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Case Series

Anaesthesia Section

Balancing Maternal Cardiac Risk and Anaesthetic Safety: A Case Series on Segmental Spinal Anaesthesia

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ABSTRACT

Pregnancy evokes significant alterations to the physiologic conditions in females and it is more dramatic for women suffering from valvular heart diseases or congenital cardiovascular diseases. Increases in blood volume and cardiac output, as well as the tendency for decreases in systemic vascular resistance, can augment and worsen underlying disease and make anaesthesia for delivery and labour more complicated. In the management of cardiovascular diseases in women, a tailored, multidisciplinary approach can ensure the best outcome for both mothers and neonates. The present case series reports the application of Segmental Spinal Anaesthesia (SSA) in pregnant women suffering from complex cardiac conditions who require a caesarean section. The use of SSA has been recognised to minimise haemodynamic changes compared to spinal anaesthesia. By providing a regional block to select portions of the spinal cord, SSA mitigates hypotension and does not suffer from the sympathetic blockade that is readily seen in a traditional spinal anaesthetic. The present case series underscores the importance of individualised anaesthetic planning, holistic assessment of patients and multidisciplinary collaboration among obstetricians, anaesthetists and cardiologists. The findings suggest that SSA can be a safe and effective anaesthetic technique for high-risk obstetricpatients, particularly those with cardiovascular diseases, thereby providing a promising alternative togeneral anaesthesia or conventional spinal techniques for caesarean sections.

Keywords: Afterload, Cardiac output, Fluid therapy, Haemodynamics, Preload

INTRODUCTION

Pregnancy presents significant cardiovascular challenges inparturients with pre-existing valvular heart disease. The physiologicalchanges of pregnancy, like elevated cardiac output, increased intravascular volume and decreased systemic vascular resistance, can worsen underlying cardiac pathology, resulting in complications like pulmonary congestion, arrhythmias, or heart failure. In these high-risk parturients, anaesthetic care needs to balance maternal haemodynamic stability with foetal well-being [1].

The SSA can be used in such cardiac disease patients. Unlike conventional spinal anaesthesia, which may cause intense sympathetic blockade and hypotension, SSA is designed to achieve specific sensory blockade while maintaining preload and afterload. This is especially important in stenotic lesions, where the maintenance of afterload avoids cardiovascular decompensation and in regurgitant lesions, where maintained preload reduces sudden volume changes [2].

The present case series describes the anaesthetic care of five parturients with different valvular diseases undergoing caesarean delivery under SSA. The cases illustrate the significance of careful perioperative planning, personalised fluid and vasopressor management and postoperative care. Through the optimisation of haemodynamic stability, SSA enabled favourable maternal and neonatal outcomes while reducing the hazards of general anaesthesia or standard spinal methods.

CASE SERIES

The diagnosis, key findings and medications are described in [Table/Fig-1].

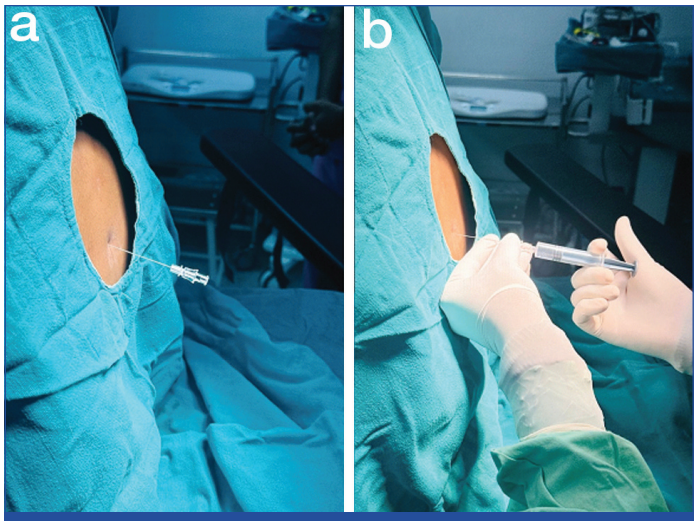
Anaesthetic Management

Patients were planned for elective lower-segment caesarean-section under SSA to ensure adequate surgical anaesthesia with minimal haemodynamic disturbances, which is vital in parturients with pre-existing cardiac valvular disease. Informed consent was obtained after the procedure and possible risks had been detailed. Patients were transferred to the operating room following sufficient fasting. Standard ASA monitoring was done. Two 18G intravenous cannulas were secured. Under aseptic conditions, the

Cases	Gestational age (WOG)	Diagnosis and duration	Key findings	Medications
Case 1	38 weeks	Severe Mitral Stenosis (MS)+Pulmonary Hypertension (Diagnosed 5 years ago)	Mitral valve area: 1.0 cm², Mean gradient: 12 mmHg, Pulmonary arterial systolic pressure: 50 mmHg, NYHA Class III, Mid-diastolic murmur, Peripheral oedema	Frusemide 20 mg/day, Metoprolol 50 mg/day
Case 2	37 weeks	Mild Aortic Stenosis (AS) (Diagnosed 3 years ago)	Valve area: 1.6 cm², Systolic ejection murmur, Normal EF, Mild fatigue	Metoprolol 25 mg/day, Aspirin 75 mg/day
Case 3	39 weeks	Mitral Valve Prolapse (MVP)+Severe Mitral Regurgitation (MR) (Diagnosed 2 years ago)	EF: 60%, Palpitations, Intermittent exertional dyspnoea, Pan-systolic murmur radiating to the axilla	Bisoprolol 2.5 mg/day, Spironolactone 25 mg/day, Ramipril 2.5 mg/day (stopped at pregnancy confirmation)
Case 4	38 weeks	Severe Tricuspid Regurgitation (TR)+RHD (Diagnosed 6 years ago)	Severe TR, Mild right ventricular dilatation, Holosystolic murmur, Pedal oedema, JVP distension	Frusemide 20 mg/day, Spironolactone 25 mg/day
Case 5	37 weeks	Prosthetic mitral valve with anticoagulation (Mitral valve replacement 5 years ago)	Mechanical mitral valve (5 years post-replacement), Well-functioning prosthesis on echocardiogram	Warfarin 3 mg/day (until 36 WOG, LMWH 40 mg SC BD (since 36 WOG)

[Table/Fig-1]: Clinical and diagnostic details of five pregnant women with cardiac valvular disease undergoing caesarean delivery under segmental spinal anaesthesia.
WOG: Weeks of gestation; JVP: Jugular venous pressure; RHD: Rheumatic heart disease; EF: Ejection fraction; TR: Tricuspid regurgitation; BD: Twice daily; LMWH: Low molecular weight heparin; NYHA: New York heart association

T9-T10 interspace was identified. Under local anaesthesia, a 27G Quincke spinal needle was advanced using the midline approach cautiously into the subarachnoid space. After obtaining free flow of cerebrospinal fluid, 7 mg of isobaric levobupivacaine and 25 µg of fentanyl were administered, as seen in [Table/Fig-2a,b]. The resulting sensory block extended from T4-T6 to L2-L3 assured satisfactory anaesthesia.



[Table/Fig-2a,b]: Administration of SSA.

Fluid resuscitation was individualised for each patient. The patients were placed supine with a slight left lateral tilt to promote uteroplacental perfusion. Phenylephrine, ephedrine and atropine were used to manage hypotension and bradycardia as required. Patients were monitored closely in the High Dependency Unit (HDU) for 24 to 48 hours. Early mobilisation was promoted in order to avoid thromboembolic complications. The pain was managed by intravenous paracetamol 1 g or tramadol 50 mg. Neonatal outcome was excellent, with good Appearance, Pulse, Grimace, Activity and Respiration (APGAR) scores in all newborns.

Intraoperative Findings and Neonatal Outcomes

In Case 1, there were occasional hypotensive episodes necessitating intermittent administration of phenylephrine. The neonate had APGAR scores of 8 and 9 at one and five minutes, respectively. The patient was treated with diuretics and discharged on postoperative day 5 without any complications. Case 2 exhibited minimal fluctuations in blood pressure and the infant's APGAR scores were 9 at one and five minutes. The patient was discharged uneventfully on day 3.

Case 3 had uneventful intraoperative haemodynamics without arrhythmias. The neonate had one and 5-minute APGAR scores of 9 and 10, respectively. She was discharged on day 4 in a stable condition. Case 4 had insignificant blood pressure variations, which were controlled by phenylephrine. The neonate was well, with APGAR scores of 8 and 9. Postoperative management involved 48-hour observation in HDU and diuretics. She was discharged uneventfully on day 6.

Case 5 underwent an uneventful surgery without hypoxia or excessive haemorrhage. The neonate had APGAR scores of 8 and 9 at one and five minutes, respectively. The patient was given LMWH for prophylaxis against thromboembolism. On the 7th postoperative day, the patient was discharged and did an excellent recovery. She was closely followed during recovery for signs of thromboembolism or other postoperative problems and followed-up for any progress in the management of her cardiac condition.

DISCUSSION

Pregnancies complicated by heart disease require an understanding of the maternal cardiovascular physiology, as well as the pathological implications of the underlying condition [3]. Pregnancy causes a series of adaptive cardiovascular changes in the form of increased intravascular volume, cardiac output and decreased systemic vascular resistance. These alterations pose a tremendous load on the heart in patients with heart disease and can cause arrhythmias or heart failure, particularly during delivery and labour.

Pulmonary hypertension, which is commonly seen in these patients, further complicates the situation. This population is at greatest risk of experiencing right ventricular failure as well as hypoxaemia during this critical gestation time [4,5].

Conventional spinal anaesthesia causes a profound sympathetic blockade and leads to marked hypotension. SSA uses local anaesthetics to block segments that are involved in the procedure specifically rather than blocking all of them. This approach results in a decrease in the levels of the sympathetic blockade and thus preserves the systemic vascular resistance without a sharp fall inblood pressure [6]. This is especially valuable in stenotic valvular lesions because the patients rely on the preservation of afterload for adequate cardiac output and systemic perfusion. SSA resolves the haemodynamic problems in the setting of regurgitant lesions through the provision of stable preload and controlled systemic vascular resistance that minimises the volume overload to the heart. The reduced sympathetic blockade by SSA will decrease the risk of acute right ventricular failure due to its aversion to the dramatic afterload reduction that occurs with traditional spinal anaesthesia. Even in patients who have prosthetic valves, it is equally helpful, as preserving haemodynamic stability is critical for preventing valve dysfunction, thrombosis, or embolic events [7,8].

Apart from the haemodynamic stability, there are other benefits of SSA. By limiting the motor block to minimum levels, SSA maintains diaphragmatic function, which is highly significant for patients with pulmonary hypertension or advanced heart failure, as these conditions are associated with diminished respiratory reserve. In addition, SSA allows excellent intraoperative anaesthesia with a reduction the need for systemic opioids, that may depress respiratory function or aggravate pulmonary congestion. The sensory block obtained with SSA is adequate for providing surgical anaesthesia and rendering rapid recovery of motor function postoperatively, thus promoting early mobilisation and minimising the risk of thromboembolic complications [9,10].

In the present cases, SSA played a crucial role in bringing about successful maternal and foetal outcomes. In severe MS complicated by pulmonary hypertension, SSA was indispensable in maintaining an almost precarious balance between preload and afterload in order to avoid right heart strain or pulmonary vascular crises. With Aortic Stenosis (AS) avoidance of marked vasodilation served to preserve the afterload required to maintain left ventricular function. With very severe regurgitant lesions, SSA was highly useful in the prevention of abrupt increases in systemic vascular resistance, which could potentially worsen the patient's condition. For patients with prosthetic valves, SSA provided stability within perioperative haemodynamics, with reduced risks of thromboembolic events [8].

This clinical case series underlines the importance of careful planning as well as communication between multidisciplinary teams. Detailed preoperative cardiac assessment and echocardiograms were incorporated into the preanaesthetic check-up, guided the perioperative management. Volume optimisation and heart rate control were achieved with the use of diuretics and beta-blockers, respectively. Individualised fluid management and vasopressors were used to stabilise the haemodynamic parameters without jeopardising uteroplacental flow. Care in the HDU postsurgery was focused on the closely monitoring cardiac function, fluid status and complications like arrhythmias or heart failure. Multimodal analgesia (SSA, paracetamol and tramadol) was employed for pain management with minimal opioid use. The prime focus was to ensure recovery without exerting undue stress on the cardiopulmonary system [9,11].

Kaniyil S et al., had five parturients with cardiovascular disease having caesarean section using successful SSA. The authors underscored the benefit of SSA over standard spinal anaesthesia, citing its ability to reduce haemodynamic instability. A combined epidural-SSA technique, accompanied by invasive monitoring, was used. Mild hypotension was noted in the study and was adequately controlled with phenylephrine. The postoperative course was uncomplicated, supporting SSA as a safer option for obstetric patients with cardiovascular disease [12].

CONCLUSION(S)

The present series of cases emphasises the efficacy of SSA as a useful anaesthetic technique for caesarean delivery in pregnant women with cardiac disease. Its ease, capacity to produce controlled anaesthesia and minimal haemodynamic alterations render it a valuable choice for high-risk patients. The positive results seen in these cases indicate that SSA can improve perioperative safety in parturients with cardiac disease. Further research is warranted to expand knowledge on its use and optimise management strategies for pregnant women with complex cardiovascular co-morbidities.

REFERENCES

[1] Nanna M, Stergiopoulos K. Pregnancy complicated by valvular heart disease: An update. J Am Heart Assoc. 2014;3(3):e000712.
[2] Chauhan R, Sabharwal P, Sarna R, Meena S. Thoracic spinal anesthesia for cesarean section in severe pre-eclampsia: Exploring a new dimension. Ain-Shams J Anesthesiol. 2021;13(1):22.
[3] Collins HE, Alexander BT, Care AS, Davenport MH, Davidge ST, Eghbali M, et al. Guidelines for assessing maternal cardiovascular physiology during pregnancy and postpartum. Am J Physiol-Heart Circ Physiol. 2024;327(1):H191-H220.
[4] Pieper PG. The pregnant woman with heart disease: Management of pregnancy and delivery. Neth Heart J. 2012;20(1):33-37.
[5] Sahu AK, Harsha MM, Rathoor S. Cardiovascular diseases in pregnancy- A brief overview. Curr Cardiol Rev. 2022;18(1):e250821195824.
[6] Deshpande JP, Nath RR, Kulkarni PB, Atram S. Thoracic segmental spinal anaesthesia a boon in challenging case scenarios: A case series. Indian J Clin Anaesth. 2024;11(3):421-25.
[7] Mulugeta H, Zemedkun A, Getachew H. Selective spinal anesthesia in a patient with low ejection fraction who underwent emergent below-knee amputation in a resource-constrained setting. Local Reg Anesth. 2020;13:135-40.
[8] Le Roux JJ, Wakabayashi K, Jooma Z. Defining the role of thoracic spinal anaesthesia in the 21st century: A narrative review. Br J Anaesth. 2023;130(1):e56-e65.
[9] Paul A, Borkar A. Anaesthetic management for mastectomy in a male with unilateral gynecomastia: The utilization of thoracic segmental spinal anaesthesia and erector spinae plane block. Cureus. 2023;15(10):e47502.
[10] Yeoh S, Leong S, Tiong Heng A. Anaesthesia for lower-segment caesarean section: Changing perspectives. Indian J Anaesth. 2010;54(5):409-14.
[11] Freeman WK, Gibbons RJ. Perioperative cardiovascular assessment of patients undergoing noncardiac surgery. Mayo Clin Proc. 2009;84(1):79-90.
[12] Kaniyil S, Paliwal NW, Susheela I, Mancheri S. Thoracic segmental spinal anaesthesia in high-risk obstetrics – A case series. Indian J Anaesth. 2025;69(3):328-30.

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