

# Journal Club: Intraoperative hypotension

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PGY3

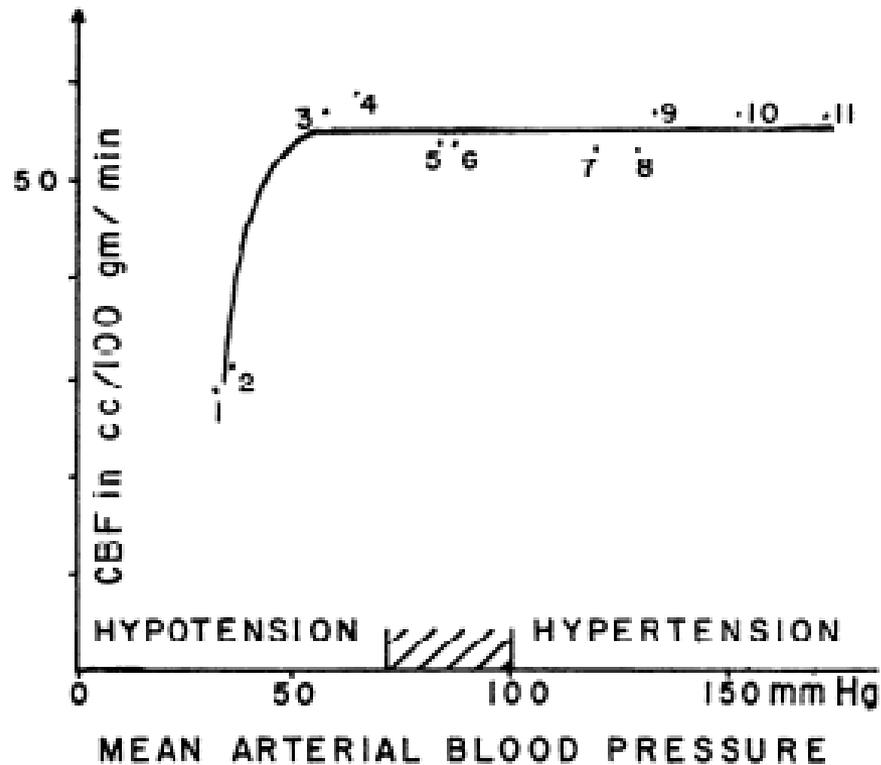
# Relationship between Intraoperative Mean Arterial Pressure and Clinical Outcomes after Noncardiac Surgery

## *Toward an Empirical Definition of Hypotension*

Walsh et. al., Anesthesiology 2013; 119:507-15

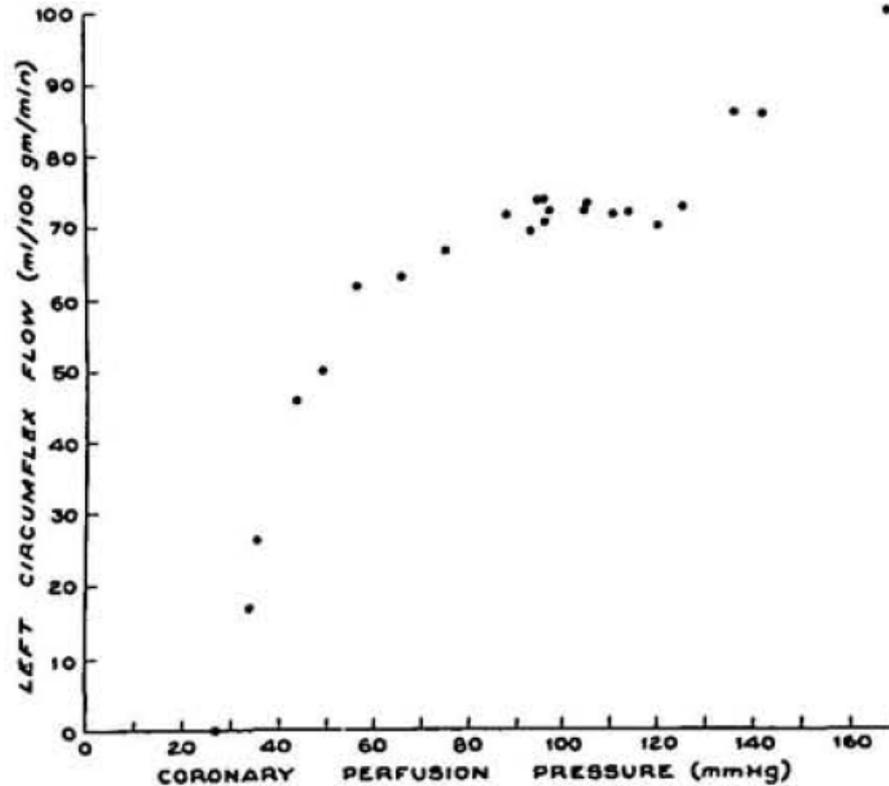
# Hypotension – why do we care?

CEREBRAL BLOOD FLOW AND OXYGEN UPTAKE



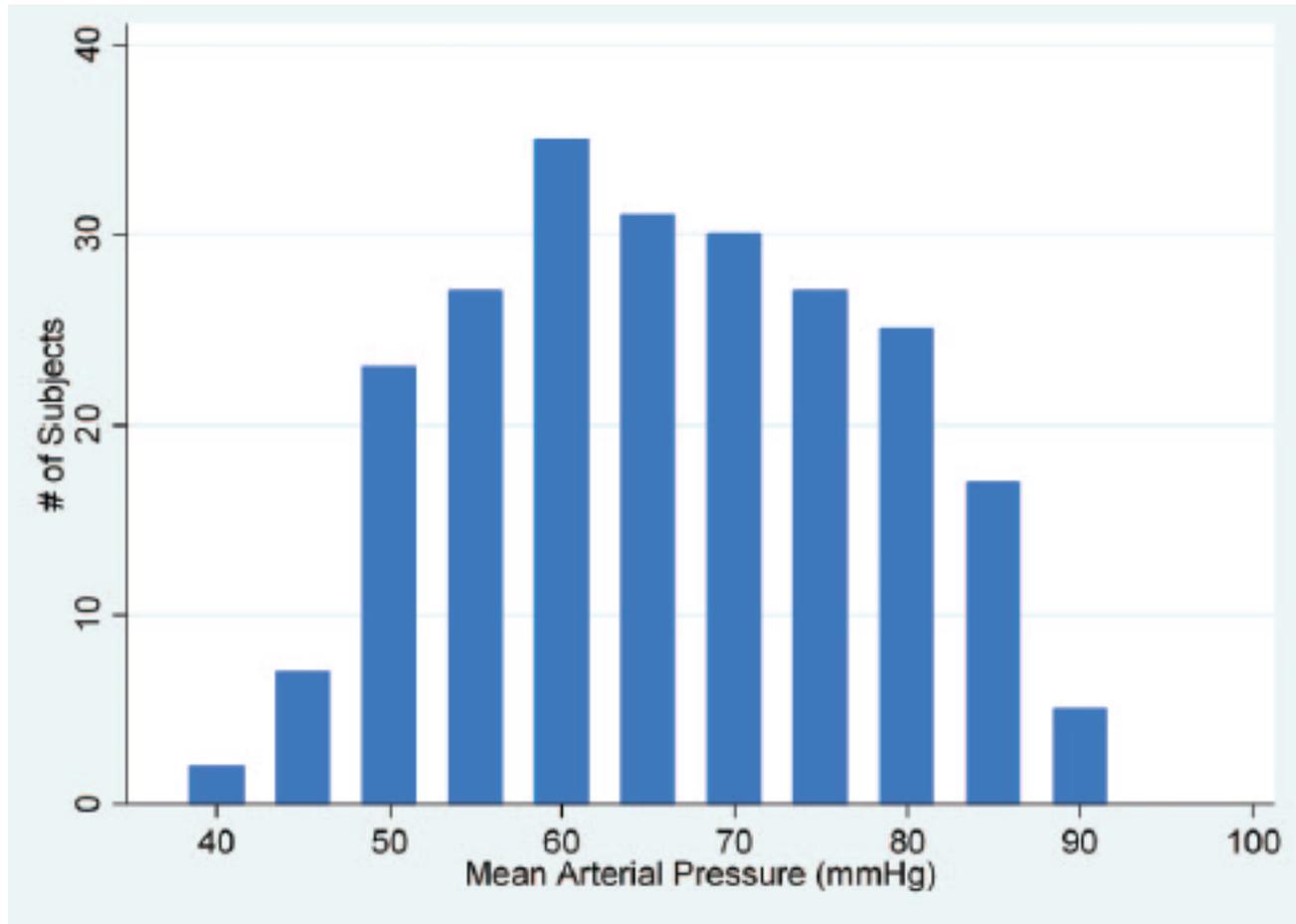
Larsen 1959

# Hypotension – why do we care?



Mosher et al 1964

# Hypotension – why do we care?



Joshi et al 2012

# Would you not expect worse outcomes in hypotensive patients?

*Does perioperative hemodynamic optimization protect renal function in surgical patients? A meta-analytic study.* Brienza N et. al.: *Crit Care Med* **2009**; 37:2079–90

*Effects of extended release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): a randomised controlled trial.* Devereaux PJ, et al. *Lancet* **2008**; 371:1839-47.

# Study question

- **What is the relationship between MAP and AKI, myocardial injury and cardiac complications?**
- *AKI = increase in serum Cr 1.5 over baseline or 0.3 mg/dl (26 umol/L)*
- *Myocardial injury = increase in troponin within 7 days of OR*
- *Cardiac complications = perioperative MI, heart failure and cardiac arrest*

# Novel aspects of study

- The authors account for each minute spent below given MAP threshold
- Found that the risk of AKI and myocardial injury escalates rapidly below MAP of 55 – i.e. no ‘safe’ duration of MAP < 55

# Patients

- Included:
  - i. All patients who had non-cardiac surgery at the Cleveland Clinic between 2005-2010 (total 33,330 surgeries)
  - ii. stayed at least one night in hospital
  - iii. Had pre and post-op creatinine values
- Excluded:
  - i. Patients who had urologic surgery
  - ii. Underlying kidney dysfunction

# Recording blood pressure

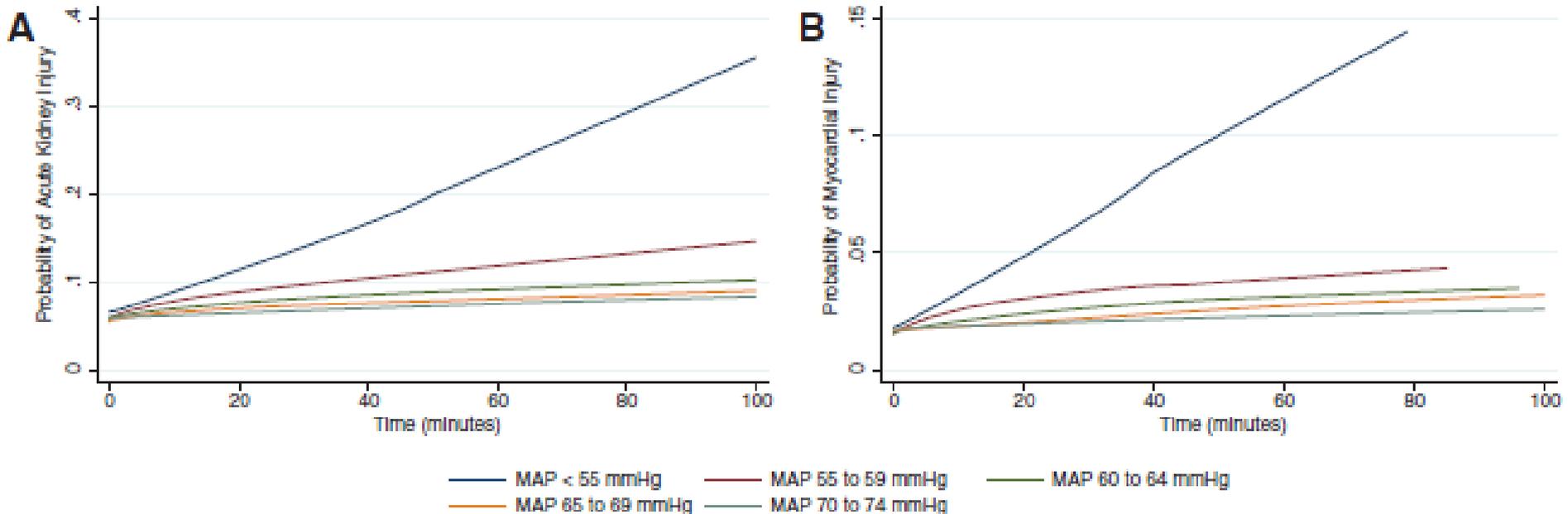
- 44.5% of patients had arterial lines
- During time periods where no BP is recorded the last BP was carried forward.

# Analysis

- Patient characteristics recorded
- Then assessed the relationship between the defined outcomes and each MAP threshold (ie <55, <60, < 65, <70 and <75 mmHg)
- Excluded patients with time spent in a lower BP strata
- Based on above constructed models of predicted risk of KAI and myocardial injury

# Results

AKI and myocardial injury occurred in 2,478 (7.4%) and 770 (3.5%) surgeries



- No increased risk for MAP > 60
- Only slight increased risk in AKI for MAP 55-59 during first 10 min, but none thereafter
- No increased risk of myocardial injury for MAP > 55
- Graded increase in risk for each minute spent < MAP 55

# Results

Time MAP <55 mmHg (min)	Adjusted Odds Ratio (95% CI)			
	Acute Kidney Injury	Myocardial Injury	Cardiac Complication	30-day Mortality
0		Referent		
1-5	1.18 (1.06-1.31)	1.30 (1.06-1.58)	1.35 (1.15-1.58)	1.16 (0.91-1.46)
6-10	1.19 (1.03-1.39)	1.47 (1.13-1.93)	1.46 (1.17-1.83)	1.16 (0.84-1.60)
11-20	1.32 (1.11-1.56)	1.79 (1.33-2.39)	1.50 (1.16-1.94)	1.26 (0.89-1.80)
>20	1.51 (1.24-1.84)	1.82 (1.31-2.55)	1.95 (1.46-2.60)	1.79 (1.21-2.65)

Increased 30 day mortality for MAP < 55 for greater than 20 min

# Results

	MAP <55 mmHg					P Value
	Never n = 18,989	1–5 min n = 8,266	6–10 min n = 2,856	11–20 min n = 1,987	>20 min n = 1,232	
Age, yr*	54.8 (15.3)	57.3 (15.5)	57.9 (15.6)	56.1 (16.6)	55.7 (16.7)	<0.001
Female, n (%)	9,519 (50.0)	4,102 (49.6)	1,516 (53.1)	1,064 (53.5)	635 (51.5)	<0.001
Emergency procedure, n (%)	1,063 (5.6)	579 (7.0)	193 (6.8)	188 (9.5)	144 (11.7)	<0.001
ASA score, n (%)						
I	418 (2.2)	121 (1.4)	42 (1.5)	26 (1.3)	16 (1.3)	<0.001
II	8,262 (43.6)	2,965 (35.9)	1,022 (35.8)	652 (32.8)	347 (28.2)	
III	9,120 (48.1)	4,387 (53.1)	1,521 (53.3)	1,087 (54.7)	654 (53.1)	
IV	1,143 (6.0)	767 (9.3)	264 (9.2)	218 (11.0)	211 (17.1)	
V	28 (0.1)	24 (0.3)	7 (0.2)	4 (0.2)	4 (0.3)	
Charlson Index†	0 (0 to 2)	1 (0 to 2)	1 (0 to 2)	1 (0 to 2)	1 (0 to 2)	<0.001
Diabetes mellitus, n (%)	2,424 (12.8)	1,056 (12.8)	384 (13.4)	246 (12.4)	156 (12.7)	0.71
Myocardial infarction, n (%)	699 (3.7)	387 (4.7)	143 (5.0)	88 (4.4)	43 (3.5)	<0.001
Congestive heart failure, n (%)	581 (3.1)	302 (3.7)	90 (3.2)	85 (4.3)	43 (3.5)	<0.001
Peripheral vascular disease, n (%)	576 (3.0)	474 (5.7)	150 (5.3)	97 (4.9)	57 (4.6)	<0.001
Stroke, n (%)	796 (4.2)	495 (6.0)	150 (5.2)	88 (4.4)	84 (6.8)	<0.001
Estimated GFR, ml·min <sup>-1</sup> ·1.73m <sup>-2</sup> *	92.3 (26.3)	91.7 (26.7)	93.2 (29.6)	94.9 (32.2)	96.6 (33.8)	<0.001
Hemoglobin, g/dl*	13.1 (2.0)	13.0 (2.0)	12.8 (2.1)	12.6 (2.1)	12.3 (2.1)	<0.001
Intraoperative erythrocyte transfusions, ml†	0 (0 to 0)	0 (0 to 0)	0 (0 to 0)	0 (0 to 320)	0 (0 to 690)	<0.001
Estimated blood loss, ml†	200 (80 to 350)	250 (100 to 550)	250 (100 to 600)	300 (100 to 700)	400 (163 to 1,000)	<0.001

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# Results - Strengths

- Large number of patients
- Small increases in troponin and Cr likely are significant (Devereaux 2012, Bellomo 2007)
- Applicable to our patients
- Able to account for each minute with MAP < 55

# Results - Drawbacks

- So are sick patients hypotensive or does hypotension make patients sick?
- No obvious compensation for pre-operative blood pressure differences
- Retrospective study
- The duration of 'risk' of surgery is not addressed
- Will aggressive BP control cause deleterious consequences elsewhere?

Thank you