CASE REPORT

Implications for Anesthesia in Takayasu's Arteritis for Bentall Surgery

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Abstract

Takayasu's arteritis (TA) is a rare chronic granulomatous inflammatory disease of the aorta, commonly affecting young females. Cardiovascular manifestations of TA include a carotid bruit, blood pressure (BP) differences in arms and claudication of extremities. Anesthesia in TA necessitates precise monitoring of BP. Preservation of end-organ perfusion, especially in cardiac surgery on cardiopulmonary bypass (CPB), is one of the most challenging aspects of anesthesia in TA undergoing aortic surgery. We report a case of a young lady of TA who presented with ascending aortic aneurysm, occlusion of branches of the aorta with severe aortic regurgitation (AR), who underwent Bentall surgery successfully. We also describe the anesthesia implications in this case to demonstrate the challenges of monitoring pulseless disease, maintenance of hemodynamics, and perfusion, which is essential for preventing permanent tissue damage in a tissue-flow compromised state.

Keywords: Anesthesia implication, Aorta occlusion, Bentall surgery, Takayasu arteritis.

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Introduction

Takayasu arteritis is a rare chronic granulomatous inflammatory arteritis of unknown etiology, also known as the pulseless disease, aortic arch syndrome, or occlusive thrombo-arthropathy. TA affects the large arteries, aorta, and branches. The disease is associated with end-organ ischemia and failure.[1] It is common in the Asian population, and mostly young females are affected. The highest prevalence of 40/million is found in Japan and the lowest one at 0.9/million in the United States.[2] From the insertion of invasive monitoring cannulae to perioperative management, the physician, should be well-versed in multimodality monitoring to prevent complications at various phases of surgery. Here we describe a case of a young lady who presented to us with ascending aorta aneurysm, occlusion of various branches of the aorta, with severe AR and underwent an uneventful Bentall.

Case Description

A 27-year-old lady (weight- 50 kg, height- 160 cm) presented with complaints of dyspnea on exertion, palpitations, and chest pain for the last 2 years. Her past history included a cesarean section 4 years ago, which was uneventful. She was on metoprolol 25 mg/day and prednisolone 5 mg/day preoperatively. On clinical examination, she had a feeble left brachial arterial pulse, audible carotid bruit on the left neck and on auscultation, and high-pitched, early diastolic decrescendo murmur. Her noninvasive BP was 150/90 mm Hg in the right upper limb, 120/70 mm Hg in the left upper limb, 130/80 mm Hg in the right lower limb, and 132/84 mm Hg in the left lower limb. The preoperative electrocardiogram (ECG) was normal, and oxygen saturation was 99% by pulse oximetry in the four extremities. Transthoracic echocardiography revealed severe AR, with flow reversal in descending aorta and a dilated ascending aorta of 47 mm in size. Computed tomographic angiography (CTA) showed circumferential thickening of ascending aorta, arch of the aorta and descending aorta (7 mm maximum thickness) with mild narrowing of the lumen (Fig. 1) and normal coronaries. Complete occlusion of the left common carotid artery with distal reformation through collaterals, ostial stenosis of the celiac trunk, and left superficial

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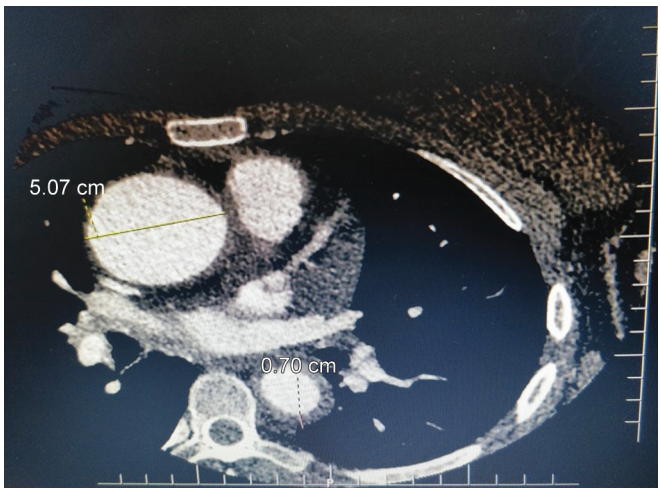

Fig. 1: A CTA showing diffuse circumferential thickening of aortic wall and aneurysm of ascending aorta

femoral artery were other significant findings. CTA brain was normal. The ascending aorta was aneurysmally dilatation with a diameter of 5 cm. Blood investigations were within normal limits. In the operating room, standard American society of anesthesiologists monitoring was applied before the insertion of invasive lines. Peripheral wide bore 14G intravenous cannula secured on right-hand and ultrasound (USG) guided four French right femoral artery cannula secured under local anesthesia. Anesthesia was induced with a combination of fentanyl, midazolam, propofol 1%, and endotracheal intubation was performed after administration of pancuronium with a 7.5 French endotracheal tube using video laryngoscope (McGrath MAC™, Medtronic; United Kingdom). A central venous triple lumen catheter 7 French 13 cm line was inserted under USG guidance into the right internal jugular vein, along with a pulmonary artery (PA) continuous cardiac output catheter (CCO) monitoring (over an 8.5 French sheath). We inserted the right radial arterial line (20 gauges) after modifying Allen's test. Antibiotic prophylaxis, tranexamic acid (1.5 gm) and methylprednisolone (1 gm) were administered prior to the skin incision. Anesthesia was maintained with isoflurane, and depth of anesthesia was monitored with bispectral index (BIS), maintaining a value between 40 and 50. Additionally, cerebral oximetry, peripheral abdominal tissue oximetry by placing oximetry leads on the bilateral flanks, arterial blood gas (ABG) parameters with lactate, pulmonary mixed venous oxygen saturation (SvO_2), temperature (rectal and nasal) and urine output were monitored during the course of surgery.

Precardiopulmonary bypass transoesophageal echocardiography (TEE) revealed a thickened wall of descending aorta (8 mm) (Fig. 2), arch of aorta, and ascending aorta (showed severe AR, dilated ascending aorta- 4.7 cm), and moderate left ventricular systolic dysfunction.

Intraoperatively, there was a marked thickening of the aortic wall visualized by the surgeons (Fig. 3). Surgically, a composite graft valve conduit (mechanical aortic valve- 23 mm; St. Jude Medical, Abbott; Minneapolis and a woven Dacron graft- 26 mm; Hema shield, Maquet; Germany) with coronary reimplantation (Bentall procedure) was performed under moderate hypothermia on CPB with regular cannulation technique.

Weaning from CPB commenced with dobutamine (5 mcg/kg/minute) and adrenaline (0.05 mcg/kg/minute) infusion. Separation from CPB was successful, with the patient in sinus rhythm, good hemodynamics, and satisfactory blood gas parameters with minimal inotropic support. Post-CPB, TEE showed moderate left ventricular systolic dysfunction, with the normal function of the composite graft. Post-CPB coagulopathy is managed using blood and blood products, with the help of thromboelastometry. We shifted the patient to the intensive care unit sedated, ventilated, and with stable hemodynamics. She was extubated after a period of overnight ventilation.

Discussion

A Japanese ophthalmologist named Mikito Takayasu first described TA in 1908.[3] Out of the five types of TA (angiographically), type IV (abdominal aorta and its branches), and type V (diffuse variant) are common in the Indians.[4] They have proposed genetic predisposition with the presence of human leukocyte antigen-Bw52 and class I chain-related gene A is responsible for this disease. Diagnosis of the disease is usually confirmed by clinical presentation, arteriography, vessel biopsy, magnetic resonance imaging, CTA, and laboratory findings [erythrocyte sedimentation rate (ESR), C-reactive protein (CRP)].[5] In the case presented, the patient was on appropriate medical treatment before and during surgery. As the preoperative TTE revealed severe AR, with flow reversal in descending aorta and a dilated ascending aorta of 47 mm size, a Bentall surgery was performed. Although the preoperative CTA revealed diffuse thickening of the aorta, causing mild narrowing of the lumen, there was no difficulty in the cannulation of the aorta. Complete occlusion of the left common carotid artery with distal reformation through collateral was seen, hence was not addressed. Ostial stenosis of the celiac trunk and left superficial femoral artery were other significant findings but were not addressed as there was adequate collateralization seen. CTA brain was normal. Hypothalamic-pituitary-adrenal axis suppression is a clinical concern in chronic steroid therapy. Although the evidence for administering perioperative stress dose steroids is inadequate, giving steroids appears to carry minimal risk compared to the risk of adrenal crisis.[6] TA is the most common cause of renovascular hypertension (HTN) in India; therefore control of HTN, to prevent aneurysm rupture, cerebral hemorrhage, and cardiac dysfunction is vital. Monitoring of both upper and lower limb BP was done, as there is a difference of 20 mm Hg. Table 1 shows a brief outline of various systemic involvement of the disease and its anesthesia implications.

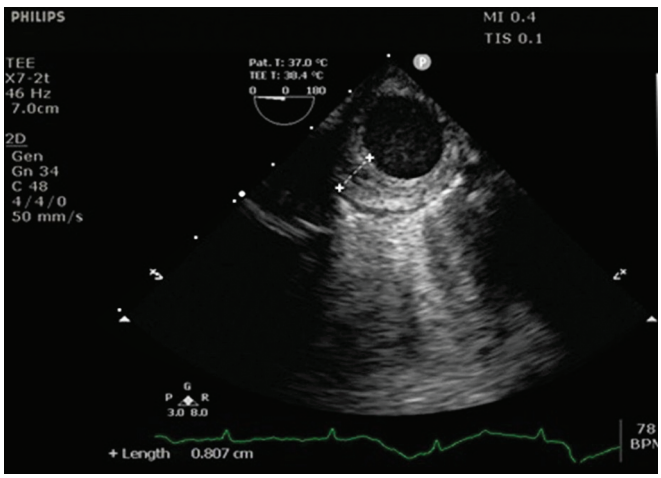

Fig. 2: Descending aortic short axis view on TEE showing thickening of wall

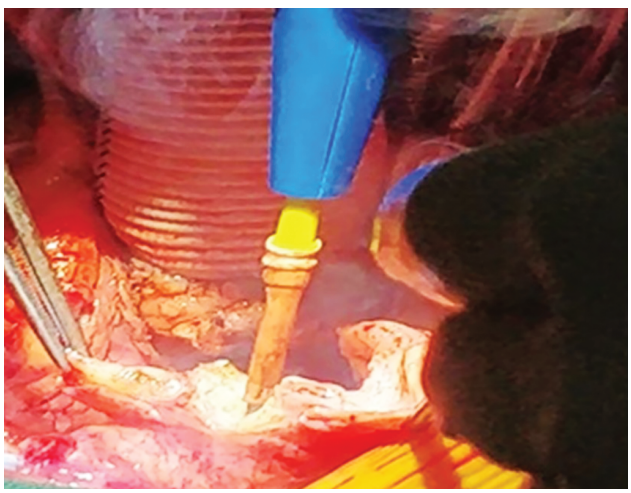

Fig. 3: Intraoperative findings showed thickened aortic wall (biopsy confirmed Takayasu's arteritis)

Table 1: Special anesthesia implications for Takayasu's arteritis

Special concerns in Takayasu arteritis	*Anesthesia implication*
Preoperatively • Patients present with uncontrolled HTN • Pre-op ESR and CRP to guide treatment[5] (steroids/ immunosuppressants) • Avoid surgery for active disease	• Continue antihypertensives (excluding ACE i, ARBs—to avoid refractory hypotension, vasoplegia intraoperative) • Steroids continue–postinduction supplement with an intravenous steroid to avoid surgical stress (adrenal crisis)[6] • Anxiolysis-avoid hypertensive episodes prior to induction.
• Airway management[8]	• Minimize hemodynamic response to intubation using adjuncts to intubation • Avoid excessive neck extension—stenosis of vessels reduces perfusion. • End tidal carbon dioxide maintain 35–40 mm Hg (Avoid hypocapnia induced cerebral vasoconstriction)[9]
• Monitoring cardiovascular system[10] • Occlusion and aneurysm of arteries • Periop myocardial events • Avoid PAH	• Five lead ST segment change (coronary lesions) • Pulse oximetry measure in all four limbs (artery stenosis) • Upper and lower limb BP- Invasive lines—USG-guided (central pressures higher than peripheral pressure) • TEE—aortic cannulation plaques, thrombus, the function of the heart • PA catheter—CCO • (Fluids and inotrope management) • ABG—lactate, SvO_2
Monitoring cerebrovascular system (carotid + cerebral artery lesions)	• Maintain CPP • Cerebral oximetry (saturations monitored especially after cannulation of the aorta and BP fluctuation) • BIS—depth of anesthesia • SedLine monitoring (Fig. 4) • Transcranial Doppler • Electroencephalogram
Monitoring gastrointestinal + renal system (renal and mesenteric artery lesions)	• NIRS of abdominal vessels on flanks • Lactate • $ScVO_2$ on CPB • Urine output—renal protective strategy
Hematological issues[7] (fragile tissue due to steroids and vasculitis) Temperature	• Point of care monitoring for coagulation • Blood and blood products
CPB	• Cannulation techniques and cerebral perfusion • Coagulopathy • MAP
Postoperative blindness (vasculitis, thromboembolism, perfusion)	Maintain MAP

ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; ACE I, angiotensin-converting enzyme inhibitor; ARBs, angiotensin receptor blockers; CPP, cerebral perfusion pressure; NIRS, near-infrared spectroscopy; $ScVO_2$/SvO_2, central/pulmonary mixed venous oxygen saturation; MAP, mean arterial pressure

Fig. 4: SedLine® Brain Function Monitoring (Masimo Corporation, Irvine, United States of America) showing BIS and cerebral oxygenation

It is advisable to defer surgery during the active phase of the disease, as the tissues will be friable with a high probability of bleeding and graft failure. Patients who fail to respond to steroids are offered immunosuppressants in the active phase of the disease, which consists of two or more of the following features: (1) fever or arthralgia, (2) ESR (>20 mm/hour), (3) new claudication, bruit, or vascular pain, (4) new typical angiographic features. Alternate treatment options other than surgery can be angioplasty. The success rate of patients who underwent renal angioplasty was better than patients with mesenteric angioplasty.[7] In this case, there was adequate collateralization of both carotid and celiac arteries.

Conclusion

Takayasu arteritis can cause vasculitis in all arteries and its consequences on various organs. Meticulous perioperative management, knowledge about how the disease affects various systems, and managing complications are vital for an anesthesiologist.

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