CASE REPORT

Impella left ventricular assist device in cardiac arrest after spinal anaesthesia for caesarean section

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SUMMARY

Cardiac arrest after neuraxial anaesthesia is very well described. Inhibition of the sympathetic efferent system and vagal activation leading to decrease preload and severe bradycardia results in cardiac arrest. Pregnant patients undergoing spinal anaesthesia are at increased risk for vasovagal events due to aortocaval compression and higher level of spinal block. A 36-year-old pregnant woman at 39 weeks presented for an elective caesarean section. She underwent spinal anaesthesia. Immediately after, she had severe bradycardia followed by asystole cardiac arrest. She had spontaneous return of circulation. The patient was in cardiogenic shock causing pulmonary oedema and required four vasopressors to maintain her blood pressure. An Impella 2.5 percutaneous microaxial left ventricle (LV) support device was inserted to support her haemodynamics. She fully recovered and was discharged in stable condition. To the best of our knowledge, this is first case report of the use of an LV-assist device in a patient postcardiac arrest from spinal anaesthesia.

BACKGROUND

Incidence of cardiac arrest after spinal anaesthesia is 0.07%.¹ When it occurs in pregnant patients undergoing caesarean section, it adds to maternal mortality and morbidity. Cardiac arrest should be promptly recognised and managed appropriately. Left ventricular assist devices (LVADs) can be very helpful in supporting haemodynamics in these critically ill-patients. Early use of a temporary LVAD should be considered in patients with cardiogenic shock.

CASE PRESENTATION

A 36-year-old G4P3 woman presented at 39 weeks for an elective caesarean section for obstetrical indications. She was in normal health and had undergone two prior caesarean sections. She had performed all her normal daily activities hours before presenting to the hospital. She received spinal anaesthesia and her uterus was exteriorised; minutes later, she became bradycardic and hypotensive, and had pulseless electrical activity (PEA)/asystole cardiac arrest. She was successfully resuscitated after 2 min of advanced cardiac life support, and intubated. She received 1 mg of epinephrine. Her uterus was incised and the infant was delivered in healthy condition. After repair of the uterine incision and closure, the patient was transferred to the intensive care unit. Postresuscitation, hypothermia protocol was initiated and she was cooled to a temperature of 35°C for 24 h. She continued to remain

hypotensive and required four vasopressors to maintain her blood pressure: epinephrine, phenylephrine, vasopressin and norepinephrine. There was no evidence of increased blood loss during her caesarean section.

The patient had no known past medical history and had not been on any medications apart from her prenatal medicines; she was a non-smoker, and did not drink alcohol or indulge in illicit drug use.

Her vitals postarrest were: pulse 132 bpm, blood pressure 86/64 mm Hg and saturation 85% on 100% oxygen. S1 and S2 were normal and S3 had no gallop and no murmurs. There were bilateral crepitations on auscultation. The postoperative state of the abdomen included a clean incision site, and firm and contracted uterus.

INVESTIGATIONS

Complete haematological work up postarrest showed haemoglobin of 11.8 (12–14 g/dL). The coagulation panel was not consistent with disseminated intravascular coagulation (DIC). Creatinine was 1.29 mg/dL (0.6–1.2 mg/dL) and potassium was 6.7 mmol/L (3.5–5.0 mmol/L).

Chest X ray was consistent with bilateral coarse alveolar opacities. Lower extremity duplex ultrasound was negative for deep venous thrombosis (DVT). ECG showed sinus tachycardia. Two-dimensional echocardiogram was performed and revealed severe impairment of LV systolic function with ejection fraction of <20% and mild right ventricular dysfunction. On right heart catheterisation, the wedge pressure was elevated 20 mm Hg and cardiac index was depressed to 2.0 L/min/m².

DIFFERENTIAL DIAGNOSIS

Four differential diagnoses were considered while managing the patient.

1. Cardiac arrest secondary to spinal anaesthesia, vagotonia and inhibition of sympathetic nervous system followed by postarrest stunning and cardiogenic shock
2. Peripartum cardiomyopathy
3. Amniotic fluid embolism
4. Pulmonary embolism

The patient's presentation and temporal course of asystole/PEA cardiac arrest immediately following spinal anaesthesia was consistent with Bezold-Jarisch reflex, which results in a cardioinhibitory response, peripheral vasodilation and circulatory collapse.²

The patient was in normal health before the cardiac arrest and denied any shortness of breath or pedal oedema. She did not receive a massive

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Figure 1 Fluoroscopic view of the Impella left ventricular assist device.

transfusion or intravenous fluid, which can result in fluid overload and pulmonary oedema if the LV function is impaired. Thus peripartum cardiomyopathy was low on the list but could not be excluded.

Cardiac arrest occurred before the delivery and the coagulation panel was not consistent with a DIC-like state. Hence amniotic fluid embolism was excluded. There was no evidence of right ventricular strain and lower extremity duplex was negative for DVT, making the diagnosis of pulmonary embolism unlikely.

TREATMENT

The patient was in critical condition on presentation. She was in cardiogenic shock requiring four vasopressors and inotropes to maintain her blood pressure. Pump failure was the primary operant mechanism with cardiogenic pulmonary oedema. The hypoxic event was transient and responded with high positive end-expiratory pressure and recruitment. Therefore temporary LV support with the Impella was chosen as an initial strategy. If hypoxia would be persistent, V-A extracorporeal membrane oxygenation (ECMO) would be considered and was reserved as a backup option. A 13 Fr Impella 2.5 percutaneous microaxial heart pump was inserted from the right femoral artery into the LV, to achieve a cardiac output of 2.5 L/min (figure 1). The inlet of the Impella was positioned into the LV and the outlet was in the ascending aorta; it unloaded the LV by pumping the blood from the LV into the aorta. Intravenous unfractionated heparin therapy was initiated and continued until the Impella was in place. There was marked improvement in haemodynamics; vasopressors were weaned off in 48 h and the Impella LVAD was removed after 48 h. The patient was extubated on day 4 of her hospital stay. Her course was complicated by acute tubular necrosis, which recovered without the need for renal replacement therapy. She was discharged from the hospital on day 14 on carvedilol and advised to follow-up in 4 weeks.

OUTCOME AND FOLLOW-UP

The patient continued to follow-up until 6 months after her index event. There was complete recovery of her LV function.

She is back to her baseline and can perform all her usual activities without any limitation.

DISCUSSION

Spinal anaesthesia, although considered a safe procedure, is not without its complications. These can range from a simple headache to a far more serious cardiac arrest. Cardiac arrest after spinal anaesthesia has been reported in the literature since the early 1990s. The exact mechanism of cardiac arrest is not completely understood, but the imbalance in the autonomic nervous system with the blockade of sympathetic nerves and increased activity of the parasympathetic nerves seems to be the final pathway.² During pregnancy and delivery, these reflexes are exaggerated due to aortocaval compression.^{3 4} After resuscitation, there can be myocardial stunning leading to a decrease in cardiac output and hence cardiogenic shock. The initial therapy for treatment of non-ischaemic cardiogenic shock is use of inotropes or vasopressor agents or both, and use of mechanical circulatory support. Intra-aortic balloon pump (IABP), ECMO, Impella and TandemHeart are current temporary mechanical circulatory devices used for circulatory support in cardiogenic shock. Augmentation of cardiac output by IABP is 0.5 L/min versus ECMO and LVAD is (2.5–5 L/min). ECMO (V-A) is the device of choice in patients with hypoxic respiratory failure from cardiogenic pulmonary oedema. In our patient, an Impella LVAD was used to provide circulatory support as there was improvement in oxygenation with ventilator support. This is the first case report describing the use of an Impella LVAD in a patient postcardiac arrest from spinal anaesthesia.

Learning points

- ▶ Cardiac arrest after spinal anaesthesia is due to a cardioinhibitory response resulting in bradycardia and asystole.
- ▶ It should be identified early and treated appropriately with atropine and epinephrine.
- ▶ Mechanical circulatory support with a ventricular assist device can help in unloading of the left ventricle, and can provide haemodynamic support.
- ▶ Early use of left ventricular assist device should be considered in patients with cardiac arrest.

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REFERENCES

- 1 Pollard JB. Cardiac arrest during spinal anesthesia: common mechanisms and strategies for prevention. *Anesth Analg* 2001;92:252–6.
- 2 Limongi JA, Lins RS. Cardiopulmonary arrest in spinal anesthesia. *Rev Bras Anesthesiol* 2011;61:110–20.
- 3 Osazuwa MO, Edomwonyi NP. Cardiac arrest following spinal anaesthesia for caesarean section: a case report. *West Afr J Med* 2012;31:207–10.
- 4 Birnbach DJ, Ranasinghe JS. Anesthesia complications in the birthplace: is the neuraxial block always to blame? *Clin Perinatol* 2008;35:35–52.

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