Combined Epidural Anesthesia and General Anesthesia for Aorto-renal Bypass: Two Case Reports

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ABSTRACT:

Aorto-renal bypass surgery is associated with significant hemodynamic alterations as well as other comorbidities due to necessity of aortic cross-clamping and release during vascular anastomosis. Combined epidural and general anesthesia for the aorto-renal bypass surgeries provides not only hemodynamic stability during aortic cross-clamping but is also assosciated with increased graft blood flow, graft survival and decreased morbidity and mortality in intraoperative and postoperative period. Two cases of aorto-renal bypass are presented, for which combined epidural and general anesthesia techniques were applied.

Key words: *anesthesia, cross clamp, epidural, infrarenal,*

CASE REPORTS

FIRST CASE

The first case was a twenty-two year female who, after having seven months' complaints of headache with occasional nausea and vomiting, was diagnosed as a case of left renal artery stenosis after examination and investigations. The surgical management planned was aorto-renal bypass graft. She was on antihypertensive medication, amlodipine 10 mg and atenolol 25 mg since the last seven months. In the pre-anesthetic assessement, she did not give any history of previous exposure to anesthetics or of any systemic comorbidities, was a non-smoker and non-alcoholic. The results of the sytemic examinations as well as that of the airway assessment were within normal limits. Hemograms as well as renal function tests and the coagulation profile were also within normal limits. Peripheral angiogram showed 100% occlusion of the left renal artery including the ostium, and the distal arterial segment just before the hilum was visualised. The right kidney was supplied by two renal arteries and were normal. Contrast computed tomograph scan revealed a non-opacified segment of the left renal artery at its junction with the aorta-suggestive of proximal left renal artery stenosis causing a contracted left kidney.

The patient was premedicated with oral diazepam 10 mg a night before and in the morning of surgery. Pre anesthetic vitals in the operation theatre showed regular heart rate of 74/min, blood pressure of 120/70 mm of Hg & oxygen saturation of 99% in room air. Thoracic epidural catheterisation was performed with the patient in the sitting position via the T9/T10 interspace and the epidural catheter was kept 5 cm in the epidural space. After confirmation of negative aspiration of blood and cerebrospinal fluid, 3 ml of 2% Xylocaine with Adrenaline (1:200,000) was injected epidurally as the test dose. 8 ml of 0.5% Bupivacaine with 25 mg pethidine was given thereafter. General anesthesia was induced with thiopental sodium 200 mg and endotracheal intubation was facilitated with vecuronium 8 mg. The right internal

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jugular vein was cannulated with a double lumen 7 Fr central venous catheter. The left radial artery was cannulated with a 20 Gz canula. Anesthesia was maintained with oxygen, isoflurane (0.5%), nitrous oxide and vecuronium and analgesia with 0.1% bupivacaine and 0.1% pethidine with an infusion rate of 10 ml/hour epidurally. No intravenous analgesia were given. During surgery blood pressure was maintained betweeen 75 – 100 mm of Hg systolic and diastolic 50 – 70 mm of Hg, heart rate 50 – 70/min, oxygen saturation of 98 – 100%, and CVP in the range of 4 – 8 mm of Hg. Heparin 5000 IU was given. Injection mannitol 20% 200 ml was given around 30 mins before cross clamp. Infrarenal cross clamp was applied and was released after aorto-renal bypass with saphenous vein graft in around 30 mins. There was no significant change in blood pressure, heart rate an no arrhythmia was observed during clamping and release of the clamp. No vasodilators and/or vasopressors were required. Intraoperatively, three litres of ringer lactate and 500 ml of gelofusine was infused. Urine output was 800 ml. The patient was extubated and awake at the end of the surgery in the operation theatre. The duration of anesthesia was three hours.

The operative findings were a small-caliber renal artery without pulsation, atherosclerotic plaque up to the hilum, and a collateral artery with good a volume and a normal renal parenchyma. Postoperatively, in the ICU, heparine was infused at the rate of 1000 units per hour. Analgesia was maintained with continuous infusion of 0.1% bupivacaine and 0.1% pethidine at the rate of 10 ml/hr. CVP line, arterial line and foleys catheter were removed in the second post-operative period. The epidural catheter was removed on the fourth postoperative day. The patient was transferred to the post-operative ward on the second postoperative day and was discharged on the eighth day after surgery.

SECOND CASE

The second case was a thirty-two year female who presented with headache, dizziness and tingling sensation over the lower limbs and had been diagnosed as hypertensive due to left renal artery stenosis with right hypoplastic kidney four years back. The patient was on atenolol 50 mg, amlodipine 10 mg and amifru 20 mg once daily since then. She had gotten pregnant two years ago and had given birth to a healthy baby by vaginal delivery. Blood pressure was 170/100 mm of Hg. Aorto-renal bypass was planned for the patient.

All the baseline investigations along with renal function test and coagulation profiles were within normal limits. Echocardiography showed ejection fraction of 77%, pulmonary artery pressure of 45 mm of Hg and mild tricuspid regurgitation. Angiogram revealed 80% stenosis of left renal artery and a diffusely-small right renal artery. Intravenous urography showed dye excretion well from both the kidneys and a smaller right kidney. Isoptope scan renogram showed 27% uptake by the right kidney, size 7.5 x 3.5 sq. cm, and 72% uptake by left kidney, size 9.5 x 4.9 sq. cm. Aortogram showed 100% occlusion of the left subclavian artery with retrograde filling of the neck artery, diffuse narrowing of the abdominal and descending thoracic aorta, 99% occlusion of the left renal artery near the origin and a normal right renal artery. Ultrasonography of the abdomen also showed a smaller right kidney with an increased parenchymal echostructure.

The patient was premedicated with diazepam 10 mg the night before and in the morning of surgery. Preoperative vitals were within normal limits. Intraoperative monitors were pulse oximetry, ECG (Lead II and chest lead), heart rate, invasive blood pressure, central venous line, inspired oxygen concentration and urine output. Thoracic edpidural catheterisation was kept at T7/T8 level and 3 ml of 2% xylocaine with adrenaline (1:200,000) was given as test dose epidurally. 0.5% bupivacaine 8 ml with 25 mg pethidine was given epidurally. Anesthesia was induced with sodium thiopentone 200 mg and the trachea intubated with 30 mg of atracurium. Maintainance of anesthesia was done by isoflurane (0.5 %), oxygen, nitrous oxide and atracurium. Internal jugular vein canulation was done with 7 Fr double lumen catheter. Right radial artery canulation was done with 20 Gz canula. 0.1% bupivacaine and 0.1% pethidine was infused at the rate of 10 ml/hour epidurally during surgery. Intraoperatively, blood pressure was mainitained within normal limits. Injection mannitol 20% 200 ml was given intravenously 30 mins before cross-clamp. Aortic cross clamp time during the aorto-renal bypass period was 35 mins. During release of the clamp, systolic blood pressure dropped to 80 mm of Hg. Colloid (hemaccele) 500 ml was infused rapidly after which it was restored to 100 mm of Hg.

The operative findings were diffuse narrowing of abdominal aorta, narrowing of left renal artery and grossly dilated left renal vein. The operative time was four hours and 30 mins.

The patient was extubated in the theatre and was transferred to the ICU. Heparin infusion was started at the rate of 1000 U/hour in the post operative period. Analgesia was maintained with epidural infusion of

bupivacaine and pethidine in 0.1% concentration of both at the rate of 10 ml/hour. The post-operative period was uneventful. CVP, A line and urinary catheter were removed in the first post-operative period. The patient was transferred to the post-operative ward on the second post-op day. The epidural catheter was removed on the third post-operative day and the patient discharged on the 10th post-operative day.

DISCUSSION

Two cases have been presented, for which aorto-renal bypass was done under epidural anesthesia and light, general anesthesia. Aortic cross-clamping and unclamping is assosciated with significant hemodynamic changes which may be influenced by various factors like preoperative coronary circulation and myocardial function, site of cross clamping, intravascular volume, anesthetic technique and agents employed and surgical pathology, i.e., collateral circulation. Significant and immediate effects are seen in the cardiovascular system which show increased afterload, increased systemic vascular resistance up to 40%, increased mean arterial pressure, decreased preload, decreased stroke volume and cardiac index upto 35 %, acute left ventricular failure and regional wall motion abnormalities.[1] It is associated with hypoperfusion of the kidneys, intestine and spinal cord and accumulation of acid metabolites in the tissues below the clamp. Renin angiotensin mechanism is activated during surgery and may persist a few hours after surgery. Infrarenal cross-clamping is also associated with up to 38 % decrease in renal blood flow and 75% increase in renal vascular resistance. Approximately 0.2 – 3 % of the patients develop acute renal failure.[1] In both of these cases, no haemodynamic instability and arrhythmia were noted during aortic cross clamping and release. So there was no necessity of anitarrhythmics or vasodilators during cross-clamping. However, mild hypotension was noted in the second case during aortic cross-clamp release.

Thoracic epidural anesthesia with light, general anesthesia has shown to decrease intraoperative as well as post-operative morbidity and mortality associated with aortic cross-clamping surgeries. Use of light general anesthesia with regional anesthesia for surgery of aorta abdominal and its major branches is gaining popularity by evidence of its association with improved operative outcome.[2,3,4] Yeager et al compared postoperative morbidity and mortality in high risk surgical patients undergoing aortic and major vascular surgery, where one group had epidural anesthesia with general anesthesia and the other group had general anesthesia only intraoperatively and post operative analgesia was provided with epidural anesthesia and parenteral opoids respectively. Postoperative morbidity due to myocardial infarction, congestive heart failure, or major infection, and operative mortality were all significantly lower in patients receiving epidural anesthesia and postoperative epidural analgesia.[2] Although the exact mechanism of the beneficial effect has not been elucidated, few studies have demonstrated that thoracic epidural blockade dilates epicardial coronary vessels and improves left ventricular function in stress-induced ischemia.[5,6] Cousins and Wright have demonstrated elevation in skin temperature, increased graft flow and reduced muscle blood flow in patients with epidural anaesthesia and light, general anesthesia undergoing aortic cross clamping surgeries.[7] Breslow et al have also reported fewer hypertensive episodes, low plasma nor adrenaline levels in patients with epidural anesthesia undergoing such surgeries.[8]

In both these cases, the concentration of bupivacaine used for epidural anesthesia was 0.5%, so as to obtain surgical anesthesia; and in both of these cases intravenous analgesics were not used. The high concentration of the bupivacaine also helped in maintaining light, general anesthesia with 0.5 % of isoflurane only.

Renal fuction protective strategies during infrarenal aortic cross-clamping includes mannitol infusion about 30 mins prior to cross-clamping, decreased cross-clamping time, infusion of verapamil in renal arteries and epidural anesthesia in combination with light, general anesthesia as evidenced by many studies.[1,13] Mannitol has been shown to act as renal protective agent by increasing cortical blood flow, reducing cell swelling following total ischemia and preventing sludging of cellular debris in renal tubules.[1,13]

Mankikian and colleagues have shown that segmental epidural blockade following abdominal aortic surgery is assosciated with significant improvement in postoperative diaphragmatic function, as evidenced by increases in forced vital capacity, tidal volume and indices of diaphragmatic contractility.[9]

Epidural anesthesia with general anesthesia for abdominal aortic surgeries is not popular universally due to controversy of epidural catheter and anticoagulation, and its dreadful complication of neurologic injury following epidural hematoma formation following systemic heparinisation. There has been one large study where the incidence of epidural haematoma formation was not found to be increased by intraoperative heparinisation in large series of vascular surgical patients.[10]

Anticoagulation of patient following placement of epidural catheter is justified. Studies involving several thousand patients have been reported in which patients have been anticogulated with heparin primarily for vascular surgical procedures following placement of epidural catheter without reports of epidural hematomas occurring.[11,12]

However, my personal opinion is that epidural catheterisation should be done by an expert hand in these types of patients for minimal procedure-related complications like vessel puncture. Concern is frequently expressed with regard to patients in whom an epidural vein is punctured during epidural catheterisation and in whom heparinisation is planned for the surgical procedure. Puncture of an epidural blood vessel should not be an automatic cause for cancellation of sugery or abandonement of the epidural technique. If heparinisation is not accomplished until 30 – 60 mins following the puncture of the epidural blood vessels, this should allow sufficient time for the clot formation at the puncture site.[13] In this case series, the coagulation profile of both the patients were within normal limits and the systemic heparinisation was done about one hour after the epidural catheterisation, which increases the safety period even if there was vessel puncture and prevents hematoma formation. However, caution should be applied during catheter removal; and the minimum duration the stopping of heparinisation and catheter removal should be six hours. In both the above cases, catheters were removed on the third postoperative day.

CONCLUSION

Along with the safety associated with epidural catheterisation and anticoagulation and the intraoperative and postoperative beneficial advantages, it is concluded that the combination of epidural anesthesia with general anesthesia should be considered an anaesthetic technique of choice for patients undergoing abdominal aortic surgeries. Larger studies need tp be conducted to draws out definitive conclusions.

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