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Perioperative Management of An Elderly with Coronary Artery Disease and Aortic Stenosis Undergoing Emergency ORIF for Intertrochanteric Fracture. Report of A Rare Case and Systematic Mini Review

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ABSTRACT

Aortic valve stenosis (AS) is the most common form of valvular heart disease in the elderly population and often associated with significant coronary artery disease (CAD), as both conditions have common risk factors. Patients with untreated severe AS with concomitant coronary CAD requiring a noncardiac surgery (NCS) is associated with worse prognosis and higher risk for major adverse cardiovascular events (MACE). Patients with symptomatic severe AS and significant CAD (>70% stenosis of any major epicardial coronary vessel or >50% stenosis of the left main coronary artery) have a higher risk profile because of a greater number of cardiovascular risk factors and comorbidities, which can complicate their management. Furthermore, such patients are at increased risk of perioperative MI during cardiac and non-cardiac surgery. Recent guidelines suggest surgical aortic valve replacement (AVR) or balloon aortic valvotomy (BAV) or transcatheter aortic valve implantation (TAVI) for severe AS and percutaneous coronary artery intervention (PCI) or coronary artery bypass grafting (CABG)for the significant CAD before noncardiac surgery for better outcome. However, mild to moderate asymptomatic AS might proceed with NCS, but strict hemodynamic monitoring is recommended. The unoperated patients of severe AS with CAD requiring NCS should be managed by multidisciplinary approach and focus is to avoid the hypotension/ hypertension, tachycardia to prevent the MI, MACE and mortality. The sinus rhythm and mean arterial pressure (>65 mmHg) should be maintained with the use careful anaesthetic management and using beta- blockers and phenylephrine or norepinephrine or vasopressin. Untreated patients of AS with concomitant CAD requiring emergency lower limb surgery can be managed safely under spinal anaesthesia with the collaboration of multidisciplinary approach including cardiac anaesthetist, cardiologist and surgeon. The aggressive hemodynamic monitoring such as ECG, CVP/ PAC, arterial catheter, and TEE and arterial blood gas analysis in selected patients is most crucial for early detections of

hemodynamic deterioration, and their appropriate management with fluid and vasoactive agents administration, and use of beta-blockers or calcium channel blockers to control the tachycardia or even use of mechanical circulatory support such as intra- aortic balloon counter pulsations (IABP). We describe a successful perioperative management of a challenging case of a 75 yrs- female, weighing 80Kg, a known post-PTCA coronary artery disease with symptomatic severe aortic stenosis, who developed left intertrochanteric fracture and required open reduction and internal fixation (ORIF) with plating. The emergency surgery was performed under spinal anaesthesia with heavy bupivacaine (0.5%),2 ml with fentanyl (25 mcg) used in L4-5 space after obtaining an informed consent from the relatives along with permission for the publication. A review of literature on the CAD with severe symptomatic aortic stenosis requiring emergency non-cardiac surgery will be discussed.

Keywords: Aortic stenosis, coronary artery disease, echocardiography, multidisciplinary team, non-cardiac surgery, spinal anaesthesia

INTRODUCTION

Aortic valve stenosis (AS) is the most common form of valvular heart disease in the elderly population and often occurs in conjunction with coronary artery disease (CAD), as both conditions have common risk factors.[1,2] The incidence of significant CAD in severe symptomatic AS in elderly patients at age of more than 70 yrs is approximately 50%.[3,4] Severe aortic stenosis with symptoms like chest pain, dyspnoea, and syncope significantly increases the risk of sudden death due to decreased coronary blood flow, diminished cardiac output, CHF, diastolic dysfunctions, arrhythmias.[5,6] The elderly patients with Severe symptomatic AS and CAD may require the elective or urgent / emergency non-cardiac procedures and should be managed with the multidisciplinary approach. The ACC/AHA/ ESC has recommended the treatment of symptomatic AS and CAD before the elective non-cardiac surgery (NCS) to prevent the MACE and mortality. [7,8]

Though, the emergency non-cardiac surgery in symptomatic AS with CAD patients carries higher risks, but is feasible with balanced general anaesthesia or regional anaesthesia and rigorous hemodynamic management including avoiding hypotension/ hypertension, tachycardia, maintaining myocardial oxygen balance, and often require invasive monitoring like CVP, arterial catheter for continuous invasive BP monitoring and arterial blood gas analysis, pulmonary artery catheter (PAC) and Transesophageal echocardiography (TEE) under the supervision of expertise of multidisciplinary team including cardiologist and cardiac anaesthetist, and surgeon.

MATERIALS & METHODS

Electronic searches for this case report and mini systematic review included PubMed, Medline, research gate, Google, and the Cochrane database up to December 2025. Selection criteria were case reports, case series, randomized studies, meta-analysis, reviews, and clinical guidelines and recommendations on aortic stenosis with coronary artery disease for elective and emergency noncardiac surgery. The primary focus was on the perioperative management including hemodynamic stability, anaesthetic management and prevention of perioperative complication.

CASE PRESENTATION

A 75 yrs female, weighing 80Kg, presented with a left sided intertrochanteric fracture after a fall 3 days back. It was not associated with loss of consciousness, seizures, vomiting or ear, nose or oral bleeding. She was a known case of hypertension and coronary artery disease for the last 20 yrs, for that she received drug eluting stents (DES) in left anterior descending artery

(LAD) and right coronary artery (RCA) and was inconsistent with the treatment (Amlong-H 5/12.5 mg) OD orally and regularly getting ecosprin-AV 75/10mg OD orally, and metoprolol+telmisartan 50/40mg OD orally. Furthermore, she also had a triad of chest pain, dyspnea, and syncope 3-4 episodes in the last 3 months suggestive of symptomatic severe AS and presently in the NYHA Class-III. On examination, she was conscious, comfortable in bed, but over talkative with METS <4. Chest examination revealed a normal bilateral air entry without any added sounds. Cardiovascular examinations revealed heaving sustained and laterally displaced apex beat to the lateral axillary line in the 6th intercostal space suggestive of severe aortic stenosis with enlarged LV and, a systolic murmur in the right upper parasternal area. Her pulse rate was 93/ min and BP was 150/ 88 mmHg and SPO2 was 93% on room air. Her hemoglobin was 8gm% and so one PRBC was transfused, HCT -25.5%, total leucocytes counts (TLC) -7630 /microliters, platelets- 2.07 lacs/microliters, prothrombin time/ international normalization ratio (PT/INR) – 11.6 sec/ 1.03, Random Blood Sugar-116mg/dl, HBA1C-6.40, Blood urea 44.06 mg/dl, S. creatinine- 0.76 mg/dl, Serum sodium/ K 135/4.8 meq/l, SGOT/PT 39/18 u/L. ECG was suggestive of LVH with ST/T strain pattern changes (Figure 1). Chest X-Ray revealed cardiomegaly with prominent and calcific aortic arch and knuckle with reverse "C' sign suggestive of atherosclerosis. (Figure 2). Transthoracic 2-D echocardiography revealed concentric LVH, with calcific severe aortic stenosis, with pressure gradient of 72mmHg across the AV, normal LV functions with EF of 58%, but enlarged LV (LVIDD – 58 mm, LVIDS 30mm), and normal ascending aorta size(30mm). (Figure 3). An informed consent was taken from the family member and posted for emergency ORIF with nailing.

In OR, all standard monitors including noninvasive/invasive BP, 5-lead ECG, SPO2, EtCO2, temperature were attached. TEE machine was kept standby for hemodynamic management in any perioperative cardiovascular adverse events. ECG revealed a HR of 139/min with occasional PVCs, and required intravenous fluid 250ml, magnesium sulphate 1gm over 10 min and incremental total metoprolol (6mg) to optimize the HR of 70-80 bpm and then spinal anaesthesia was administered using 0.5 % heavy bupivacaine plus 25 mcg fentanyl in L3-L4 space by 25 G Quincke's needle. The intraoperative BP and HR remained stable (Figure 4), except one episode of hypotension (MAP 56 mmHg) that required volume and 8mcg bolus of norepinephrine to restore MAP of >65 mmHg and prevention of MI, arrhythmias in view of severe AS, diastolic dysfunction and CAD. The total duration of surgery was approximately 2 hrs., blood loss was 150 - 200 ml, and ringer lactate (1.5 L) and one unit of PRBC were transfused. Total intraoperative urine output was 450ml. Postoperative pain management was achieved using multimodal strategy including fentanyl, tramadol, acetaminophen(1gm) and buprenorphine patch. The patient was shifted to the ICU for hemodynamic monitoring and rest of the course remained uneventful. She was discharged from the hospital on 7th postoperative day in stable condition with an advice to attend the cardiology OPD after one week.

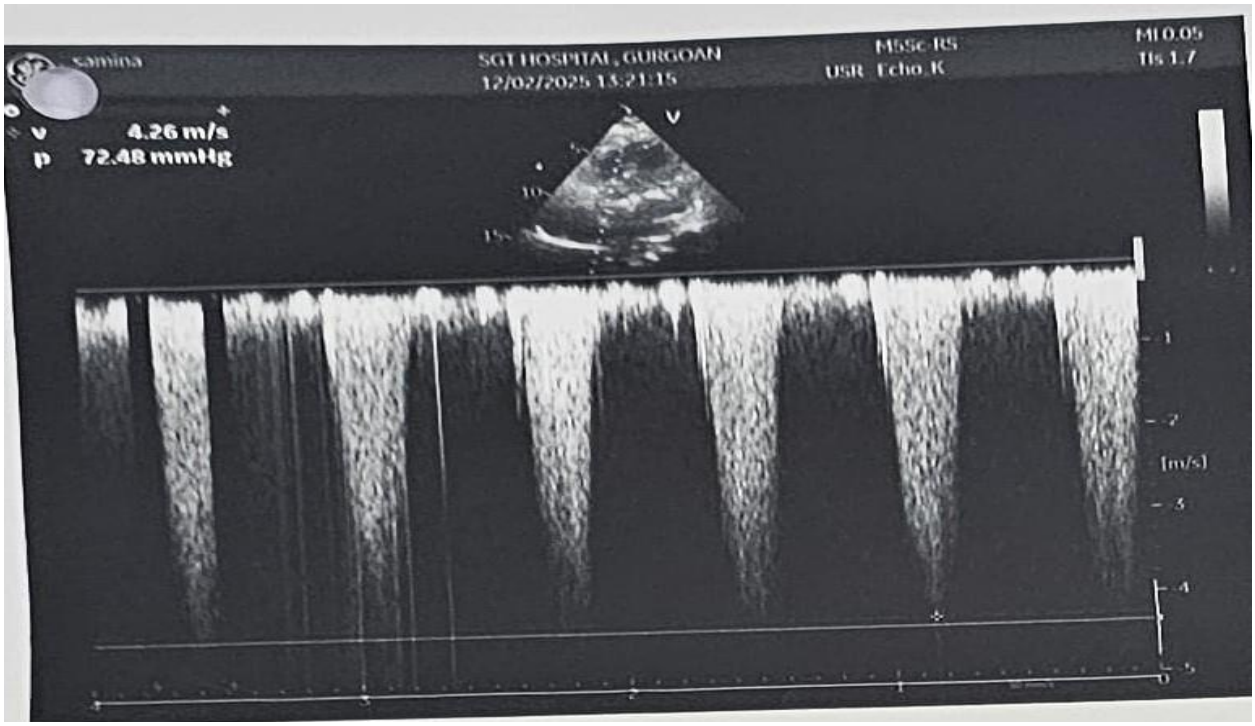

Figure 1. Showing LV strain pattern of LVH as steep downward slope of ST segment in Lead 1,2,3. There is LVH as S wave in V1 + R wave in lead V4 is 45 (>35 mm suggestive of LVH) (Arrows)

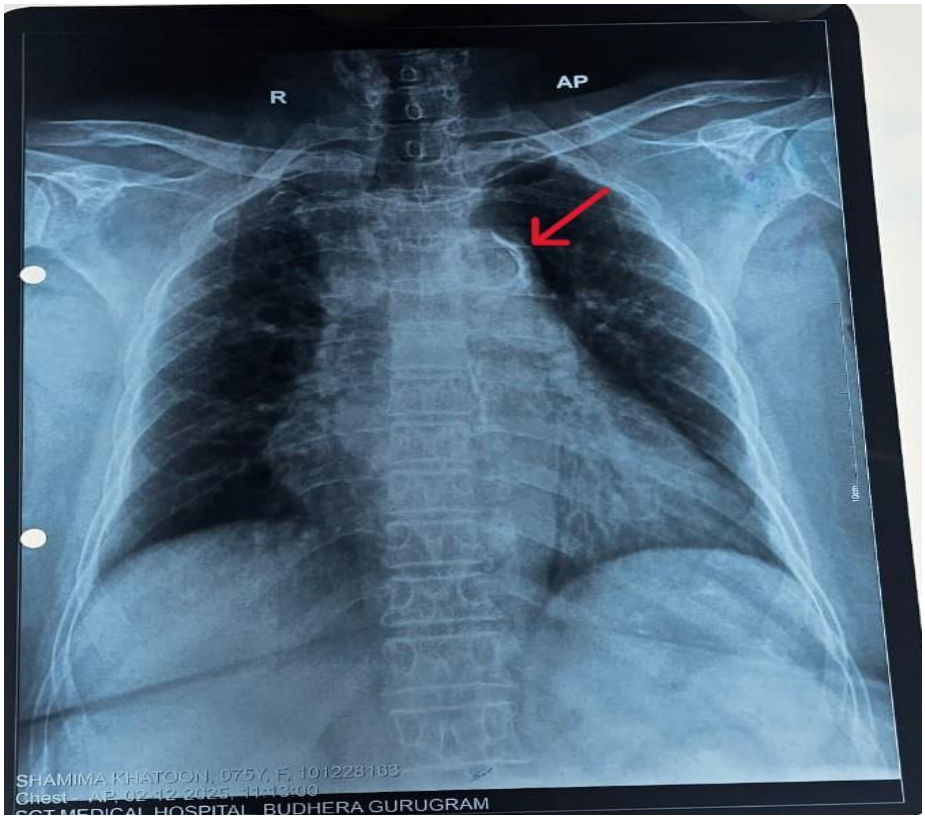

Figure 2. Chest X-Ray, AP view shows normal cardiac shadow and lung fields. In addition, a reverse" C" sign (red arrow) is observed at the aortic knuckle suggestive of aging and atherosclerosis and potential for CAD

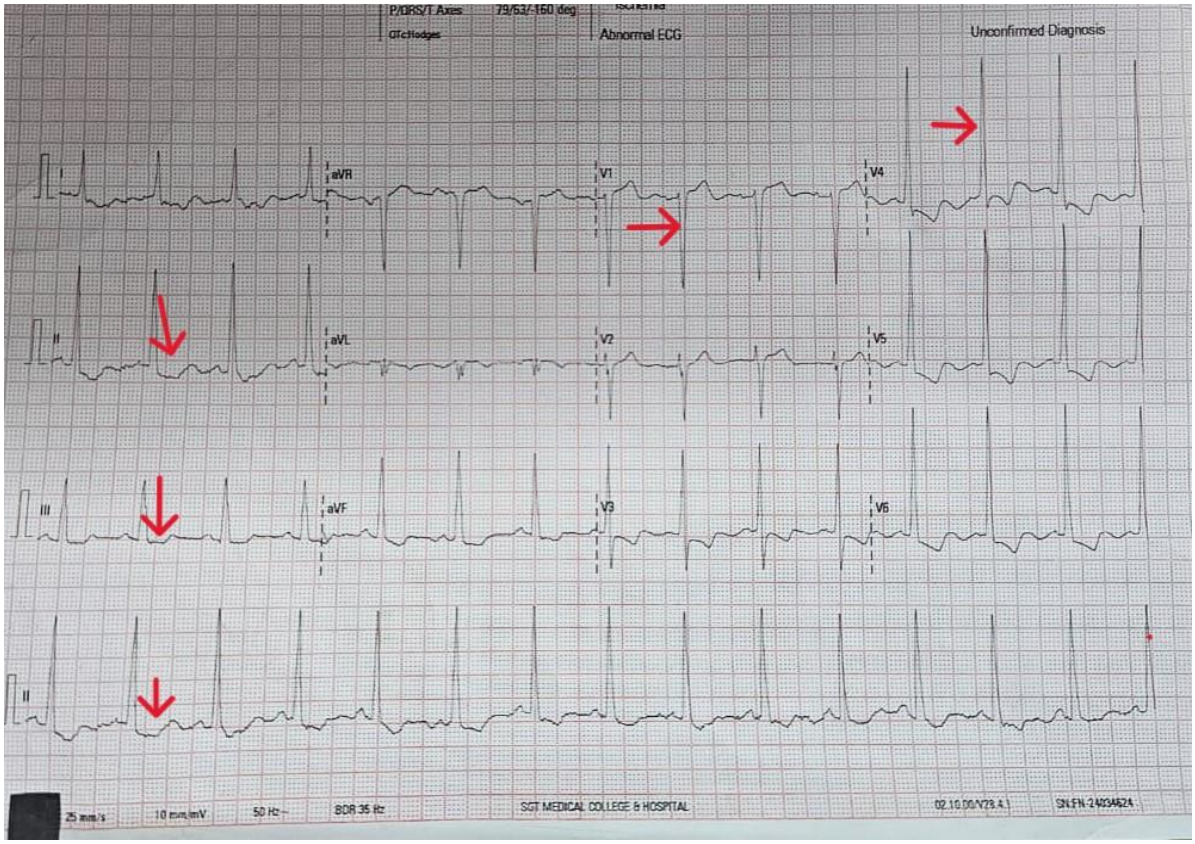

Figure 3. AV flow velocity in the deep TG- LAX view of the TEE revealed a PG of 72mmHg suggestive of severe AS. AV-aortic valve, TG-LAX- transgastric long axis view, TEE-transesophageal echocardiography

Figure 4. The photograph of intraoperative monitor showing stable hemodynamics as sinus rhythm with HR of 75 bpm, SPO2 of 100% and BP of 116/ 67 mmHg. Intraoperative ECG also confirms LV strain pattern(arrow)

Operation Room preparation

OT should be well equipped for intensive vital signs monitoring before during and after the surgery such as invasive arterial BP for early detection of hypotension/ hypertension; CVP line for intravenous fluid status and RV function and to administer various vasoactive and anaesthetic agents; 5

lead ECG to detect arrhythmias and MI via ST/T changes; BIS for depth of anaesthesia; SPO2 for assessment of ventilation; TEE for continuous cardiac function monitoring, and diagnose LV dysfunction, RWMA for newly developed MI, and to guide the fluid and drug therapy and severity of AS. PA catheter for selective patients for monitoring level of PAH, RV dysfunctions, and PADP/PCWP for left sided filling pressure, to guide the fluid and drug therapy on the parameters such as CO/CI, SVR, PVR and mixed venous oxygen saturation. All vasoactive and antiarrhythmic agents should be made available like epinephrine, norepinephrine/ vasopressin, milrinone, levosimendan, NTG, diuretics, beta-blockers, calcium channel blockers, magnesium sulphate, defibrillator for emergent cardioversion. Finally, multidisciplinary team should be available to deal with any unforeseen eventualities.

Table 1- Various clinical, echocardiography and CT /MRI parameters used to determine the severity of AS and their prognostic values. [9,16,17,18,19,20]

Parameters	**Mild**	**Moderate**	**Severe**	**Remarks**
Clinical signs & symptoms of significant AS	-	-	Triad of Dyspnoea, chest pain &syncope	Increased perioperative risk of complications HF, arrhythmias, cardiogenic shock, stroke, death-perform AV intervention before elective NCS
Average jet velocity (m/s)	2.6-2.9	3-4	>4	
Mean PG	<20	20-40	<40	
Peak Gradient	30-50	50-70	>70	
AVA (cm2)	>1.5	1-1.5	<1	
Indexed AVA (cm2/m2)	>0.85	0.60-0.85	<0.6	
Dimensionless velocity	>0.5	0.25-0.50	<0.25	
EF	>70 % Best Outcome	<50 % Decreased survival	<40 %	AVA<1 cm^2or ≤0.6 cm^2/m^2, MPG<40mm Hg, SVI<35ml/m^2, EF<40 % (Low flow, Low gradient, Severe AS) -Poor outcome
LVIDD				
SVI/C.O	>35 ml/m2		<35 ml/m2 / decreased C.O	More I/O Complications, poor outcome
E/e'			>14	Suggestive of diastolic dysfunction
BNP (pg/ml)	<550		>550	<550 has better survival prognosis
PAH			PAH +ve	Suggestive of severe DD, increased risk of complications
Rate of increase in flow velocity			>0.3 m/sec/yr	Requires early intervention of AV- AVR, TAVR,BAV
Average calcification scoring (Au)			Males >2065 Females>1275	Suggestive of severe AS

AVA- aortic valve area, EF- ejection fraction, PG- pressure gradient, LVIDD-Left ventricular internal diastolic diameter, SVI-stroke volume index, C.O-cardiac output, MPG-mean pressure gradient, PAH-pulmonary artery hypertension, BNP-B type natriuretic peptide, HF-heart failure, E/e'-mitral inflow velocity/ e' of mitral lateral annulus

DISCUSSION

Aortic valve stenosis (AS) is the most common valve disease in the elderly population, the severity of AS in the elderly population is often concurrent to the presence of significant CAD.[9,10] Both CAD and AS presents with angina, dyspnoea, and fatigue, usually with physical activity, but AS uniquely presents with syncope with exertion, whereas, CAD symptoms can vary from silent ischemia to heart attack, with pain often radiating to the arm, jaw or neck. Though both share atherosclerosis, and common risk factors like age, diabetes, hypertension, hypercholesterolemia, renal disease on dialysis and can occur together, making differentiation tough. The incidence of significant CAD in severe AS is strongly related to the age of the patient; 7.2% at the age below 50 years, 30.2% at 50-60 years and 50% at the age of 70 years, and 65% at the age of 80 years.[4]

AS causes a pressure gradient between LV and the aorta, and thus a much higher systolic LV cavity pressure is needed to overcome the left ventricular outflow tract (LVOT) flow obstruction. This higher LV cavity systolic pressure directly increases the wall tension that is a direct stimulus for the further parallel replication of sarcomeres, which produces the concentric LVH because of chronic pressure overload. The chronic concentric LVH may result in the decreased diastolic compliance, imbalance between myocardial oxygen demand and supply, and intrinsic ischemic myocardial contractile dysfunctions due to subendocardial ischemia and reduced coronary flow reserve, and heart failure and sudden death due to arrhythmias or decreased CO. [11,12] The concomitant CAD adds the ischemic risk making BP and HR control crucial.

For AS and CAD gold-standard diagnostic methods are echocardiography, cardiac computed tomography, and magnetic resonance imaging, in addition, coronary angiography for CAD only.[13,14,15] Echocardiography facilitates perioperative management by determining AS severity, quantifying LV systolic and diastolic function, identifying other valvular lesions like mitral regurgitation, tricuspid regurgitation, and evaluating RV function, PA pressure and aortic enlargement. Table-1 describes the various echocardiography parameters to determine the severity of the aortic stenosis and risk assessment such as aortic valve area (AVA), mean and peak gradient across aortic valve (AV), AV flow velocity, CO or CI, stroke volume, indexed AVA, dimensionless velocity, LV EF and LV end diastolic and LV end systolic area.[9,16,17,18,19,20,21] Perioperative risk is higher in symptomatic severe AS versus asymptomatic patients, and those with reduced LV EF, poor myocardial contractile reserve, diastolic dysfunctions with reduced LV compliance, and concomitant PAH, more severe AS, and large aortic aneurysm secondary to long duration AS, and in the setting of urgent/emergency compare to elective NCS.[11,22,23,24] With suspected moderate or severe symptomatic AS requiring elective elevated-risk NCS, a preoperative echocardiography is recommended to determine the severity of AS and its effects on the LV functions and aorta(aneurysm) for the risk assessment or surgical decision making for aortic valve interventions before elective NCS to reduce perioperative risk.[25,26] The echocardiography assessment of CAD and significant AS for LV systolic dysfunctions in the patients with new onset dyspnoea, chest pain and palpitations and syncope help guide the perioperative management. Indeed, the LV systolic and diastolic dysfunctions are associated with increased perioperative MACE during NCS.[27]

Patients with CAD and coexisting severe aortic stenosis usually encountered during cardiac surgery, however, rarely a patient

with untreated CAD with AS presents for noncardiac surgery. Surgical aortic valve replacement (SAVR) and concomitant coronary artery bypass grafting (CABG) has been the traditional standard of care for patients with severe AS and significant CAD.[28] If non cardiac surgery is emergent, proceed without cardiac intervention; if elective; evaluate for active cardiac conditions. A total percutaneous approach including transcatheter aortic valve replacement (TAVR) and PCI has been suggested as a reasonable treatment option for patients with heavy comorbid burden.[28] The described patient also had both CAD and severe AS, which has been subjected to the PTCA for LAD and RCA and receiving medical therapy with ACEi, beta-blockers and calcium channel blockers and HMG-CoA reductase inhibitors(statins) for hypertension and severe AS. There are well defined guidelines available for the patients of isolated CAD or AS undergoing cardiac or non-cardiac surgeries, however guidelines for combined AS with CAD for emergency noncardiac surgery have not been described in the literature. Perioperative management for noncardiac surgery in such patients require multidisciplinary approach to develop an individualized treatment strategy, formulate the anaesthetic plan and perioperative and postoperative hemodynamic management, and to weigh the risk of NCS. The primary focus of the team should be to accurately assess the severity of the AS, extent and stability of the CAD, to estimate the risk of the specific noncardiac surgery being planned (low, intermediate, or high risk). In urgent NCS, where valve intervention or CAD intervention is not feasible, the focus shifts to careful anesthetic management and intensive monitoring to maintain the hemodynamic and avoid the major complications like heart failure, MI, fatal arrhythmias or even death. Several clinical and echocardiographic characteristics have been reported to be significantly associated with the risk of sudden death, particularly requiring haemodialysis, prior MI, body mass index <22, peak aortic jet velocity ≥5 m/s, and left ventricular ejection fraction <60%.[29]

Patients with symptomatic severe aortic stenosis (AS) requiring elective NCS, guidelines recommend valve intervention (surgical replacement or TAVR or BAV) and postponing elective major NCS as risk of complications like CHF, arrhythmias, cardiogenic shock and stroke and mortality is high. The AHA/ACC and European Society of Cardiology guidelines have also released a potential role for preoperative TAVR in the patients of severe AS prohibitive of surgical AVR to prevent the perioperative complications. [11,23,30,31] The presence of CAD in patients undergoing major NCS is associated with increased risk of perioperative MACE and a history of an acute coronary syndrome (ACS) confers greater perioperative risks than chronic coronary disease (CCD) does, whereas, a history of MI has been associated with a 3.5-fold increased risk of perioperative MACE.[32] In the patients with ACS ST-segment elevation myocardial infarction (STEMI) or high-risk non–ST-segment elevation myocardial infarction (NSTEMI), and patients with CCD involving left main coronary artery, revascularization before NCS can be beneficial in reducing MACE during elective NCS. it's recommended to perform coronary revascularization and defer the NCS to reduce the perioperative cardiovascular events. Even in patients with CCD and hemodynamically significant LMCA stenosis i.e. >50%, the coronary revascularization is recommended to prevent the perioperative cardiovascular events. [33,34] In patients with STEMI, coronary revascularization with PCI or CABG before NCS improves the cardiac outcome. In addition, the reperfusion is recommended even in patients with unstable angina NSTEMI with arrhythmias, cardiogenic shock, refractory angina and NCS should be deferred to prevent the adverse cardiovascular events.[34] The presence of untreated CAD has been shown

to increase perioperative mortality in patients undergoing SAVR, whereas CABG combined with surgical AVR is safe and decreases the late mortality by 33%.[35,36]

The American College of Cardiology(ACC) has proposed a management algorithm based on a higher benefit of PCI in patients undergoing TAVI with proximal epicardial coronary stenosis >70% or left main coronary stenosis >50%, patients' symptoms or if CAD access in the future would be limited by TAVI.[37]The patients with Severe AS combined with CAD usually presents with Diastolic dysfunctions in addition to the systolic and even diastolic dysfunction is associated with intraoperative MACE in NCS.[38,39,40] Patients of isolated or combined AS with CAD undergoing intermediate- and high-risk NCS procedures, with severely reduced LVEF ≤30% identified with preoperative echocardiography is an independent predictor of 30-day mortality.[41]

However, stable CAD does not require prophylactic coronary intervention before NCS to mitigate the risk of MACE.[42] Further, if a patient has a prior coronary artery calcium score of 0 within 2 years, it is reasonable to proceed for the NCS without additional testing.[43] Associated CAD and AS is a risk factor for poor outcomes, including heart failure, cardiogenic shock, arrhythmias and increased mortality, where each condition worsens the other, necessitating integrated treatment. If emergent surgery is required in a patient with CAD and severe AS, then perioperative management needs the supervision of multidisciplinary team including cardiac anaesthetist with closely vigilant and monitoring throughout surgery and early postoperative period, particularly if hemodynamic instability, large volume shifts, or high risk for bleeding is anticipated in the perioperative period.[32,44]

The anaesthetic management of severe AS for cardiac or non-cardiac surgery is based on the avoidance of hypotension, tachycardia, maintenance of sinus rhythm and adequate intravascular volume and avoidance of over volume. Nodal rhythm or supraventricular arrhythmias can compromise the diastolic LV filling of a poorly compliant LV and sudden hypotension and rapid hemodynamic deterioration.[45] In addition, awareness about the potential for myocardial ischemia is vital during perioperative management of the patients with severe AS with CAD. However, in Patients with asymptomatic severe AS, or mild to moderate AS, NCS can be performed safely with strict monitoring and careful anaesthetic/ hemodynamic management and necessitates perioperative echocardiography for assessment of cardiac functions, to guide fluid and drugs therapy and aggressive perioperative care. All cardiac medications like calcium channel blockers, beta-blockers and statins should be continued. The continuation of statins on the day of surgery or on the next day decreases the mortality.[46] Even amiodarone is effective in prevention of postoperative AF in NCS patients.[47] On the contrary, the ACEi (lisinopril, enalapril) and angiotensin receptor blockers(ARBs) agents should be stopped 24 hrs before surgery to avoid the refractory hypotension during induction of anaesthesia.[48,49] Recently, the SPACE trial investigated the impact of preoperative management of ACEIs/ARBs on postoperative myocardial injury and reported that myocardial injury occurred in 48.3% patients randomised to discontinue and 41.3% patients randomised to continue ACEI/ARB. In addition, patients randomised to the 'Stop' group had more postoperative hypertension. In a post hoc analysis, patients in the 'Continue' group with low preoperative NT-proBNP concentrations (<100 pg ml^{-1}) experienced less myocardial injury after surgery than the 'Stop' group, whereas no significant difference was observed in patients with elevated preoperative NT-proBNP concentrations. The SPACE trial provides important and new reassuring data on the safety of continuing ACEIs/ARBs before

major NCS, and challenging previous beliefs.[50] Some patients of severe AS with low flow low gradient and reduced EF(<30%), where minimum pressure gradient may reflect the severe degree of AS or LVOT flow obstruction when CO is significantly reduced, such patients may require levosimendan (0.05 to 0.1mcg/kg/min) infusion well before the surgery(1-2 hr before) to stabilize and improving the LV functions, CI, diuresis and decreasing the PCWP, and also for the outcome benefits in both cardiac as well as NCS patients. In addition, levosimendan can be utilised as a bridge to the cardiac surgery in patients with severe LV dysfunctions and cardiogenic shock as a result of severe AS or with CAD.[51] However, levosimendan therapy may require co-administration of norepinephrine to ameliorate the systemic hypotension secondary to profound systemic vasodilatation. Some authors have reported that pre-emptive levosimendan increases myocardial functions and finally counteracts acute myocardial strain occurring immediately postoperative period of NCS. Even levosimendan might mitigate inflammation induced subclinical heart failure in postoperative period.[52] Pretreatment with levosimendan in CAD patients with low EF decreases low cardiac output syndrome(LCOS), length of ICU and hospital stay, decreases AKI, and mortality, decreases postoperative AF, low troponin levels, reduces stress and improves cardiac index and reduces the requirement of mechanical support like IABP during cardiac and noncardiac surgery.[52,53,54] Though, the described patient had undergone coronary revascularization with PCI using DES in LAD and RCA for CAD to mitigate the MI and heart failure and death, even then it's worth to highlight the perioperative hemodynamic goals focus on maintaining myocardial oxygen balance by keeping MAP of >70 mmHg, HR of 70-80bpm, adequate arterial oxygen content and HB, minimize wall tension and after load, and avoidance of tachycardia, hypertension and optimize cardiac contractility to prevent MI. However, in a patient with CAD plus severe AS the cardiac contractility should be maintained to overcome the LVOT flow obstruction in aortic stenosis. So, the anaesthetic goals are almost similar in isolated lesions or combined CAD and aortic stenosis.[11]

The anesthetic plan should be individualized, balancing the risks of the procedure with the severity of AS and CAD including LV dysfunctions (EF, CO, RWMA). At large prefer techniques that provide controlled, stable hemodynamics. General anaesthesia is usually preferred in AS with CAD due to limited SV, and MAP is maintained by HR and SVR. The sudden drop of MAP due to profound decrease in SVR and HR during spinal anaesthesia may reduce the coronary perfusion resulting in MI and arrhythmias. The balanced general anaesthesia with etomidate (0.2-0.3 mg/kg) with minimum cardiac depression, provide stable hemodynamic. Propofol with myocardial depression, vasodilatation and hypotension is not an ideal induction agent. Opioids like fentanyl (1-2 mcg/kg) or short acting remifentanil (2-5 mcg/kg) are preferred to provide analgesia and blunt the sympathetic response of laryngoscopy and intubation. Inhalational agent like sevoflurane (1-2 MAC) and midazolam (0.05-0.1 mg/kg) may be required to allow the lower doses of opioids and to treat the increased BP and facilitate the rapid recovery and tracheal extubation. Neutral muscle relaxant without any sympathetic response such as vecuronium bromide (0.05-0.1 mg/kg), or atracurium (0.5-0.6mg/kg) or cisatracurium (0.1-0.2mg/kg) are preferred to mitigate the myocardial oxygen imbalance by prevention of tachycardia and hypertension. Therefore, the placement of arterial catheter for continuous BP monitoring and early detection of hypotension is indicated before administration of anaesthesia. The focus is to maintain a MAP of >70 mmHg or within 20% of the baseline to avoid the myocardial ischemia.

If emergent surgery is required in a patient with CAD and severe AS, then careful haemodynamic monitoring is vital. Intensive monitoring is suggested including invasive hemodynamic monitoring (CVP, PAC, invasive arterial BP, BIS, ECG) and intraoperative TEE under the supervision of multidisciplinary heart team including cardiac anaesthetist, particularly if hemodynamic instability, large volume shifts, or high risk for bleeding is anticipated in the perioperative period. [32,44,] 5-lead ECG is also essential to early detect the tachyarrhythmias, nodal or junctional rhythm these may affect the diastolic LV filling in a poorly compliant LV, and so maintenance of sinus rhythm and adequate intravascular volume is vital to ensure ventricular filling. Indeed, it's vital to control the hemodynamically significant AF with amiodarone, beta- blockers or calcium channel blockers or even biphasic DC shock (100 200J). Arrhythmias must be treated promptly, as in a reduced LV compliance LA kick plays a vital role in diastolic LV filling up to 40% as compared to 10-15% in normal LV.

An arterial catheter for continuous BP monitoring and to detect early changes in blood pressure (hypotension/ hypertension). Central venous access provides a route for the administration of fluid and vasopressors/ inotropic therapy, but not only CVP, even PCWP underestimates the LVEDP in a patient with reduced LV compliance in concentric LVH. Pulmonary artery catheterization is relatively contraindicated because of the risk of precipitating arrhythmias; however, it is worth use to obtain important information about the left sided filling pressures, CO/CI, SVR. Mixed venous oxygen saturation and even pacing is facilitated in severe bradycardia. On availability of expert cardiac anaesthetist, Intraoperative transoesophageal echocardiography may be appropriate and allows assessment of left ventricular filling, contractility, diastolic dysfunction and guides fluid and drug therapy particularly in patients with severe AS or CAD with severe LV dysfunctions and regional wall motion abnormalities (RWMA). TEE also determines the aetiology and mechanism of mitral regurgitation i.e. ischemic or annular dilatation as a result of AS or CAD induced LV enlargement, and its hemodynamic effects. TEE also helps in the early detection of MI via newly developed RWMA and diastolic dysfunction before the ECG changes. [55,56,57] Regional wall motion abnormalities (WMAs) after MI are associated with adverse remodelling and increased mortality in the short to medium term.[57]

Spinal anaesthesia is considered as risky due to rapid and unpredictable fall in the BP as a result from sympathetic block which may severely reduce the coronary perfusion in a heart already struggling with fixed low cardiac output, decreased coronary flow reserve and reduced coronary flow due to CAD and severe AS, and so potential for heart failure or MI. This is based on the precautionary expert recommendations. However, the lower limb surgery can safely be performed under spinal anaesthesia using unilateral block under the supervision of expertise cardiac anaesthetist, it avoids profound vasodilatation and better BP stability and provides better postoperative pain control but require meticulous management to prevent catastrophic hypotension. The early detection and treatment of hypotension, bradycardia and arrhythmias are essential. The hypotension should be managed with titrated intravenous fluid infusion as adequate fluid volume is crucial for ventricular filling, and for persistent hypotension despite volume infusion, an aggressive use of phenylephrine bolus(60 -100mcg) or norepinephrine boluses(5-10 mcg)is vital to prevent the hypotension induced MI and arrhythmias.[58,59,60] Norepinephrine is considered superior to phenylephrine in controlling the spinal hypotension with a potency ration of 12.[61] in selected patients of severe AS and CAD with LV dysfunctions an inotropic support with milrinone or dobutamine or levosimendan

along with safely utilization vasopressors (norepinephrine) may help improving the LV functions and cardiac output, and mitigates the hypotension during spinal anaesthesia.

CONCLUSION

Elderly Patients with severe AS and concomitant CAD may require elective or emergent non cardiac surgery. Severe AS should be treated with surgical AVR/ TAVR/ BAV before noncardiac surgery to prevent the MACE and mortality. Patients with Mild to moderate AS can safely subjected to the elective Non cardiac surgery under the supervision of cardiac anaesthetist and intensive monitoring. Severe symptomatic CAD involving tight stenosis of multivessel or >50% of left main coronary needs coronary intervention before noncardiac surgery. However, asymptomatic non-significant CAD patients can safely undergo the NCS preferably under spinal anaesthesia. This single case report suggests that even the patients of CAD and AS can undergo non cardiac surgery involving the lower limb under spinal anaesthesia under the supervision of multidisciplinary team. The hypotension of spinal anaesthesia should be aggressively managed with fluid infusion and boluses of norepinephrine or phenylephrine to avoid the MACE (MI, arrhythmias, cardiogenic shock) and mortality.

Declaration by Authors

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