

In the name of GOD

Hypertension Management Before Surgery In CKD

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- Preoperative evaluation and preparation of CRF patients is mandatory to minimize perioperative morbidity and mortality.

• Preexisting hypertension is the most common medical reason for postponing surgery

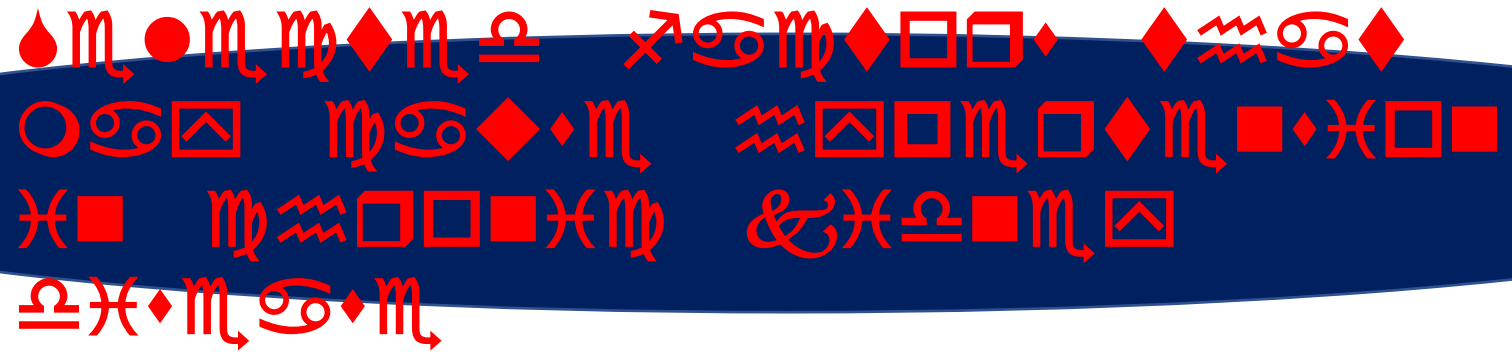


- Hypertension is found in more than 80% of CRF patients.
- Whether hypertension is a cause or a result of CRF remains debatable



- The most common cause of hypertension is volume overload
- Nonvolume-dependent hypertension is related to an altered autonomic-hormonal milieu of uremia.





Factor	Dominant Mechanism
Impaired sodium excretion	Expansion of ECF volume
Activation of RAS	Direct vasoconstriction Sympathetic activation
Sympathetic activation	Direct vasoconstriction Stimulation of renin release
Imbalance in prostaglandins or kinins	Vasoconstriction
Endothelin	Direct vasoconstriction Renal injury
Reduced nitric oxide	Loss of vasodilator effect



Common causes of acute intraoperative increases in BP

- sympathetic stimulation during laryngoscopy and endotracheal intubation
- surgical stimulation (Inadequate anesthetic depth during painful surgical stimulation)
- emergence and tracheal extubation
- hypercarbia or hypoxemia (due to sympathetic stimulation) -higher fraction of inspired oxygen (F_iO_2)
- Hypervolemia
- withdrawal of antihypertensive medications
- bladder distention



Perioperative Management of the Hemodialysis Patient

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Hypertension is common in HD patients, and good control should be achieved to minimize perioperative instability.

Management will include achieving the **correct dry weight** with **optimization of fluid removal**, **adjusting the dose of antihypertensive drugs**, or **adding additional agents**.



The preanesthesia consultation involves:

- ● overall risk assessment
- blood pressure measurement
- determination of **target BP** values for the intraoperative period
- decisions regarding whether to employ noninvasive BP monitoring or an intra-arterial catheter for direct continuous monitoring



When assessing patients for anaesthesia who have elevated blood pressure, a number of questions must be answered.

Is the patient known to be hypertensive on a previous occasion?

Are they on antihypertensive medication?

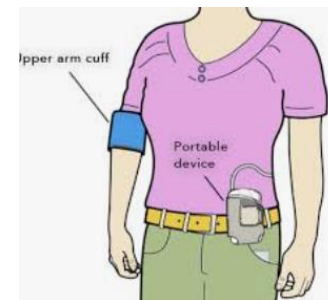
Does the patient have a treatable cause for their hypertension?

Does the blood pressure control need alteration before surgery?

Does the patient have “white coat” hypertension?



- In the absence of a recent **ambulatory arterial pressure measurement**, experts propose that a office baseline measure should be obtained (ideally within 30 days) before the day of surgery to limit the effects of white coat hypertension
- These preoperative measures may be **used for setting intraoperative arterial pressure targets.**



In patients more than 65 yr of age undergoing non-cardiac surgery, there is evidence that low preoperative arterial pressure is more strongly associated with increased postoperative risk of mortality than high pressure using primary care data.

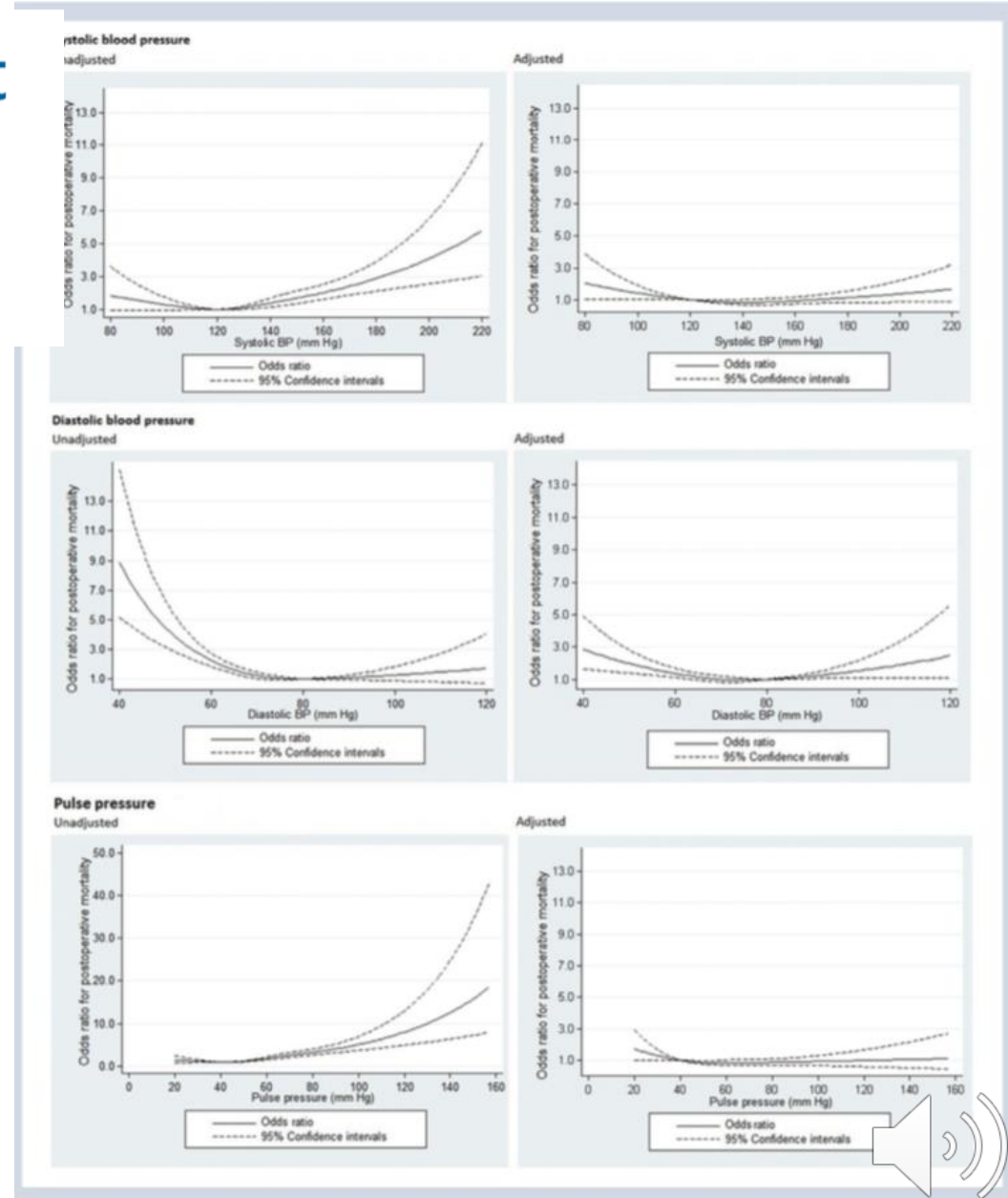
In a large study, increased mortality risk was identified in patients with a preoperative systolic arterial pressure <119 mm Hg, diastolic <63 mm Hg, and pulse pressure <37 mm Hg.



Perioperative Quality Initiative consensus statement on preoperative blood pressure, risk and outcomes for elective surgery

Examples of the association of preoperative arterial pressure and postoperative mortality. The unadjusted data on the left demonstrate **the J-curve phenomenon for the association between preoperative systolic, diastolic, and pulse pressures, and postoperative mortality.**

Br J Anaesth 2017



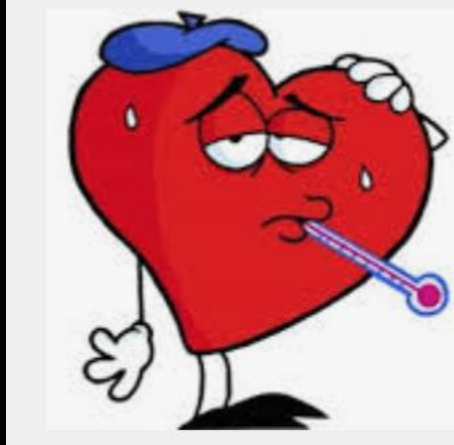
2018 ESC/ESH Guidelines for the management of arterial hypertension

- While a BP elevation is per se not a strong risk factor for CV complications in non-cardiac surgery, overall CV risk assessment, including the search for **HMOD hypertension mediated organ damage**, is important in treated and untreated hypertensive patients, and mandatory when a BP elevation is newly detected

The effect of chronic hypertension on perioperative risk is determined primarily by the presence of target organ damage, that is, coronary artery disease, stroke, heart failure, and renal failure, all of which are known to affect perioperative morbidity and mortality.



*There are **no** randomized clinical trial data showing what the optimal blood pressure should be at the time of surgery.*



The patients with preoperative isolated systolic hypertension (where the pressure is greater than 180 mmHg or the pulse pressure is greater than 80 mmHg) had a 40% increase in perioperative cardiovascular events.



Patients with untreated or poorly controlled hypertension have increased **intraoperative hemodynamic instability** and an increased risk in the presence of a pre- operative **diastolic blood pressure >110 mm Hg**

Increased complications including myocardial infarction , myocardial ischemia, dysrhythmias, cerebrovascular events , and renal failure have been reported if the preoperative diastolic blood pressure is 110 mmHg or higher .





- Evidence-Based Guideline for the management of high BP in adults, suggests a BP goal of $< 140/90$ mmHg in patients with CKD.
- However, this recommendation and goal are for long-term management.
- Although, a specific guideline for an upper acceptable limit of preoperative BP in CKD patient is not available, yet, a patient can be accepted for elective surgery if the preoperative BP is $< 180/105$ mmHg





ESC

European Society
of Cardiology

European Heart Journal (2018) **39**, 3021–3104

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ESC/ESH GUIDELINES

2018 ESC/ESH Guidelines for the management of arterial hypertension

POSTPONED

- Postponing necessary surgery is usually not warranted in patients with grade 1 or 2 hypertension, whereas in those with an SBP \geq 180 mmHg and/or DBP \geq 110 mmHg, deferring the intervention until BP is reduced or controlled is advisable, except for emergency situations



- For most patients with chronic hypertension, experts suggest maintaining BP **within 20 percent of resting baseline value** and mean arterial pressure **(MAP) >65 mmHg (Grade 2C)**.
- Some patients may require a higher MAP.
- Lability of perioperative BP is likely, and we prevent and treat both hypertension and hypotension

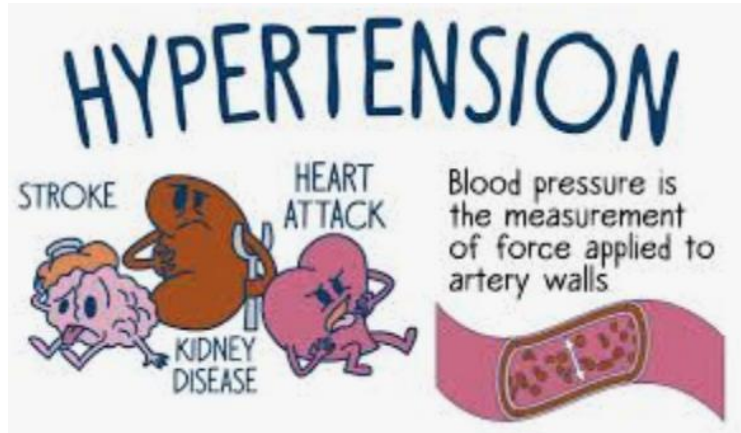


- A mean arterial pressure of 65 mmHg may be suboptimal and *predispose the patient to AKI* in chronic hypertensive patients.

As intraoperative hypotension adversely affects the *renal microvasculature* and has been shown to be associated *with increased 30-day operative mortality in non-cardiac surgery*

maintenance of BP within 20% of baseline can be regarded as paramount especially for those who are at risk of developing AKI.





What seems to be also important is to **avoid large perioperative BP fluctuations.**

These patients often have higher BP and their **auto regulations** are also set at higher levels

It will be prudent to reduce the blood pressure (if presented with high BP, e.g. 180/100) by **20%** during the intraoperative period, and then slowly targeting towards the goal in the postoperative period over the next few days



[JAMA](#). 2017 Oct 10; 318(14): 1346–1357.

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doi: [10.1001/jama.2017.14172](https://doi.org/10.1001/jama.2017.14172)

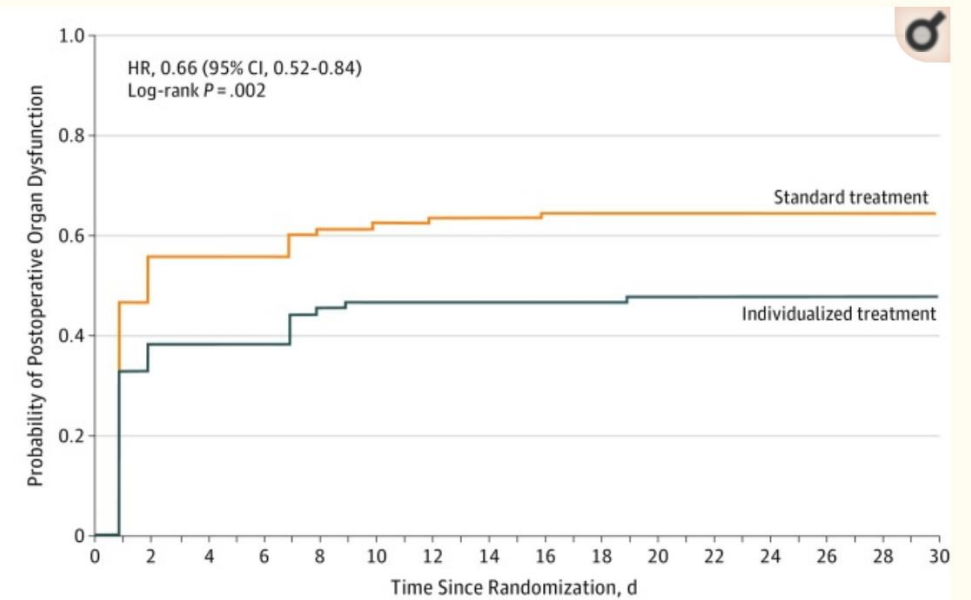
PMCID: PMC5710560

PMID: [28973220](https://pubmed.ncbi.nlm.nih.gov/28973220/)

Effect of Individualized vs Standard Blood Pressure Management Strategies on Postoperative Organ Dysfunction Among High-Risk Patients Undergoing Major Surgery A Randomized Clinical Trial

conclusion

Among patients predominantly undergoing abdominal surgery who were at increased postoperative risk, management targeting an individualized systolic blood pressure, compared with standard management, reduced the risk of postoperative organ dysfunction.



No. at risk	Standard treatment	Individualized treatment
0	145	147
2	78	99
6	65	91
8	58	82
16	54	80
30	54	80

[Figure 3.](#)

Kaplan-Meier Estimates of the Probability of Postoperative Organ Dysfunction by Day 30 After Surgery

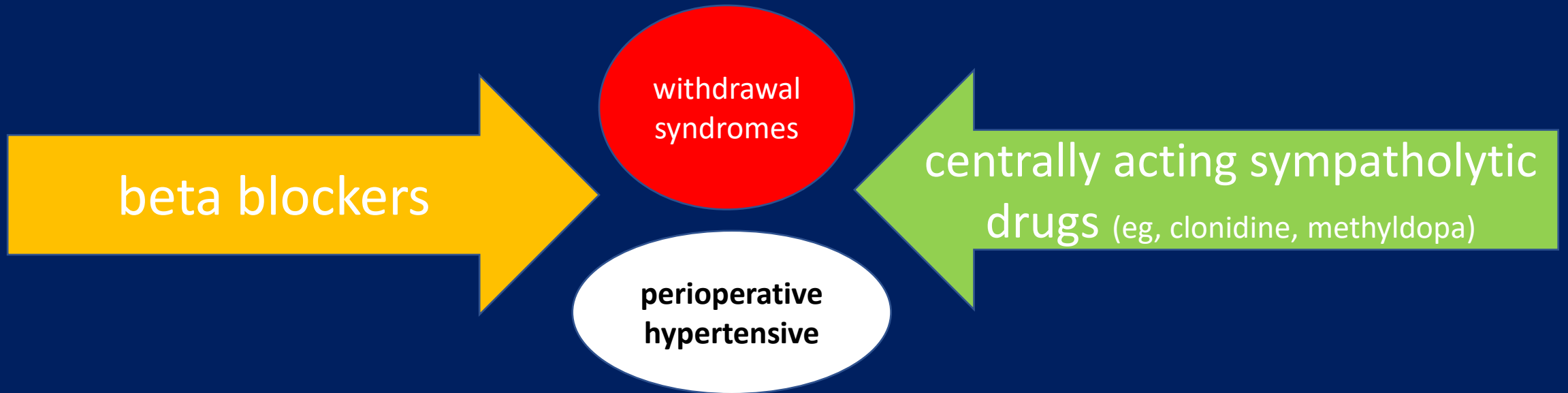


- There is no clear evidence in favour or against one vs another antihypertensive treatment mode in patients undergoing non-cardiac surgery, and thus the general drug treatment algorithms apply to these patients as well.
- However, the perioperative use of **beta-blockers** has been the object of controversy for many years, and the concern has recently been revived by meta-analyses showing some increase in the risk of **hypotension, stroke, and mortality** in patients on perioperative beta-blockers vs placebo

Continuation of beta-blockers is nevertheless recommended in hypertensive patients on chronic beta-blocker treatment in whom their abrupt discontinuation may lead to BP or heart rate rebounds



oral antihypertensive medications should be continued up to the time of surgery



If the patient failed to take a morning dose of an antihypertensive medication, the missed dose is administered with a sip of water in the preoperative area when feasible



What about RAS Blockers

- . Many centers routinely withhold angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs) for 24 hours before surgery or administer the evening dose before elective surgery (but not on the morning of surgery), particularly if significant perioperative fluid shifts are anticipated.





Perioperative angiotensin-converting enzyme inhibitors or angiotensin II type 1 receptor blockers for preventing mortality and morbidity in adults

Perioperative angiotensin-converting enzyme inhibitors or angiotensin II type 1 receptor blockers for preventing mortality and morbidity in adults (Review)

Zou Z, Yuan HB, Yang B, Xu F, Chen XY, Liu GJ, Shi XY

Authors' conclusions Overall, **this review did not find evidence to support that perioperative ACEIs or ARBs can prevent mortality, morbidity, and complications (hypotension, perioperative cerebrovascular complications, and cardiac surgery-related renal failure).**

We found no evidence showing that the use of these drugs may reduce the rate of **acute myocardial infarction.**

However, ACEIs or ARBs may increase cardiac output perioperatively



Withholding *versus* Continuing Angiotensin-converting Enzyme Inhibitors or Angiotensin II Receptor Blockers before Noncardiac Surgery

An Analysis of the Vascular events In noncardiac Surgery patients cOhort evaluation Prospective Cohort

- Conclusions
- This international prospective cohort study suggests that withholding ACEI/ARBs on the day of a **noncardiac surgery** may reduce the risk of perioperative **death, stroke, or myocardial injury** in patients who take these medications chronically.

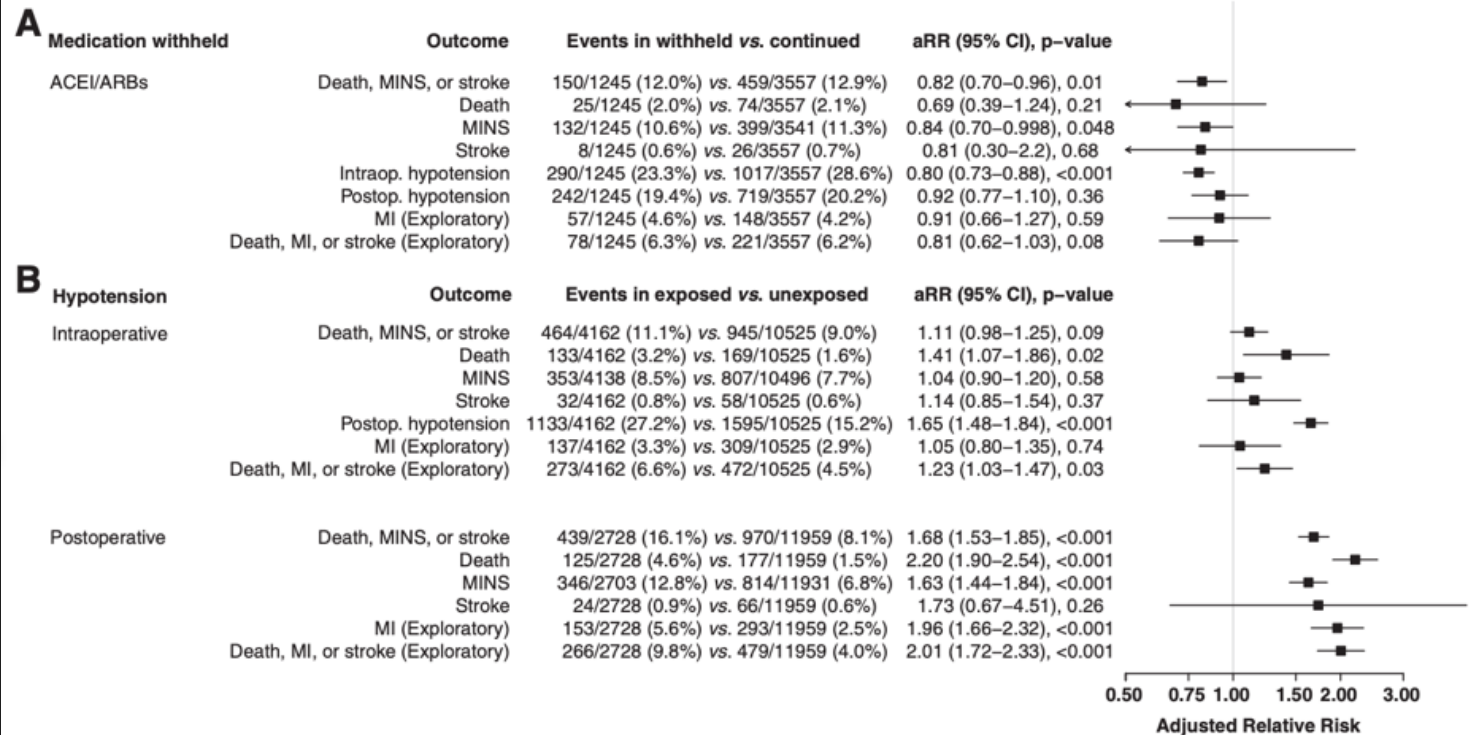
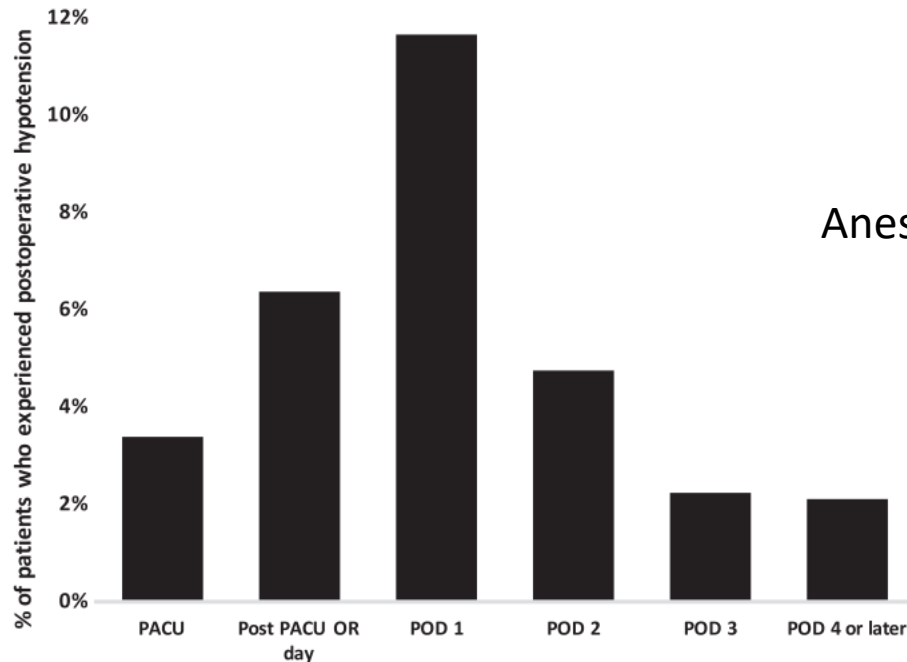


Fig. 2. (A) Adjusted association between withholding *versus* continuing preoperative angiotensin-converting enzyme (ACE) inhibitors or angiotensin II receptor blockers (ARBs) with postoperative 30-day death from any cause, myocardial injury after



Vision study

PERIOPERATIVE MEDICINE



Anesthesiology 2017

Fig. 3. Clinically significant hypotension in the postoperative period. In total, 2,860 of 14,687 patients (19.5%) experienced at least one episode of clinically significant hypotension after their surgery; 2,728 (95.4%) of those patients experienced a hypotensive episode by postoperative day (POD) 3. OR = operating room; PACU = postanesthesia care unit.



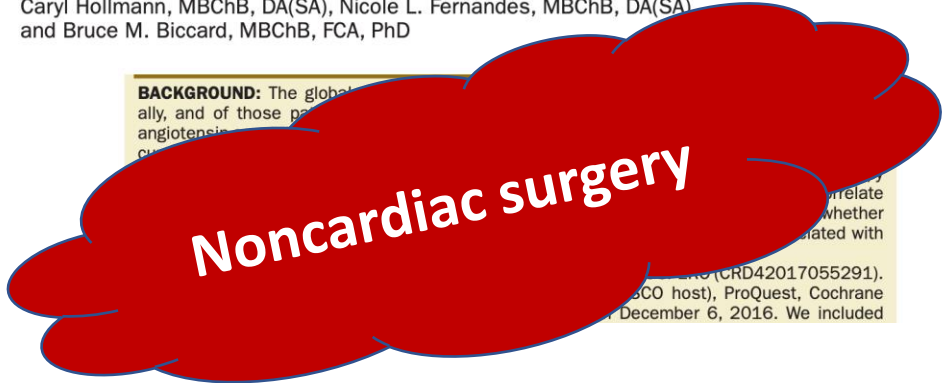
“...findings suggest that administration [of angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers] on the day of surgery is hazardous...”



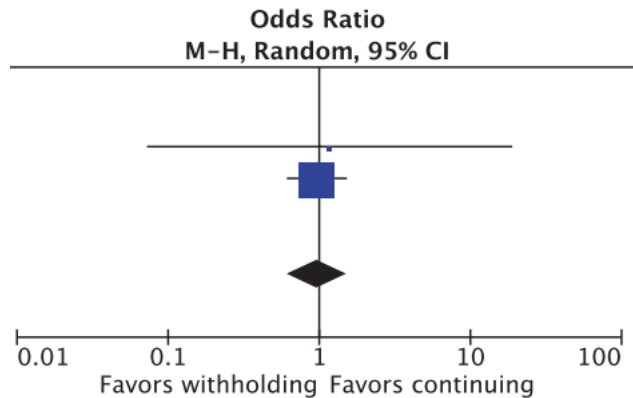
A Systematic Review of Outcomes Associated With Withholding or Continuing Angiotensin-Converting Enzyme Inhibitors and Angiotensin Receptor Blockers Before Noncardiac Surgery

Caryl Hollmann, MBChB, DA(SA), Nicole L. Fernandes, MBChB, DA(SA) and Bruce M. Bickard, MBChB, FCA, PhD

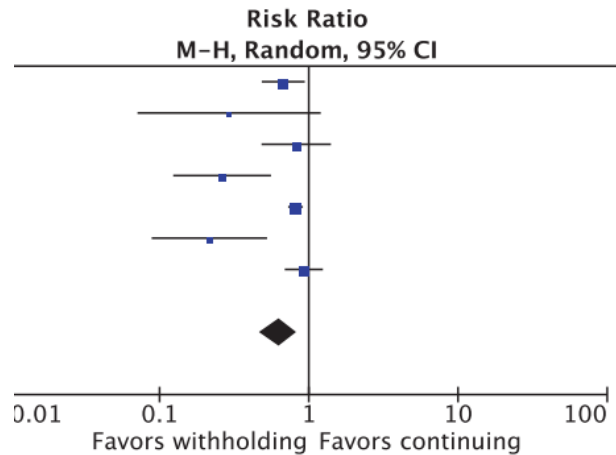
BACKGROUND: The global prevalence of hypertension is increasing, and of those patients with hypertension, approximately 50% are treated with antihypertensive medications. Angiotensin-converting enzyme inhibitors (ACE-I) and angiotensin receptor blockers (ARB) are commonly used antihypertensive medications. It is unclear whether withholding or continuing ACE-I or ARB therapy before noncardiac surgery is associated with improved outcomes. We conducted a systematic review (CRD42017055291). We searched Medline, Embase, Cochrane (CRD42017055291), and the Cochrane Central Register of Controlled Trials (Cochrane host), ProQuest, Cochrane, and ClinicalTrials.gov on December 6, 2016. We included



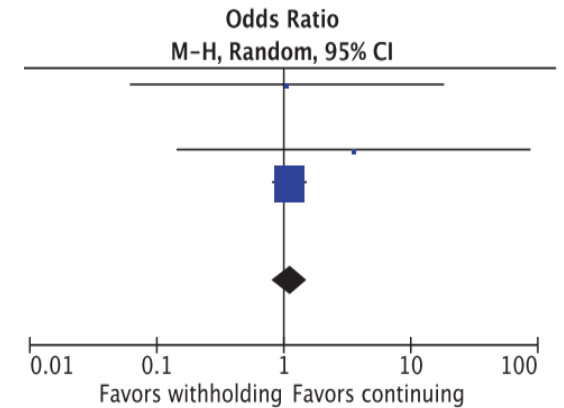
2018 International Anesthesia Research Society



Mortality associated with withholding or continuing ACE-I or ARB therapy



Intraoperative hypotension associated with withholding or continuing ACE-I or ARB therapy.



Major adverse cardiac events associated with withholding or continuing ACE-I or ARB therapy



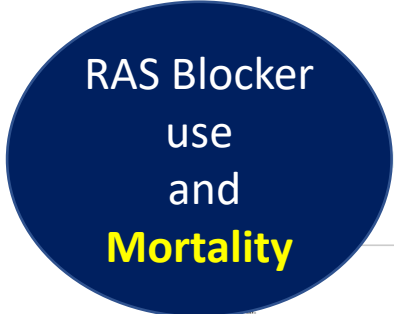
- Intra-operatively the neurohumoral response to surgery causes a sympathetic response, releasing vasopressin, aldosterone and cortisol in the „fight or flight“ response. One of the aims of this is to aid salt and water retention protecting the renal vasculature.

**** N.B.** Anaesthetic agents, ACE inhibitors and NSAIDs will alter this protective response



Acute Kidney Injury and Death Associated With Renin Angiotensin System Blockade in Cardiothoracic Surgery: A Meta-analysis of Observational Studies

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 Srinji Rajagopalan, PhD,⁶ Nader Nader, MD, PhD,⁷ and Pradeep Arora, MD^{4,5}



Background: Acute kidney injury (AKI) is a common complication after cardiovascular surgery. The use of renin angiotensin system (RAS) blockers preoperatively is controversial due to conflicting results of their effect

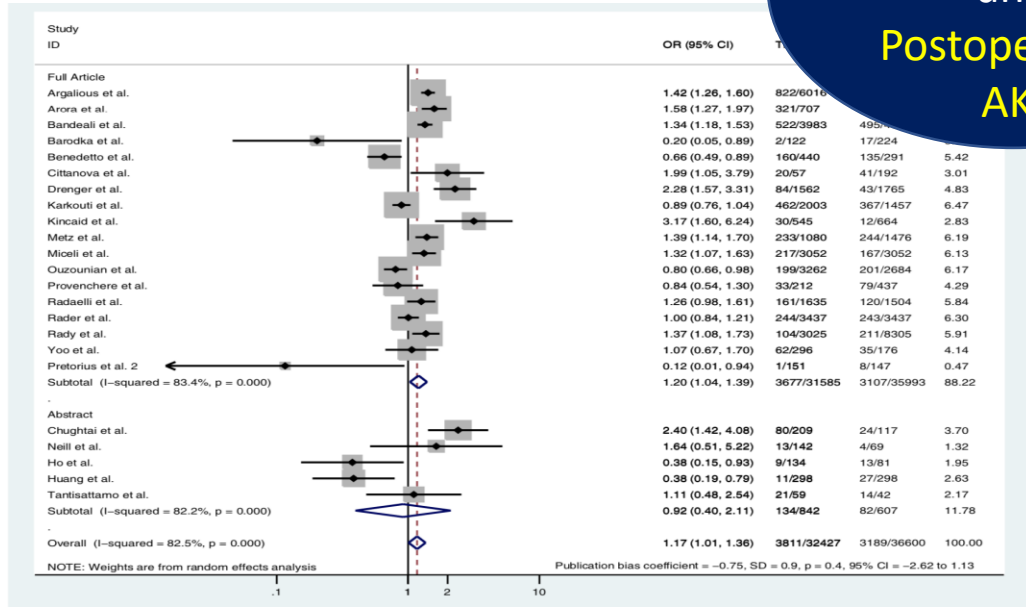
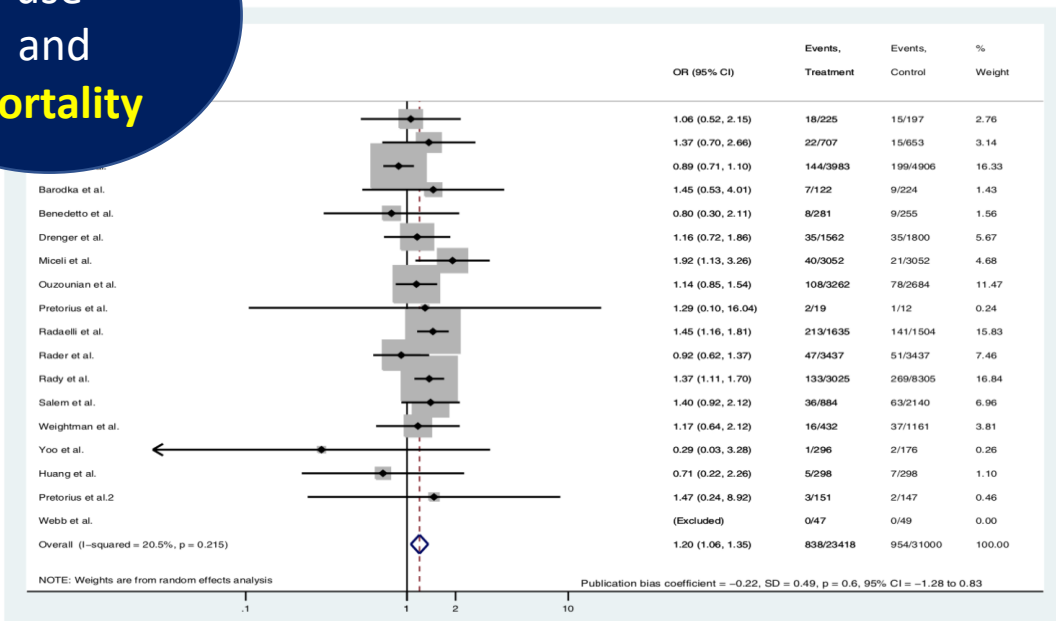


Figure 3. Renin angiotensin system blocker use and mortality: forest plot and analysis results. Abbreviations: CI, confidence interval; OR, odds ratio; p, probability value SD, standard deviation.

Figure 2. Renin angiotensin system blocker use and postoperative acute kidney injury: forest plot and analysis results. Abbreviations: CI, confidence interval; OR, odds ratio; p, probability value SD, standard deviation.



RESEARCH ARTICLE

Pre- and/or Intra-Operative Prescription of Diuretics, but Not Renin-Angiotensin-System Inhibitors, Is Significantly Associated with Acute Kidney Injury after Non-Cardiac Surgery: A Retrospective Cohort Study

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Conclusions Prescription of diuretics, but not ACE-I/ARB, was independently associated with **postoperative AKI** after **non-cardiac surgery**, especially in patients with low propensity for diuretic use. It might be reasonable to **withhold preoperative diuretics in these patients.**



Association Between Preoperative Diuretic Use and In-hospital Outcomes **After Cardiac Surgery**

Salman J. Bandeali,¹ Waleed T. Kayani,¹ Vei-Vei Lee,² MacArthur Elayda,² Mahboob Alam,^{1,3} Henry D. Huang,^{1,3} James M. Wilson,⁴ Hani Jneid,^{1,5} Yochai Birnbaum,^{1,3} Anita Deswal,^{1,3,5} John Farmer,^{1,3} Christie M. Ballantyne^{1,3,6,7} & Salim S. Virani^{1,3,5,6,7,8}

¹ Department of Medicine, Baylor College of Medicine, Houston, TX, USA

Conclusion:

Preoperative **diuretics use** is associated with an increased incidence of **MAEs after cardiac surgery.**

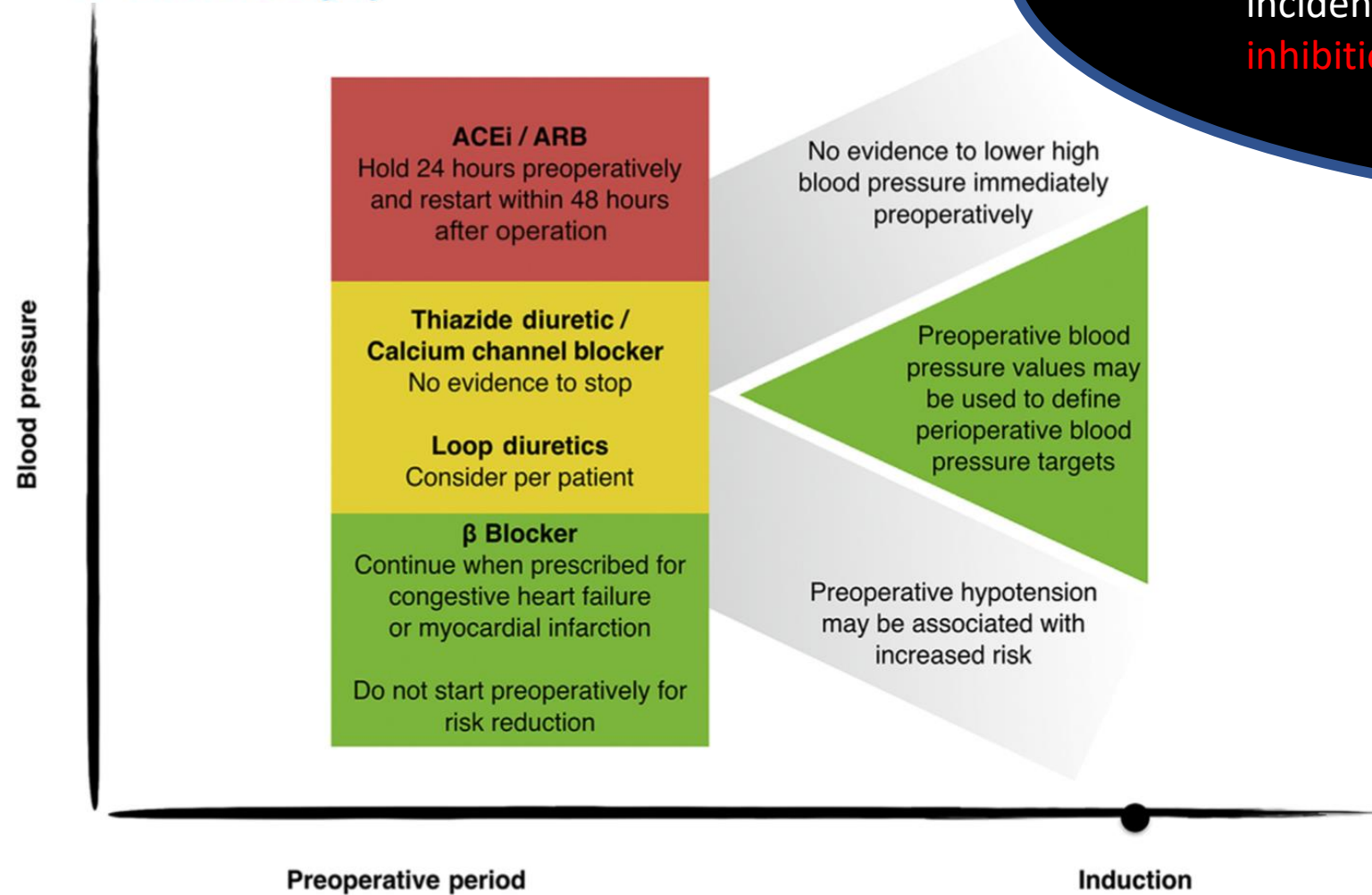
In patients in whom diuretics could be safely withheld (patients on diuretics for hypertension and peripheral edema and patients with mild systolic dysfunction and compensated heart failure), an attempt can be made to stop it prior to cardiac surgery. Given our results, **it might be prudent to more carefully examine the need for preoperative diuretic use in patients undergoing cardiac surgery.**

Table 2 Incidence of major adverse events and individual secondary outcomes in the “All cardiac surgery group”

Outcome	Preoperative diuretic		P ^a -value
	Yes (n = 3546)	No (n = 9047)	
Major adverse events, n (%)	1748 (49.29)	3212 (35.50)	<0.0001
In-hospital mortality, n (%)	269 (7.59)	347 (3.84)	<0.0001
Postoperative renal dysfunction, n (%)	716 (20.19)	880 (9.73)	< 0.0001
Postoperative stroke, n (%)	125 (3.53)	259 (2.86)	0.06
Postoperative atrial fibrillation, n (%)	1238 (34.91)	2388 (26.40)	<0.0001
Postoperative myocardial infarction, n (%)	115 (3.24)	239 (2.64)	0.07



Perioperative Quality Initiative consensus statement
on preoperative blood pressure, risk and outcomes
for elective surgery



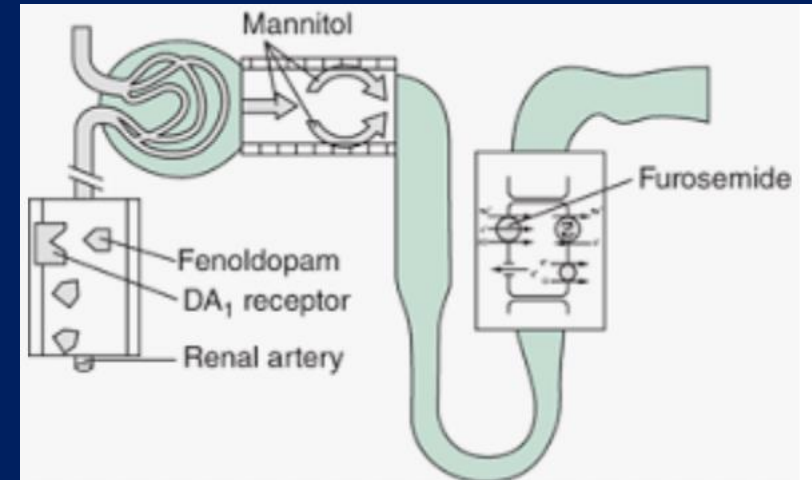
Calcium channel blockers — Patients receiving calcium channel blockers may have an increased incidence of **postoperative bleeding**, probably due to **inhibition of platelet aggregation**.

The multiple benefits of these drugs probably outweigh the small risk of continued therapy.



Fenoldopam

a peripheral **dopamine-1-receptor agonist**, induces peripheral vasodilation; administered by intravenous infusion used as an antihypertensive agent postoperatively and also IV to treat ahypertensive crises



Only agent that improve renal perfusion

- Concomitant use of fenoldopam with a beta-blocker should be avoided if possible, as unexpected hypotension can result from beta-blocker inhibition of sympathetic-mediated reflex tachycardia in response to fenoldopam



2018 ESC/ESH Guidelines for the management of arterial hypertension

Perioperative management of hypertension

Recommendations	Class ^a	Level ^b
It is recommended that newly diagnosed hypertensive patients who are scheduled for elective surgery should be preoperatively screened for HMOD and CV risk.	I	C
It is recommended to avoid large perioperative BP fluctuations during the perioperative period. ⁵⁸⁷	I	C
Non-cardiac surgery may not be deferred in patients with grade 1 or 2 hypertension (SBP <180 mmHg; DBP <110 mmHg).	IIb	C
Perioperative continuation of beta-blockers is recommended in hypertensive patients on chronic treatment with these drugs. ^{592,593}	I	B
Abrupt discontinuation of beta-blockers or centrally acting agents (e.g. clonidine) is potentially harmful and is not recommended. ^{589,594}	III	B
Transient preoperative discontinuation of RAS blockers should be considered in patients with hypertension undergoing non-cardiac surgery.	IIa	C

BP = blood pressure; CV = cardiovascular; DBP = diastolic blood pressure; HMOD = hypertension-mediated organ damage; RAS = renin–angiotensin system; SBP = systolic blood pressure.

^aClass of recommendation.

^bLevel of evidence.



Preoperative	Intraoperative	Postoperative
SAP \leq 180 mmHg, DAP \leq 110 mmHg	MAP not lower than 25–30% of awake	Resume antihypertensive drugs upon oral intake or substitute i.v.
ECG, serum creatinine, electrolytes (diuretics) search for target organ damage (heart, brain, kidney)	Attenuate sympathetic response to laryngoscopy (or use laryngeal mask)	Measure blood pressure every 5–15 min first hour then every 30 min until 3 h postoperative
Antihypertensive drugs; <u>continue day of surgery:</u> b-blockers, CCB; <u>stop day of surgery:</u> diuretics, ACEI, ARB	Consider use of noninvasive cardiac output monitoring and near-infrared spectroscopy (NIRS)	Treat postoperative hypertension to MAP > 100 and <130 mmHg and HR 50 bpm; <u>Metoprolol:</u> repeat 2–5 mg bolus i.v.; <u>labetolol:</u> repeat 10–20 mg bolus i.v.; <u>nicardipine:</u> 0.5–1 ug/kg/min i.v.; <u>nitroglycerine:</u> 0.1–5 ug/kg/min i.v.



