

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	CAD LVH/LVF	MI, angina, previous CABG or PCI Dyspnea, orthopnea	Displaced apex beat S ₃ , basal crepitations Rales Pulses Ankle brachial pressure index	ECG CXR, ECHO
	Peripheral vascular/aortic disease	Claudication/rest pain		Doppler Angiography/CT angiography/MR angiography
METAB	Metabolic syndrome		Central obesity	Fasting blood glucose Triglycerides HDL cholesterol
RENAL	Renal impairment			Creatinine Estimated creatinine clearance Microalbumin urine test
CNS	TIA/CVA	Hx of TIA/CVA	Neurologic signs Carotid bruit	Doppler CT/MRI Angiography/CT angiography/MR angiography

Key References: Lapage KG, Wouters PF: The patient with hypertension undergoing surgery. *Curr Opin Anaesthesiol* 29(3):397–402, 2016; James PA, Oparil S, Carter BL, et al.: 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *J Am Med Assoc* 311(5):507–520, 2014.

Perioperative Implications

Preinduction/Induction/Maintenance

- There is no clear evidence to support deferring surgery or for acute management of BP in pts presenting with moderate Htn in the absence of CAD.
- Severe Htn (>180/110 mm Hg) confirmed on multiple readings should be controlled prior to surgery if the delay necessary to achieve this will not compromise the pt (especially if the pt has evidence of target-organ damage).
- Consider withholding ACEIs and ARBs for 12 h before surgery, as they may be associated with an increased incidence of intraop hypotension. If they are held, it is critical to restart them as soon as possible.
- Maintain treatment with other antihypertensive medications (in particular beta-blockers) unless the pt is hypotensive or has evidence of postural hypotension.
- Maintain euvoolemia, especially in pts taking vasodilating drugs such as ACEIs or ARBs.

Monitoring

- Standard monitoring.
- Frequent BP readings should be taken at times of potential CV instability, such as induction, in order to detect sudden changes in BP.

- Consider direct arterial pressure monitoring if surgery is proceeding in the face of severe Htn or a large fluid shift.
- Consider dynamic (e.g., pulse pressure variation) or static (CVP) monitoring if significant hypovolemia is suspected.

General Anesthesia

- Pts may develop profound hypotension at induction and Htn at intubation.
- Consider a fluid preload prior to induction if relative hypovolemia is suspected.
- Consider preparing a short-acting vasopressor prior to induction.
- Consider the use of opiates or short-acting vasoactive drugs to control the response to intubation in pts with significant CVD.
- Aim to keep intraop BP within 20% of best estimate of preop BP with appropriate use of fluids and vasoactive drugs.
- No anesthetic maintenance technique has been demonstrated to be superior in this setting.

Regional Anesthesia

- Risk of hypotension with neuroaxial blockade.
- Consider a fluid preload prior to neuroaxial blockade.

- Take BP readings every 1–2 min immediately after neuroaxial blockade if using noninvasive monitoring.
- As with general anesthesia, aim to keep intraop BP within 20% of best estimate of preop BP.

Postoperative Period

- Resume normal antihypertensive treatment as soon as possible.
- If the pt is not on appropriate CVD prevention, make appropriate medical referrals to rectify this if possible.
- In some cases, parenteral treatment of BP may be required if the pt cannot take oral medications.
- Consider parenteral beta blockade if a pt who is chronically treated with a beta-blocker is unable to resume this treatment.

Anticipated Problems/Concerns

- In pts with preexisting CVD, poorly controlled BP in the postop period may precipitate myocardial ischemia and cardiac complications.

Hypertension, Uncontrolled With Cardiomyopathy

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Risk

- 1.5 billion worldwide in 2014
- 70 million people in USA; approximately 1:3 people
- USA highest prevalence: African American
- Male = female

Perioperative Risks

- Increased risk of MI and stroke
- Increased risk of CHF, ventricular hypertrophy, coronary artery disease, and atrial fibrillation
- Increased risk of cerebral hypoperfusion due to right shift of the cerebral blood flow autoregulation curve
- Increased risk of renal failure
- Increased blood loss
- Prolonged hospitalizations

Overview

- Eighth Joint National Commission Hypertension Guidelines:

- BP goal <150/90 mm Hg—anyone >60 y who does not have DM or CKD.
- BP goal <140/90 mm Hg—anyone <60 y without major comorbidities and in pts >60 y with DM, CKD, or both.
- Possibility of masked hypovolemia.
- Silent myocardial ischemia may occur from supply-demand mismatches, even in absence of CAD.
- May be forerunner of renal failure and/or stroke.
- CHF may be presenting sign.
- May develop LVH ± strain pattern on ECG.
- May require >6 wk of treatment for regression of LVH.

Etiology

- Idiopathic with genetic predisposition (>90%) and with up to 50% of global population
- Secondary hypertension due to thyroid, renal, and adrenal abnormalities

- Substance abuse (alcohol, cocaine, amphetamines)
- Valvular heart pathology (e.g., aortic insufficiency)
- High peripheral resistance is accelerated with time

Usual Treatment

- Preload optimization (diuretics, venodilators)
- Afterload optimization (ACE inhibitors, angiotensin receptor blockers, CCBs, alpha₁-blockers, beta-blockers with alpha₁ activity, alpha₂ adrenomimetics, direct vasodilators, and sodium nitroprusside for emergencies)
- Drugs with negative inotropic effect (beta-blockers, calcium channel blockers)
- Atherosclerosis prophylaxis (statins)
- Surgical correction of secondary forms of hypertension

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	LV function LVH	Exercise tolerance	Two-flight walk	ECG, CXR ECHO, MUGA Stress thallium
RESP	Pulm edema	Orthopnea Dyspnea	Rales	CXR
CNS	Stroke	Blackouts	Carotid bruit	Carotid study
RENAL	Nephropathy	Edema		BUN/Cr

Key References: James PA, Oparil S, Carter BL, et al.: 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8), *J Am Med Assoc* 311(5):507–520, 2014; Mauck KF, Sundstedt KK: *Update in perioperative medicine: evidence published in 2014*, *Ann Intern Med* 162(9):W111–W116, 2015.

Perioperative Implications

Preoperative Risks

- Continue and/or increase antihypertensive medicine.
- Short-acting vasodilators prepared, including nitroglycerin.
- Assess myocardial and volume status.
- Anxiolytics on the day before surgery.
- Correction of electrolyte imbalances if present.

Monitoring

- Arterial monitoring
- Foley catheter to monitor urine output for traumatic or long procedures or for the procedures with expected significant blood loss
- Volume status monitoring depending on LV function (e.g., CVP, possibly PA cath, TEE)

Induction

- Preintubation opiates to blunt hypertensive response to laryngoscopy and ETT placement.
- Consider administration of the high end of the dose range of the IV induction agent with uncontrolled Htn. However, with significant cardiomyopathy consider etomidate to maintain cardiac hemodynamics.
- Use of defasciculating dose of nondepolarizing neuromuscular blocker to prevent mesenteric blood mobilization during abdominal muscle contractions during acetylcholine-induced muscular fasciculations.
- Avoiding significant fluctuations in blood pressure during induction and intubation by using lidocaine, fentanyl, and esmolol.
- Rapid correction of hypotension with ephedrine or phenylephrine.

- If severely hypertensive, consider vasodilators (e.g., nitroglycerin or nitroprusside prior to induction).

Maintenance

- Careful monitoring of the depth of anesthesia to avoid light anesthesia masking intravascular volume deficit.
- Maintain euvoolemia.
- Preemptive analgesia to prevent primary sensitization phenomenon.
- Consider high-dose opioids if high hemodynamic stability is needed and prolonged postop ventilation is not an issue.

Extubation

- Adequate analgesia prior to termination of anesthesia
- Short-acting vasodilator and/or beta-blockers to prevent hypertension and tachycardia

Adjuvants

- Regional: May prevent severe increases in BP. Hypotension may occur due to vasodilation.
- Continuous infusions of nitroglycerin, nitroprusside, or esmolol.
- If treated with antihypertensives preop, severe hypotension may not respond to usual doses of vasoconstrictors.
- Consider use of alpha-2 adrenomimetics.
- Inhalational agents, in particular, above 1 MAC can cause dose-dependent increase in heart rate and have different hemodynamic effects.

Postoperative Period

- Restart antihypertensive medication as soon as possible in postop period.

- Patch therapy for some drugs (e.g., clonidine and fentanyl) must be started 12 h prior to allow absorption from skin.
- Effective pain control using opioids and/or NSAIDs or continuous blockade.

Anticipated Problems/Concerns

- Watch for symptoms of CNS, renal, or myocardial dysfunction.
- Preop period affords opportunity to educate pts about importance of complying with antihypertensive therapy.
- Rebound hypertension if certain medications are discontinued (e.g., clonidine).
- Discontinue ACEIs and ARBs >10 h prior to surgery. Continuation of ACEIs and ARBs has increased risk of intraop hypotension. Discontinuation not associated with increased prevalence of postop Htn.
- Periop BP lability has been reported to increase the risk for stroke, acute kidney injury, and 30-day mortality in pts undergoing cardiac surgery.
- It is generally recommended that elective surgery be delayed for severe hypertension (diastolic BP >115 mm Hg, systolic >200 mm Hg) until BP <180/110.
- Expect with anesthetics, such as propofol or any inhalational agents, to have clinically apparent vasorelaxation of excessively constricted arterioles in long-standing hypertension, resulting in hypotension post induction.
- Human physiology and the Frank-Starling Law explain the rationale for treatments, such as diuretics in congestive heart failure and cardiomyopathies.

Hyperthyroidism

Michael F. Roizen

Risk

- Incidence in USA: 300,000-500,000 individuals/yr develop hyperthyroidism. In addition, 7.5% of pregnant women become hyperthyroid (highest prevalence in second trimester).
- 1:1000 females; 1:3000 males.
- Race with highest prevalence: Unknown.

Perioperative Risks

- Risk related to occurrence of thyroid storm; increased risk of storm even if pt is made euthyroid prior to surgery.
- Some increased risk of resp insufficiency.
- Progressive increased risk of hypothyroidism after surgery on thyroid, radioactive Rx of hyperthyroidism, and thyroiditis.

Worry About

- Assessing that pt is euthyroid.
- Securing airway in pt with large goiter or displaced trachea.
- Postop risks of nerve injury (immediate stridor requires immediate reintubation), surreptitious

bleeding (examine wound, which can drain externally, prior to PACU discharge), and thyroid storm (uncommon without another acute illness or >3 d postop).

Overview

- Endocrinopathy with CVD: Tachycardia (commonly idiopathic if no prior Dx of hyperthyroidism has been made), CHF, dysrhythmias AFIB as major manifestations.
- Other targets: Resp and CNS (decreases drive to breathe; worsens anxiety, psychoses) and metabolic (hypermetabolism and increased protein turnover, resulting in weakened muscles and malnourishment); can present as unintentional weight loss.
- If pt is euthyroid prior to operation, risk of storm and of periop CV problems is diminished by >90%.
- If pt is not euthyroid, delay operation if possible until he or she is euthyroid.
- If emergency (life-threatening trauma, ruptured viscus), use beta-blocking agents and iodides to decrease periop effects as well as further synthesis and release of thyroid hormones; keep pt in ICU until risk of storm has passed.

Etiology

- Multinodular diffuse enlargement (Graves disease); almost never malignant; soft large gland; thought to be autoimmune (thyroid-stimulating IgGs that bind to TSH receptors on thyroid associated with goiter and ophthalmopathy)
- Pregnancy (ectopic TSH-like substance)
- Thyroiditis (autoimmune) in acute phase, often with sore neck and hoarseness
- Thyroid adenoma: Toxic multinodular goiter (firm gland) later in life and rarely (almost never) malignant; unilateral solitary nodule with autonomous function earlier in life, also almost always benign
- Choriocarcinoma
- TSH-secreting pituitary adenoma
- Surreptitious ingestion of T₄ or T₃

Usual Treatment

- Antithyroid drugs for 2–6 mo; if hyperthyroidism recurs, retreat; if recurs again, consider surgery or radioiodine Rx.