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Original Research Article

A Retrospective Observational Study to Evaluate Anesthetic Management of Idiopathic Pulmonary Arterial Hypertension for Cesarean Section

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Conflict of interest: Nil

Abstract

Aim: Anesthetic management of idiopathic pulmonary arterial hypertension for cesarean section in Bihar region.

Material and methods: This retrospective observational study was carried out in the Department of Anaesthesiology, Nalanda Medical College and Hospital, Patna, Bihar, India for 12 months. We studied the obstetric case records of 4 patients with IPAH who underwent elective cesarean section. We studied the maternal and fetal outcome and anesthetic management of these high-risk patients. The demographic variables, details of pregnancy, preoperative maternal evaluation by New York Heart Association classification, signs and symptoms, echocardiographic assessment, medications (prostonoids, calcium channel blockers, oral anticoagulants), anesthetic management (general or regional), intraoperative monitoring, hemodynamic supports, number of days of hospital and intensive care unit (ICU) stay, maternal complications, and fetal outcome were noted. Neonatal outcomes studied included Apgar score, birth weight, and neonatal ICU admission.

Results: All the 4 patients studied had severe pulmonary arterial hypertension. Our maternal mortality rate was 25%. Except for the first patient, all the others received regional anesthesia. Invasive central line and arterial line were used for all our patients. Pulmonary artery catheter was not used in any of our patients. All the patients went on inotropic support that was gradually tapered in the ICU. Two babies were shifted to neonatal ICU in view of poor Apgar scores.

Conclusion: Multidisciplinary approach involving cardiologist, obstetrician, and anesthetist is required in planning and management of these high-risk obstetric patients. Epidural anesthesia seems to be an alternative to general anesthesia for cesarean section in patients with IPAH.

Keywords: cesarean section, epidural anesthesia

Introduction

Primary pulmonary hypertension is a rare disease with an incidence of two to five per million per year with higher incidence in women [1]. Long-term prognosis is poor with 5 year mortality being very high. Peripartum mortality is high when pregnancy is associated with PPH. When pregnancy is diagnosed early, termination is recommended. Pulmonary hypertension represents an important risk factor for increased perioperative morbidity and mortality. Stress, pain, ventilation, and surgery-related inflammation can further increase pressure and resistance within the pulmonary arteries and cause right-sided heart failure. Ramakrishna et al. have described a number of independent factors leading to an increased perioperative risk for patients with pulmonary hypertension. Conditions that caused one or more perioperative complications in 42% of all patients were heart failure of NYHA class II or higher, a history of pulmonary embolism, high-risk surgery (e.g., thoracic or major abdominal surgery), and an anesthesia duration of more than 3 hours.2 The literature reports a perioperative mortality of 7–24% depending on the primary disease and the type of surgical intervention—with the highest risk for pregnant women and patients undergoing emergency interventions [2,3]. In a recently published study, Kaw et al. examined the clinical progression of 96 patients with pulmonary hyper- tension who underwent a noncardiac surgical procedure. The PH patients had a significantly increased risk for hemodynamic instability, heart failure, postoperative sepsis, and respiratory failure. In addition, they required significantly prolonged postoperative ventilation and a longer intensive care stay and had to be readmitted for inpatient treatment much more frequently with in the first 30 days following surgery [4].

Material and methods:

This retrospective observational study was carried out in the Department of Anaesthesiology, Nalanda Medical College and Hospital, Patna, Bihar, India for 12 months.

Methodology:

We studied the obstetric case records of 4 patients with IPAH who underwent elective cesarean section. We studied the maternal and fetal outcome and anesthetic management of these high-risk patients. The demographic variables, details of pregnancy, preoperative maternal evaluation by New York Heart Association classification, signs and symptoms, echocardiographic assessment, medications (prostonoids, calcium channel blockers, oral anticoagulants), anesthetic management (general or regional), intraoperative monitoring, hemodynamic supports, number of days of hospital and intensive care unit (ICU) stay, maternal complications, and fetal outcome were noted. Neonatal outcomes studied included Apgar score, birth weight, and neonatal ICU admission.

Results:

All the 4 patients studied had severe pulmonary arterial hypertension [Table 1]. Our maternal mortality rate was 25%. Except for the first patient, all the others received regional anesthesia. Invasive central line and arterial line were used for all our patients. Pulmonary artery catheter was not used in any of our patients. All the patients went on inotropic support that was gradually tapered in the ICU. Two babies were shifted to neonatal ICU in view of poor Apgar scores [Table 2].

Table 1: Profile of the patient

Age	Parity	POG in weeks	Signs/symptoms	NYHA	ECHO	RVSP	Drugs
27	G3P1L1A1	38	Dyspnea	2	TR, RV-N, pericardial effusion	RVSP-58+RA	Tadalafil, ambrisentan, heparin
21	Primigravida	37	Dyspnea	3	TR, RV-N, no pericardial effusion	RVSP-75+RA	Sildinafil, ambrisentan, heparin
28	G2P1L1	35	Dyspnea	3	TR, RV-N, no pericardial effusion	RVSP-75+RA	Sildinafil, ambrisentan, heparin
25	Primigravida	29	Dyspnea	4	TR, mild RV dysfunction, no pericardial effusion	RVSP-108+RA	Sildinafil, digoxin, lasilactone, heparin

POG: Period of gestation; NYHA: New York Heart Association; RVSP: Right ventricular systolic function

Table 2: Anesthetic outcome

Anesthesia/ monitors	**Inotropic supports**	**Post-op supports**	**Maternal mortality**	**Hospital/ICU Stay**	**Fetal outcome**
CSE/central line and arterial line	Noradrenaline	Noradrenaline	No	10/6 post op	Birth wt: 2.2 kg, Apgar good
Epidural/central line and arterial line	Noradrenaline	Noradrenaline	No	20/8 post op	Birth wt: 2.9 kg, Apgar good
Epidural/central line and arterial line	Noradrenaline	Noradrenaline	No	30/6 post op	Birth wt: 2.2 kg, Apgar good
Epidural/central line and arterial line	Noradrenaline	Noradrenaline	No	40/6p	Birth wt: 2.8 kg, poor Apgar, NICU

ICU: Intensive care unit; GA: General anesthesia; CSE: Combined spinal epidural; NICU: Neonatal intensive care unit

Discussion:

Although mortality rate among parturients with IPAH has decreased in the past decade, the number still remains high. Even with a multidisciplinary approach in the management of these patients, we had a 25% maternal mortality rate (one of five patients). Mortality in a pregnant patient with IPAH has declined from 36% to 28% due to incorporation of PAH-specific therapy [5]. Prostacyclin analogs, phosphodiesterase inhibitors, and endothelin receptor antagonist are used in the treatment of IPAH. High-dose calcium channel blockers can reduce pulmonary artery pressure in 5%–10% of patients with IPAH. Diuretics are prescribed for patients with right ventricular (RV) failure. Patients with IPAH with functional New York Heart Association class 3 and 4 showed improved survival and quality of life with intravenous infusions of prostacyclin [6]. All our patients received advanced therapy with sildenafil/tadalafil ± prostonoids during pregnancy. Normal pulmonary arterial pressure is 12–16 mmHg. Pulmonary artery

hypertension is defined as a mean pulmonary artery pressure (mPAP) greater than 25 mmHg at rest. The World Health Organization has classified pulmonary hypertension (PH) into five groups: arterial, venous, hypoxic, thromboembolic, or miscellaneous [7]. IPAH belongs to the first group. Pulmonary artery pressures and pulmonary capillary wedge pressures can only be measured accurately by right heart catheterization. Right heart catheterization also helps identify the vasoreactivity, to identify patients who would benefit from long-term therapy with calcium channel blockers. Right heart catheterization is considered as gold standard in diagnosing PH except in pregnancy because of the risk involved [8]. mPAP can be roughly calculated from systolic pulmonary artery pressure (sPAP) of echocardiogram reports (mPAP = 0.61 × sPAP + 2) [9]. In normal pregnancy due to physiological changes, pulmonary vascular resistance (PVR) decreases and cardiac output increases. In IPAH, there is vasoconstriction of blood vessels connected to the lungs. This increases the cardiac load, which causes the right ventricle to hypertrophy, ultimately causing right heart failure.10 Sudden death from dysrhythmia can occur in these patients. There is decreased blood flow through the lungs and the left side of the heart receives poorly oxygenated blood, decreasing oxygen supply to the rest of the body. Pain and valsalva maneuver during labor stimulates the sympathetic nervous system resulting in increase in heart rate, blood pressure, and myocardial oxygen consumption. RV volume overload can occur easily as around 500 mL of blood is pushed into maternal circulation with each contraction. Moreover, autotransfusion that occurs after delivery can lead to large fluid shifts [7]. The mode of delivery to be chosen is controversial. Some centers advocate planned cesarean section at 34 weeks under regional anesthesia. Whereas some other studies showed better outcome with vaginal delivery [10]. Better results obtained with normal vaginal delivery could be due to the fact that patients with less severe disease would have been allowed to deliver vaginally. Labor epidural analgesia can be provided to patients if vaginal delivery is planned. All patients with IPAH who reported to our hospital were delivered by cesarean section. Except for the first patient who died, all others were taken electively.

Preinduction invasive arterial line and central line monitoring, five-lead electrocardiogram, and saturation probe are required. The central line was inserted to start inotropic support and to monitor the trend in central venous pressure (CVP), as CVP is not reliable in patients with PH. The use of pulmonary arterial catheter (PAC) is controversial because of the risk of arrhythmia, pulmonary artery rupture, and embolization [11,13]. We did not use PAC in the management of any of our patients. Noninvasive cardiac output monitor if available could have been used to record stroke volume, stroke volume variation, systemic vascular resistance, and cardiac output [14]. The choice of anesthesia is controversial. General anesthesia combined spinal epidural or plane epidural could be used for cesarean delivery. Recent studies show that regional technique is preferred [Table 3]. Patients receiving general anesthesia were four times more likely to die than patients receiving regional anesthesia [7]. General anesthesia may be required in severe cases where a patient cannot lie supine. Use of general anesthesia also helps better control the use of nitric oxide. Infusions of noradrenalin and phenylephrine should be loaded and

Table 3:

	No. of patients	Anesthesia	NYHA	Mode of delivery	Timing of delivery	Maternal outcome
Bonnin *et al*.[7]	1	GA	2	LSCS	37	Stable
	2	EA	4	VD	12	Death 12 weeks
	3	GA	4	LSCS	33	Death at 3 months
	4		1	LSCS	37	postpartum
Curry *et al*.[15]	1	GA	2	LSCS	32	Worsening RV function
Harsoor *et al*.[16]	1	EA	1	LSCS	-	Stable
Prasad *et al*.[17]	1	EA	2	LSCS	-	Stable
Ma *et al*.[18]	8	1-7EA 8-GA	1-2	LSCS	-	No mortality
Our study	1	CSE	2	LSCS	38	death
	2	EA	3	LSCS	37	Stable
	3	EA	3	LSCS	35	Stable
	4	EA	4	LSCS	29	Stable

connected to the central line to support systemic circulation before induction. Narcotic-based technique is used for induction of general anesthesia but has the disadvantage of slow induction in a patient with full stomach and can cause neonatal respiratory depression. Use of nitrous oxide is avoided as it is a cardio depressant, and it increases PVR. Another disadvantage of general anesthesia is that positive pressure ventilation produces undesirable hemodynamic effects and reduces pulmonary blood flow. Care has to be taken in maintaining temperature, acid–base balance, and oxygen and carbon dioxide levels within the normal range. Incremental regional anesthesia helps in maintaining a better hemodynamic in these group of patients [12]. Hypotension that develops after a regional technique should be aggressively managed with phenylephrine and/or noradrenalin infusions to avoid decreased RV coronary perfusion.

Oxytocin boluses at the time of delivery should be avoided as it can cause hypotension by systemic vasodilation and also increase PVR [19,20]. Small doses of oxytocin can be used as infusions to augment uterine contraction after delivery of the baby. Use of ergometrine and prostaglandin F2□ is contraindicated in PH as they are known to cause pulmonary vasoconstriction. In contrast, PGE_1 is known to cause pulmonary vasodilaton [19]. Our neonatal survival rate was 100%. Two babies were shifted to neonatal ICU in view of poor Apgar score, and one of the babies was on ventilator. Postoperatively, all patients were intensively monitored in the ICU. Use of anticoagulation is highly recommended in these groups of patients. All patients in our series were anticoagulated with subcutaneous LMWH. This was continued for 6-12 weeks after delivery.

Conclusion:

Multidisciplinary approach involving cardiologist, obstetrician, and anaesthetist is required in planning and management of these high-risk obstetric patients. Epidural anesthesia seems to be an alternative to general anesthesia for cesarean section in patients with IPAH. The risks versus benefit of PAC should be considered before its insertion, and newer non-invasive or semi-invasive modalities could be used for better patient outcome. Despite all the treatment efforts, maternal mortality is high.

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