

Assessment Points			
System	Effect	Assessment/PE	Test
CV	CAD, HTN, increased, dysrhythmias	Decreased exercise tolerance, diaphoresis, palpitations, angina, CHF symptoms	ECG and/or invasive testing if indicated
RESP	Obstructive lung disease, OSA	Decreased exercise tolerance	Generally not needed
GI	Irritable bowel syndrome	Nausea, diarrhea	
ENDO	Increased cholesterol		
CNS	Migraines Insomnia Hyperarousal state	Headaches, fatigue, tremor, sweating, restlessness	
MS	Muscle tension	Headaches and skeletal muscle pain	
IMMUNO	Altered immune response to stress and environment	Hay fever, hives	

Key References: Grant BF, Stinson FS, Dawson DA, et al: Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions, *Arch Gen Psychiatry* 61(8):807–816, 2004; Clarke H, Kirkham KR, Orser BA, et al: Gabapentin reduces preoperative anxiety and pain catastrophizing in highly anxious patients prior to major surgery: a blinded randomized placebo-controlled trial, *Can J Anesth* 60(5):432–443, 2013.

Perioperative Implications

Preoperative Preparation

- Discuss the periop needs and benefits of psychiatric intervention with surgeons and psychiatrists.
- Continue outpatient medications; abrupt cessation may cause withdrawal.
- Treat acute anxiety with benzodiazepine or beta-blockers if indicated.
- Alpha-2-delta blockers such as gabapentin and pregabalin may be effective in reducing preop anxiety and postop pain.
- Assess cardiovascular status: HR, cardiac rhythm, and BP.
- Review pt's medications, which may have significant interactions with periop medications.

Monitoring

- Myocardial ischemia, cardiac dysrhythmias, and BP control
- Altered temperature regulations; hyperpyrexia

Induction

- Sudden reduction of autonomic hyperactivity may cause BP and HR fluctuations.

Maintenance

- Altered drug metabolism and anesthetic requirements and potential drug interactions with intraop medications, incl:
 - SSRIs: CYP450 inhibitor (fluoxetine) associated with serotonin syndrome (tramadol, dextromethorphan, pethidine, and pentazocine)
 - TCAs: IMAC, ↓response to indirect-acting vasopressors and sympathetic stimulations, increased response to indirect-acting vasopressors (e.g., ephedrine) and sympathetic stimulation
 - MAOIs: Orthostatic hypotension, tyramine-induced hypertensive crisis, excessive effects of sympathomimetic drugs and sympathetic stimulation and serotonin syndrome (meperidine)
 - Antipsychotics: Orthostatic hypotension, increased QT and PR intervals, decreased BP under GA, extrapyramidal side effects (typical antipsychotics), decreased seizure threshold, abnormal temperature regulation, sedation, and neuroleptic malignant syndrome
 - Benzodiazepine: Diazepam, clonazepam, and midazolam are metabolized via CYP-mediated

oxidation: Increased duration of effect with liver impairment; synergistic effects among benzo, hypnotics, and opioids

- Kava-kava: Decreased SVR, increased effects of CNS depressants, abnormal platelet aggregation, and liver toxicity

Extubation

- Confusion and combativeness
- Prolonged narcosis

Postoperative Period

- Continue psychiatric medications to avoid acute relapse.
- Consider early psychiatric intervention.

Anticipated Problems/Concerns

- Anticipate enhanced postop acute pain and PONV.
- Anticipate complications related to substance abuse (e.g., alcohol withdrawal).
- Anticipate and treat postop delirium.
- Anticipate prolonged hospital course.
- Be cautious before introducing any new medications for potential drug interactions.

Aortic Regurgitation

Risk

- There are on the order of 100,000 aortic valve surgeries each year, with approximately 18,000 of them performed annually in the USA.
- Of aortic valves, 20% to 30% have isolated regurgitation at time of replacement.
- At time of replacement, 12-30% of aortic valves have combined regurgitation and stenosis.
- M:F ratio: 3:1.
- Racial predominance: None known.

Perioperative Risks

- Left ventricular failure
- Right ventricular failure
- Subendocardial ischemia
- Splanchnic ischemia

Worry About

- Underlying causes of acute aortic regurgitation including aortic dissection, a malfunctioning valve prosthesis, or endocarditis

- Hypertension, which increases aortic regurgitation and decreases cardiac output
- Bradycardia, which increases aortic regurgitation and decreases cardiac output
- When going onto bypass, avoid LV distention from fibrillatory arrest before aortic cross-clamping (frequently occurs during cooling on pump) until LV decompression is immediately achievable

Overview

- Long latency period between onset of hemodynamic changes and symptoms with the exception of acute aortic regurgitation (~20-30 y)
- Myocardial ischemia uncommon
- Bicuspid valve +/- ascending aortic aneurysm frequently associated with aortic regurgitation
- Abdominal pain a manifestation of splanchnic ischemia

Etiology

- Congenital bicuspid valve
- Damage to leaflets
- Aortic root dilatation
- Loss of commissural support

Treatment

- Medical: Control of systolic hypertension via vasodilators (e.g., ACE inhibitor), calcium channel blockers, and diuretics.
- In Marfan syndrome, which is often accompanied by aortic regurgitation and root dilation, angiotensin receptor blockers are a promising treatment to prevent or slow the progression of aortic dilation.
- Surgical: Aortic valve replacement.

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Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Aortic valve dysfunction	Dyspnea with exercise	High-pitched, early diastolic, decrescendo blowing murmur Mid-diastolic low-pitched murmur (Austin Flint) Widened arterial pulse pressure (water-hammer) To and fro bobbing of head (de Musset sign)	CXR ECHO Cardiac MRI
	LV dysfunction	Dyspnea with exercise Nocturnal dyspnea	Displaced posterior MI S ₃	ECG CXR ECHO Cardiac MRI Cardiac cath
RESP	CHF	Dyspnea Nocturnal dyspnea	Rales S ₃	CXR
GI	Splanchnic ischemia	Abdominal pain	Distended abdomen	

Key References: Nishimura RA, Otto CM, Bonow RO, et al: 2014 AHA/ACC guideline for the management of patients with valvular heart disease: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 129(23):2440–2492, 2014; Wilson W, Taubert KA, Gewitz M, et al: Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *Circulation* 116(15):1736–1754, 2007.

Perioperative Implications

Preoperative Preparation

- Consider optimizing LV performance with vasodilators, inotropes, and diuretics.
- Avoid reduction in aortic diastolic pressure, and be vigilant regarding low mean arterial pressures despite apparently normal systolic pressures.
- Emergent procedures (acute aortic regurgitation); full-stomach precautions.

Monitoring

- Arterial cath.
- ECG leads II/V5 and ST-segment analysis.
- Consider pulmonary artery cath and transesophageal ECHO.

Preinduction/Induction

- Elective: Avoid hypertension, hypotension, hypoxemia, and bradycardia; nondepolarizing muscle relaxants may be preferred over succinylcholine due to their lack of bradycardic effects.
- Emergency (acute aortic regurgitation with aortic dissection): Weigh the aspiration risk against the danger of acute increases in aortic wall tension and avoidance of bradycardia and consider rapid-sequence technique.

- Decreased aortic diastolic pressure combined with elevated LV diastolic pressures can lead to decreased coronary perfusion and subendocardial ischemia.
- Bradycardia and elevations in SVR increase regurgitant fraction and decrease cardiac output.

Maintenance

- Hemodynamic goals remain to avoid bradycardia, increases in SVR and decreases in diastolic blood pressure.
- Pulmonary capillary wedge pressures may underestimate LVEDP due to premature closure of the mitral valve.
- Pulmonary capillary wedge pressures may overestimate LVEDP in pts with combined aortic regurgitation and mitral regurgitation.

Extubation

- Consider extubation for patients undergoing valve replacement in the intensive care unit after respiratory and hemodynamic criteria are met.

Postoperative Period

- Consider augmenting preload to maintain and preserve filling volume of a still-dilated LV cavity.

- Inotropic support may be required to maintain cardiac output if inadequate intraop myocardial preservation was achieved.
- Evaluation for neuro injuries secondary to embolism during valve replacement. Meticulous de-airing maneuvers will lessen gaseous microembolization.

Anticipated Problems/Concerns

- Prolonged Trendelenburg position may be poorly tolerated during central venous cath insertion.
- Intraaortic balloon counterpulsation contraindicated before valve replacement.
- Atrial fibrillation or other SVTs may be poorly tolerated and may require aggressive treatment.
- Retrograde cardioplegia (not anterograde) may be required for myocardial protection.
- Associated diseases may present difficult intubation (e.g., rheumatoid arthritis, Marfan syndrome, trauma from acute aortic dissection).
- On separation from cardiopulmonary bypass, complete ECHO exam is recommended to examine the integrity of the replacement, as well as unanticipated iatrogenic injuries to other cardiac structures.

Aortic Stenosis

Jared Feinman

Risk

- Most common valvular heart disease; prevalence only 0.2% among adults aged 50–59 y, but increases to almost 10% after age 80 y.
- Calcific aortic stenosis: Major risk factors are increasing age, LDL, diabetes mellitus, smoking, hypertension, and bicuspid valve anatomy. Less common risk factors include disorders of calcium metabolism, renal failure, and history of mediastinal radiation.
- Bicuspid aortic valve is present in 1–2% of USA population and accounts for 60% of AVRs in pts under age 70 y and 40% over 70 y.
- Rheumatic aortic stenosis: Late sequela of streptococcal infection, more common in developing countries and often involves other valves.

Perioperative Risks

- Hypovolemia and/or vasodilation from anesthetic drugs lead to hypotension due to lack of preload reserve necessary to overcome systolic pressure gradient in pts with severe AS

- Risk of myocardial ischemia is elevated due to increase in LVED pressure (reducing coronary perfusion gradient) and LVH (associated with structural coronary abnormalities)
- Bicuspid valve associated with ascending aortic aneurysm and dissection, with a lifetime risk of about 6%

Worry About

- Drop in SVR and preload leads to reduced stroke volume through stenotic valve.
- Reduced SVR and stroke volume leads to hypotension, which reduces coronary perfusion and may lead to myocardial ischemia.
- Tachycardia poorly tolerated.
- Rheumatic dysfunction very common.
- Atrial fibrillation; atrial kick provides up to 40% of LVED volume in AS pts, and its loss can lead to profound hypotension.

Overview

- Normal valve area (AVA) 2.6–3.5 cm²; AS classified as mild (AVA >1.5 cm²), moderate (AVA 1–1.5 cm²), and severe (AVA <1 cm²).

- Stenosis at the aortic valve leads to development of pressure gradient from LV to aorta.
- Increase in LV systolic pressure increases wall tension, producing LV hypertrophy.
- LV hypertrophy and augmented preload are primary means of maintaining adequate stroke volume and cardiac output in severe AS.
- Hypertrophy decreases LV compliance and diastolic dysfunction may ensue, making atrial contraction critical for maintaining adequate LV filling and stroke volume.
- Preload reserve generally exhausted in severe AS, so hypovolemia and reduced SVR are poorly tolerated.
- Elevated LVED pressure and alterations in coronary microcirculation associated with LV hypertrophy reduce coronary perfusion.
- Angina, dyspnea, and syncope are common presenting symptoms.
- Diagnosis of AS is made using ECHO or in the cath lab by assessing pressure gradient and valve area.
- Mean and peak pressure gradients across the valve also are used to classify severity.