Successful Management of a Patient with Moderate Pulmonary Hypertension with Severe Tricuspid Regurgitation for Open Reduction and Internal Fixation Acetabulu

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Abstract

Patients with pulmonary hypertension (PH) and consequent severe tricuspid regurgitation (TR) pose a significant risk for anesthesia and surgery due to high possibility of perioperative complications and mortality. Ideal anesthetic technique consists of maintaining right ventricular cardiac output by ensuring an adequate balance between mechanical matching of the right ventricle and pulmonary circulation. Factors such as hypoxia, hypercarbia, hypothermia, and inadequately controlled pain that lead to increase pulmonary vascular resistance must be avoided. Here, we present a case of a 70-year-old man with moderate PH and consequent moderately severe TR, with multiple rib fractures and bilateral lung contusions who successfully underwent open reduction and internal fixation of acetabulum. The patient was operated under low-dose spinal and graded epidural regional anesthesia. Inhaled nitroglycerin was given night before surgery and on the day of surgery, and a low-dose intravenous nitroglycerin infusion was used throughout the procedure. We thus conclude that moderate PH with back pressure changes can be managed safely and efficiently with combined low-dose spinal and graded epidural anesthesia.

Keywords: Primary pulmonary hypertension, regional anesthesia technique, open reduction and internal fixation acetabulum, inhaled nitroglycerin.

Introduction

Pulmonary hypertension (PH) is defined as an elevated mean pulmonary arterial pressure of ≥25 mmHg at rest[1,2]. Pulmonary arterial hypertension (PAH) is often associated with severe PH and the right ventricle(RV) remodeling, which may lead to progressive RV failure and death[3]. Long-standing elevated pulmonary arterial pressure can lead to back pressure changes leading to dilated right heart chambers and tricuspid regurgitation (TR). Most of the cases have been reported of pregnant patients with PH, but we present a case of 70-year-old male with moderate PH and severe TR who sustained multiple rib fractures and bilateral pulmonary contusions that further compromised pulmonary system. The patient also sustained an acetabular fracture that needed open reduction and internal fixation. Patient's condition was optimized using multidisciplinary approach and surgery was accomplished successfully with low-dose spinal and graded epidural anesthesia.
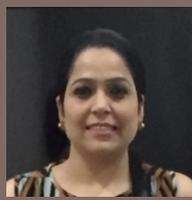
Case Report

A 70-year-old male patient weighing 50 kg presented with chief complaint of fall in the bathroom leading to fracture acetabulum on the left side with multiple rib fracture on both sides. There was no history of loss of consciousness or bleeding from ear, nose, or throat. Physical examination revealed thin-built male, heart rate (HR)of 110/min, blood pressure (BP) 130/75mmHg, and room air oxygen saturation (SpO2) of 90–92%, with no rise in jugular venous pressure. His lungs had conducted sounds on auscultation and also had slightly decreased air entry at bases, and cardiac examination showed regular rate and rhythm with loud P2 and systolic murmur on auscultation. He did not have any other comorbidities and was asymptomatic. Considering his sedentary lifestyle, advanced age and murmur on auscultation we got two-dimensional echocardiography (2D-ECHO) done besides all other routine investigations. Chest radiograph showed the increased prominence of the central pulmonary vessels, bilateral blunting of cardiophrenic angles and bilateral 2nd–5th rib fracture with crowding of ribs on the right side. Electrocardiography (ECG) revealed P pulmonale, right axis deviation with the right ventricular hypertrophy. 2D-ECHO with color Doppler revealed the right atrial enlargement, a dilated RV, and jerky septum. The ECHO further revealed a severe TR with the right

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ventricular systolic pressure of ≈ 75 with flail tricuspid valve and a good left ventricular function (ejection fraction 52%). Estimated pulmonary artery systolic pressure was measured as 57 mmHg. Transesophageal ECHO confirmed these findings. His stress thallium for ruling out coronary vessel involvement was done which turned out to be negative. His hemoglobin was 11.3 g% and platelet count was 150,000/mm3. Arterial blood gas (ABG) on room air revealed; pH of 7.42, PaO2 58 mmHg, PaCO2 37mmHg, and bicarbonate 23.7mmol/L. The arterial oxygen saturation (SaO2)was measured as 92%. Cardiologist evaluated and opined that the patient was a high-risk case for surgical intervention with possibility of fatal outcome in the perioperative period due to moderate PH and associated severe TR. The patient was premedicated with ranitidine 150 mg orally on the night before surgery and nitroglycerin (NTG) 2.5 μg/kg in 4 mls saline was administered through nebulizer at night and on the morning of the surgery to mitigate the pulmonary pressures [4]. The patient was classed as an American Society Anesthesiologists Grade III physical status and an informed high-risk consent was obtained. In the operation theater, standard monitoring (ECG, non-invasive BP, and pulse oximetry)was established which recorded his basal HR to be 98/min and BP was 120/65. The SpO2 on room air was 92–93%. Intravenous (IV) access was established with a wide bore 18 G cannula. A 20 G right radial arterial line and a right-sided central venous catheter in the right internal jugular vein were placed under local infiltration. The surgery was planned under combined low-dose spinal and graded epidural anesthesia. 1.5 ml of 0.5% bupivacaine heavy with 20 μg fentanyl was injected intrathecally at L3-L4 space, and epidural catheter was inserted through 18 G Tuohy needle at the same space and fixed at 9 cm. Initial sensory level achieved with spinal anesthesia was at L1 which was further extended to T10 by administering 4ml of 2% plain 0.5% bupivacaine in 2 ml aliquots through epidural catheter after negative aspirations. For maintenance of anesthesia, after 2 h of initial bolus, injection bupivacaine 0.25% plane was started as an infusion through epidural catheter @ 6ml/h for rest of the duration of the surgery. Injectioncefuroxime 1.5 g and gentamicin

80 mg IV were given half an hour before incision. Injection dexmedetomidine infusion at a dose of 0.2 μg/kg/hwas usedfor mild sedation. Injection NTG infusion at 2–2.5μg/kg/min was also administered for mitigating PH, it was gradually tapered and stopped 24 h after the surgery. Noradrenaline and dobutamine infusions were kept as standby, but we did not need to start any of them due to stable hemodynamics. Intraoperatively, ABG has done showed pH 7.45, PCO 232.2, PO2 145, HCO3−22, K+4.15, Na+137, and lactates 0.8. Total blood loss during the surgery was 450 ml. Intraoperatively, central venous pressure (CVP) was used as a guide to administer IV fluids and was maintained around 4–6 cm of H2O. Total IV fluid given was 500 ml ringer lactate, 500 ml hydroxyethyl starch, and one packed red cell (400 ml). Volume over load was avoided as it could easily precipitate the right ventricular failure in such cases. Intraoperatively, SpO2, ECG, invasive arterial BP(ABP), andCVPwere monitored. His vitals remained stable with HR between 89 and 95/min, mean BPwas maintained around 65 mmHg and CVP was maintained around 4–6 cm of H2O. Surgical procedure lasted for 4 h without any significant changes in HR and BP. Total urine output during the surgery (4 h) was more than 1ml/kg/h (300 ml). Hypoxia,hypercarbia, acidosis, and hypothermia were avoided. Postoperatively, the patient was monitoredin surgical intensive care unit (SICU) for 24 h. As his stay in SICU was uneventful, he was shifted to the ward the next day. Postoperatively, pain relief was achieved with 0.1% plane with 2μg/ml fentanyl through epidural catheter running at 6ml/h and injection paracetamol (PCM) 1 gIV TDS for 3 days. Injection low-molecular-weight heparin 30 mg was started 8 h after surgery and was given once daily for next 7 days. He was treated with tablet sildenafil 50 mg OD after ruling out other causes for PH and was labeled to have primary PH, postoperatively. He remained clinically stable and was discharged on the10th post-operative day. Regular follow-up in the surgery and cardiology departments were arranged.

Discussion

Arterial pressure of ≥25 mmHg at rest [1,2].It presents an important risk factor for

increased perioperative morbidity and mortality [5]. The outcomes of major non-cardiac surgeries in patients with PH showed mortality and short-term morbidity rates of 7% and 42%, respectively[6]. Anesthetic management of PH with severe TR can be quite a challenging affair. Stress, pain, ventilation, and surgery-related inflammation can further increase PH. The right ventricular contractility can be affected directly or indirectly by either depression from anesthetic drugs or acute changes in the sympathetic/parasympathetic balance. Hypoxia, hypercarbia, hypothermia, and inadequately controlled pain must be avoided[7]as it can lead to increase in pulmonary vascular resistance (PVR) and hence precipitating the right ventricular failure. In addition, during hip surgeries, the embolization of bone marrow debris and fat to the lungs will further increase pulmonary arterial pressures [8].The acuity with which this deterioration can occur makes the intraoperative management of patients with PH challenging and demands particular attentiveness [9].The number of case reports highlighting the use of regional anesthesia with good outcomes is increasing. Regional anesthetic techniques offer the advantage of not impairing spontaneous breathing and of avoiding elevated pulmonary pressure, which is induced by mechanical ventilation and cause right-sided heart failure. In addition, techniques of continuous regional anesthesia can be used for post-operative analgesic therapy. Regional anesthesia also reduces the incidence of deep vein thrombosis [10] and especially slow titrated epidural provides better-controlled hemodynamics and gradual fall in systemic vascular resistance (SVR)[11]. Moreover in this case, patient already had fractured ribs bilaterally and pulmonary contusions compromising lung mechanics and function, therefore, we chose regional anesthesia as our technique of choice in this patient. Although central neuraxial blockade has been used safely in patients with PH, blocking cardiac sympathetic in the upper thoracic region disrupts the right ventricular [12],therefore, slow-graded epidural after low-dose spinal was chosen as the plan. Patient was nebulized with inhaledNTG (iNTG) (2.5 μg/kg for 10 min) at night and on the morning of the surgery to mitigate the pulmonary arterial pressure. iNTG leads

to selective pulmonary vasodilation unlike IV NTG which leads to systemic and pulmonary vasodilation[4]. Oxygen was continuously administered as it is a pulmonary vasodilator which plays a pivotal role in reducing PVR[13] and avoids hypoxia. Patient was mildly sedated with low-dose dexmedetomidine(0.2 µg/kg/h) and excessive sedation was avoided to prevent hypercarbia. IV NTG @ 2.5µg/kg/min was given to mitigate pulmonary arterial pressure and a balance was maintained between dexmedetomidine and NTG to avoid bradycardia and excessive tachycardia (HR was maintained between 89 and 95/min). It is a good practice to eliminate any air from IV syringes and lines in these cases. Hypothermia can cause pulmonary vasoconstriction and it was prevented using forced air-warming blankets and warmed IVfluids[14]. Heat and moisture exchangers should be used if case is under general anesthesia. Hemodynamic changes can occur rapidly in these patients, and therefore, invasive ABP monitoring is almost always indicated as part of the anesthetic plan[7]. Systemic hypotension should be managed with vasopressors rather than reducing or stopping the pulmonary vasodilator infusion [7]. Dobutamine is the most commonly used agent as it increases contractility and HR along with systemic and pulmonary vasodilation. If hypotension persists then a vasoconstrictor should also be added to restore coronary artery perfusion[7]. Norepinephrine provides both vasoconstriction and inotropic support and decreases PVR/SVR ratio at lower doses (<0.5 µg/kg/min) [7]. Used in lower doses, it can improve RV/pulmonary artery coupling and is considered the best first-line agent in patients with PH, right heart failure, and hypotension [7]. Therefore, we kept dobutamine and noradrenaline as standby. If hypotension occurred these agents would be used to increase the BP without the need for pushing the fluid to avoid increase in preload and hence leading to right heart failure. We infused fluid judiciously and with blood replacing blood, we did not have to start either dobutamine or noradrenaline infusions. Postoperatively, these patients should be monitored in SICUto ensure the adequacy of oxygenation, perfusion, pain management, and the continuation or initiation of pulmonary vasodilator therapy[15]. Post-operative pain relief is very important as pain may exacerbate the PVR and can lead to right heart failure. Therefore, we took great care of the pain by epidurally infusing 0.1% ropivacaine with fentany l2µg/ml and regular 1g IV PCM was given thrice a day round the clock. We chose multimodal analgesia so that we could reduce the concentration of ropivacaine to 0.1% to avoid any fall in BP. Therefore, the patient was observed in the hospital for 10 days postoperatively. To conclude, there have been case reports of patients with severe PAH scheduled for hip procedures who could not survive the post-operative period due to increased risk of major perioperative morbidity and mortality associated with this condition[15]. The purpose of our case report is to stress that high-risk case with moderate PH and severe TR can be managed safely if adequately optimized by a collective team of anesthesiologist, cardiologist, and pulmonologist planning of extended perioperative care.

References

1. Rich S,editors. Executive summary from the World Symposium on Primary Pulmonary Hypertension, Evian, France:Co-Sponsored by The World Health Organization. 1998. p. 6-10.

2. Simonneau G, Gatzoulis MA, Adatia I, Celermajer D, Denton C, Ghofrani A, et al. Updated clinical classification of pulmonary hypertension. J Am CollCardiol 2013;62:D34-41.

3. Rich JD, Rich S. Clinical diagnosis of pulmonary hypertension. Circulation 2014; 130:1820-30.

4. Mandal B, Kapoor PM, Chowdhury U, Kiran U, Choudhury M. Acute hemodynamic effects of inhaled nitroglycerine, intravenous nitroglycerine, and their combination with intravenous dobutamine in patients with secondary pulmonary hypertension. Ann CardAnaesth 2010; 13:138-44.

5. Lai HC, Lai HC, Wong KY, Lee WL, Ting CT, Liu TJ. Severe pulmonary hypertension complicates postoperative outcome of cardiac surgery. Br J Anaesth 2007; 126:1-7.

6. Ramakrishna G, Sprung J, Ravi BS, Chandrasekaran K, McGoon MD. Impact of pulmonary hypertension on the outcomes of noncardiac surgery: Predictors of perioperative morbidity and mortality. J Am CollCardiol 2005; 45:1691-9.

7. Ortega R, Connor C. Intraoperative Management of Patients with Pulmonary HypertensionAdvances in Pulmonary Hypertension.2013;12:1: 18-23.

8. Ereth MH, Weber JG, Abel MD, Lennon RL, Lewallen DG, Ilstrup DM, et al. Cemented versus noncemented total hip arthroplasty – Embolism, hemodynamics, and intrapulmonary shunting. Mayo ClinProc 1992; 67:1066-74.

9. Höhn L, Schweizer A, Morel DR, Spiliopoulos A, Licker M. Circulatory failure after anaesthesia induction in a patient with severe primary pulmonary hypertension. Anesthesiology 1999; 91:1943-5.

10. Tuman KJ, McCarthy RJ, March RJ, DeLaria GA, Patel RV,Ivankovich AD. Effects of epidural anaesthesia and analgesia on coagulation and outcome after major vascular surgery. AnesthAnalg 1989;62:243-7.

11. Spinnato JA, Kraynack BJ, Cooper MW. Eisenmenger's syndrome in pregnancy: Epidural anesthesia for elective cesarean section. N Engl J Med 1981; 304:1215-7.

12. Missant C, Rex S, Claus P, Derde S, Wouters PF. Thoracic epidural anaesthesia disrupts the protective mechanism of homeometricautoregulation during right ventricular pressure overload by cardiac sympathetic blockade: Arandomisedcontrolled animal study. Eur J Anaesthesiol 2011; 28:535-43.

13. Marshall HW, Swan HJC, BurchellHB, Wood EH. Effect of breathing oxygen on pulmonary arterial pressure and pulmonary vascular resistance in patients with ventricularseptal defect. Circulation 1961; 23:241-52.

14. PilkingtonSA, TaboadaD, Martinez G.Pulmonary hypertension and its management in patients undergoing non-cardiac surgery. Anaesthesia 2015; 70:56-7.

15. Urban MK, Jules-Elysee KM. Apatient with severe pulmonary hypertension for hip arthroplasty.HSSJ 2014; 10:171-17.

Conflict of Interest: Nil Source of Support: None	How to Cite this Article
	Chopra P, Stephen J. Successful management of a patient with moderate pulmonary hypertension with severe tricuspid regurgitation for open reduction and internal fixation acetabuluJournal of Anaesthesia and Critical Care Case Reports Sep-Dec 2017; 3(3):16-18.