

## Obstetrical and Pediatric Anesthesia

# Labour analgesia guided by echocardiography in a parturient with primary dilated cardiomyopathy

*[L'analgésie guidée par échocardiographie pendant le travail chez une parturiente atteinte d'insuffisance cardiaque primitive]*

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**Purpose:** To evaluate the effects of intrathecal analgesics on cardiac function during labour analgesia using echocardiography in a parturient with idiopathic dilated cardiomyopathy (DCM).

**Clinical features:** Induction of labour was planned in a 35-yr-old primiparous woman suffering from DCM. In order to stabilize hemodynamics in this patient, we induced continuous spinal analgesia with an infusion of fentanyl and epinephrine. Although her analgesia was well maintained for three hours during the first stage of labour, the patient complained of pain towards the second stage of labour. At this point, we administered bupivacaine intrathecally to alleviate her pain. Transthoracic echocardiography showed that the left ventricular end-diastolic and systolic dimensions, as well as the ejection fraction were not impaired by use of these analgesic medications.

**Conclusion:** Measurement of left ventricular dimensions by echocardiography allowed us to monitor the patient's response to intrathecal analgesic medications. In this patient with DCM, analgesia with intrathecal fentanyl and bupivacaine was well tolerated.

**Objectif :** Évaluer les effets d'analgésiques intrathécaux sur la fonction cardiaque pendant le travail en utilisant l'échocardiographie chez une patiente qui présente une insuffisance cardiaque primitive (ICP).

**Éléments cliniques :** L'induction du travail était planifiée chez une primipare de 35 ans souffrant d'ICP. Une rachianalgésie continue avec une perfusion de fentanyl et d'épinéphrine a été induite pour stabiliser l'hémodynamique. L'analgésie avait été bien maintenue pendant trois heures au cours de la première phase du travail, mais la patiente a eu des douleurs pendant la seconde phase. Nous avons donc donné de la bupivacaine intrathécale. L'échocardiographie transthoracique a montré que les dimensions télédiastoliques et systoliques du ventricule

gauche, de même que la fraction d'éjection, n'étaient pas atteintes par l'usage de ces analgésiques.

**Conclusion :** La mesure des dimensions du ventricule gauche par échocardiographie a permis de vérifier la réaction à l'analgésique intrathécal. L'administration intrathécale de fentanyl et de bupivacaine a été bien tolérée chez cette patiente atteinte d'ICP.

**R**EGIONAL analgesia for labour is not contraindicated in a patient with idiopathic dilated cardiomyopathy (DCM) when the patient's coagulation is normalized. Although there may be a detrimental effect on the cardiac function following epidural or intrathecal administration of local anesthetics as a result of sympathetic blockade, previous reports have demonstrated successful management of parturients with DCM by the use of regional analgesia during their labour.<sup>1,2</sup> Discrepancies amongst these reports may be due to different cardiovascular responses to different analgesic medications. In order to elucidate the cause, it may be beneficial to evaluate the effects of neuraxial anesthetic agents on cardiac function during labour analgesia. We report on the successful management of a parturient with DCM, who received continuous spinal analgesia (CSA) with fentanyl during the first stage of labour, as well as a bolus injection of intrathecal bupivacaine as the cervix became fully dilated. Of greater importance, this report shows the usefulness of

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measuring left ventricular dimensions by echocardiography, which allowed us to monitor in a detailed manner the patient's response to analgesic medications in the setting of DCM.

### Case report

A 35-yr-old primiparous woman, who was 175 cm in height and weighed 73 kg was transferred to our institution at six weeks gestational age. She had a history of primary DCM diagnosed at 22 yr of age following episodes of syncope. Termination of her pregnancy was offered by an attending obstetrician, but was declined by the patient. Her mother was diagnosed with DCM, and her brother had died soon after his birth with a cardiac event. However, the patient remained asymptomatic as long as she limited her physical exercise prior to pregnancy with a regimen of metoprolol 120 mg *po* daily. Her functional physical status at the time of presentation was consistent with the New York Heart Association Class II. Her electrocardiogram (ECG) at eight weeks gestational age showed normal sinus rhythm with an abnormal Q wave in lead I and the first degree atrioventricular block. A Holter ECG showed 3% premature ventricular complexes. Echocardiographic evaluation demonstrated grade II mitral valve regurgitation with dilated left ventricle (LV). LV measurements demonstrated that the LV end-diastolic dimension was 60 mm (normal 40–55 mm) and the end-systolic dimension of the LV was 49 mm (normal 30–45 mm) without increased LV wall thickness. The ejection fraction was 32%.

The echocardiatic evaluations of the patient at 20, 24, 28 and 32 weeks gestational age demonstrated no significant changes when compared to the initial findings at eight weeks gestational age. However, she felt slight dyspnea when she walked, beginning at 27 weeks gestational age.

At 38 weeks gestational age, the patient went into early labour with cervical dilation of 4 cm and uterine contractions every ten minutes, at which time the obstetrician decided to start an oxytocin augmentation. For maternal surveillance, ECG and pulse oximetry, as well as continuous arterial pressure with a radial arterial catheter and central venous pressure (CVP) were monitored from the right internal jugular vein. In addition, repeated transthoracic echocardiographic evaluations (SONOS 5500 ultrasonograph, Philips Co., Bothell, WA, USA) were performed during and after labour. Fetal monitoring included conventional cardiotocography. For *iv* fluids the patient received Ringer's Lactate at 200 mL·hr<sup>-1</sup>.

A continuous spinal catheter (22 gauge Spinocath, B. Braun, Melsungen, Germany) was placed at the

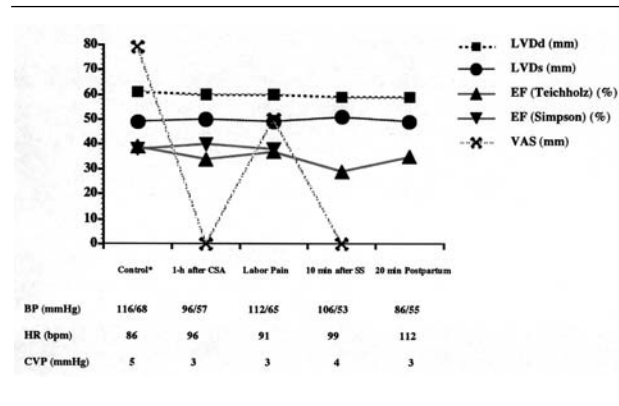


FIGURE Hemodynamic parameters and visual analogue scores (VAS) during and after labour

\*One hour before initiation of labour analgesia. CSA = continuous spinal analgesia; SS = spinal shot; BP = blood pressure; HR = heart rate; CVP = central venous pressure; LVDd = left ventricular end-diastolic dimension; LVDs = left ventricular end-systolic dimension; EF = ejection fraction with Teichholz and/or Simpson method.

L3–4 intervertebral level into intrathecal space 3 cm beyond the spinal tap position, using an over-the-needle (27 gauge) technique. Since the patient complained of painful labour with a visual analogue score (VAS) of 79 mm at this time, labour analgesia was initiated with intrathecal fentanyl 25 µg plus epinephrine 40 µg (diluted with 5% dextrose, total 1.5 mL) through the intrathecal catheter, followed by an hourly infusion of fentanyl 25 µg plus epinephrine 40 µg (diluted with normal saline at an infusion rate of 5.0 mL·hr<sup>-1</sup>). This resulted in adequate pain relief (VAS was 0 mm) without a hemodynamic change (Figure).

Three hours after the initiation of CSA, she requested additional pain relief and her VAS had increased to 50 mm. At this time, hemodynamic data including arterial blood pressure, heart rate, CVP, LV dimensions and ejection fraction were unchanged (Figure). The *iv* rate was increased to 400 mL·hr<sup>-1</sup>, then 1 mg of hyperbaric bupivacaine diluted in normal saline was intrathecally administered every 30 min for three doses. However, this did not adequately relieve the patient's pain, so we suspected her catheter might have migrated or fallen out. When we checked the depth of the catheter, it was withdrawn 2 cm from the initial positioning, and cerebrospinal fluid was not aspirated through the catheter. Since her cervix was dilated to 7–8 cm, we decided to perform a combined spinal-epidural. Hyperbaric bupivacaine 2.5 mg and fentanyl 25 µg were administered by a 27-gauge

Whitacre needle through the 17-gauge epidural needle (Adjustable Durasafe CSE needle system, Becton-Dickinson, Franklin Lake, NJ, USA). The epidural catheter was then successfully placed. This resulted in satisfactory analgesia with VAS of 0 mm with a minimal hemodynamic change (Figure). The cephalad level of sensory blockade to cold was bilaterally T6 ten minutes after drug administration.

Eighty minutes later, she delivered a neonate with assistance of forceps, weighing 2316 g with Apgar scores of 8 and 9 at one and five minutes, respectively. We did not need to use the epidural catheter. The intrapartum and postpartum course of the mother was uneventful without side effects of respiratory depression or nausea/vomiting, and only mild pruritus. Her cardiac status remained stable throughout.

On postpartum day one, the patient noted a very mild headache when in the upright position, which did not require any treatment.

### Discussion

DCM is characterized by cardiac enlargement and impaired contractility. The incidence of the disease which has a familial component is reported to be one case per 10,000 to 20,000 population. Women with DCM have traditionally been advised not to continue their pregnancy, because increases in intravascular volume and cardiac output as pregnancy progresses are often not well tolerated. However, a retrospective cohort study suggested that women with stable DCM might not experience such a decline in cardiac status during pregnancy.<sup>3</sup>

For labour and delivery, effective analgesia may blunt the hemodynamic effects of uterine contractions and the associated pain response, if a parturient tolerates hemodynamic changes during regional anesthesia. Use of local anesthetics for labour and delivery is not contraindicated in patients with DCM, because mild reduction of cardiac afterload due to the vasodilation could be beneficial for myocardial function. However, it is possible that a large dose of local anesthesia may cause impairment of myocardial function.

In order to minimize the change of hemodynamic status, CSA with infusion of fentanyl is one option for these patients. As expected, the LV end-diastolic and systolic dimensions as well as ejection fraction were not affected with continuous infusion of fentanyl and epinephrine in this patient. It has been reported that an intrathecal injection of fentanyl provides a rapid onset of analgesia without evidence of sympathetic blockade.<sup>4,5</sup> In this case, the patient's hemodynamics were stable during the bolus and continuous infusion of fentanyl. Epinephrine was added to augment the

analgesic effect of intrathecal fentanyl, by stimulation of  $\alpha_2$  receptors.<sup>6</sup> This combination provided adequate analgesia in early labour, but as the patient's labour became more active, the spinal narcotic alone appeared to be insufficient towards the second stage of labour. Therefore, we changed the analgesic to intrathecal bupivacaine. It may be possible to define in advance, based upon serial echocardiography during pregnancy, whether a patient with DCM could tolerate regional labour analgesia including local anesthetic agents. Previous reports have demonstrated successful management of parturients with DCM using local anesthetic agents.<sup>1,2</sup> However, it is hard to evaluate the extent to which regional anesthesia with local anesthetic agents can influence cardiac function without a measure of LV dimension. Therefore, echocardiographic measurements can be helpful in these cases for the choice of anesthetic agents and optimizing fluid loading, as well as the prevention of developing pulmonary edema.

Some articles suggest usefulness of impedance cardiography or transesophageal echocardiography for monitoring of cardiac function during Cesarean section.<sup>2,7</sup> However, these monitors are relatively invasive or inconvenient during labour, compared with transthoracic echocardiography. In this patient, the addition of spinal bupivacaine was well tolerated hemodynamically, proven by the use of an intrapartum echocardiography. Otherwise, dobutamine or other catecholamines may be required to augment cardiac contractility, in addition to fluid loading under the vigilance of CVP and echocardiographic monitoring.

In this report, the ejection fraction changed minimally after administration of bupivacaine. Some reports demonstrate that increased LV end-diastolic dimension ( $> 45$  mm/body surface area) and decreased ejection fraction ( $< 30\%$ ) are related to a poor prognosis in DCM patients.<sup>7,8</sup> Furthermore, reduced thickness in the LV posterior wall is a sensitive marker of unfavourable clinical course.<sup>9</sup> It is likely that wall thickness is a compensatory mechanism for contractility failure. These parameters may be predictors of the tolerance for cardiovascular changes following regional anesthesia. Blood pressure and LV function measured by echocardiography in this patient were stable.

The major disadvantage of CSA is a risk of post-dural puncture headache (PDPH). However, the over-the-needle-catheter used in this patient minimized the risk of PDPH due to less potential for leakage of CSF around the catheter because the outer diameter of the spinal needle is smaller than the diameter of the catheter. This newly designed catheter is

also superior to the microcatheter-through-needle technique of placing a spinal catheter in terms of ease of insertion, retraction of the needle, ease of threading of the catheter, spread of the anesthetic agent, and the incidence of obstruction or kinking of the catheter.<sup>10</sup>

In conclusion, continuous spinal infusion of fentanyl and epinephrine, using a catheter-over-needle system, provided satisfactory analgesia during the first stage of labour in the parturient with DCM. Furthermore, the addition of spinal bupivacaine was also well tolerated hemodynamically, as demonstrated by the use of intrapartum echocardiography in this patient.

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