

Utility of intra-operative ultrasound in choosing the appropriate site for blood pressure monitoring in Takayasu's arteritis

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ABSTRACT

Takayasu's arteritis (TA) is rare, chronic progressive, pan-endarteritis involving the aorta and its main branches, with a specific predilection for young Asian women. Anaesthesia for TA patients is complicated by their severe uncontrolled hypertension, extreme arterial blood pressure differentials, aortic regurgitation (AR), end-organ dysfunction, stenosis/aneurysms of major blood vessels and difficulties encountered in monitoring arterial blood pressure. We present the usefulness of ultrasound during anaesthetic management of a 35-year-old woman posted for emergency caesarean section due to intra-uterine growth retardation, foetal tachycardia in active labour, who was already diagnosed to have TA along with moderate AR and uncontrolled hypertension, using epidural technique. The use of intra-operative doppler helped resolve the initial dilemma about the diagnosis and treatment of the differential blood pressure between the affected and the normal upper limb in the absence of prior arteriogram.

Key words: Aortic regurgitation, arterial blood pressure differentials, doppler ultrasound, Takayasu's arteritis

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INTRODUCTION

Takayasu's arteritis (TA) is a rare, progressive pan-endarteritis predominantly affecting females,^[1] characterised by occlusion of principal arteries arising from aortic arch. Associated hypertension, aneurysm formation, aortic regurgitation (AR), retinopathy, cerebrovascular accidents, syncope, right heart strain and pulmonary hypertension increase anaesthetic risks.^[2,3]

Extreme arterial blood pressure differentials affect regional blood flow, and pressure measured in one area may not reflect the perfusion in another, making intra-operative blood pressure (BP) monitoring and management challenging.^[4,5] Ultrasound is useful in determining affected vessels and in choosing the extremity for reliable BP monitoring.

CASE REPORT

A 35-year-old woman with the following characteristics

was posted for emergency caesarean delivery in view of intra-uterine growth retardation and foetal tachycardia: Second gravida at 35 weeks of gestation with TA, AR and hypertension for 5 years, on treatment with tablet methyldopa 500 mg, amlodipine 5 mg and extended release metoprolol 50 mg, each, twice daily.

Her pulse rate was 114/min and BP was 183/78 mmHg in right arm supine position. Volume of upper limb pulses appeared to be bilaterally equal on palpation. However, right radial pulse was collapsing in nature along with radio-femoral delay. Grade four early diastolic murmur, loudest in aortic area, with palpable thrill-radiating to left sternal border was present. Examination of other systems and investigations were unremarkable. Two dimensional (2D) echocardiogram revealed narrowing of thoracic and abdominal aorta to 9 mm with a high blood flow velocity of 2.0 m/s. Ascending aorta and aortic arch were dilated along with moderate AR. Left ventricular ejection fraction was 58% with normal

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biventricular systolic function and normal pulmonary artery pressure. Doppler performed 5 years back showed high resistant flows in common, internal and external carotid arteries bilaterally, with possible proximal stenosis of right subclavian artery (SCA).

Baseline vitals in the operating room were as follows: Heart rate of 115/min, non-invasive blood pressure (NIBP) of 188/78 mmHg in right upper limb and SPO₂ of 97% [Figure 1].

Anaesthetic plan was lumbar epidural anaesthesia with invasive radial arterial BP monitoring prior to placing the epidural. Since the doppler report showed possible stenosis of right SCA, left radial arterial line was secured and the invasive BP (IBP) was 112/55 mmHg. Lower limb arterial monitoring was not considered due to narrowing of thoraco-abdominal aorta. Epidural catheter was secured in L₁-L₂ intervertebral space, and the position was confirmed with test dose of 3 ml of 2% preservative free lignocaine. Patient was positioned supine with a wedge under the right buttock. To achieve a sensory block up to T₆ level, 10 ml of 0.5% ropivacaine was given in 5-ml increments every 10 minutes. There was a drop in IBP to 80/40 mmHg along with a drop of NIBP to 122/60 mmHg after the epidural over 10 minutes. We treated the drop in IBP with 6 mg ephedrine boluses to avoid any cerebral or utero-placental hypoperfusion. There was ill-sustained increase in IBP and NIBP after each bolus (3 boluses provided). BP increased up to 122/64 mmHg, while the NIBP increased up to 198/94 mmHg after the third bolus of ephedrine. Patient complained of headache after each bolus of

ephedrine. Possibility of over treating IBP leading to headache was considered after ruling out possibilities of monitoring error. On-table doppler ultrasound of upper limb arteries was performed specifically looking at the luminal diameter and amplitude of pulsations. Both were reduced in the left radial and axillary artery when compared to the right radial and axillary artery. Right radial pulsation was collapsing in nature, which is expected in AR. Thereafter, we considered treating using the NIBP values of the right upper limb. Meanwhile, the baby delivered was shifted to neonatal intensive care unit in view of prematurity. Rest of the intra-operative period was uneventful. Postoperatively, the patient was monitored in a high dependency unit. Post-operative aortogram revealed normal right SCA and diffuse disease of the left distal SCA, which confirmed our intra-operative findings.

DISCUSSION

TA is a rare, progressive inflammatory disease causing focal stenosis or aneurysms of large arteries like the aorta and its branches, and it predominantly affects Asian women.^[6] TA can be classified into four types:^[7] Type I involves aortic arch and its main branches; type II involves descending thoracic and abdominal aorta; type III has features of both type I and type II; and type IV has features of type III and pulmonary artery involvement. Ishikawa *et al.* graded TA into three stages depending on the presence of four major complications: Hypertension, retinopathy, aneurysm formation and AR.^[2] Our patient was type III TA, stage III with hypertension and AR.

Anaesthetic concerns are related to severe uncontrolled hypertension, end-organ dysfunction, stenosis or aneurysms of major blood vessels affecting regional circulation and difficulties in monitoring BP. Preoperative assessment should evaluate the distribution of arteritis and the degree of organ involvement.

We selected lumbar epidural anaesthesia because regional anaesthesia is safer in cases of TA and associated AR with possible carotid artery involvement because consciousness provides a simple yet reliable monitor of neurological function.^[8] Epidural block offers smooth control of BP in the peri-operative period. Under general anaesthesia, tracheal intubation, extubation and inadequate depth result in considerable fluctuations in BP that can



Figure 1: Monitor showing the different blood pressure readings. The NIBP reading of the right upper limb is much higher than the invasive arterial BP of the left

lead to cerebral haemorrhage. Hyper-extension of spine during laryngoscopy may compromise blood flow through obstructed carotid artery and may cause post-operative visual disturbances, vertigo, hemiparesis and seizures.^[9] Cerebral ischaemia due to hypotension was identified in a conscious patient in a previous study.^[8]

Reports of anaesthetic management in TA have emphasised the importance and difficulties of cardiovascular monitoring.^[3,5,10] Both NIBP as well as IBP monitoring have been described previously.^[4,8] Peri-operative pulmonary capillary wedge pressure monitoring has been recommended in view of increased risk of pulmonary hypertension and myocardial depression.^[5,10,11]

BP is best interpreted from the extremity least affected by the disease process that has to be established preoperatively. A difference of about 60-80 mmHg of systolic BP between the two upper limbs, and patient complaining of headache after correction of IBP drew our suspicion into possibility of an affected left upper limb. The disease process that had started with possible proximal stenosis of right SCA had eventually progressed to involve the left upper limb vessels, which was proven by our on-table ultrasonogram. Regional anaesthesia helped us monitor the neurological status effectively and also indicated that we were over treating the BP.

Ultrasound and angiography are complementary in diagnosis of TA. Ultrasonography may show minimal wall changes in smaller number of arteries, whereas angiography may show luminal changes in vessels.^[12] Maeda *et al.* used ultrasound to show homogenous, circumferential wall thickening of the common carotid artery described as 'Macaroni sign,' which is pathognomonic of TA.^[13] Henderson *et al.* showed that it was possible to accurately measure and monitor BP from the brachial artery using doppler in TA.^[14]

Doppler is widely available, reliable and used by many anaesthesiologists. Observing differences in luminal diameter, wall thickness and amplitude of pulsations

do not require advanced skills. Doppler helps to decide on arterial catheter insertion and authenticity of BP monitored and treated.

CONCLUSION

In cases of TA, bedside doppler helps to select appropriate site for intra-arterial BP monitoring, where achieving haemodynamic stability is crucial. Scanning carotids for stenosis may prompt the anaesthesiologist to avoid hyperextension of the neck during laryngoscopy.

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