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GÖMRÜK HOSPİTALI

TƏDBİRLƏR

MANAGEMENT OF HYPERTENSION IN PREOPERATIVE PATIENTS

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DISCLOSURES

- None.

CONTENT

- Cardiovascular risk assessment: pre-OP
- Anesthesia and BP
- Perioperative risks
- Management of patients with HTN
- Intra- & postoperative HTN

REFERENCES

- Current 2022 guidelines on cardiovascular assessment and management of patients undergoing noncardiac surgery (NCS) of the European Society of Cardiology (ESC) (an update on the guidelines published in 2014).
- 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice guidelines. *J Am Coll Cardiol.* 2014;64:e77–e137.
- The 2017 American College of Cardiology/American Heart Association (ACC/AHA) hypertension guidelines

PATIENT M.M.

- 79 yo F h/o hypertension, ischemic heart disease and s/p elective PCI with 2 stents
- BP on anti-HTN meds:
  - ranges, BP 140-160/85-100 mmHg, lately
  - rarely 200/108 mmHg
- Asymptomatic:
  - Able to walk over 4 km at normal pace
- She is diagnosed with acute cholecystitis and large umbilical hernia w/o strangulation
- General surgery is calling for “consult” **to clear** the patient for surgery

CLEARING PATIENT vs PERIOPERATIVE MANAGEMENT

- Clearing patient vs Optimization vs else?
- Better to do Perioperative Management
- Surgical & Clinical risks: should be individualized
- **What are those risks or MACEs:**
  - Perioperative MI
  - Heart failure
  - Cardiac arrest
  - VF
  - Complete heart block
  - Cardiac death

At first… ask yourself

How would I manage this patient in the absence of the surgical operation in question?

Surgical risk for perioperative MACE

Low Risk, <1%	High Risk, >5%
• Ambulatory (same day) surgery • Endoscopic procedures • Superficial procedures • **Laparoscopic appendectomy/cholecystectomy** • Cataract surgery • Breast surgery (simple mastectomy, lumpectomy)	• Aortic, major vascular surgeries • Open lower limb revascularisation, thrombectomies, amputation • Liver resection, bowel repair, adrenal resection, open ventral hernia repair, bile duct surgery, etc • Liver transplant, lung transplant • Pneumonectomy
Intermediate Risk, 1-5%	**Always Higher risk%**
• Carotid endarterectomy • Endovascular aneurism repair • Renal transplant • Head and neck surgery • Abdominal intraperitoneal surgeries (splenectomy, open cholecystectomy, hiatal hernia repair) • Intrathoracic surgery • Orthopedic surgery • Urological and gynecological surgeries	• Emergency surgery

Surgical risk estimate according to type of surgery or intervention

Low surgical risk (<1%)	Intermediate surgical risk (1–5%)	High surgical risk (>5%)
• Breast • Dental • Endocrine: thyroid • Eye • Gynaecological: minor • Orthopaedic minor (meniscectomy) • Reconstructive • Superficial surgery • Urological minor: (transurethral resection of the prostate) • VATS minor lung resection	• Carotid asymptomatic (CEA or CAS) • Carotid symptomatic (CEA) • Endovascular aortic aneurysm repair • Head or neck surgery • Intraperitoneal: splenectomy, hiatal hernia repair, cholecystectomy • Intrathoracic: non-major • Neurological or orthopaedic: major (hip and spine surgery) • Peripheral arterial angioplasty • Renal transplants • Urological or gynaecological: major	• Adrenal resection • Aortic and major vascular surgery • Carotid symptomatic (CAS) • Duodenal-pancreatic surgery • Liver resection, bile duct surgery • Oesophagectomy • Open lower limb revascularization for acute limb ischaemia or amputation • Pneumonectomy (VATS or open surgery) • Pulmonary or liver transplant • Repair of perforated bowel • Total cystectomy

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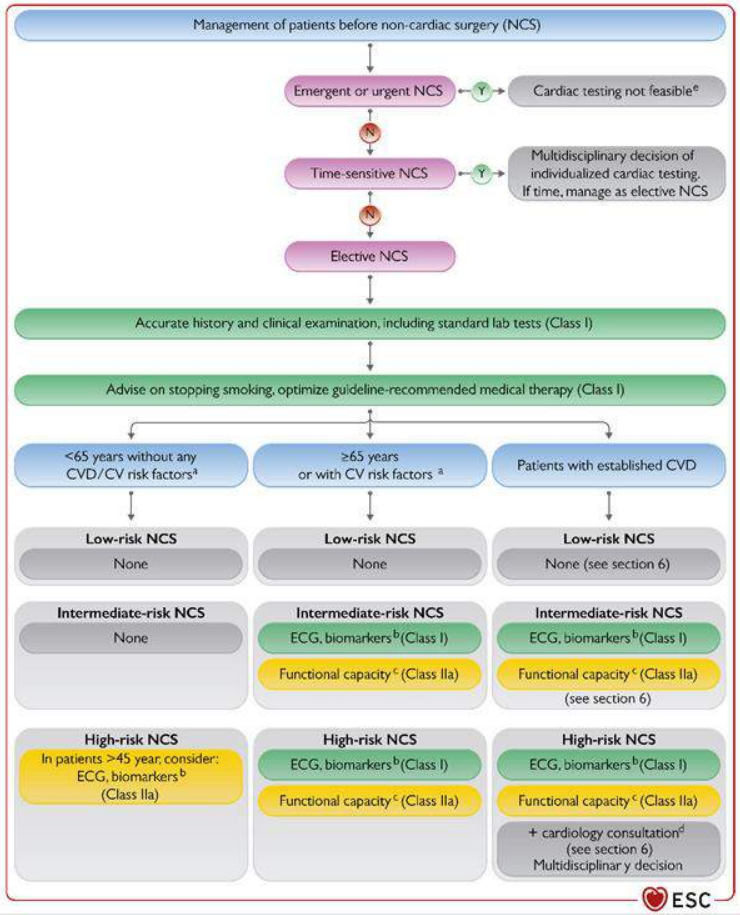
CLINICAL RISK FACTORS

- Coronary artery disease
  - h/o MI: predictor of MACE
  - Recent MI (within 6 months)
  - Better wait for 60 days after MI/ACS
- Heart failure
  - Absolute mortality rate is very high if EF<30%
  - Mortality rate higher even for HFpEF when compared to patients without it
  - Better to delay surgery if decompensated
- Cardiomyopathy
- Valvular heart disease

Figure 2

Pre-operative assessment before non-cardiac surgery



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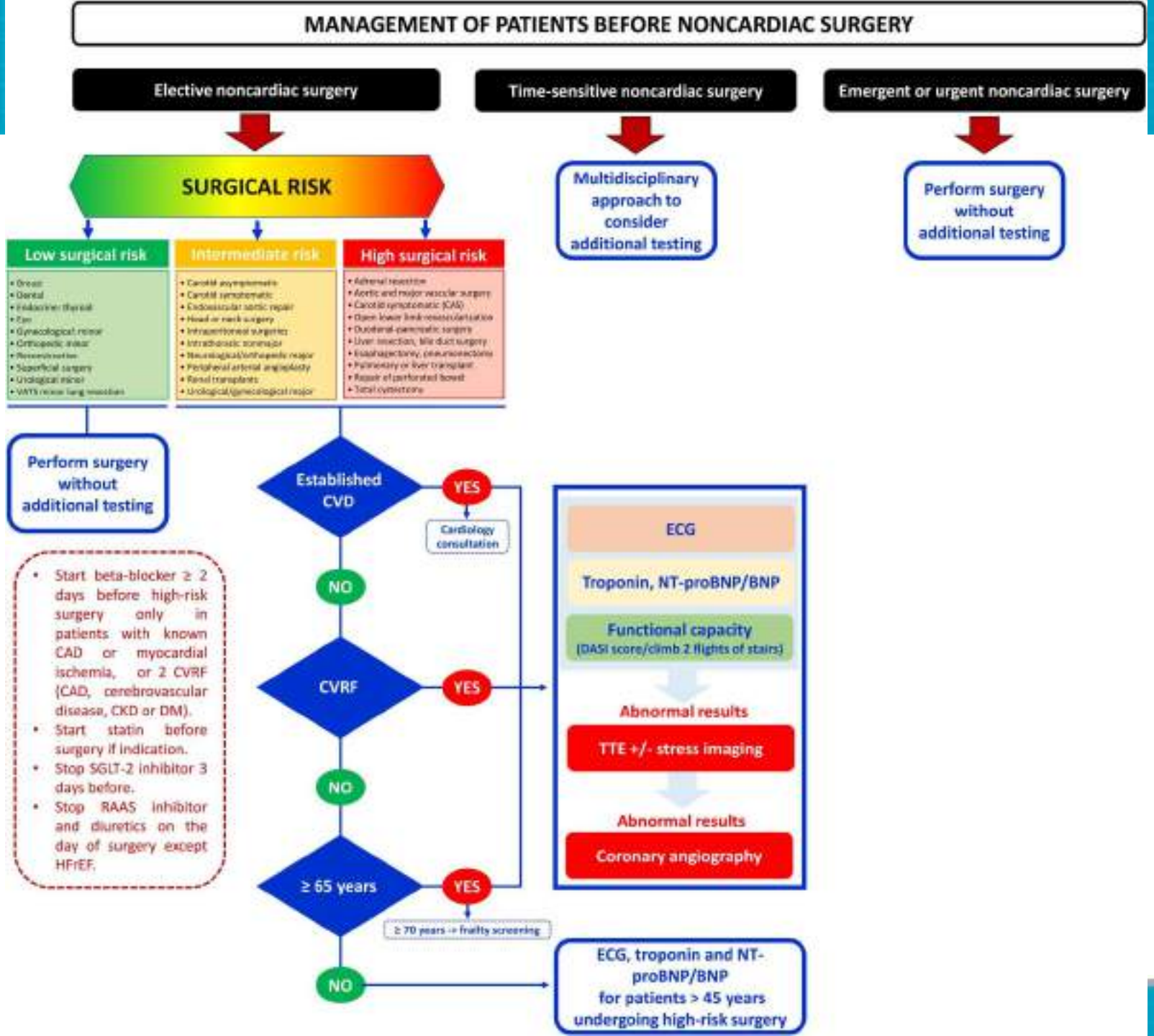
MANAGEMENT OF PATIENTS BEFORE NONCARDIAC SURGERY
Elective noncardiac surgery
Time-sensitive noncardiac surgery
Emergent or urgent noncardiac surgery
SURGICAL RISK
Multidisciplinary approach to consider additional testing
Perform surgery without additional testing
Low surgical risk
Intermediate risk
High surgical risk
Perform surgery without additional testing
Established CVD
YES
Cardiology consultation
NO
CVRF
YES
NO
≥ 65 years
YES
≥ 70 years -> frailty screening
NO
ECG, troponin and NT-proBNP/BNP for patients > 45 years undergoing high-risk surgery
ECG
Troponin, NT-proBNP/BNP
Functional capacity
(DASI score/climb 2 flights of stairs)
Abnormal results
TTE +/- stress imaging
Abnormal results
Coronary angiography
• Start beta-blocker ≥ 2 days before high-risk surgery only in patients with known CAD or myocardial ischemia, or 2 CVRF (CAD, cerebrovascular disease, CKD or DM).
• Start statin before surgery if indication.
• Stop SGLT-2 inhibitor 3 days before.
• Stop RAAS inhibitor and diuretics on the day of surgery except HFrEF.

Risk score calculators (1)

	Revised Cardiac Risk Index (RCRI) (1999)	Surgical Risk Calculator (2011)	The American College of Surgery National Surgical Quality Improvement Program (ACS NSQIP) (2013)	Surgical Outcome Risk Tool (SORT) (2014)	The American University of Beirut (AUB)-HAS2 Cardiovascular Risk Index (2019)
Variables	Ischaemic heart disease Cerebrovascular disease History of congestive heart failure Insulin therapy for diabetes Serum creatinine level ≥2 mg/dL High-risk surgery (each assigned 1 point)	Age ASA–PS grade Pre-operative dependent functional status Creatinine >1.5 mg/dL Type of surgery	Age Sex Functional status Emergency case ASA class Current steroid use Ascites within 30 days Systemic sepsis within 48h Ventilator dependence Disseminated cancer Diabetes Hypertension on treatment Congestive HF Dyspnoea Current smoker History of severe COPD Dialysis Acute renal failure Body mass index Surgery code	ASA–PS grade Urgency of surgery High-risk surgical specialty Surgical severity (from minor to complex major) Cancer Age ≥65 years or over	History of Heart disease Symptoms of Heart disease (angina or dyspnoea) Age ≥75 years Anaemia (haemoglobin <12 g/dL) Vascular Surgery Emergency Surgery (2 H, 2 A and 2 S) (each assigned 1 point)

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Revised cardiac risk index (RCRI)

6 independent predictors of major cardiac complications[1]
High-risk type of surgery (examples include vascular surgery and any open intraperitoneal or intrathoracic procedures)
History of ischemic heart disease (history of myocardial infarction or a positive exercise test, current complaint of chest pain considered to be secondary to myocardial ischemia, use of nitrate therapy, or ECG with pathological Q waves; do not count prior coronary revascularization procedure unless one of the other criteria for ischemic heart disease is present)
History of heart failure
History of cerebrovascular disease
Diabetes mellitus requiring treatment with insulin
Preoperative serum creatinine >2.0 mg/dL (177 micromol/L)
Rate of cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest according to the number of predictors[2]
No risk factors – 0.4% (95% CI 0.1-0.8)
1 risk factor – 1.0% (95% CI 0.5-1.4)
2 risk factors – 2.4% (95% CI 1.3-3.5)
3 or more risk factors – 5.4% (95% CI 2.8-7.9)
Rate of myocardial infarction, pulmonary edema, ventricular fibrillation, primary cardiac arrest, and complete heart block[1]
No risk factors – 0.5% (95% CI 0.2-1.1)
1 risk factor – 1.3% (95% CI 0.7-2.1)
2 risk factors – 3.6% (95% CI 2.1-5.6)
3 or more risk factors – 9.1% (95% CI 5.5-13.8)

ECG: electrocardiogram.

References:

1. *Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. Circulation 1999; 100:1043.*
2. *Devereaux PJ, Goldman L, Cook DJ, et al. Perioperative cardiac events in patients undergoing noncardiac surgery: A review of the magnitude of the problem, the pathophysiology of the events, and methods to estimate and communicate risk. CMAJ 2005; 173:627.*

HOW ABOUT HYPERTENSION PERIOPERATIVELY?

INTRODUCTION: HTN & Surgery

Preexisting hypertension is (was) the most common medical reason for postponing surgery.

Hypertension is well known to be a risk factor for cardiovascular catastrophe, a risk that logically extends into the perioperative period.

Hypertension is common in older patients, having a prevalence of over 60% in people aged >60 yrs*. Risk for AKI and CKD.

* Williams B., Mancia G., Spiering W. 2018 ESC/ESH guidelines for the management of arterial hypertension: the task force for the management of arterial hypertension of the European Society of Cardiology (ESC) and the European Society of Hypertension (ESH) *Eur Heart J.* 2018;39:3021–3104.

PERI-OPERATIVE HTN… not only preOP

Postoperative hypertension

- Postoperative hypertension can occur in up to 20% of patients after elective non-cardiac surgery and is associated with adverse outcomes, including stroke, myocardial injury, arrhythmias and bleeding.
- Systolic pressures over 180 mmHg - indicating high risk.

Intraoperative management of blood pressure

- General anaesthetic agents can cause hypotension by causing vasodilation and by reducing cardiac output.
- Patients with HTN can display greater cardiovascular lability during surgery with increases in BP and heart rate at induction of anaesthesia and risks of hypotension in the intraoperative period.
- Maintaining a systolic arterial pressure of over 100 mmHg and a MAP over 60 mmHg may reduce risk.

- McEvoy M.D., Gupta R., Koepke E.J. Perioperative Quality Initiative consensus statement on postoperative blood pressure, risk and outcomes for elective surgery. *Br J Anaesth.* 2019;122:575–586.
- Sanders R.D., Hughes F., Shaw A. Perioperative Quality Initiative consensus statement on preoperative blood pressure, risk and outcomes for elective surgery. *Br J Anaesth.* 2019;122:552–562.
- Walsh M., Devereaux P.J., Garg A.X. Relationship between intraoperative mean arterial pressure and clinical outcomes after noncardiac surgery: toward an empirical definition of hypotension. *Anesthesiology.* 2013;119:507–515.

BLOOD PRESSURE & ANESTHESIA

- Sympathetic activation during the induction of anesthesia can cause
  - the blood pressure to rise by 20 to 30 mmHg and
  - the heart rate to increase by 15 to 20 beats per minute in normotensive individuals.

- In patients with untreated or poorly controlled HTN this response may be exaggerated:
  - systolic blood pressure can increase by 90 mmHg and the heart rate by 40 beats/min.

BLOOD PRESSURE & ANESTHESIA

- MAP tends to fall as the period of anesthesia progresses due to a variety of factors, including direct effects of the anesthetic, inhibition of the sympathetic nervous system, and loss of the baroreceptor reflex control of arterial pressure.
  - This can result in episodes of intraoperative hypotension.
  - Preexisting HTN more likely to cause intraoperative blood pressure lability (either hypo- or hypertension) and may lead to myocardial ischemia.

POSTOPERATIVE – RECOVERY:

- Blood pressure and heart rate slowly increase as patients recover from the effects of anesthesia during the immediate postoperative period.
- Parameters generally return to preoperative levels, although hypertensive individuals, in particular, may experience significant increases in blood pressure and heart rate.

PERIOPERATIVE RISKS & HTN

Preexisting hypertension can induce a variety of cardiovascular responses that may increase the risk of surgery, including:

- diastolic dysfunction from left ventricular hypertrophy,
- systolic dysfunction leading to congestive heart failure,
- renal impairment, and
- cerebrovascular and coronary occlusive disease.

- ✓ The level of risk is dependent upon the severity of hypertension.
- ✓ It is still unclear whether postponing surgery to achieve blood pressure control will lead to reduced cardiac risk.
  - ✓ The American College of Cardiology/American Heart Association (ACC/AHA) guidelines list uncontrolled hypertension as a "minor" risk factor for perioperative cardiovascular events.

Severe hypertension

- Patients with untreated, severe hypertension (mean systolic and diastolic pressures of 211 and 105 mmHg, respectively) had exaggerated hypotensive responses to the induction of anesthesia and marked hypertensive responses to noxious stimuli.

- Conversely, patients with well-controlled hypertension responded similarly to normotensive individuals.

- Diastolic pressure over 110 mmHg immediately (within the several days) before surgery is associated with a number of complications including dysrhythmias, myocardial ischemia and infarction, neurologic complications, and kidney failure.

Stage 1 to 2 hypertension

Patients with less marked hypertension (eg, systolic pressure less than 180 and diastolic pressure less than 100 mmHg) do not appear to be at increased operative risk*.

- Experiencing perioperative hypertension:
  - Normotensive patients > Normotensive on medication > Hypertensive despite treatment > Untreated hypertension
- Cardiac complications:
  - Inadequately treated or untreated hypertension **=** Normotensive patients not taking diuretics.

- Patients with h/o hypertension, multivariate analysis identified only two independent risk factors for cardiac complications:
  - preoperative cardiac risk index score (RCRI) (does not include hypertension); and
  - marked reductions in intraoperative blood pressure (a decrease to less than 50 percent of preoperative levels or a decrease of 33 percent or more for more than 10 minutes).

**Anesthesiology. 1979 Apr;50(4):285-92. doi: 10.1097/00000542-197904000-00002.*
Risks of general anesthesia and elective operation in the hypertensive patient. L Goldman, D L Caldera.

PERIOPERATIVE RISKS & HTN

- ✓ Elective surgery in patients with non-severe hypertension does not need to be delayed, although intra- and postoperative blood pressures should be carefully monitored to prevent hyper- or hypotensive episodes.

- ✓ When hypertension has **caused end-organ disease** such as heart failure and kidney function impairment, the probability of adverse cardiac outcome in the perioperative period increases significantly.

- ✓ The association of **systolic hypertension** with operative risk is less clear than the association of **diastolic hypertension** with risk.
  - ✓ One study of patients undergoing carotid endarterectomy found that a systolic pressure greater than 200 mmHg was associated with an increased risk of postoperative hypertension and neurologic deficits.
  - ✓ Patients with isolated systolic hypertension are at increased risk for cardiovascular morbidity after coronary artery bypass surgery.

SECONDARY HYPERTENSION

- Hypertension resulting from an identifiable pathology is referred to as secondary hypertension and accounts for 5–15% of patients with hypertension.
- Patients with suspected secondary hypertension should ideally undergo a diagnostic evaluation prior to elective surgery.
  - Most patients are not at increased perioperative risk as long as the hypertension is not severe, serum electrolytes, and kidney function are normal.
  - Important exception is **pheochromocytoma**, in whom operative mortality may be as high as 80 percent in unsuspected cases.

'Red flags' include young patients with an absence of risk factors, sudden increases in blood pressure in previously stable patients and resistant hypertension.

Common causes include obstructive sleep apnoe, renal disease and endocrine abnormalities.

Non-urgent surgery should be delayed to enable these patients to have further investigations.

Peri-operative antihypertensive medication management

Recommendations for pre-operative management of hypertension

Recommendations	Class	Level
In patients with chronic hypertension undergoing elective NCS it is recommended to avoid large peri-operative fluctuations in blood pressure, particularly hypotension, during the peri-operative period.	I	A
It is recommended to perform pre-operative screening for hypertension-mediated organ damage and CV risk factors in newly diagnosed hypertensive patients who are scheduled for elective high-risk NCS.	I	C
It is not recommended to defer NCS in patients with stage 1 or 2 hypertension.	III	C

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What is new (35)

2014 Guidelines	Class	2022 Guidelines	Class
Specific diseases — Hypertension			
Large peri-operative fluctuations in blood pressure in hypertensive patients should be avoided.	IIa	In patients with chronic hypertension undergoing elective NCS it is recommended to avoid large peri-operative fluctuations in blood pressure, particularly hypotension, during the peri-operative period.	I
Clinicians may consider not deferring non-cardiac surgery in patients with grade 1 or 2 hypertension (systolic blood pressure <180 mm Hg; diastolic blood pressure <110 mm Hg).	IIb	It is not recommended to defer NCS in patients with stage 1 or 2 hypertension.	III

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Recommendations for pharmacological treatment (2)

Recommendations	Class	Level
Continuation		
Peri-operative continuation of beta-blockers is recommended in patients currently receiving this medication.	I	B
In patients already on statins, it is recommended to continue statins during the peri-operative period.	I	B
In patients with stable HF, peri-operative continuation of RAAS inhibitors may be considered.	IIb	C
Interruption		
In patients without HF, withholding RAAS inhibitors on the day of NCS should be considered to prevent peri-operative hypotension.	IIa	B
For patients on diuretics to treat hypertension, transient discontinuation of diuretics on day of NCS should be considered.	IIa	B
It should be considered to interrupt SGLT-2 inhibitor therapy for at least 3 days before intermediate- and high-risk NCS.	IIa	C

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Perioperative management of cardiovascular agents

Name or class of drug	Clinical considerations	Recommended strategy for surgery with brief NPO state	Recommended strategy for surgery with prolonged NPO state
Beta blockers	Abrupt withdrawal can result in hypertension, tachycardia, and myocardial ischemia. Perioperative initiation can prevent postoperative myocardial ischemic events in patients with significantly-increased cardiac risk but may increase risk for stroke. Perioperative initiation of beta blockers is recommended in patients with CAD or ischemia on stress testing who are undergoing vascular surgery; and reasonable in patients with at least one cardiac risk factor who are undergoing vascular surgery, or with CAD or >1 cardiac risk factor undergoing intermediate risk surgery. Perioperative initiation of beta blockers is not recommended in patients with baseline heart rate <50 beats per minute, systolic blood pressure <90 mmHg, or when time is not sufficient for titration.	Continue therapy up to and including day of surgery.	Continue therapy up to and including day of surgery. Substitute IV propranolol, metoprolol, or labetalol during NPO state.
Alpha 2 agonists	Withdrawal can cause extreme hypertension and myocardial ischemia.	Continue therapy up to and including day of surgery.	Continue therapy up to and including day of surgery. Substitute transdermal clonidine.
Calcium channel blockers	Conflicting evidence on whether there is an increased risk of bleeding.	Continue therapy up to and including day of surgery.	Continue therapy up to and including day of surgery. No IV substitution necessary unless poor hemodynamics (hypertension or arrhythmia).
ACE inhibitors and angiotensin receptor blockers	Continuation can result in hypotension.	Continue therapy up to day of surgery and hold morning dose unless indication is heart failure or poorly controlled hypertension.	Continue therapy up to day of surgery and hold morning dose unless indication is heart failure or poorly controlled hypertension. Use parenteral enalapril as needed in postoperative period.
Diuretics	Continuation can result in hypovolemia and hypotension.	For the majority of patients we continue therapy up to day of surgery but hold the morning dose. For patients with heart failure whose fluid balance is difficult to manage, we often continue the diuretic without interruption.	Continue therapy up to day of surgery but discontinue morning dose. However, for patients with heart failure whose fluid balance is difficult to manage, we often continue the diuretic without interruption. Use parenteral forms as needed in postoperative period.
Statins	Continuation may elevate risk of myopathy, but provides cardiovascular protection.	Continue statins.	Continue statins up to and including day of surgery.
Non-statin lipid-lowering agents	Niacin and fibric acid derivatives may cause rhabdomyolysis. Bile acid sequestrants interfere with absorption of other medications.	Discontinue day before surgery.	Discontinue day before surgery. Resume with oral intake.

NPO: nil per os (nothing by mouth); CAD: coronary artery disease; IV: intravenous; ACE: angiotensin-converting enzyme; HF: heart failure.

Reduction of preoperative anxiety and pain

- ✓ Pain or anxiety in the immediate preoperative period is common and may result in increased blood pressure (BP). It is reasonable to administer small doses of an intravenous (IV) anxiolytic (eg, midazolam 1 to 2 mg) and/or an IV opioid (eg, fentanyl 25 to 50 mcg) to patients with significant preoperative anxiety or pain.

- ✓ For those who take a benzodiazepine or opioid on a chronic basis, the morning dose should be administered on the day of surgery to prevent withdrawal and assure patient comfort.

Recommendations for peri-operative monitoring and anaesthesia

Recommendations	Class	Level
In order to preserve optimal CV stability, it is recommended to apply goal-directed haemodynamic therapy in patients undergoing high-risk NCS.	I	A
It is recommended to avoid post-operative acute pain.	I	B
In order to minimize the risk of post-operative organ dysfunction, it is recommended to avoid intra-operative mean arterial pressure decrease of >20% from baseline values or below 60–70 mmHg for ≥10 min.	I	B
Non-aspirin NSAIDs are not recommended as first-line analgesics in patients with established or high risk of CVD.	III	B

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Thank you
for your kind attention!