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CASE REPORT: PERIOPERATIVE MANAGEMENT OF A GERIATRIC LADY WITH SEVERE AORTIC COARCTATION SUBJECTED TO EXTENDED MAJOR SURGERY

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ABSTRACT
Coarctation of the aorta (CoA) is a congenital cardiac anomaly usually diagnosed and treated in early life. The mortality rate is very high, reaching 80% by the fifth decade; hence, it is very rare to encounter an elderly patient with a severe form of CoA. This report presents the case of a 65-year-old obese female with severe CoA who underwent an extended open reduction and internal fixation (ORIF) of a complicated femur fracture lasting over five hours. The report aims to highlight the challenges in perioperative management posed by CoA and its associated pathophysiological changes in an elderly patient undergoing major surgery. To our knowledge, this circumstance is rare in the anesthesia field, and it could be beneficial to the anesthesia society to be highlighted.

KEYWORDS: Coarctation of the aorta (CoA) is a congenital cardiac anomaly usually diagnosed and treated in early life.

INTRODUCTION
Coarctation of the aorta (CoA) is a congenital cardiac condition typically diagnosed and treated early in life. It is rare for individuals with CoA to reach adulthood, with mortality rates exceeding 80% by the fifth decade of life. This report presents the case of a 65-year-old obese female with severe CoA who underwent an extended open reduction and internal fixation (ORIF) of a complicated femur fracture lasting over 5 hours. To the best of our knowledge, it is exceedingly rare to encounter such a scenario; consequently, highlighting the perioperative management in this context and its impacts on perioperative course and postoperative outcomes may provide valuable insights for similar cases. In this report, we aimed to address the challenges posed by CoA and its associated pathophysiological changes in a geriatric lady subjected to a lengthy major surgery.

CASE PRESENTATION
A 65-year-old obese lady with a recent BMI of 36 kg /M^2 was admitted to our hospital due to a fractured shaft of the femur after a road traffic accident. She is a known case of severe congenital CoA, dyslipidemia, hypertension, and diabetes which was complicated by diabetic retinopathy and poor vision. She has limited exercise tolerance (grade III dyspnea) according to the NYHA classification and was taking the following drugs: Carvidolol, amlodipine, statin, frusemide, and oral hypoglycemic metformin regularly. Previous computerized tomography angiography (CTA) showed severe aortic coarctation with an aortic root diameter of 41 mm, postductal severe degree of stenosis of 0.6-0.7 cm diameter, and poststenotic aortic dilatation, (figure1,2). The CTA showed multiple collaterals connecting right and left subclavian arteries to intercostal arteries arising from the descending thoracic aorta distal to the coarctation, which appeared on the chest X-ray as indentations of the ribs. The patient suffered from hypertension at the age of 42, CoA was first diagnosed at the age of 51 years old when she was admitted because of severe uncontrolled hypertension associated with retro-sternal chest pain. The plan of CoA correction and treatment was put but she refused despite repeated efforts to convince the patient.

On examination, right upper and lower limb calf blood pressure (BP) was 148/ 78, and 77/ 48mmHg respectively, respiratory rate 22, and SpO2 was 97 % on room air, ECG showed sinus bradycardia with 56 heart rate (HR) per minute and left ventricular hypertrophy (LVH), and chest X-ray showed bilateral 5,6,7,8th ribs indentations. An echocardiographic study revealed a CoA pressure gradient of 80 mmHg, a bicuspid aortic valve with mild regurgitation, severe concentric LVH, and an ejection fraction of 65%. Preoperative complete blood picture showed mild anemia; HB level 9.5% gmdl^{-}

[1], liver, renal, and coagulation functions as well as troponin T levels were normal. After a thorough preoperative evaluation and multidisciplinary team discussion among the managing team of an anesthesiologist, cardiologist, and orthopidician; the perioperative surgical, anesthesia plan including a high possibility of major adverse cardiac events was informed to the patient and her son who acknowledged and gave the consent.

Inside the operation theatre, the Bair Hugger active warming system was applied to maintain normothermia, then the patient was connected to the following monitors: BP, ECG, SpO2, and temperature. As the patient was anxious, 1 mg IV midazolam was given and 1μ-kg-[1] dexmedetomidine was infused within 10 minutes which reduced the upper limb BP from 186/ 99 mmHg to 155/81, then two arterial cannulae were inserted in the right dorsal pedis and right radial arteries. Induction of anesthesia was completed using an IV bolus of: fentanyl dose;1.5 μkg^{-1}, ketamine 1mgkg^{-1}, propofol 0.5mg^{-1}kg, followed by cisatracurium 0.15 mgkg^{-1} to facilitate endotracheal intubation. To achieve maintenance of anesthesia; a combined inhalational (0.5 to 1% sevoflurane) plus infusion of dexmedetomidine 0.5 to 1 μ-kg-^{1}hour^{-1}, and ketamine 0.5 to mg-^{1}kg^{-1}hour^{-1}, top up or down of the infusion rate was manipulated according to the BP which was targeted to be around 20% of her preoperative noninvasive basal BP(148/78, 77/48 mmHg. Arterial blood samples for blood gases were taken immediately after intubation, after 2 hours, and at the end of surgery.

Hypotension

defined by a reduction of systolic blood pressure less than 20 % of the basal was managed by noradrenaline infusion 0.05 to 0.1 μ^{-1}kg minute $^{-1}$ plus a bolus of 250 ml Ringer's lactate (RL), which was used only in the non-stimulated anesthesia period (～50 minutes needed for draping and positioning). The total amount of fluids given was 1250 ml of RL plus one unit of cross-matched packed cells, urine output was about 1.5 mlkg^{-1}hour^{-1}.

On completion of surgery (5 hours and 15 minutes duration of surgical time), a suprainguinal fascia iliaca catheter was inserted guided by ultrasound, activated with 30 ml 0.25 % bupivacaine, and used according to our protocol for postoperative analgesia, after cessation of anesthesia, reversal of muscle relaxant and administration of 10 mg IV labetalol given as 5 mg increments to keep BP within the target, we extubated our patient smoothly who was awake, pain-free, and vitally stable. The patient was shifted to the ICU after fulfilling discharge criteria, for close and continuous monitoring, where multimodal analgesia was using 1 gm IV paracetamol 6 hourly backed up with the fascia iliaca protocol. She was comfortable and had a good quality of sleep on the first night of surgery.

On the 3rd postoperative day she felt chest discomfort, CT chest with contrast was done and showed multiple defects at the right posterior upper and middle pulmonary subsegmental arterial branches, denoting pulmonary embolism features. Lower limbs venous doppler showed no evidence of deep venous thrombosis(DVT), the managing team escalated the dose of low molecular weight heparin(LMWH) from prophylactic to therapeutic dose of 1mg-1kg till discharge. The patient was discharged on postoperative day 10, and advised to take her preoperative regular cardiac medications for life after revision by a cardiologist with regular follow-up. The anticoagulant LMWH was replaced by oral rivaroxaban for six months.

DISCUSSION

Coarctation of the aorta (CoA) is a congenital heart disease characterized by a narrowing of the aorta, most commonly at the site of insertion of the ductus arteriosus (aortic isthmus), just distal to the left subclavian artery. This narrowing of the aorta causes an increase in the left ventricular afterload, and the associated activation of the renin-angiotensin-aldosterone system could explain upper-body hypertension and lower-body hypotension.[1] The development of collateral flow in the intercostal, internal mammary, and scapular vessels are compensatory mechanisms to bypass the stenosis and to perfuse abdominal organs and lower limbs. Cardiac and non-cardiac complications can occur which shorten CoA patient's life span, especially if not treated (75% and 90% mortality by 46 and 58 years of age, respectively), causes of mortality include congestive heart failure, myocardial infarction, endocarditis, aortic dissection, and aneurysm, or cerebral aneurysm.[2,3] Treatment options of CoA either by traditional open surgery or endovascular catheter-based therapy improve the life span, however, our patient who was diagnosed at the age of 51 years unfortunately refused any interventional management.

No specific or best anesthetic technique can be used; however, the multidisciplinary team approach, which includes a clear perioperative plan of smooth induction and emergence, proper whole perioperative stress response management, avoiding severe hemodynamic fluctuations, optimizing fluid management, as well as maintaining an effective postoperative analgesic strategy could be more important than the type of anesthesia. The choice of epidural anesthesia alone with titrated doses could help reduce sudden hemodynamic fluctuations and offer effective postoperative analgesia[4,5], however, our patient refused this option, so was our anesthesia choice; combined inhalational and intravenous balanced anesthesia technique. We used the balancing hemodynamic effects of dexmedetomidine and ketamine supported by oxygen-air enriched with a low concentration of sevoflurane to avoid a high concentration of sevoflurane as a main anesthetic agent with its known cardiac depressant and vasodilating effects which could compromise hemodynamic goals; our enough experience with this combined technique in

cardiac patient e.g severe aortic stenoses encouraged us.[6-8]

Using both upper and lower limb invasive continuous arterial blood pressure monitoring helped us to assess upper and lower limb BP continuously, giving fast onset and offset vasodilating and vasoconstricting medications without delay, in addition to meticulous fluid management was essential to achieve our hemodynamic goals. Serial blood gases, lactate level, base deficits, arterial oxygen tension, and hourly urine output monitoring urine output together were important surrogate markers guiding tissue perfusion and oxygenation. Maintaining glucose at approximately 10 mmole-1L using an IV regular insulin was our target to avoid the known hazards of perioperative hyperglycemia.[9] The use of fascia iliaca regional block as a backbone of postoperative multimodal analgesia is our routine practice for fracture femur surgery which was very effective and important especially in such patients to avoid pain-related sympathetic surge associated with pain and its known hazards in cardiac patients.[10]

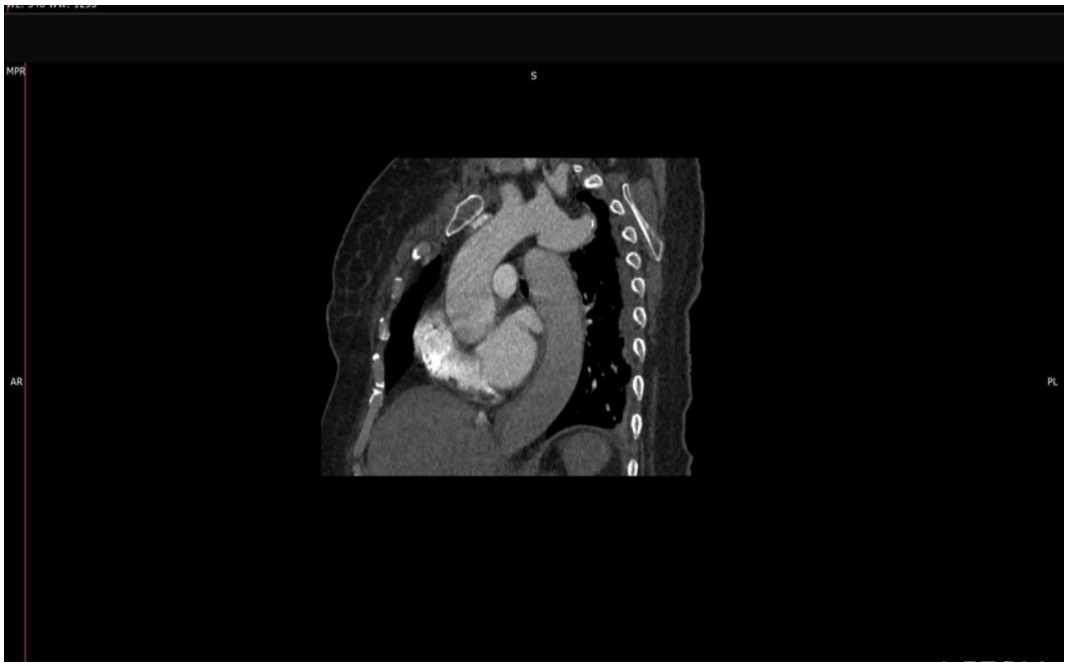

Figure 1: shows severe postductal aortic coarctation with pre and pos-stenotic dilation.

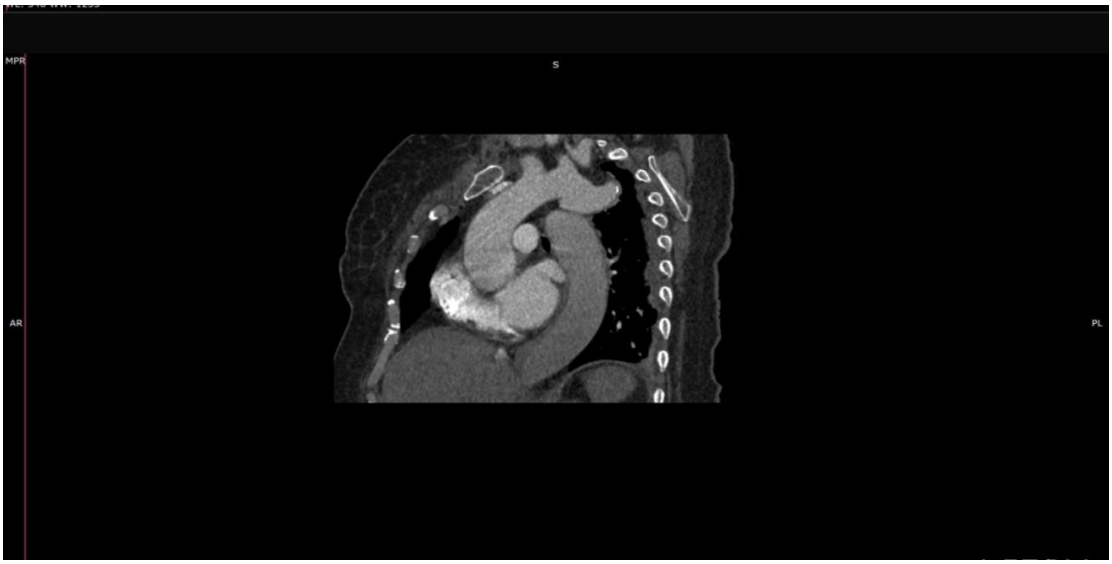

Figure 2: CTA shows severe postductal aortic coarctation with pre and pos-stenotic dilation.

Table 1: Show serial arterial blood gases, immediately after induction, 2 hours alter and at the end of surgery just before extubation.

Arterial blood gases parameter	Immediately after induction	2 hours later	At the end of surgery
Ph	7.4	7.4	7.4
PaC02 mmHg	34	33	33
PaO2(FiO2 0.35)mmHg	98	100	108
HCO3 $mEq^{-1}L$	24	24	22.9
Base Excess $mEq^{-1}L$	-1.75	-O.73	-0.7
Blood glucose($mmole^{-1}L$	11	15	11.3
Lactate $mmole^{-1}L$	1.3	1.5	3.7

CONCLUSION

Anesthetic management of severe untreated CoA in the geriatric population subjected to extended major orthopedic surgery is a rare topic in anesthesia literature. Despite being warned of the risks and complications that shorten the life span, our patient declined any CoA treatment intervention and opted only for very regular follow-up care. A multidisciplinary approach, including an anesthesiologist, cardiologist, and orthopedician, was a crucial step for developing a vigilant, meticulous, and clear perioperative plan. maintenance of hemodynamic stability, proper fluid management, and postoperative analgesia is the keys to good outcomes and could be more important than the type of anesthesia.

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Conflicts of interest
There are no conflicts of interest.

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