Clinical Reports

Extreme arterial blood pressure differentials in a patient with Takayasu's arteritis

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Purpose: To describe the extreme arterial blood pressure differentials in a patient with Takayasu's arteritis and its implications for the preservation of cerebral perfusion during anaesthesia.

Clinical features: A 26-yr-old woman with Type III Takayasu's arteritis presented with a tentative diagnosis of mesenteric ischaemia. Determination of systolic arterial blood pressure assisted by oximetry revealed pressures of 114 mmHg in the left and 90 mmHg in the right arm while direct arterial line pressure monitoring of the left posterior tibial artery showed a pressure of 322/113 mmHg. Following induction of anaesthesia with thiopentone and succinylcholine and maintenance with N₂O, isoflurane and fentanyl, posterior tibial arterial pressures were maintained (low of 213/96 mmHg) to maintain cerebral blood flow despite surgical requests to lower blood pressure. Epidural local anaesthesia was not considered for intra- or postoperative management due to the regional differences in blood pressure and the effect that sympathectomy may have had on cerebral perfusion.

Conclusion: In patients with Takayasu's arteritis, extreme arterial blood pressure differentials may exist which may affect regional blood flow, and monitoring of both upper and lower extremity arterial blood pressure should be considered.

Objectif : Mettre en évidence les écarts extrêmes de la pression artérielle d'une patiente souffrant de l'artérite de Takayasu et leurs conséquences sur la préservation de la perfusion cérébrale pendant l'anesthésie.

Éléments cliniques : Une femme de 26 ans atteinte d'une artérite de Takayasu de type III s'est présentée avec un diagnostic provisoire d'ischémie mésentérique. L'enregistrement assisté par oxymétrie de la pression artérielle systolique montrait des pressions de 114 mmHg au bras gauche et de 90 mmHg au bras droit alors que la mesure continue de la pression sanglante au niveau l'artère tibiale postérieure indiquait une pression de 322/113 mmHg. Après l'induction de l'anesthésie au thiopentone et à la succinylcholine et l'entretien avec du N₂O, de l'isoflurane et du fentanyl, la pression de l'artère tibiale postérieure a été maintenue (au moins 213/96 mmHg) pour préserver le débit sanguin cérébral malgré la demande du chirurgien d'abaisser la pression artérielle. L'anesthésie épidurale avec un anesthésique local n'a pas été retenue pour la prise en charge per- et postopératoire à cause des différences régionales de pression artérielle et des conséquences possibles de la sympathectomie sur la perfusion cérébrale.

Conclusion : L'artérite de Takayasu peut produire des écarts extrêmes de pression artérielle susceptibles d'affecter le débit sanguin régional. Il est préférable de monitoriser la pression artérielle à la fois aux extrémités supérieures et inférieures.

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TAKAYASU'S arteritis is a chronic occlusive inflammatory disease of uncertain etiology affecting medium to large sized arteries. The disease is classified on the basis of vessel involvement.¹ Type I affects the aortic arch and its branches, Type II involves the descending thoracic and abdominal aorta with sparing of the arch, Type III is a mixture of Type I and Type II, and Type IV is any of the above with involvement of the pulmonary arterial system. Involved vessels are characteristically thickened, shortened, subject to thrombus formation and luminal obstruction and unsuspected ischaemia of regional vascular beds may pose considerable anaesthetic risk.² The following report describes the extreme arterial blood pressure differentials observed in a patient with Type III Takayasu's arteritis and the importance of appropriate cardiovascular monitoring during anaesthesia.

Case report

The patient was a 26-yr-old Caucasian woman with longstanding Type III Takayasu's arteritis. A recent aortogram demonstrated severe stenosis of the innominate, left subclavian, external carotid, and vertebral arteries, as well as occlusion of the coeliac axis and superior mesenteric artery. Her recent history was remarkable for a cerebrovascular accident six months previously which had resolved without neurological deficits, and an elective laparoscopic cholecystectomy seven days before presentation. Medical therapy consisted of prednisone, methotrexate, and ticlopidine, an inhibitor of platelet aggregation. An echocardiogram six months previously was normal.

On presentation to the Emergency Department, the patient complained of abdominal pain. An abdominal ultrasound demonstrated no free fluid and with a tentative diagnosis of mesenteric ischaemia based on her previous angiographic findings, she was scheduled for emergency coeliac bypass.

Preoperative physical examination revealed a woman with Cushingoid features. Her carotid pulses were weakly palpable, upper limb pulses absent, and lower limb pulses present. Determination of systolic arterial blood pressure using pulse oximetry was made at the disappearance of the visual display with blood pressure cuff inflation and found to be 114 mmHg in the left and 90 mmHg in the right arm. On airway assessment, she was able to extend her neck without neurological symptoms. The remainder of the physical examination was normal. A complete blood cell count, blood urea nitrogen, creatinine, electrolyte concentration and partial thromboplastin time were all within normal limits and an ECG showed sinus tachycardia.

In the operating room following 2 mg midazolam and 150 µg fentanyl *iv*, two 14 gauge intravenous catheters were placed for venous access. In addition, a Foley catheter, 8.5 French left internal jugular introducer sheath, and a 20 gauge 1¼" Cathlon® into the left posterior tibial artery for haemodynamic monitoring were inserted. The initial posterior tibial arterial pressure was 322/113 mmHg with an appropriate wave form. To confirm this measurement, a manual blood pressure cuff was applied to the left calf and inflated to its maximum pressure of 300 mmHg. The arterial line tracing indicated flow despite this high pressure. Due to the discrepancy between posterior tibial arterial line pressure and right arm pressure derived by oximetry, both were followed for the duration of the case.

Following 100 mg hydrocortisone *iv* and pre-oxygenation, a rapid sequence induction with cricoid pressure was performed with 250 mg thiopentone and 100 mg succinylcholine *iv*. Ventilator settings were 11 breaths·min⁻¹, tidal volume 500 ml, and peak inspiratory pressure ranged from 31–36 cm H₂O. Anaesthesia was maintained with nitrous oxide 50% in oxygen, 0.3–0.5% end-tidal isoflurane, fentanyl (500 µg–total) and vecuronium for muscle relaxation.

Upon opening the peritoneum, the surgeons noted brisk bleeding and a request was made to decrease systemic blood pressure. However, in order to maintain cerebral perfusion pressures, systemic blood pressure was allowed to stay near pre-induction values. Throughout the procedure, the posterior tibial arterial line pressures ranged from an initial high of 322/113 to a low of 213/96 mmHg, with corresponding right arm pressures of 120 to 80 mmHg systolic. The laparotomy revealed a biliary leak and the procedure was converted to a biliary repair lasting two hours. The anaesthetic was otherwise unremarkable and the trachea was extubated with the patient awake and she was taken to the Intensive Care Unit where she made an uneventful recovery.

Discussion

Pathophysiological features in several organ systems of patients with Takayasu's arteritis have been described previously by Ramanathan.² These include cerebrovascular accidents and syncope, multiple arterial occlusions, hypertensive heart disease and right heart strain. In addition, pulmonary hypertension and renal artery stenosis with compromised renal function have been reported.²

The patient described in this report had severe arterial occlusions diagnosed on the basis of both arteriography and systolic pressure gradients. Previous reports

have stated that "the pressure measured in one area may not reflect the perfusion in another."³ To our knowledge blood pressure gradients of the magnitude observed in this patient of approximately 200 mmHg have not been reported. Although different methods were used to obtain blood pressure measurements, the use of pulse-oximetry to measure arterial pressure accurately has been validated in non-hypertensive controls⁴ and has been previously reported in Takayasu's arteritis.⁵ Determination of arterial blood pressure using oximetry in healthy volunteers was made at the disappearance of visual display upon blood pressure cuff inflation, at the reappearance of visual display upon cuff deflation, and by averaging the two. Good agreement was obtained when the average of oximetry-based systolic blood pressure estimates were compared with Korotkoff sound pressures and non invasive equipment pressures.⁴ It is, therefore, likely that the blood pressure measurements obtained in our patient represent the true pressure gradient although the arterial pressure contour does become progressively more distorted as the wave is transmitted down the arterial system. There is transmission delay, a damping out of high frequency components of the pulse, a narrowing of systolic portions of the pressure wave and greater peak values.⁶ High arterial pressures in the surgical field and lower extremity were maintained throughout the case in an attempt to maintain cerebral perfusion. On the other hand, arterial pressures were not allowed to increase (above baseline levels) so as to avoid unnecessary heart strain. Sole use of the posterior tibial artery pressure to monitor arterial blood pressure and the use of agents to "normalize" blood pressure may have resulted in severe cerebral hypoperfusion. Transcranial Doppler has been used as an intra-operative cerebral haemodynamic monitor in a patient with Takayasu's arteritis who underwent carotid revascularization⁷ and this technique along with EEG monitoring⁸ may have been useful in our case had we needed to decrease arterial blood pressure.

In terms of pulmonary artery involvement, in a study using pulmonary angiography 50% of Takayasu arteritis patients were found to have pulmonary artery lesions.¹ None of these patients with pulmonary artery involvement reported pulmonary symptoms but, despite this, 72% had either clinical signs (increased pulmonic sound, early systolic click, mid systolic murmur in pulmonary area) chest x-ray or ECG (right bundle branch block, or right ventricular hypertrophy) abnormalities. As the patient described above showed no clinical, chest x-ray, ECG or echocardiographic evidence of right heart dysfunction it is likely that her pulmonary arterial system was spared.

It has been previously suggested that perioperative pulmonary artery catheter monitoring be routinely employed in patients with Takayasu's arteritis.^{1,3,9} These recommendations are based on several factors. First, because of the increased risk of pulmonary hypertension in these patients, it has been deemed necessary to use invasive monitoring to exclude this possibility. Second, it has been observed that Takayasu's arteritis patients may be sensitive to myocardial depressants³ and therefore require more intensive perioperative monitoring of cardiovascular status. Finally, concern has been raised over the correlation between blood pressure and cardiac output in Takayasu's patients. There is at least one case report³ in which a small decrease in blood pressure was associated with a large decrease in cardiac index. Such poor correlation between systemic blood pressure and cardiac index may necessitate invasive cardiac monitoring in these patients. In our patient we did not feel pulmonary hypertension was present and the left internal jugular introducer sheath allowed for pulmonary artery access should the need arise.

Epidural bupivacaine 0.5% and morphine have been reported for post-operative analgesia³ in Takayasu's arteritis. The authors point to the decrease in systemic vascular resistance and increase in cardiac index as beneficial effects. In addition, successful delivery and postpartum tubal ligation with epidural anaesthesia¹⁰ and abdominal hysterectomy with combined general and epidural anaesthesia in patients with this disease¹¹ have been reported. However, we question the safety of this technique with its induced sympatholysis in a patient such as ours, with marked regional differences in blood pressures without arterial blood pressure monitoring of both upper and lower extremities.

In summary, in patients with Takayasu's arteritis, extreme arterial blood pressure differentials may exist which may affect regional blood flow. Monitoring of both upper and lower extremity arterial blood pressure should be considered.

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