Case Report

Anesthetic considerations in a patient of autosomal dominant polycystic kidney disease on hemodialysis for emergency cesarean section

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Abstract

Renal disease, either preexisting or occurring during gestation may impair maternal and fetal health. A 35-year-old primigravida with autosomal dominant polycystic kidney disease on hemodialysis was scheduled for emergency cesarean section. She was managed successfully with low-dose intrathecal bupivacaine and fentanyl. In the case of pregnancy in such a patient, early involvement of the nephrologists along with the obstetrician can improve maternal and fetal outcome.

Key words: Autosomal dominant polycystic kidney disease, cesarean section, hemodialysis, neuraxial anesthesia

Introduction

Autosomal dominant polycystic kidney disease (ADPKD) affects between 1 in every 500 and 1 in every 1000 individuals and is found in all racial and ethnic groups. The disease may not be clinically apparent until the third or fourth decade of life and only about half of the patients will progress to renal failure. In young patients, there is no way to predict whether or when renal failure will develop, although several risk factors such as hypertension, renal hemorrhage, multiple pregnancies, male gender, and PKD1 disease genotype have been associated with a more rapid course.[1] Pregnancy in such patients is usually associated with rapid deterioration in the renal function. Complications associated with pregnant subjects with chronic renal failure undergoing dialysis include maternal hypertension, preeclampsia, anemia, infected renal and hepatic cysts, pyelonephritis, and rupture of cerebral artery aneurysm during labor with subarachnoid hemorrhage. However, with careful and effective perioperative monitoring spinal anesthesia can be safely performed for cesarean section in patients undergoing hemodialysis.

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Access this article online	
Quick Response Code:	Website: www.joacp.org
	DOI: 10.4103/0970-9185.83694

Case Report

An 80 Kg 35-year-old full term primigravida with oligohydramnios was scheduled for emergency lower segment cesarean section (LSCS). Gestation was uneventful for the first 6 months. She was diagnosed to have ADPKD in the seventh month when she complained of flank pain, generalized swelling, and decreased urine output. She was hospitalized and hemodialyzed thrice a week for the next 2 months to maintain blood urea nitrogen (BUN), serum creatinine, and potassium values within acceptable limits. She was started on oral amlodepin 5 mg BD for hypertension. Her last hemodialysis was performed 24 h prior to surgery using unfractionated heparin. There was one episode of drop in the fetal heart rate. The nephrologists and obstetricians decided to proceed with an emergency LSCS as she was full term. Clinical parameters were heart rate of 102/min regular, systemic blood pressure of 120/74 mm Hg in supine position, central venous pressure (CVP) 1-2 cm H_2O. She had normal heart and breath sounds. Airway was graded as modified Mallampati classification Class 2. She had a short neck with a thyromental distance of 4 cm. A right internal jugular vein catheter was in situ for hemodialysis. Preoperative investigations showed hemoglobin (Hb) of 10.2 gm%, normal leucocyte count, and mild proteinurea and pus cells in urine. Her biochemical profile revealed BUN of

30 mg/dL, serum creatinine 3.7 mg%, serum sodium 140 mmol l^{-1}, serum potassium 5 mmol l^{-1}, and normal liver function tests. Coagulation profile was bleeding time 3 min, clotting time 9 min, activated partial thromboplastin time (aPTT) 30 s, platelet count 150 × $10^9 L^{-1}$, prothrombin time 13 s, and international normalized ratio 1:2. Electrocardiogram and echocardiography were normal. Arterial blood gas on air showed pH 7.41, pCO_2 30.8 mm Hg, pO_2 93.3 mm Hg, SpO_2 98%, and HCO_3 22 mEq.

After obtaining informed written consent, patient was wheeled into the operation theater maintaining the left lateral tilt. Monitoring included pulse oximeter, cardioscope, noninvasive blood pressure (NIBP), CVP, and urine output measurement. A peripheral line of 18 G in the left arm was used to preload her with 500 ml of normal saline till CVP was 5 cm H_2O. Spinal anesthesia was successfully given in the L3-4 intervertebral space using 1 ml of 0.5% hyperbaric bupivacaine (5 mg) with 25 mcg fentanyl in the left-lateral position with a 25 G spinal needle. Skin incision was made when the block up to T4-T6 dermatome level was achieved. Intraoperatively, BP was in the range of 100-120 mm Hg systolic, HR 70-100/min, CVP 5-6 cm H_2O and urine output of approximately 1 ml/kg/hr. A 2.0 kg live male child was delivered (APGAR score of 9 at 5 min). Patient did not complain of pain for about 4 h; thereafter, she was given intravenous tramadol 8 hourly. Postoperatively, she maintained normal hemodynamic and biochemical parameters and did not require any hemodialysis. There was no neurological deficit; she was shifted to the nephrology unit after 72 h and discharged on day 7.

Discussion

Women with moderate or severe antenatal renal insufficiency often experience deterioration of their renal functions during pregnancy. The pathophysiology by which pregnancy exacerbates renal disease is unknown. One hypothesis is that increased glomerular perfusion which normally accompanies pregnancy paradoxically causes further injury to the kidneys in patients with preexisting impairment of function.[2] However, this hypothesis is not supported by published data, which reveal no evidence of hyperfiltration. Epstein outlined an alternative hypothesis in which preexisting renal disease may induce a cascade of platelet aggregation, microvascular fibrin thrombus formation, and endothelial dysfunction that leads to microvascular injury in the already tenuous kidneys.[3] Increased cardiac output and decreased intrarenal vascular resistance in pregnancy cause an 80% increase in renal blood flow and a 50% increase in glomerular filtration rate (GFR). Because of the increased GFR, a serum creatinine concentration greater than 0.8 mg/dl and a BUN concentration greater than 13 mg/dl (which are normal values for the nonpregnant patient) suggest renal insufficiency. Tubular sodium reabsorption and osmoregulation are reset, allowing a "physiologic hypervolemia" during gestation. Modest proteinuria also occurs during pregnancy (up to 300 mg in 24 h).[4] When serum creatinine concentration exceeds 2.0 mg/dl there is a one in three chance of developing dialysis-dependent end stage renal disease during or shortly after pregnancy. Our patient presented with symptoms of renal insufficiency only in the seventh month of gestation, it is difficult to opine whether her disease progressed during pregnancy or the diagnosis was missed earlier.

On presentation, patient had Hb of 10.2 gm/dL and normal platelet count. The blood erythrocyte count and hematocrit may be increased above normal possibly because of abnormal erythropoietin production by the cysts; hence, they do not have anemia as profound as that occurring in other types of terminal renal disease. For ambulatory chronic renal failure patients, Hb of 11-12 g/dL is considered optimal although not supported by clinical evidence. Correction of anemia helps improve platelet dysfunction associated with renal failure. Blood coagulation studies and platelet counts are usually normal in patients of ADPKD, as was the case in our patient.

Hypertension an early symptom, occurring in approximately 60% of patients secondary to stretching of arterioles across expanding cysts leading to increased secretion of renin and angiotensin.[5,6] Although the patient was not anuric and did not have ECG changes due to hyperkalemia, it was decided to dialyze her at least thrice a week. During pregnancy early dialysis is recommended (when the GFR is approximately 10 mL/min, rather than waiting until it falls further) and treating with more frequent and longer hemodialysis sessions.[7] Problems occurring in a pregnant patient on hemodialysis are need for vascular access, cardiovascular instability, large fluid, and electrolyte shifts, need for anticoagulation of extracorporeal circuit and risk of hepatitis.[2] Hypotension may compromise uteroplacental perfusion and cause fetal distress. Fetal heart rate monitoring is recommended,[8] even when hypotension and major fluid shifts are avoided, as Doppler examination of uterine and umbilical artery flow during hemodialysis suggest redistribution of arterial flow away from the uteroplacental vascular bed.[8] BUN levels are kept below 80 mg/dL predialysis and 30 mg/dL postdialysis.[10] At birth, neonatal azotemia is similar to that of the mother.

The choice of anesthesia should be made on an individual basis. Proper evaluation of coagulation profile must be made if regional anesthesia is planned. The increase in concentration of most coagulation factors is associated with a shortening of the prothrombin and aPTT during pregnancy. Uremic

toxins cause functional platelet defects and a prolonged bleeding time. Thrombocytopenia may also occur as a result of increased peripheral destruction of platelets. These effects are reversed by dialysis.

There are reports of safe administration of epidural anesthesia, without any neurologic complications, in thrombocytopenic (platelet count <100 000/cumm) healthy pregnant women, preeclampsia, and women with autoimmune thrombocytopenic purpura. They state that in the absence of clinical evidence of bleeding, regional anesthesia should not necessarily be withheld in pregnant women with a platelet count of less than 1 00 000/cu mm.[11] No hemorrhagic complications were observed in 24 women with unsuspected thrombocytopenia (platelet counts of 15-99 $\times$ 10^9/L) who received spinal anesthesia[12] or in 24 children with acute lymphoblastic leukemia and platelet counts below 20 $\times$ 10^9/L.[13]

Intravenous unfractionated heparin should be stopped 4-6 hrs before neuroaxial blockade and a normal aPTT should be confirmed.[14] Since our patient had been dialyzed the previous day and her electrolytes, aPTT, platelet counts, bleeding time and hemoglobin values were within acceptable limits, we decided to proceed with spinal anesthesia. High degree of suspicion for any neurological complications should be maintained in the postoperative period. Thus, a carefully conducted regional anesthesia may be performed in these patients.

Patients may be hyper or hypovolemic depending on the time since their last dialysis. Preservation of renal function intraoperatively depends on maintaining an adequate intravascular fluid volume and minimizing drug-induced cardiovascular depression. We used low dose of local anesthetic with intrathecal opioid in an effort to preserve renal and uterine blood flow. Low dose of spinal anesthesia has the advantage of providing cardiovascular stability and it is advocated that 8 mg of 0.5% hyperbaric bupivacaine is the optimal dose for cesarean section.[15] We were able to achieve a sensory level of T6 with 5 mg of 0.5% bupivacaine combined with fentanyl 25 mcg. There was no significant respiratory depression or fall in blood pressure. Bogra J *et al*. studied the synergistic, potentiating effect of fentanyl on bupivacaine in spinal anesthesia for cesarean section, on comparing the hemodynamic stability of equipotent doses of bupivacaine and bupivacaine fentanyl, they found the latter to be more stable.[16]

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How to cite this article: Fernandes SD, Suvarna D. Anesthetic considerations in a patient of autosomal dominant polycystic kidney disease on hemodialysis for emergency cesarean section. J Anaesth Clin Pharmacol 2011;27:400-2.
Source of Support: Nil, **Conflict of Interest:** None declared.