Hypertension And Cardiac surgery

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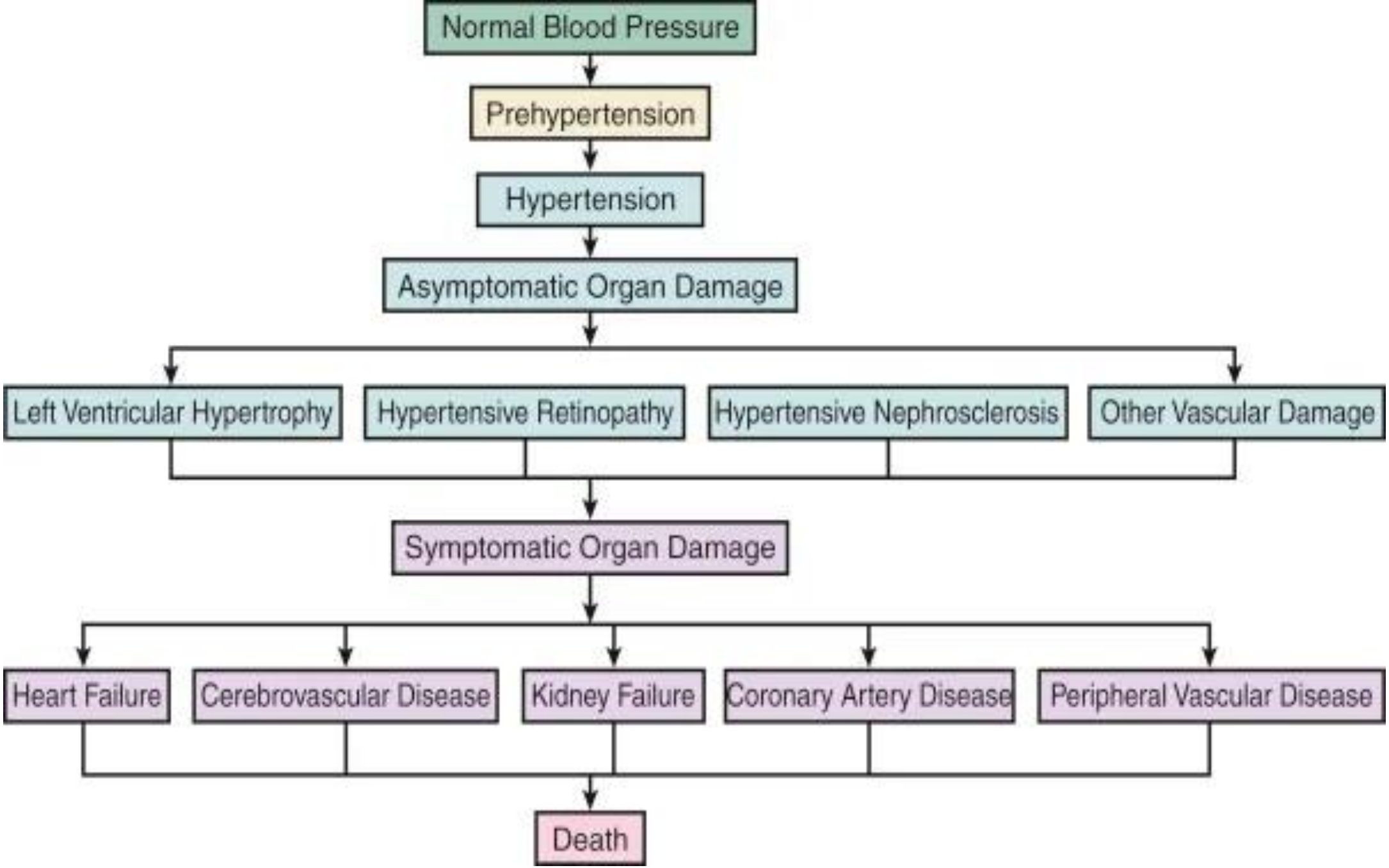
Missan cardiac center

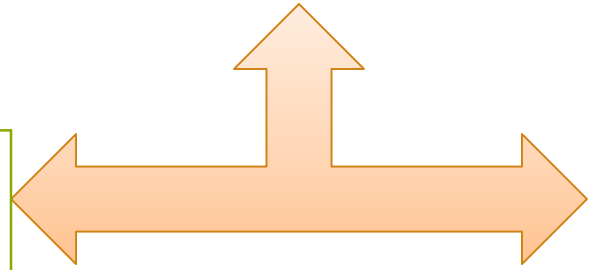

Normal Blood Pressure
Prehypertension
Hypertension
Asymptomatic Organ Damage
Left Ventricular Hypertrophy
Hypertensive Retinopathy
Hypertensive Nephrosclerosis
Other Vascular Damage
Symptomatic Organ Damage
Heart Failure
Cerebrovascular Disease
Kidney Failure
Coronary Artery Disease
Peripheral Vascular Disease
Death

Blood Pressure Categories

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)	and/or	DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

Methods of Blood Pressure measurement

Techniques of BP measurements in cardiac surgeries



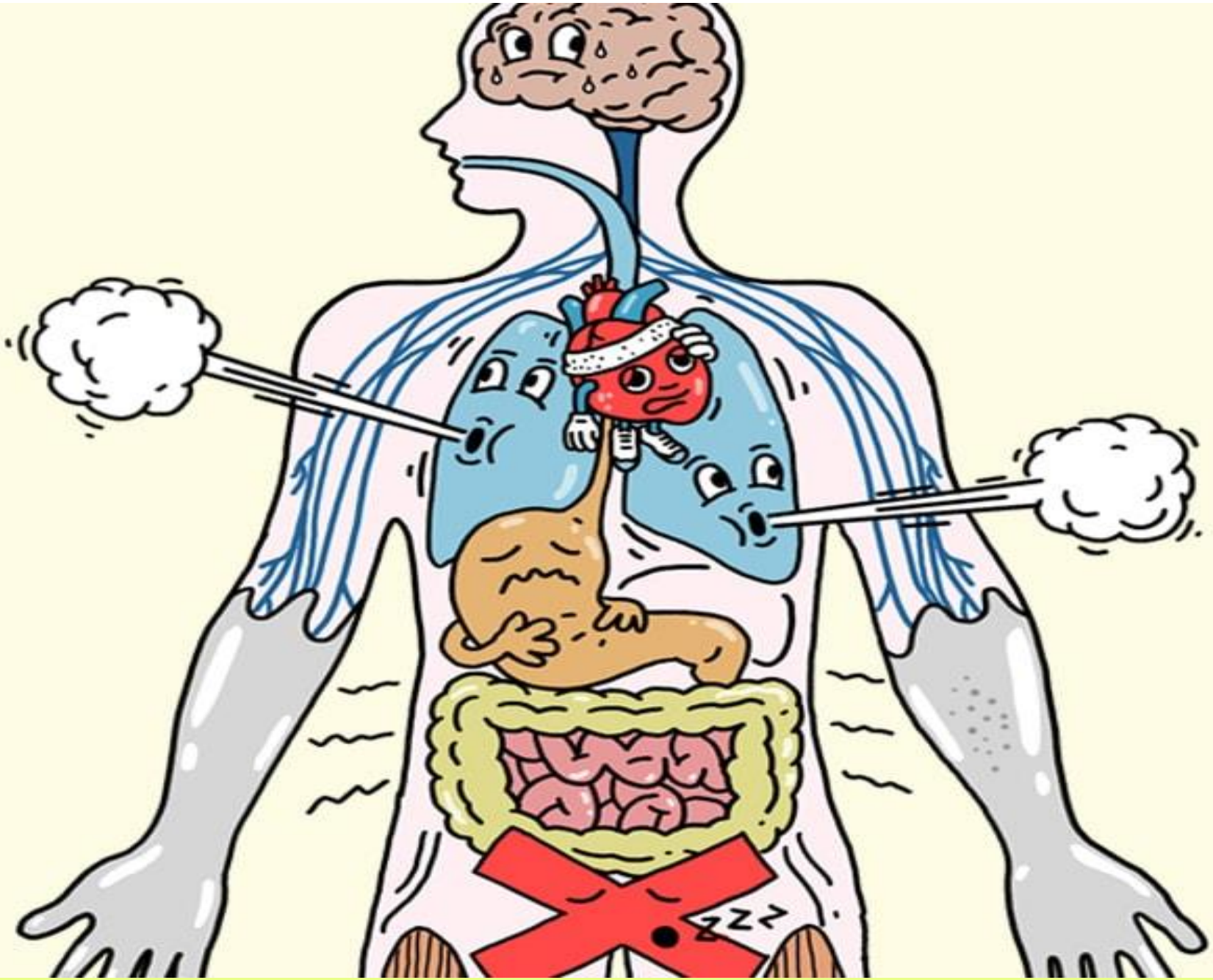
Invasive

- Intra-arterial catheter
- Continuous monitoring
- More accurate

Non-invasive

- Traditional site-dependent e.g. arm
- Intermittent monitoring
- Less accurate


108
107
100
84/40
(56)
(10)
82/63 (68)
24.1
20:00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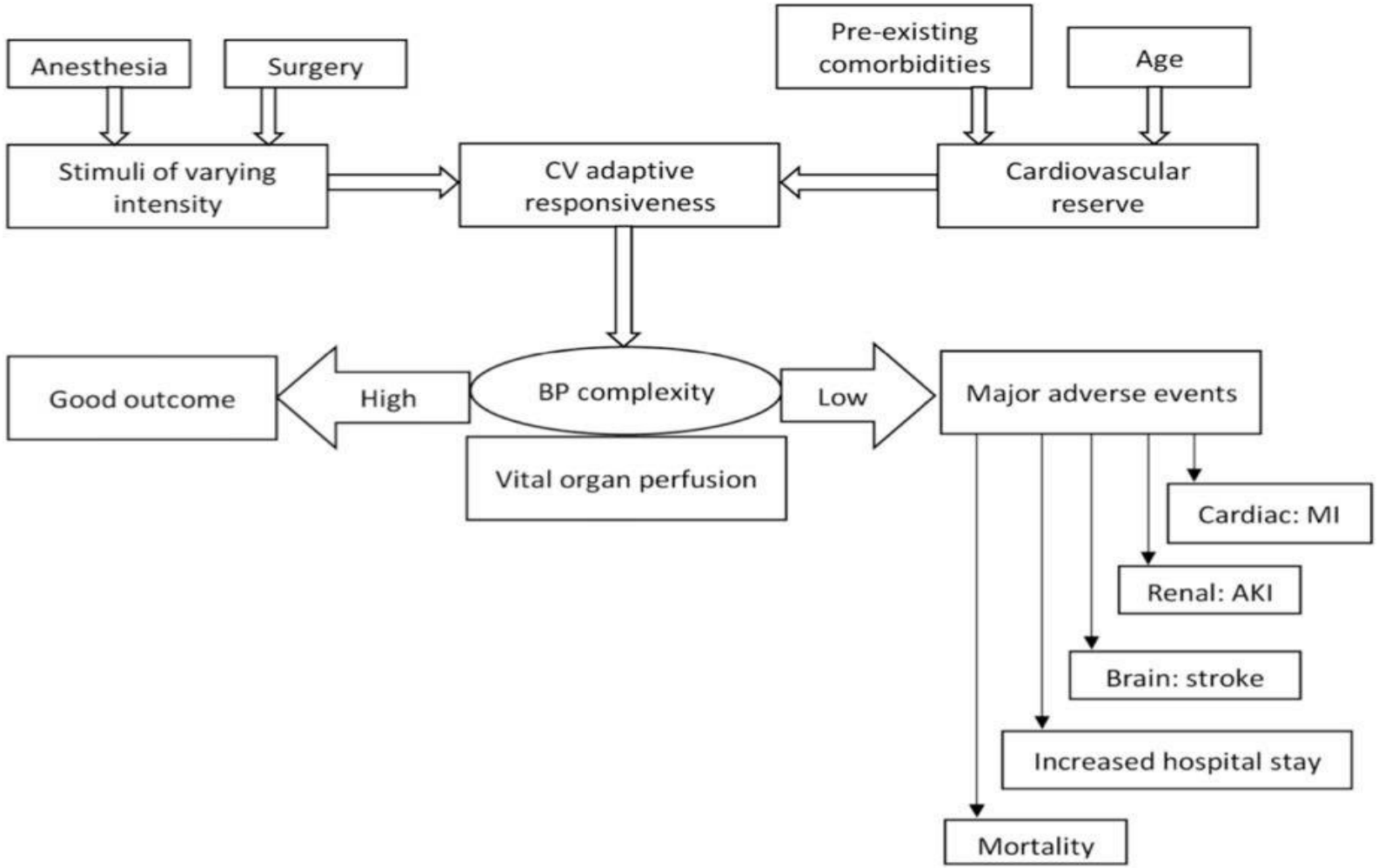
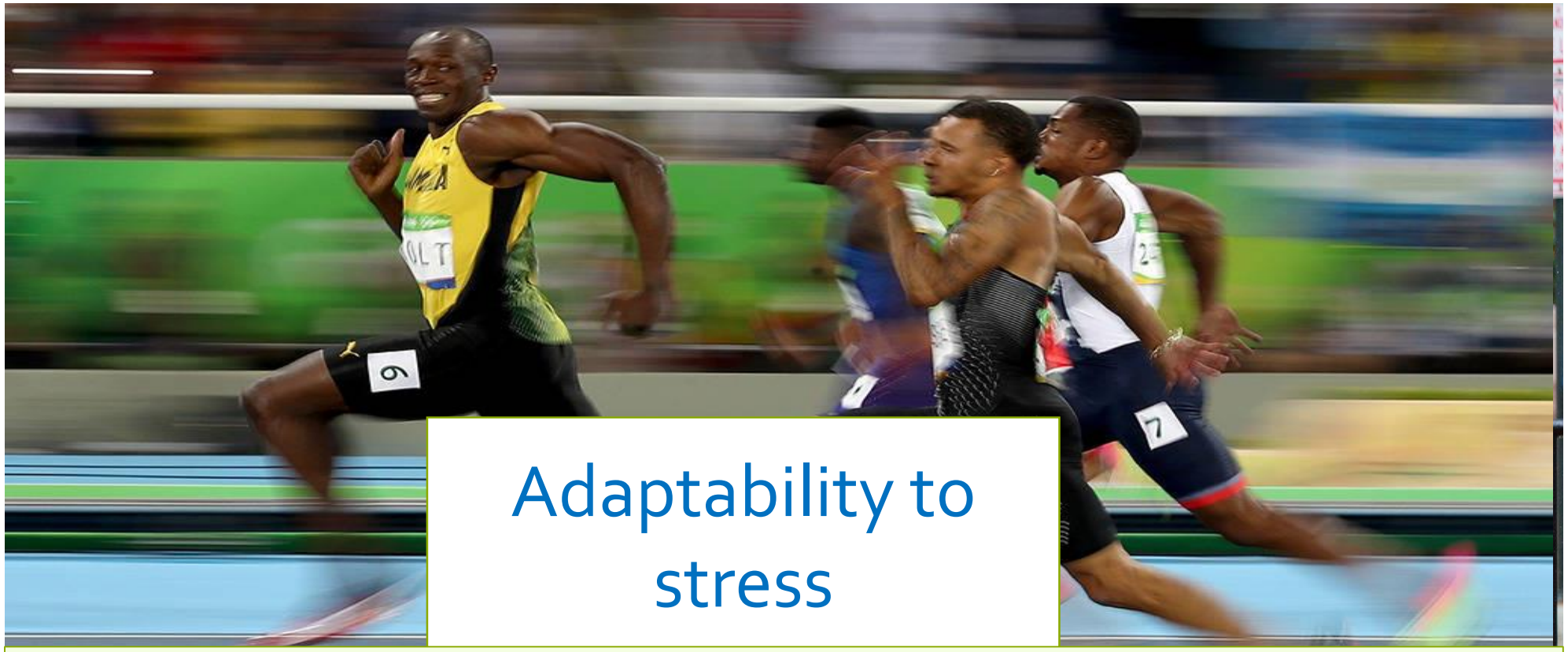
BP complexity, contributing factors and outcome association



physiological reserve (cardio-pulmonary reserve) of adaptability to stress.



Adaptability to stress

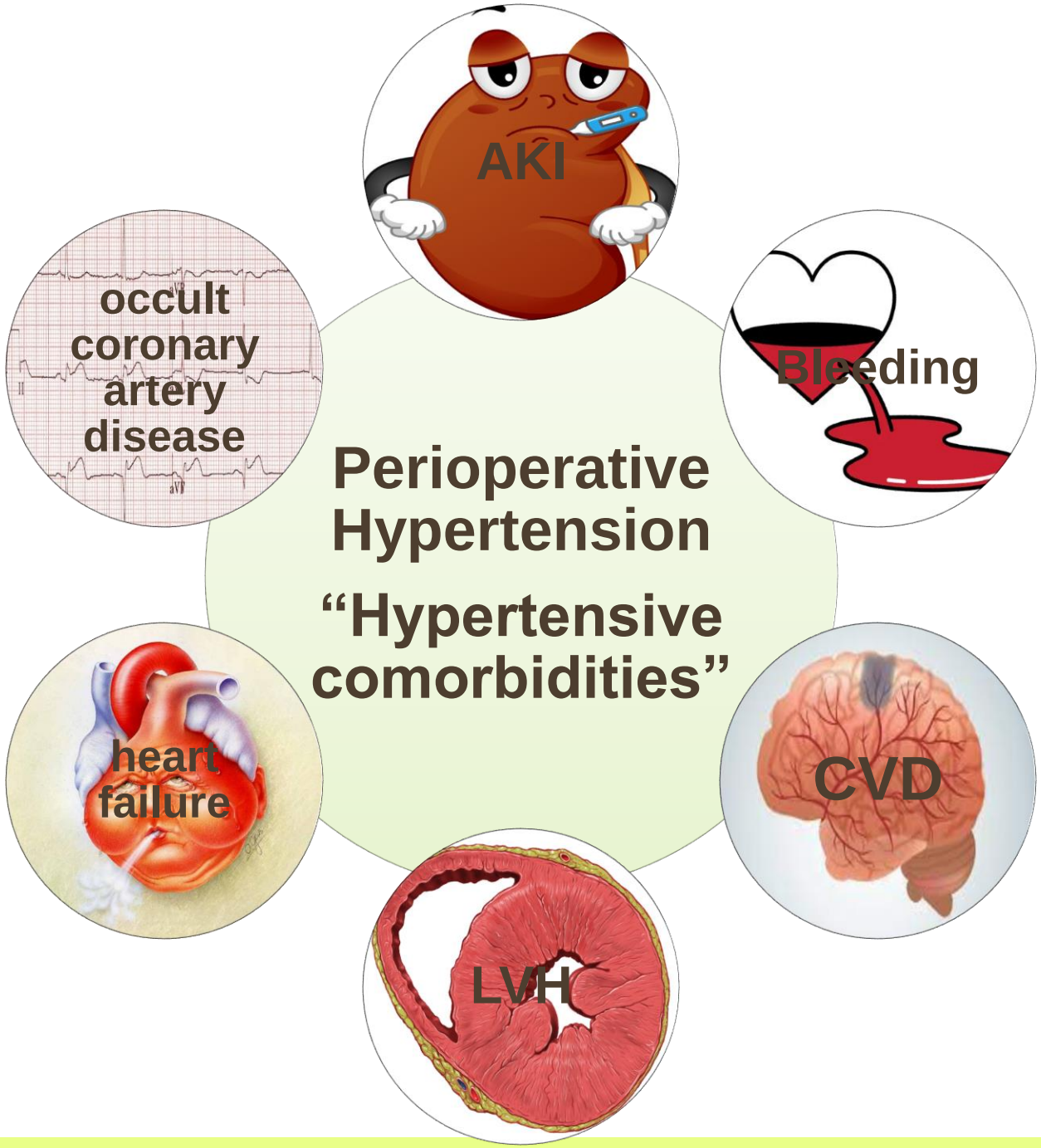
A seasoned athlete could perform a physical challenge with relative ease, while in amateur it will result in rapid exhaustion

Effects of blood pressure on surgical outcome

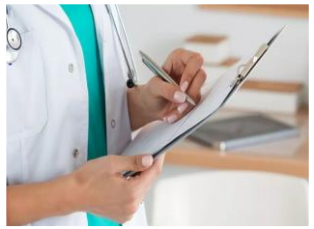
As much as 80% of patients having cardiac surgery have perioperative hypertension

perioperative HTN increases cardiovascular events, cerebrovascular events, bleeding, and mortality.

The higher the blood pressure, the greater the risk.


AKI
occult coronary artery disease
Bleeding
Perioperative Hypertension
"Hypertensive comorbidities"
heart failure
CVD
LVH

Peri-operative hypertension



Preoperative HTN

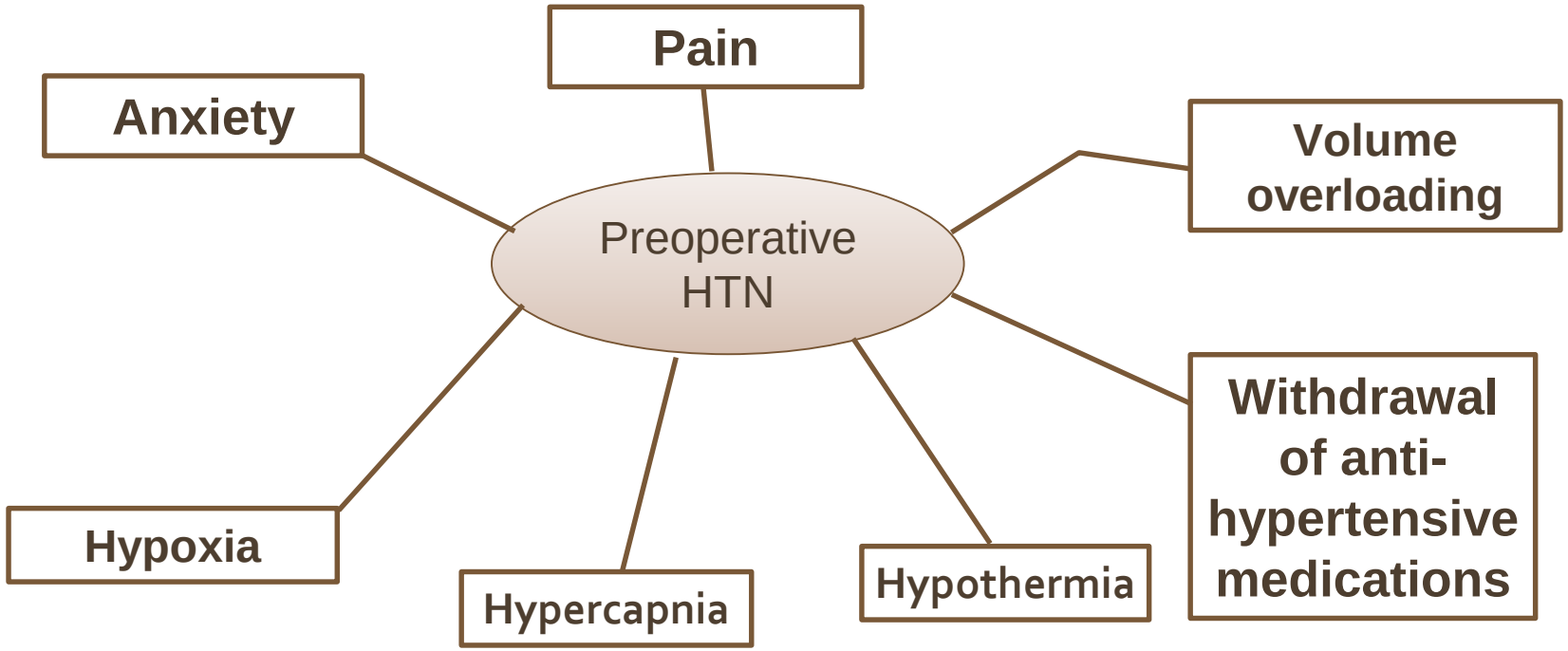
Intraoperative HTN

Post-operative HTN

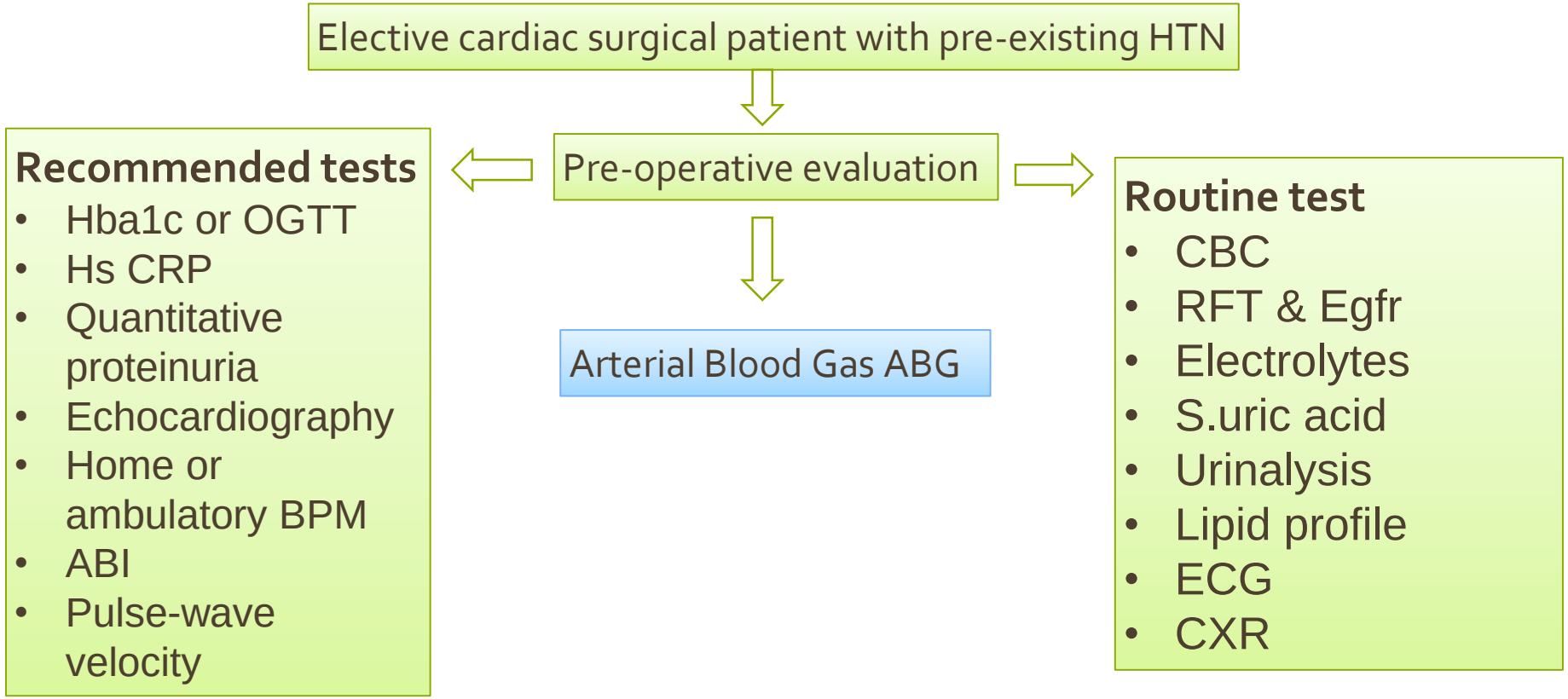
Preoperative Hypertension

- It has been recommended to cancel elective surgery if the SBP is 180 mmHg or higher or if the DBP is 110 mmHg or higher.
- In a study of 2,069 patients undergoing elective coronary artery bypass grafting surgery, 29.6% had preoperative isolated systolic hypertension,
- The patients with preoperative isolated systolic hypertension had a 40% increase in perioperative cardiovascular events.

Causes of preoperative hypertension



Evaluation of surgical patient with pre-operative HTN



Intraoperative hypertension

- The overall RCT evidence demonstrates that strategies of maintaining a higher perfusion pressure, compared with a lower one, during CPB have no detrimental effect and may lead to favorable outcomes in cardiac surgical patients.

One RCT (n=248) showed that the combined incidence of cardiac and neurological complications was significantly lower in the high-MAP group (80–100 mm Hg; incidence, 4.8%) than in the low-MAP group (50–60 mm Hg; incidence, 12.9%)

Another RCT (n=92) corroborated this finding, showing that maintaining a higher perfusion pressure target (80–90 mm Hg), compared with a lower target (60–70 mm Hg), during normothermic CPB is associated with significantly less early postoperative cognitive dysfunction and delirium.

- .
- The frequency of acute postoperative hypertension has been reported to be between 22 - 54% in patients undergoing cardiac surgery.

Blood pressure target during the first 48 hours

Normal (MAP > 65 mmhg) → default blood pressure goal

High (MPA > 75 mmhg) →
age > 75 years.
Poorly controlled hypertension.
Pre- and / or post operative renal impairment.
Uncorrected carotid artery stenosis.
Pre- and/ or post operative ischemic Strock.

Low (MPA < 55 _60 mmhg) →
age < 50 years, with pre operative hypertension.
High risk of bleeding.
Surgery for chronic valve regurgitation.

Sidebotham D, et al: cardiothoracic critical care. Butterworth- Heinemann, philladelphia 2007;20:295-297

Blood pressure in CABG Vs AVR

- **In *CABG* the higher blood pressure variability associated with higher early mortality.**
- **Versus *AVR* the lower blood pressure variability associated with poorer prognosis.**

frontiers in Cardiovascular Medicine

ORIGINAL RESEARCH
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Association of Post-operative Systolic Blood Pressure Variability With Mortality After Coronary Artery Bypass Grafting

Zhuoming Zhou[1,2†], Jiantao Chen[1,2†], Guangguo Fu[1,2], Xiaodong Zhuang[2,3,4], Jian Hou[1,2], Sida Chen[1,2], Suiqing Huang[1,2], Yuan Yue[1,2], Liqun Shang[1,2], Keke Wang[5], Linhua Lv[1,2], Mengya Liang[1,2] and Zhongkai Wu[1,2*]*

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Background: Blood pressure variability (BPV) has long been considered a risk factor for cardiovascular events. We aimed to investigate whether post-operative systolic BPV was associated with early and late all-cause mortality in patients undergoing coronary artery bypass grafting (CABG).

Methods: Clinical variables and blood pressure records within the first 24 h in the post-operative intensive care unit stay from 4,509 patients operated on between 2001 and 2012 were extracted from the Medical Information Mart for Intensive Care III (MIMIC-III) database. BPV was measured as the coefficient of the variability of systolic blood pressure, and we compared patients in the highest quartile with patients in the other three quartiles.

Results: After full adjustment, patients in the highest quartile of BPV were at a higher risk of intensive care unit mortality (OR = 2.02, 95% CI: 1.11–3.69), 30-day mortality (OR = 1.92, 95% CI: 1.22–3.02), and 90-day mortality (HR = 1.64, 95% CI: 1.19–2.27). For 2,892 patients with a 4-year follow-up, the association between a higher post-operative BPV and the risk of 4-year mortality was not significant (HR = 1.17, 95% CI: 0.96–1.42). The results were supported by the comparison of survival curves and remained generally consistent in the subgroup analyses and sensitivity analyses.

Conclusions: Our findings demonstrated that in patients undergoing CABG, a higher post-operative BPV was associated with a higher risk of early mortality while the association was not significant for late mortality. Post-operative BPV can support doctors in identifying patients with potential hemodynamic instability and making timely clinical decisions.

Keywords: coronary artery bypass grafting, blood pressure, variability, mortality, intensive care

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In this study their finding demonstrated that in patients undergoing CABG, a higher post-operative BPV was associated with a higher risk of early mortality while the association was not significant for late mortality.

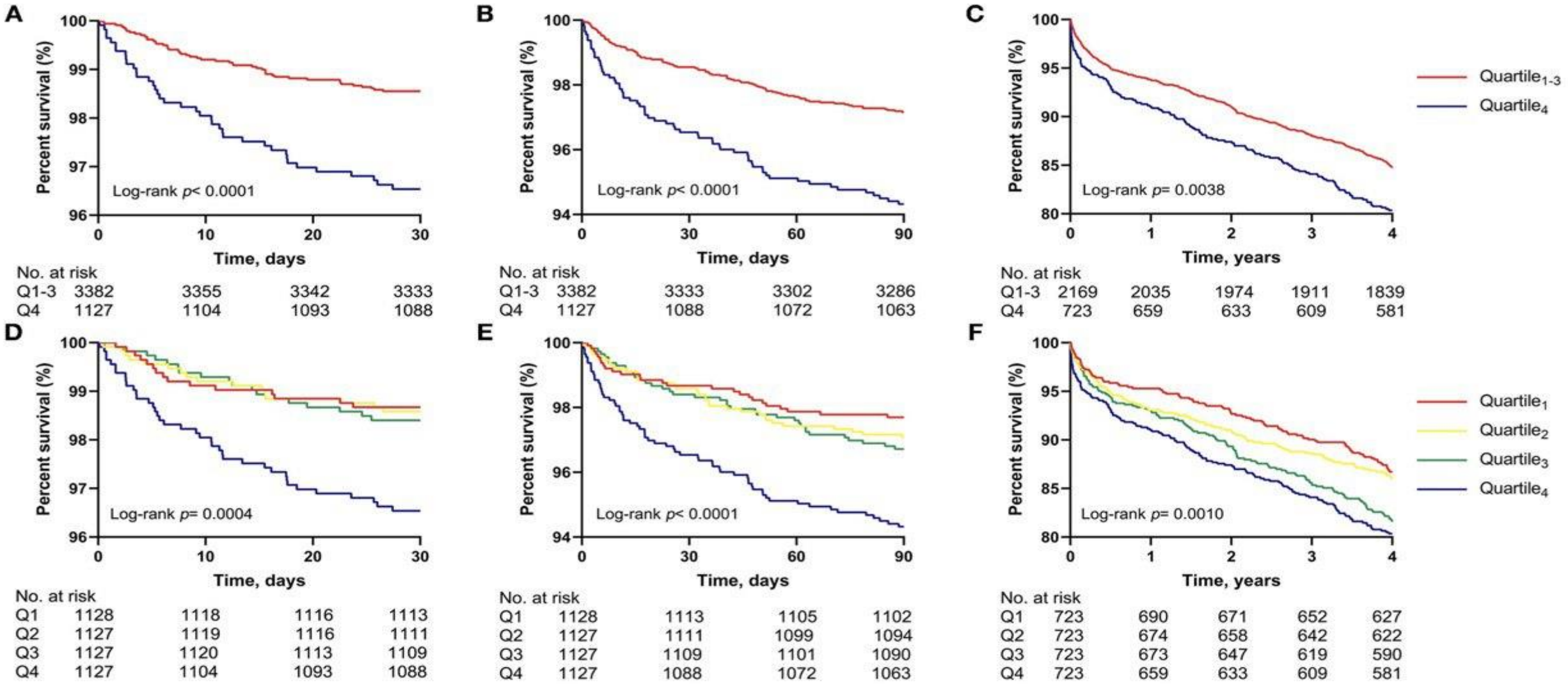

FIGURE | Kaplan-Meier survival analysis among patients stratified by quartiles of the coefficient of variation of post-operative systolic BPV. Comparison of (A) 30-day, (B) 90-day, and (C) 4-year survival of the highest quartile (Q4) vs. the other three quartiles (Q1–3); Comparison of (D) 30-day, (E) 90-day, and (F) 4-year survival of the four quartiles; BPV, blood pressure variability; Q, quartile.

The Pressure Is On: Implications of Blood Pressure After Aortic Valve Replacement

Julian Yeoh and **Philip MacCarthy**

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Journal of the American Heart Association. 2019;8:e014631

Blood pressure control in AVR

Perlman et al, who made the association that ***postprocedural hypertension*** after transcatheter AVR (TAVR) was a predictor of a better prognosis by increasing strock volume and cardiac output independently of other factors.

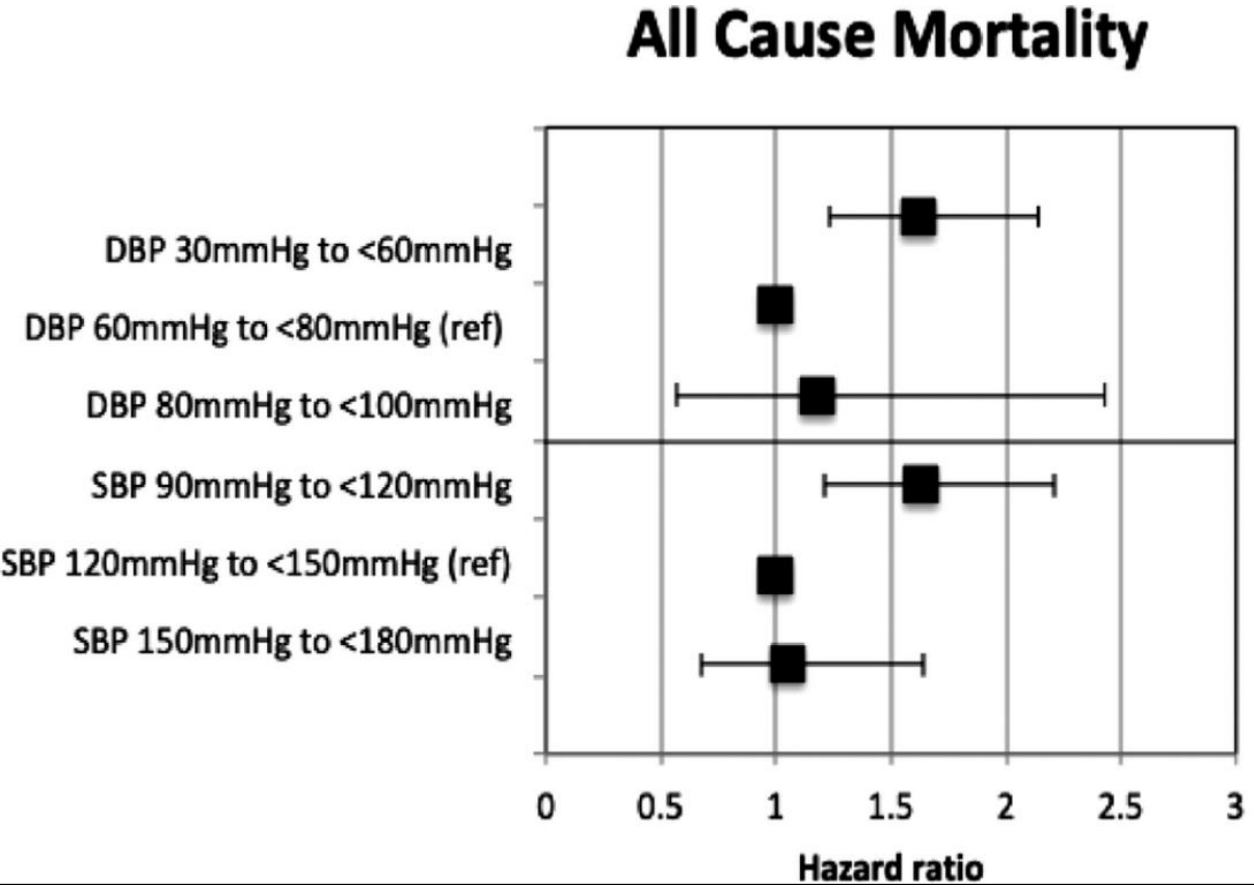
So if hypertension after AVR indicates a good prognosis, can we deduce that hypotension is a bad thing?

In this issue of the *Journal of the American Heart Association* (*JAHA*), Lindman et al demonstrate that **low** BP (both SBP and DBP) is linked to poorer outcomes after AVR via both surgical and transcatheter approaches.

Patients enrolled in the Medtronic intermediate, high- and extreme-risk trials receiving either TAVR with a self-expanding valve or surgical AVR were analyzed

They concluded that a DBP of 30 to <60 mm Hg compared with a DBP of 60 to <80 mm Hg was associated with increased all-cause mortality and cardiovascular mortality.

A similar association was shown for SBP, where SBP of 90 to <120 mm Hg compared with SBP of 120 to <150 mm Hg was again associated with increased all-cause mortality and cardiovascular mortality.



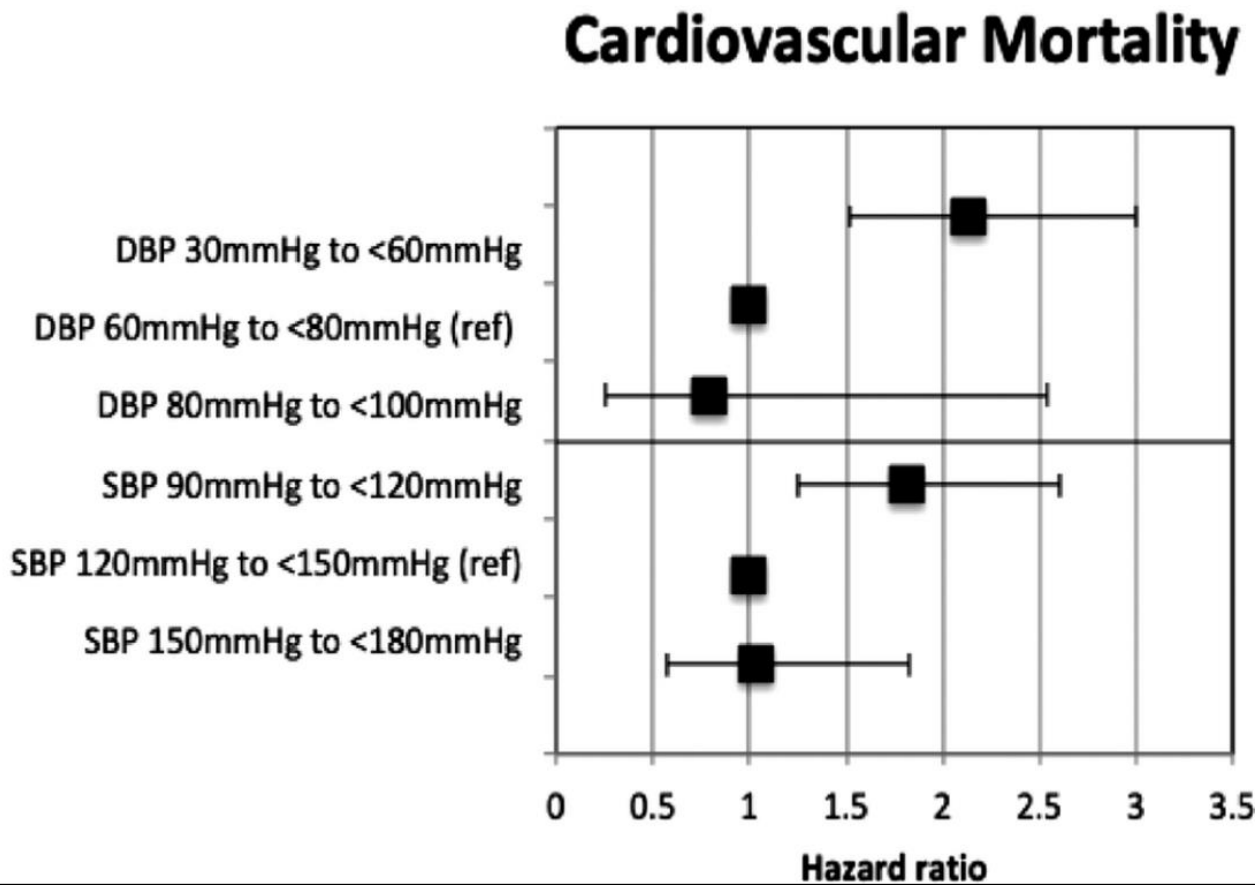


Figure Forest plot of adjusted hazard ratio of 1-year all-cause mortality and cardiovascular mortality, according to early p

Why is this phenomenon observed and what are the biological explanations for this association?

There are several potential explanations as to why low BP may be *associated* with a poor outcome:

1. variation in the complex ventriculo-aortic-arterial interaction and the changes that occur when aortic valve stenosis is suddenly relieved.

2. the possibility of low DBP being a marker of paravalvular leak (PVL), which give more worse results.

3. Possible association between low blood pressure early after AVR and impaired left ventricular function.

4. conceivable *association* would be a systemic inflammatory response, particularly in the surgical AVR group, which would lower early BP values and has previously been associated with a poor long-term outcome.

5. - possible interference of the prosthetic valve with coronary blood flow affecting myocardial contractility.

Table 1. Procedural and Postprocedural Considerations Related to Blood Pressure Management After AVR

- Avoidance of excessively low systolic (<120 mm Hg) or diastolic (<60 mm Hg) BP within 30 d after AVR.

- Avoidance of negatively chronotropic drugs early after AVR.

- Caution with early reintroduction of ACE inhibitors (particularly in patients with significant renal impairment).

- Avoidance of overmedication in the early postprocedural period.

- Low diastolic pressure should prompt detailed assessment to diagnose and subsequently manage paravalvular leak, particularly in patients with TAVR.

Optimal peri operative blood pressure management

- The scientific basis of association between hemodynamic instability and major adverse events is impaired vital organ perfusion, causing ischemia and subsequently reperfusion injury.
- autoregulation range is a variety of wide range blood pressures maintaining vital organ perfusion, which varies with the organ system.
- autoregulation range of the brain Is determined by the mean arterial pressure and intracranial pressure, Cerebral autoregulation was also found to be impaired during hypothermic cardio-pulmonary bypass and subsequent rewarming.
- Myocardial perfusion depends largely on the diastolic blood pressure, while renal perfusion depends on MAP and cardiac output within its autoregulation limits.

• Senthil K Packiasabapathy, MBBS MD1 and Subramaniam Balachundhar, MD MPH2; Optimal perioperative blood pressure management/ Published in final edited form as: Adv Anesth. 2018 December ; 36(1): 67–79. doi:10.1016/j.aan.2018.07.003.

Optimal peri operative blood pressure management

- In hypertension we should decide weather it's hypertensive emergency or urgency.
- Hypertensive emergency usually managed by parantral anti hypertensive medications
- In the acute settings, the blood pressure reduction should not be more than 25%. Or diastolic blood pressure reduction by 10 - 15 % over 30 - 60 minutes, to avoid too aggressive blood pressure control and decrease the likelihood of target organs hypo perfusion.
- Patients with chronic hypertension, the cerebral and renal autoregulation are in higher ranges, the attempts to control blood pressure should be within 24 - 48 hrs to avoid target organ injury from hypo perfusion.

Table Initial dosing of antihypertensive agents[a]

Agent	Comment
Enalaprilat	Intravenous intermittent: 0.625–1.25 mg (lower dose if hyponatremia, possible volume depletion, concomitant diuretic therapy, or renal failure) over 5 min, then double at 4- to 6-h intervals until desired response, a single maximal dose of 1.25–5 mg (doses ≥1.25 mg have not been of additional benefit, but doses ≤5 mg have been given), toxicity, or a cumulative dose of 20 mg within a 24-h period; contraindicated in 2nd and 3rd trimester of pregnancy
Esmolol	Intravenous infusion: 250–500 μg/kg/min for 1 min, followed by a 50–100 μg/kg/min infusion for 4 min, then titrate using same sequence (ie, with bolus before each rate increase) until desired response, a maximal dose of 300 μg/kg/min, or toxicity
Fenoldopam	Intravenous intermittent: 0.1 μg/kg/min initially, then titrate in 0.1 μg/kg/min increments every 15 min until desired response, a maximal dose of 1.6 μg/kg/min, or toxicity
Hydralazine	Intravenous intermittent: 3–20 mg (the lower end of the dosing range is preferred in the immediate perioperative period and in patients with renal failure) slow IV push every 20–60 min
Labetalol	Intravenous intermittent: 20 mg over 2 min, then double at 10 min intervals until desired response, a single maximal dose of 80 mg, toxicity, or a cumulative dose of 300 mg/d Intravenous infusion: 2 mg/min initially, then titrate in 2 mg increments every 10 min until response, toxicity, or a cumulative dose of 300 mg/24-h
Nicardipine	Intravenous infusion: 5 mg/h initially, then titrate dose by 2.5 mg/h increments every 5–15 min until desired response, a maximal dose of 15 mg/h, or toxicity
Nitroglycerin	Intravenous infusion: 5 μg/min initially, then titrate in 5 μg/min increments (may use 10 to 20 μg/min increments when doses >20 μg/min) every 3–5 min until desired response or toxicity; no absolute dosing limit, but the risk of hypotension increases with doses >200 μg/min; therefore, alternative therapy should be considered
Nitroprusside	Intravenous infusion: 0.25–0.5 μg/kg/min initially, then titrate dose every 1–2 min until desired response, a maximal dose of 10 μg/kg/min (limit to duration <10 min), or toxicity

Notes: [a]Use oral dosing when gastrointestinal absorption is documented and when an early response (eg, <2 h) is not needed; the IV dose titration times are the shortest times recommended for BP control but not necessarily the best for a given patient; slower titrations are often warranted to preclude excessively rapid decreases in pressure, with subsequent perfusion complications.

Table Agents used in the management of perioperative hypertension, preferred conditions, and dosing

Agent	Conditions	Dosing
Enalaprilat	Congestive heart failure	IV injection of 1.25 mg over 5 min every 6 h, titrated by increments of 1.25 mg at 12 to 24 h intervals to a maximum of 5 mg every 6 h.
Esmolol	Acute myocardial ischemia[a]	Loading dose of 500–1000 μg/kg over 1 min, followed by an infusion at 25 to 50 μg/kg/min, which may be increased by 25 μg/kg/min every 10 to 20 min until the desired response to a maximum of 300 μg/kg/min
Fenoldopam	Acute myocardial ischemia[c] Acute pulmonary edema/diastolic dysfunction[a,b] Acute ischemic stroke/intracerebral bleed Acute renal failure/ microangiopathic anemia Hypertensive encephalopathy Sympathetic crisis	An initial dose of 0.1 μg/kg/min, titrated by increments of 0.05 to 0.1 μg/kg/min to a maximum of 1.6 μg/kg/min.
Labetalol	Acute aortic dissection Acute myocardial ischemia[a] Acute ischemic stroke/intracerebral bleed Eclampsia/Preeclampsia Hypertensive encephalopathy	Initial bolus 20 mg, followed by boluses of 20–80 mg or an infusion starting at 1–2 mg/min and titrated up to until the desired hypotensive effect is achieved is particularly effective. Bolus injections of 1 to 2 mg/kg have been reported to produce precipitous falls in BP and should therefore be avoided; maximum cumulative dose of 300 mg over 24 h
Nicardipine	Acute myocardial ischemiac Acute renal failure/microangiopathic anemia Acute ischemic stroke/intracerebral bleed Eclampsia/ preeclampsia Hypertensive encephalopathy Sympathetic crisis/cocaine overdose[d]	5 mg/h; titrate to effect by increasing 2.5 mg/h every 5 min to a maximum of 15 mg/h.

Notes: In combination with nitroglycerin (up to 200 μg/min); In combination with a loop diuretic; May be added if pressure is controlled poorly with labetalol/esmolol alone; In combination with a benzodiazepine.

Home massages

- Blood pressure is a serious parameter of cardio pulmonary reserve.
- Should avoid anything can cause sudden fluctuations in blood pressure peri operatively.
- Hypertension is highly risky in early post operative periods except post AVR hypertension is beneficial.

Thanks for your attention