, but its analgesic effect can be insufficient, particularly during the late stages of labor [10]. This is due to a ceiling effect with an intrathecal opioid [11]. Furthermore, fentanyl at very low infusion rate may not spread thoroughly in the intrathecal space because it is lipophilic. Van de Velde et al. reported that continuous infusion of low-concentration local anesthetics with fentanyl in CSA is effective for labor analgesia in severe AS patients [2].

For her first delivery, intrathecal injection of fentanyl as a basal infusion provided a rapid onset of analgesia without a decrease in blood pressure and heart rate [12]. This provided adequate analgesia in an early stage of labor.

However, the patient required additional analgesia as labor progressed. Finally, we needed an extremely small dose of isobaric bupivacaine (1 mg bolus) to provide supplemental intrathecal analgesia. Looking back the course of her first labor analgesia, epinephrine, which is presumed to stimulate alpha-2 receptors [13], was added to augment the analgesic effect of intrathecal fentanyl for her second labor. Furthermore, minimal doses of continuous bupivacaine were used during labor as a basal infusion. For her additional analgesic requests, bolus co-administration of fentanyl was effective. Although her SAS in her second pregnancy was more severe than in the first, her hemodynamics exhibited less fluctuation during the second delivery with this method compared to her first delivery.

The major disadvantage of CSA is the risk of postdural puncture headache (PDPH). However, the over-the-needle catheter used in our patient minimizes the risk of PDPH due to the decreased potential for leakage of CSF around the catheter [14–16].

In conclusion, continuous spinal infusion of fentanyl combined with minimal doses of bupivacaine provided satisfactory analgesia and stable hemodynamics in parturient with severe SAS.

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