Case Series

Epidural volume extension technique in high risk obstetric patients – Case series

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ABSTRACT

Epidural volume extension involves injection of normal saline into the epidural space soon after an intrathecal injection, with the aim of augmenting the sensory block height. It has significant dose-sparing effect, providing adequate level of anaesthesia and analgesia with minimal haemodynamic disturbances. We present this case series that shows the successful use of this technique in high risk cardiac patients coming for elective lower segment caesarean section.

Key words: Anaesthesia, bupivacaine, caesarean section, epidural saline

INTRODUCTION

Obstetric patients with compromised cardiac condition coming for caesarean section pose unique challenges to the anaesthesiologist and can evoke an anesthesiologist's regional anaesthesia skills.[1] The anaesthesia technique chosen should be such that it causes minimal haemodynamic disturbances with maximum safety profile for both mother and foetus.

Combined spinal epidural (CSE) is popular in modern anaesthesia practice. It provides rapid onset, prolonged duration and can also be used for postoperative analgesia. Epidural volume extension (EVE) is another modification of CSE. In this method, normal saline is injected into the epidural space after intrathecal injection of local anaesthetic agents.[2] This case series tries to highlight the efficacy of this technique in high risk obstetric patients with compromised cardiac functional status who underwent elective lower segment caesarean section (LSCS) in our institute from 2018 to 2021.

CASE PRESENTATION

Case 1

A 25 year old primigravida with 36 weeks gestation, hypothyroidism and previous history of myocardial infarction with stenting done to left anterior descending artery presented with complaints of breathlessness in lying down position. She was in congestive heart failure and had pulmonary oedema. Her echocardiography showed a dilated right atrium (4.3 cm), moderate pulmonary artery hypertension (48 mmHg), lateral wall and apical hypokinesia with moderate left ventricular dysfunction and an ejection fraction (EF)

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of 42%. On examination, she had bilateral crepitations and her room air peripheral oxygen saturation (SpO_2) was 85% which improved to 96% with face mask oxygen of 5 litres per minute. She was on tablet aspirin 75 mg, atorvastatin 20 mg once daily (OD). Cardiac consultation was sought and she was planned for LSCS.

Case 2

A 30 year old primigravida with 36 weeks of gestation presented in the obstetrics department with the complaint of dyspnoea at rest and clinical examination revealed that she was in cardiac failure. 2D echocardiography revealed cardiomyopathy, biventricular systolic dysfunction, grade I diastolic dysfunction with an EF of 40%. A diagnosis of peripartum cardiomyopathy was made. Tablets frusemide and methyldopa were started, and she was planned for elective LSCS.

Case 3

A 28 year old primigravida with 38 weeks of gestation was posted for elective LSCS. The patient was diagnosed as a case of rheumatic heart disease (RHD) with moderate mitral stenosis during her antenatal check-up when she developed breathlessness in the second trimester. 2D echocardiography revealed a mitral valve area of 1.2 cm^2. She was started on digoxin 0.25 mg OD and tablet metoprolol 25 mg twice daily (BD) by the cardiologist. Tablet frusemide 20 mg BD was added during her third trimester.

Case 4

A 24-year-old female diagnosed as RHD with severe mitral stenosis, severe tricuspid regurgitation, and trivial mitral regurgitation with moderate pulmonary artery hypertension was posted for elective caesarean section with an indication of cephalopelvic disproportion with oligohydramnios. She developed breathlessness at 7 months of pregnancy and was diagnosed as a case of RHD with mitral stenosis with a mitral valve area of 1 cm^2. She had sinus tachycardia on electrocardiogram. She was started on treatment for right heart failure with injectable furosemide 20 mg BD and ivabradine 5 mg OD.

Case 5

A 25-year-old primigravida diagnosed with Takayasu's arteritis type III with involvement of bilateral subclavian arteries, thoracic aorta and renal artery involvement presented to the obstetric unit for safe confinement. She had renovascular and pulmonary artery hypertension and dilated cardiomyopathy secondary due to Takayasu's arteritis. She was on tablet prednisolone 30 mg OD, tablet digoxin 0.25 mg OD, tablet nifedipine 10 mg OD. She was posted for elective LSCS.

Anaesthetic plan

Pre-anaesthetic evaluation was done. Investigations were assessed and aspiration prophylaxis was administered to all of them. Once the patients were shifted inside the operating room, monitors like non-invasive blood pressure, SpO_2 and electrocardiogram were connected and baseline vital parameters were recorded. 18 G peripheral intravenous line was secured and ringer lactate infusion was started. Radial artery was cannulated for invasive arterial blood pressure monitoring. Under aseptic precautions, an 18 G epidural catheter was inserted into L2-L3 intervertebral space using an 18 G Tuohy needle. The epidural space was identified using the loss of resistance to air technique and catheter fixed such that 4 cm was inside the epidural space. This was followed by subarachnoid block with 1.2 ml of 0.5% hyperbaric bupivacaine with 25 μg of fentanyl injected intrathecally into L3-L4 intervertebral space using a 26 G Quincke Babcock spinal needle. A wedge was placed under the right hip joint. The dermatomal level achieved was checked 5 min after giving spinal anaesthesia. 8 ml of normal saline was injected in the epidural catheter 5 min after giving the subarachnoid block. The dermatomal level was again assessed at 3, 5 and 10 min after administration of epidural saline by the pin-prick method [Table 1]. Motor block was assessed using Bromage scale at the end of 5 minutes. All the patients were haemodynamically stable throughout the surgery [Table 2]. Postoperatively, the patients were shifted to the intensive care unit for overnight observation and postoperative analgesia was maintained by an epidural infusion of 0.1% bupivacaine at 5 ml/h.

Table 1: Level of sensory block and grade of motor block achieved

Case	Height (cm)	Weight (kg)	Sensory block level at 3 min	Sensory block level at 5 min	Sensory block level at 10 min	Bromage Scale (Grade)
1	160	78	T-10	T-7	T-5	2
2	156	66	T-9	T-7	T-5	3
3	163	64	T-10	T-6	T-5	2
4	155	75	T-9	T-6	T-4	3
5	152	72	T-9	T-7	T-4	3

T-Thoracic vertebral level

Table 2: Haemodynamic parameters

Time	Case 1		Case 2		Case 3		Case 4		Case 5	
	HR	IBP	HR	IBP	HR	IBP	HR	IBP	HR	IBP
0 min	70	122/78	84	140/100	72	118/78	90	130/86	78	124/78
1 min	78	116/74	87	134/98	70	116/75	85	128/80	72	124/74
3 min	74	120/72	86	135/90	68	110/70	88	124/78	70	120/68
5 min	75	119/74	92	130/88	70	112/66	92	112/68	84	94/60*
10 min	80	115/70	90	131/90	71	110/68	86	118/70	74	119/70
15 min	82	112/74	88	133/88	70	113/70	85	126/72	76	122/70
20 min	78	118/68	84	130/86	69	114/70	84	122/74	75	120/68
30 min	74	120/75	84	132/90	68	110/72	80	125/72	77	118/70
40 min	70	124/78	81	130/90	66	112/72	82	122/70	76	120/70

*responded to single bolus dose of 100 μg intravenous phenylephrine. HR: Heart rate in beats per minute; IBP: Invasive blood pressure in mmHg

DISCUSSION

Cardiac patients coming for LSCS can be administered regional or general anaesthesia. We opted for EVE technique as various reports have shown the benefits of this technique. It has significant dose-sparing effect, provides an adequate level of anaesthesia and analgesia with minimal haemodynamic disturbances and faster recovery of motor function. This technique is reliable, with the advantage of epidural anaesthesia in prolonging the duration of anaesthesia if required and it can also be used for postoperative analgesia.[3,4] It has advantages over general anaesthesia as the airway manipulation and the accompanying stress response, which has adverse effect on the patient's cardiovascular status is avoided.[5]

The most common theory for EVE is thecal compression due to the volume effect on consequent epidural injection of saline. A study done by Blumgart *et al.*[6] showed higher level of analgesia with EVE technique when compared with spinal alone. This was secondary to the volume effect in epidural space which compresses the subarachnoid space and increase the intrathecal spread of the drug. Mardirosoff and colleagues noted that EVE performed 20 min after intrathecal injection failed to produce any significant increase in the sensory level. However, EVE done 5 min after intrathecal injection produced a significantly higher sensory block.[7] This was the reason why we opted to inject 8 ml of normal saline 5 min after intrathecal injection.

Lew *et al.*[8] in his study found that CSE using EVE technique has faster motor recovery thereby reducing the time spent in the post-anaesthetic care unit. Takiguchi *et al.*[9] demonstrated thecal compression following EVE in a myelographic study conducted in healthy volunteers.

Most recently, a meta-analysis of low-dose spinal anaesthesia concluded a lower risk of hypotension[risk ratio (RR) 0.78, 95% confidence interval (CI) 0.65 to 0.93] when low doses of spinal bupivacaine (≤8 mg) are used for caesarean section.[10] All the patients in our case series were haemodynamically stable throughout the procedure. One patient had single episode of hypotension which responded to a single bolus dose of 100 μg of intravenous phenylephrine.

The main limitation of the EVE method is that it cannot be used in emergency LSCS as it is time consuming and sometimes there may be accidental migration of catheter into the intravascular or intrathecal space and a rapid rise of spinal block. Hence, it is essential to check the level of block before injecting epidural saline.

CONCLUSION

EVE technique can be safely used in high-risk cardiac patients coming for LSCS to achieve the desired level of surgical anaesthesia without causing adverse haemodynamic disturbances.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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