



Spinal Anesthesia for Cesarean Delivery in Selected Patients with Severe Pulmonary Hypertension: A Case Report

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ABSTRACT

Introduction: Pregnancy in patients with pulmonary hypertension carries a very high maternal risk and is classified as modified World Health Organization class IV, particularly when associated with congenital heart disease.

Case Description: We report a 28-year-old woman at 35 weeks of gestation with a large secundum atrial septal defect, severe tricuspid regurgitation, and significant pulmonary hypertension who underwent elective cesarean delivery. She presented in a relatively stable clinical condition without signs of decompensated right heart failure, but with limited functional capacity and low oxygen saturation on room air. Echocardiography demonstrated right-sided chamber dilatation, a predominantly left-to-right shunt with intermittent bidirectional flow, a D-shaped left ventricle, and preserved left ventricular systolic function. Delivery was planned in a tertiary referral center with intensive care support and multidisciplinary management. Single-shot spinal anesthesia with hyperbaric prilocaine was performed under invasive arterial monitoring, with a restrictive fluid strategy, careful vasopressor titration, and careful avoidance of factors that could increase pulmonary vascular resistance or compromise hemodynamic stability. Intraoperatively, hemodynamic status remained within acceptable limits without severe hypotension, arrhythmia, or signs of acute right ventricular failure. A live neonate was delivered with good early outcome, and the patient remained stable during postoperative care in the maternal intensive care unit until discharge on postoperative day 3.

Conclusion: This case suggests that spinal anesthesia may be feasible in carefully selected patients with severe pulmonary hypertension when supported by meticulous hemodynamic control, invasive monitoring, and multidisciplinary perioperative care.

Keywords: Atrial septal defect, cesarean section, pregnancy, pulmonary hypertension, spinal anesthesia



Anestesi Spinal pada Hipertensi Pulmonal Berat Terpilih untuk Seksio Sesarea: Laporan Kasus

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ABSTRAK

Pendahuluan: Kehamilan pada pasien dengan hipertensi pulmonal (HP) membawa risiko maternal yang sangat tinggi dan diklasifikasikan sebagai modified World Health Organization kelas IV, terutama bila berhubungan dengan penyakit jantung bawaan.

Deskripsi Kasus: Kami melaporkan seorang perempuan usia 28 tahun pada usia kehamilan 35 minggu dengan defek septum atrium sekundum besar, regurgitasi trikuspid berat, dan HP bermakna yang direncanakan menjalani seksio sesarea elektif. Pasien datang dalam kondisi klinis relatif stabil tanpa tanda gagal jantung kanan dekompensasi, namun dengan kapasitas fungsional terbatas dan saturasi oksigen rendah saat bernapas udara ruangan. Ekokardiografi menunjukkan dilatasi ruang jantung kanan, pirau dominan kiri-ke-kanan dengan aliran bidireksional intermiten, ventrikel kiri berbentuk D, serta fungsi sistolik ventrikel kiri yang masih baik. Persalinan direncanakan di pusat rujukan tersier dengan dukungan perawatan intensif dan tata laksana multidisiplin. Anestesi spinal single-shot menggunakan prilokain hiperbarik dilakukan dengan pemantauan arteri invasif, strategi restriksi cairan, titrasi vasopresor sesuai kebutuhan, serta perhatian khusus untuk menghindari faktor-faktor yang dapat meningkatkan resistensi vaskular pulmonal atau menurunkan stabilitas hemodinamik. Selama periode intraoperatif, hemodinamik tetap dalam batas yang dapat diterima tanpa hipotensi berat, aritmia, maupun tanda gagal ventrikel kanan akut. Bayi lahir hidup dengan luaran awal yang baik, dan pasien tetap stabil selama pemantauan pascaoperasi di ICU maternal hingga dipulangkan pada hari ketiga pascaoperasi.

Simpulan: Kasus ini menunjukkan bahwa anestesi spinal dapat dipertimbangkan pada pasien terpilih dengan hipertensi pulmonal berat apabila didukung pengendalian hemodinamik yang ketat, pemantauan invasif, serta perawatan perioperatif multidisiplin.

Kata Kunci: Anestesi spinal, defek septum atrium, hipertensi pulmonal, kehamilan, seksio sesarea

INTRODUCTION

Pulmonary hypertension (PH) is a chronic, progressive disorder characterized by elevated pulmonary arterial pressure and increased pulmonary vascular resistance, leading to sustained right ventricular pressure overload and, if untreated, eventual right heart failure.¹ Pregnancy in patients with pulmonary arterial hypertension is classified as modified WHO class IV and is generally contraindicated because of extremely high maternal risk. Despite its low reported incidence, approximately 1 in 10,000–50,000 pregnancies, PH remains associated with substantial maternal morbidity and mortality.² During pregnancy, cardiac output increases by approximately 30%–50% and plasma volume expands markedly.³ While these changes are usually well tolerated in healthy women, they may not be tolerated in patients with PH, in whom the right ventricle is already exposed to increased afterload. Additional hemodynamic stress may therefore precipitate worsening hypoxemia, arrhythmias, or acute right ventricular failure.⁴

Earlier studies reported maternal mortality rates as high as 30%–50% in pregnant women with PH.² Although outcomes have improved with pulmonary vasodilator therapy and multidisciplinary care, more recent reports still show mortality rates of around 15%–25%, particularly in patients with moderate-to-severe disease.⁵ Registry data further suggest that women with congenital heart disease-associated moderate-to-severe PH have higher rates of heart failure and other adverse cardiac events than those with mild PH. These findings support current European guideline recommendations that classify pulmonary arterial hypertension of any cause as mWHO class IV and advise against pregnancy because of the extremely high maternal risk.⁶

The peripartum period is particularly high risk. During labor and shortly after placental delivery, uterine contractions may autotransfuse approximately 300–500 mL of blood into the central circulation, increasing venous return and right ventricular preload.^{4,5} In this setting, anesthetic management for cesarean delivery becomes especially challenging. General anesthesia may increase pulmonary vascular

resistance through airway manipulation, hypoxia, hypercarbia, and positive-pressure ventilation, whereas neuraxial anesthesia may reduce systemic vascular resistance and alter intracardiac shunt dynamics in patients with a large atrial septal defect.^{1,3,4} Therefore, the anesthetic approach should be individualized, taking into account ventricular function, shunt physiology, and the anticipated hemodynamic response. In particular, the use of single-shot spinal anesthesia in patients with severe pulmonary hypertension remains controversial because abrupt sympathetic blockade may precipitate significant decreases in systemic vascular resistance, reduced venous return, and hemodynamic instability. On the other hand, when carefully planned and performed in a selected patient, spinal anesthesia may also offer potential advantages, including avoidance of airway manipulation, reduced stress response, and rapid establishment of a reliable anesthetic block. In this report, we describe the use of spinal anesthesia for cesarean delivery in a carefully selected patient with severe pulmonary hypertension and a large secundum atrial septal defect, highlighting key considerations in anesthetic decision-making and perioperative management.

CASE DESCRIPTION

A 28-year-old woman at 35 weeks of gestation was admitted for elective cesarean section. This was her third pregnancy, with a history of one previous cesarean delivery and one abortion. She had congenital heart disease with PH, a large secundum atrial septal defect (ASD), and severe tricuspid regurgitation (TR). Her pre-pregnancy body weight was 55 kg, increasing to 59.4 kg at admission.

At admission, she had no specific complaints. Her blood pressure was 120/72 mmHg, heart rate 75 beats per minute, respiratory rate 18 breaths per minute, and oxygen saturation 90% on room air. Physical examination revealed a grade II systolic murmur at the left parasternal. There were no signs of right heart failure, such as peripheral edema or dyspnea at rest. She was able to walk approximately 10 meters before developing shortness of breath, consistent with New York Heart Association functional class II

and an estimated functional capacity of 3–4 METs. Although her oxygen saturation was low, she had no cyanosis or digital clubbing.

Transthoracic echocardiography demonstrated a 4.0×3.1 cm secundum ASD with predominantly left-to-right shunting and intermittent bidirectional flow. The right atrium and right ventricle were dilated. Severe TR velocity 3.64 m/s corresponding to an estimated RV–RA gradient of 52.9 mmHg. The left ventricle appeared D-shaped, indicating right ventricular pressure overload.

Left ventricular systolic function was preserved, with an ejection fraction of 59%. Her regular medications included furosemide 40 mg once daily, digoxin 0.25 mg once daily, and sildenafil 20 mg three times daily. The pregnancy had been managed by a multidisciplinary team, and the estimated fetal weight before delivery was 2083 g.

Given her cardiac condition, delivery was planned in a tertiary referral center with postoperative intensive care capability. The anesthetic plan focused on maintaining systemic vascular resistance, avoiding increases in pulmonary vascular resistance, and preventing fluid overload. Particular attention was paid to factors that could worsen right ventricular function, including hypoxia, hypercarbia, acidosis, and excessive sympathetic stimulation.

Standard monitoring consisted of continuous electrocardiography, pulse oximetry, and invasive arterial blood pressure monitoring. Before neuraxial blockade, the patient was

positioned in the left lateral decubitus position to reduce aortocaval compression. With still in left lateral decubitus position, spinal anesthesia was then performed at the L3-L4 interspace using 60 mg hyperbaric prilocaine. Five minutes after injection, sensory block assessed by pinprick reached the T4 dermatome, which was considered adequate for cesarean delivery. Following spinal anesthesia, phenylephrine was administered in 100 mcg intravenous boluses to maintain a mean arterial pressure above 65 mmHg.

The first bolus was given immediately after the block, followed by three additional 100 mcg boluses at 3-minute intervals according to the observed blood pressure response, resulting in a total cumulative dose of 400 mcg. Hemodynamic conditions remained stable thereafter. Ephedrine was prepared as an alternative vasopressor, with its use to be guided by heart rate if needed; however, it was not required. Supplemental oxygen was administered via nasal cannula at 3 L/min throughout the procedure.

Hemodynamic parameters remained stable throughout the procedure, without severe hypotension, arrhythmia, or signs of acute right ventricular failure. After spinal anesthesia, blood pressure ranged between 94–131/68–82 mmHg and heart rate between 76–88 beats per minute. Oxygen saturation was 90–92% with 3 L/min via nasal cannula, consistent with underlying shunt physiology. Serial hemodynamic changes after spinal anesthesia and during surgery are shown in Figure 1.

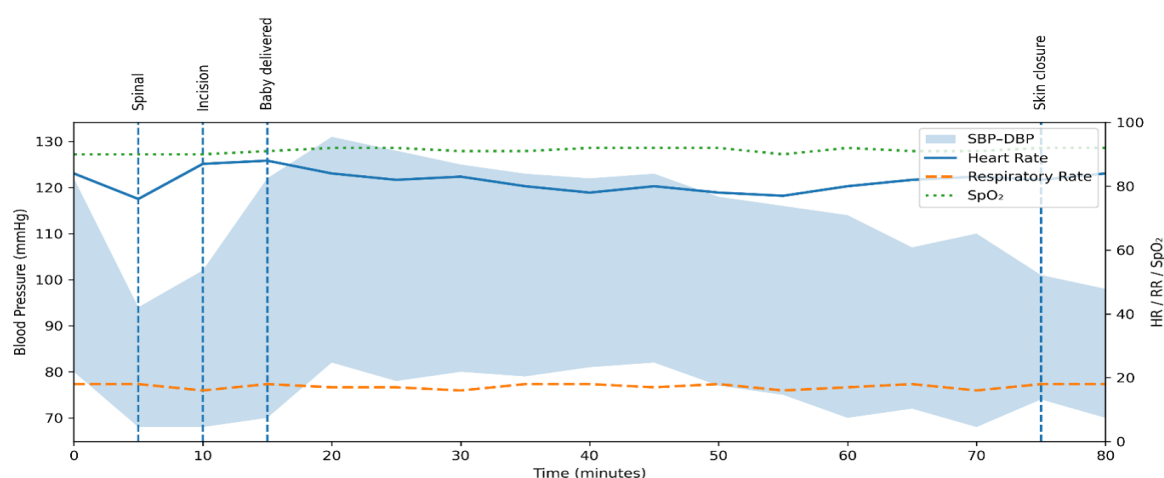


Figure 1. Intraoperative hemodynamic monitoring

A live female neonate weighing 2340 g was delivered, with Apgar scores of 7 and 8 at 1 and 5 minutes. An intravenous bolus of 3 IU oxytocin was administered slowly, followed by a continuous infusion of 20 IU over 24 hours. Intraoperative fluid administration was restricted to 500 mL of Ringer's lactate, and estimated blood loss was approximately 300 mL. Total operative time was approximately 80 minutes. Postoperatively, the patient was transferred to the maternal intensive care unit for close observation during the early postpartum period. Oxygen therapy was continued via nasal cannula at 3 L/min throughout her ICU stay. Hemodynamic status and oxygen saturation remained stable, with no cardiopulmonary complications observed. Vasopressor support was not required postoperatively. She remained in the intensive care unit for 1 day and was discharged on postoperative day 3. During the first 24 postoperative hours, analgesia consisted of intravenous morphine 20 mg delivered as a continuous infusion via syringe pump, combined with intravenous paracetamol 1000 mg three times daily. This regimen was continued until postoperative day 1, after which the patient was transitioned to oral paracetamol 500 mg four times daily.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report. The patient was informed about the purpose of publication, the nature of the clinical information presented, and the measures taken to ensure confidentiality. All identifying information has been omitted or anonymized to protect patient privacy.

DISCUSSION

Pregnancy in patients with PH remains a high-risk condition despite advances in targeted therapy and multidisciplinary care. Current European guidelines classify pulmonary arterial hypertension of any cause as mWHO class IV and generally advise against pregnancy because of the extremely high maternal risk.⁵ This recommendation is supported by observational data showing that adverse maternal cardiac events remain more frequent in women with moderate-to-severe PH than in those with mild

disease.⁶ In the present case, the patient had significant PH, a large secundum ASD, severe TR, right-sided chamber dilatation, and a D-shaped left ventricle, all of which indicated chronic right ventricular pressure overload and limited cardiopulmonary reserve. Although she had no overt signs of right heart failure, her resting oxygen saturation of 90% and intermittent bidirectional shunting suggested marked hemodynamic vulnerability.

The main anesthetic challenge in this setting is maintaining the balance between SVR and PVR. In patients with elevated PVR and bidirectional shunt physiology, a reduction in SVR may shift the shunt toward greater right-to-left flow, thereby worsening systemic oxygenation, whereas a further rise in PVR may increase right ventricular afterload, promote further right-to-left shunting, and precipitate cardiovascular decompensation.^{4,5} Ventricular interdependence also contributes to hemodynamic fragility in these patients. Septal flattening, reflected by the D-shaped left ventricle in this case, may impair left ventricular filling and make cardiac output highly dependent on stable preload and afterload conditions. Under these circumstances, both hypotension and abrupt increases in venous return may be poorly tolerated, particularly during the peripartum and early postpartum periods.

Accordingly, the choice of anesthetic technique should be individualized rather than protocol driven. Incremental epidural anesthesia is often favored in severe PH because it may provide a more gradual sympathetic block and reduce the risk of sudden hemodynamic deterioration.^{4,5} General anesthesia, however, is also associated with important risks, as airway manipulation, hypoxia, hypercarbia, and positive-pressure ventilation can increase PVR and worsen right ventricular function.⁴ The AHA scientific statement on anesthetic care in pregnant patients with cardiovascular disease emphasizes preservation of SVR, avoidance of factors that increase PVR, and close hemodynamic monitoring.⁷ The ASA Practice Guidelines for Obstetric Anesthesia likewise underscore the need for readiness to manage hypotension during neuraxial anesthesia.⁸ In this patient, single-shot spinal anesthesia was selected not

because it is inherently superior, but because it was considered to offer several advantages over the alternative approaches discussed above in this specific clinical setting. Specifically, it provided a rapid, reliable, and dense surgical block for cesarean delivery while avoiding the airway instrumentation and positive-pressure ventilation associated with general anesthesia, as well as the slower and potentially less predictable onset of block with epidural-based techniques. Nevertheless, this approach was considered appropriate only in a carefully selected clinical context involving invasive monitoring, vasopressor preparedness, controlled fluid administration, and postoperative intensive care support.

Several features of this case may help explain why spinal anesthesia was tolerated without major instability. First, the patient was clinically compensated before surgery: she had no dyspnea at rest, no peripheral edema, preserved left ventricular systolic function, and no evidence of overt perioperative decompensation. Second, careful attention was paid to modifiable determinants of PVR, including avoidance of hypoxia, hypercarbia, acidosis, and excessive sympathetic stimulation. Third, invasive arterial monitoring allowed rapid detection of blood pressure changes after spinal anesthesia, enabling prompt titration of phenylephrine to maintain mean arterial pressure above 65 mmHg. In this context, phenylephrine was used to support SVR and preserve systemic perfusion, while ephedrine was reserved as an alternative according to heart rate.⁸ The hemodynamic trend shown in Figure 1 supports this approach, as blood pressure and heart rate remained within acceptable ranges, without severe hypotension, arrhythmia, or signs of acute right ventricular failure. This is important because the safety of neuraxial anesthesia in such patients depends not only on the technique itself, but also on the ability to detect and correct hemodynamic disturbances immediately.

The use of hyperbaric prilocaine may also have supported a stable perioperative course, in conjunction with careful anesthetic management and close hemodynamic monitoring. Compared with hyperbaric bupivacaine, hyperbaric prilocaine has been associated with a shorter

duration of motor block while still providing adequate anesthesia for cesarean delivery.⁹ In a high-risk cardiac patient, a shorter duration of sympathetic blockade may be advantageous because it may limit prolonged hemodynamic effects after surgery.¹⁰ In this case, 60 mg hyperbaric prilocaine produced an adequate T4 sensory block within 5 minutes and was followed by stable intraoperative conditions. The administered dose also remained well below the commonly cited maximum safe dose in the literature on local anesthetic systemic toxicity.¹¹ Although this favorable outcome cannot be attributed to the local anesthetic choice alone, the pharmacologic profile of prilocaine may have supported a more controlled perioperative course.^{9,10}

Other perioperative decisions were similarly directed toward minimizing abrupt circulatory changes. Oxytocin was administered as a slow 3 IU intravenous bolus followed by a 20 IU infusion over 24 hours, rather than as a large rapid bolus, to reduce the risk of sudden vasodilation, tachycardia, and hypotension. Restrictive fluid administration was also used, with only 500 mL of Ringer's lactate given intraoperatively, because excessive fluid loading may worsen right ventricular strain in PH. These measures were consistent with the overall goal of avoiding rapid shifts in preload and afterload.⁴

Postoperative care was also an essential part of management, as the early postpartum period is one of the most vulnerable phases in PH because of autotransfusion from the contracting uterus and abrupt changes in venous return.^{2,5} For that reason, the patient was observed in the maternal intensive care unit, received oxygen therapy via nasal cannula at 3 L/min, and underwent continued hemodynamic and oxygen saturation monitoring. No postoperative vasopressor support was required, indicating that systemic perfusion remained adequate after the initial intraoperative period. Analgesia consisted of continuous intravenous morphine infusion combined with paracetamol. This regimen was intended to provide effective pain control and reduce sympathetic activation. NSAIDs were not used because, in patients with complex cardiovascular disease, their potential effects on renal perfusion, sodium and water

retention, and diuretic responsiveness may be undesirable.¹² Adequate analgesia is particularly important in PH, since pain, agitation, and respiratory compromise may all contribute to increased PVR and hemodynamic instability. In this case, the postoperative course was stable, with no cardiopulmonary complications, 1 day of intensive care observation, and discharge on postoperative day 3.

This case should be interpreted with caution and does not support spinal anesthesia as a standard approach for all parturients with severe pulmonary hypertension (PH) and atrial septal defect (ASD). Rather, it suggests that spinal anesthesia may be a feasible option in carefully selected patients, provided that meticulous hemodynamic planning, invasive monitoring, judicious vasopressor use, cautious uterotonic administration, restrictive fluid management, and postoperative intensive care observation.

CONCLUSION

This case suggests that single-shot spinal anesthesia may be feasible in carefully selected, clinically compensated patients with severe PH and congenital heart disease. Stable intraoperative hemodynamics, the absence of major cardiopulmonary complications, and favorable initial neonatal outcomes were achieved with invasive monitoring, timely vasopressor administration, restrictive fluid management, and multidisciplinary care.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.

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