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Tailoring anaesthesia in Takayasu arteritis: A rare vascular enigma

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Abstract
Takayasu's arteritis (TA), also called Pulseless Disease, is a rare, chronic progressive pan-endarteritis involving the aorta and its main branches. Severe uncontrolled hypertension, end-organ dysfunction resulting from hypertension, stenosis of major blood vessels affecting regional circulation, and difficulties encountered in monitoring arterial blood pressure complicate the anaesthetic management in a patient with TA. We share one such case of TA posted for restoration of bowel continuity/ stoma closure as a sequale of mesenteric ischaemia about their peri-operative concerns, difficulties and management. Vigilant intraoperative monitoring with a high index of suspicion, combined with targeted diagnostic investigations, is crucial for establishing the diagnosis, and proactive postoperative intensive care management is the foundation of achieving optimal surgical outcomes while minimising perioperative morbidity.

Keywords: Anaesthesia, Takayasu arteritis, monitoring

Introduction
Takayasu's arteritis (TA), also called Pulseless Disease, is a rare, chronic progressive pan-endarteritis involving the aorta and its main branches. Severe uncontrolled hypertension, end-organ dysfunction resulting from hypertension, stenosis of major blood vessels affecting regional circulation, and difficulties encountered in monitoring arterial blood pressure complicate the anaesthetic management in a patient with TA. As Takayasu's arteritis is a rare disease with female preponderance (9:1) and the global incidence of 1.2-2.6 cases per million annually, thence, existing literature has been limited to isolated case reports mostly in women undergoing caesarean delivery and scarcely about cardiac and neurointervention. We share one such case of TA posted for restoration of bowel continuity/ stoma closure as a sequale of mesenteric ischaemia about their peri-operative concerns, difficulties and management.

Case Report
A 30-year-old male, with a height of 172 cm and a weight of 58 kg, presented for restoration of bowel continuity surgery under general anaesthesia. He had previously undergone an exploratory laparotomy with resection of the jejunum and ileum due to mesenteric ischemia, followed by the formation of a loop ileostomy. The current procedure was planned as a corrective step to restore intestinal continuity.

The patient's medical history was significant for a cerebrovascular accident (CVA) and hypertension with complete paralysis in the left upper and lower limbs. Since then, he has been wheelchair-bound. He also reported a history of chronic active smoking, alcohol consumption, and tobacco chewing, all ongoing for the past 10 years. History s/o long-standing neuropathies also present. Additionally, he had received multiple blood transfusions in the past, possibly during or after his previous surgical interventions.

He was on regular medications, including Aspirin 75 mg, Atorvastatin 20 mg, Pregabalin 150 mg, Amlodipine 5 mg, and Atenolol 50 mg, indicating ongoing management of cardiovascular and neurological risk factors.

On general physical examination, the patient appeared underweight, with a calculated Body Mass Index (BMI) of 19.6 kg/m². Notably, palpable peripheral pulses were absent in the left upper limb, while the right upper limb showed palpable pulsations. Blood pressure measured

non-invasively in the right arm was 126/86 mmHg, and the right lower limb was 116/78 mmHg. His heart rate was 99 beats per minute, regular in rhythm. He had a baseline saturation of 98% on room air.

The patient's blood investigations, including complete hemogram, liver and renal function tests, coagulation profile, serum electrolytes, and arterial blood gas analysis, were within normal limits. His chest radiograph also appeared unremarkable.

Doppler ultrasonography of the bilateral upper limbs revealed monophasic arterial flow in the left upper limb distal to the subclavian artery, suggestive of impaired perfusion. In contrast, arterial and venous flows in the right upper limb and both lower limbs were found to be normal. No evidence of DVT. Interestingly, CT angiography of the upper limbs did not reveal any structural abnormalities, indicating no significant vascular obstruction or lesion.

Magnetic Resonance Imaging (MRI) of the brain showed evidence of a chronic infarct in the left anterior cerebral artery (ACA) territory, involving the left paramedian frontal cortex, left superior frontal gyrus, and left parietal lobe. Additionally, there was mild prominence of the cerebral sulcal spaces on the left side, likely reflecting underlying cerebral atrophy (L > R) or chronic ischemic changes.

The patient was scheduled for restoration of bowel continuity under general anaesthesia. Two 18-gauge intravenous cannulas were secured—one in the right hand and another in the left lower limb. Standard ASA monitoring was initiated, ECG shows NSR, HR-110 per minute, NIBP- 140/78 mmHg, measured in the right upper limb, temperature probe. Additionally, BIS and NMT were attached after induction (calibrated before muscle relaxation)

Premedication was administered with intravenous Inj. Fentanyl 100 micrograms and Inj. Midazolam 1 mg, given five minutes before induction. General anaesthesia was induced using Inj. Propofol 80 mg, and after confirming adequate bag-mask ventilation with 100% oxygen, intubated 3 minutes after administration of Inj. Rocuronium 40mg.

Anaesthesia was maintained using a mixture of sevoflurane and air in a 1:1 ratio, maintaining a minimum alveolar concentration (MAC) of 0.8 to 0.9, maintaining a BIS value between 40 and 60 and SEF of 15%, along with intermittent boluses of Inj. Rocuronium 10 mg for muscle relaxation guided by neuromuscular monitoring. Careful padding of all pressure points was done. A forced-air warming blanket and fluid warmer were used. DVT pumps were attached. During surgery, the BIS value suddenly dropped to 10; no drug was given to deepen the anaesthetic plane, which raised the suspicion of cerebral hypoperfusion. Repeat NIBP reading was 70/38 mmHg, which was managed aggressively with fluids and a bolus of Inj. Phenylephrine 10 mcg IV. The rest of the intraoperative course was uneventful, and the total duration of the surgery was two and a half hours. At the conclusion of the procedure, the patient was successfully extubated in the operating room and shifted to HDU for monitoring.

Discussion

Takayasu arteritis is a chronic granulomatous inflammatory illness that affects the thoracic aorta, its branches, and possibly the pulmonary artery. Symptoms of big vascular vasculitis include hypertension (renal artery stenosis), aortic regurgitation (aortitis), stroke (carotid artery blockage), claudication of the limbs, and loss of peripheral pulse.

Table 1: Classification of the disease [1]

Type	Vasculature involved
Type I	only the branches of the aortic arch
Type IIa	ascending aorta, aortic arch, and its branches
Type II b	ascending aorta, aortic arch, its branches, and thoracic descending aorta
Type III	descending thoracic aorta, abdominal aorta, and/or the renal arteries
Type IV	only the abdominal aorta and/or renal arteries
Type V	features of both Type IIb and IV

Our patient presented with Type I Takayasu arteritis involving the brachiocephalic, common carotid, and subclavian arteries. MRI, USG and Angiography commonly confirm the diagnosis.

The main issues stem from dreaded consequences such as retinopathy, renovascular hypertension, aortic regurgitation, and aneurysm. Patients typically present to the operating room as a result of complications, such as our case, who had an acute abdomen due to mesenteric ischemia, old CVA and hypertension.

Anaesthetic management presents several challenges, including assessing blood pressure at multiple places, monitoring organ perfusion during anaesthesia, maintaining acid-base and electrolyte balance, and managing body temperature.

In awake patients, under regional anaesthesia, monitoring cerebral circulation is possible. However, sympatholysis from subarachnoid block (SAB) may compromise end-organ function.

Under general anaesthesia, hemodynamic fluctuations during intubation and extubation may cause rupture of vessels, which mandates the monitoring of different organ systems to ensure adequate perfusion peri-operatively. Smooth and safe conduct of anaesthesia is recommended. These patients are prone to secondary chronic hypertension, and their cerebral blood flow (CBF) autoregulation curve shifts to the right. The lower MAP limit, at which autoregulation of CBF is maintained, is likely higher in these patients, further emphasising the importance of tighter BP control [2]. They are highly prone to intraoperative hypotension under GA because of sympatholysis. Therefore, it is preferred to combine drugs which will lead to minimal fluctuation in Heart & BP.

Blood pressure monitoring

Difficulty in monitoring blood pressure in the upper limbs, necessitating lower limb NIBP. Blood pressure measurements in the extremities may not be accurate and differ from aortic and cerebral perfusion pressures [3].

- Doppler ultrasound may be used to identify an artery for measuring blood pressure [4].
- Blood pressure recording from occluded vessels may

under-read blood pressure, leading to inappropriate use of vasopressors. This will lead to iatrogenic hypertension and subsequent adverse outcomes like headache and visual problems.

- IBP can be monitored if required, but it is better to avoid it to prevent damage to the existing normal vessels [1].

Monitoring for end-organ function

1. Bispectral index (BIS): allows adequate depth of anaesthesia (target to BIS - 40 to 60 for adequate surgical plane, with SQI -90%, SEF < 15%, EMG- 30, BSR -0)
2. Any unexplained (not drug-induced) fall in BIS value indicates cerebral hypoperfusion, which usually accompanies systemic hypotension, which happens in our case [5]. Literature reports Delayed Cerebral Ischaemia (DCI) in patients with TA who experienced systemic hypotension episodes intraoperatively. Therefore, we also suggest that BIS be used wherever possible, as BIS also helps in early detection of hypotension episodes if IBP monitoring is not done, thus taking another precaution to prevent DCI [6, 7].
3. Urine output should be maintained at least 0.5 ml/kg/hour to ensure adequate renal perfusion.
4. Respiratory monitoring: Maintaining normoxia and normocabia allows normal pulmonary blood flow. ETCO2 should be maintained within normal range to prevent cerebral vasoconstriction and thus prevent cerebral ischemia.
5. 12 lead ECG monitoring for, new onset LBBB, ST segment changes to monitor ischaemic insult to myocardium peri-operatively. Cardiac output monitoring may be considered, depending on the availability of resources (peripherally inserted), which allows for efficient fluid, blood products and vasopressor management.
6. With the evidence of thrombosis in major vessels, central venous access is controversial or may not be an option.

As there are no specific anaesthetic recommendations, either general anaesthesia or regional anaesthesia should be considered, customised to the patient's comorbidities and surgical needs, weighing the risks and the benefits of either [4]. Patients on antiplatelets and anticoagulants should be discontinued for the recommended duration preoperatively in situations where central neuraxial blocks are planned. For other medications, standard ASA guidelines should be followed. Chronic use of corticosteroids (Cushingoid's features) could potentially lead to adrenal suppression during stress, infections; therefore, peri-operative supplementation should not be missed [8].

Conclusion

Detailed pre-anaesthetic evaluation and diligent perioperative planning are required to guarantee the safe administration of anaesthesia in these individuals. Furthermore, vigilant intraoperative monitoring with a high index of suspicion, combined with targeted diagnostic investigations, is crucial for establishing the diagnosis, and proactive postoperative intensive care management is the foundation of achieving optimal surgical outcomes while minimising perioperative morbidity.

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