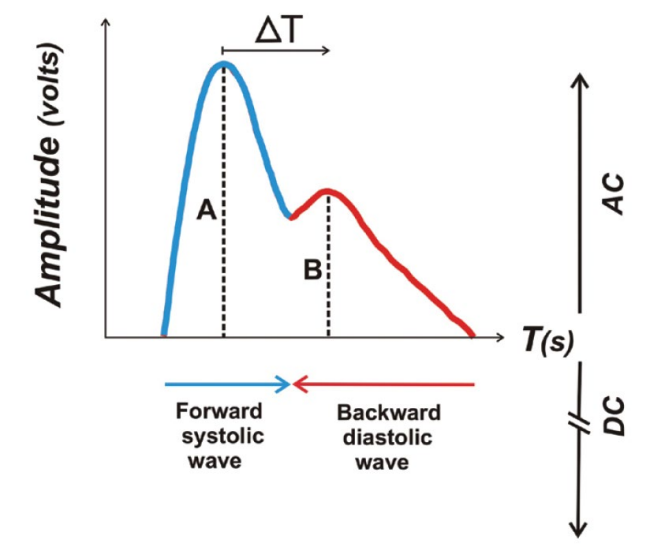
Perioperative haemodynamic optimization of hip fracture patients



Nicolai Bang Foss, MD, DMSc
Professor
Dept. of anaesthesiology & intensive care
Hvidovre University Hospital
Copenhagen, Denmark

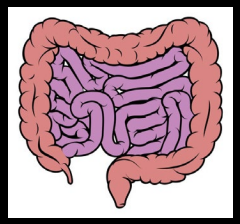
Hypovolaemia

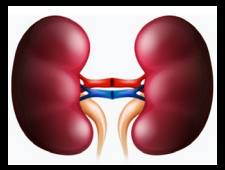
Anaemia

Vasoplegia

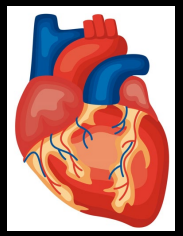
Cardiac failure

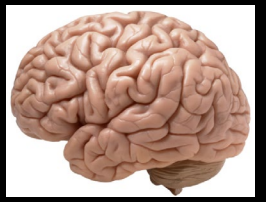
Perfusion failure





Organ failure





Hidden blood loss after surgery for hip fracture

Estimated total blood loss based on admission hb, hb on day 4, transfusions and estimated blood volume

N=546

	Screws	Arthroplasty	DHS	IMHS
Observed blood loss (ml)	50	200	200	500
Total blood loss (ml)	612	1301	1480	1861

Foss, J Bone Joint Surg Br 2006

Hidden blood loss after surgery for hip fracture

Estimated total blood loss based on admission hb, hb on day 4, transfusions and estimated blood volume

50% of blood loss preop.

	Screws	Arthroplasty	DHS	IMHS
Observed blood loss (ml)	50	200	200	500
Total blood loss (ml)	612	1301	1480	1861

Foss, J Bone Joint Surg Br 2006

Journal of Clinical Monitoring and Computing (2018) 32:1033–1040
https://doi.org/10.1007/s10877-018-0107-6

ORIGINAL RESEARCH

Cerebral oximetry during preoperative resuscitation in elderly patients with hip fracture: a prospective observational study

C. G. Clemmesen[1] · L. M. Pedersen[1] · S. Hougaard[1] · M. L. Andersson[2] · V. Rosenkvist[3] · H. B. Nielsen[4] · H. Palm[5] · N. B. Foss[1]

	Postop.delirium			Death (30 days)		
	Yes	No		Yes	No	
NIRS AUC S*<55%	306	0	0.08	2871	0	0.03

No differences in HR or MAP between groups

Perioperative time with NIRS < 55% associated with death

Preoperative hypoperfusion

	Postop.delirium		Death (30 days)		
	Yes	No	Yes	No	p
	10	30	4	36	
Preop.					
NIRS	58	66	57	66	0.04
BP (MAP)	85	86	76	85	0.42
Intraop.					
NIRS	52	56	43	56	0.31
BP (MAP)	78	74	73	77	0.49

NIRS lower intraoperatively ”after resuscitation”

BP not associated with outcomne

Clemmensen, J Clin Monit Comp 2018

Continuous Hb (SpHb) measurements in hip fracture patients

N=42

Perioperative anaemia: Admission – 24 hrs postop

Delirium

	yes	no	p
SpHb minutes < 6.0 mmol/l	162 (30-819)	22 (4-137)	0.03

Death/complication

	yes	no	
SpHb minutes < 6.0 mmol/l	119 (49-325)	22 (4-514)	0.1

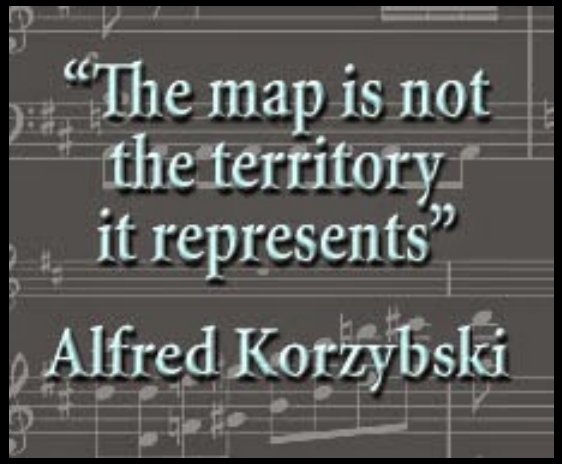
Median (IQR)

Clemmensen J Clin Monit 2019

Perioperative RBC transfusion in hip fractures – RCT studies

Pre | Intra | Postoperative phase

Foss → Favours liberal 10.0 g/dl trigger



Carson x 2 →

Parker →

Gregersen - - - - →

Perioperative haemodynamic challenges in hip fractures

Potential dehydration

Insufficent fluid intake

Blood loss From fracture

Blood loss from surgical site

Cardiac failure: inotropic / chronotropic incompetence

Hypovolaemia + anaemia + tissue ischaemia + fluid overload + cardiopulmonary failure + hypoxia = organ failure

= complications + delayed recovery + death

British Journal of Anaesthesia Page 1 of 16
doi:10.1093/bja/aeu386

BJA

LiDCO-based fluid management in patients undergoing hip fracture surgery under spinal anaesthesia: a randomized trial and systematic review

I. K. Moppett[1*], M. Rowlands[1], A. Mannings[1], C. G. Moran[2] and M. D. Wiles[3] The NOTTS Investigators[†]

GDT by intraop. preload optimization with colloid (dynamic uncalibrated)

Vs

A-line monitoring only

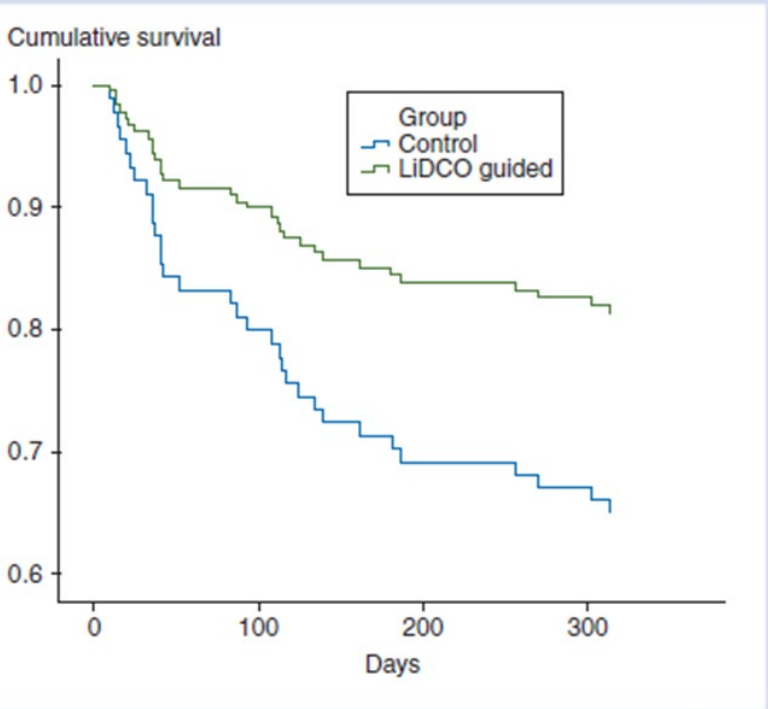
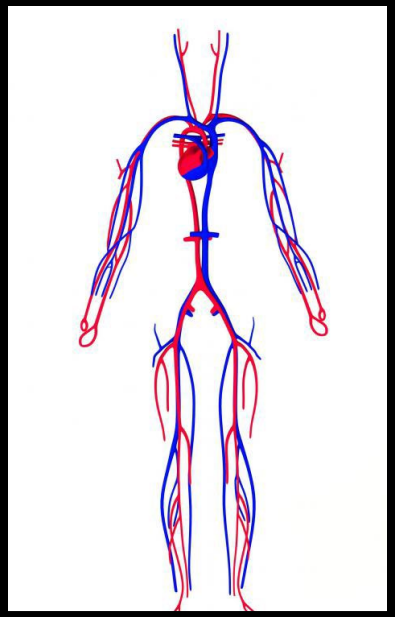


Fig 2 Cumulative survival for control and LiDCO-guided groups. There was no significant difference (P=0.148) with outcomes adjusted for NHFS or age.

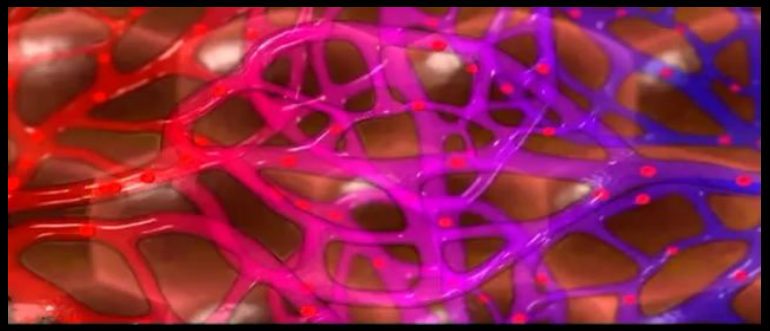
Optimizing tissue perfusion in the perioperative period

Macrocirculation



SV, SVV, HR, CO, MAP, Hb

Microcirculation



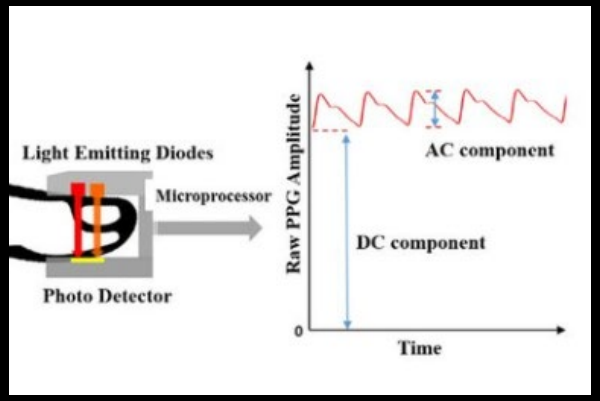
Lactate, ScVO2, ScO2, PI, SpHb

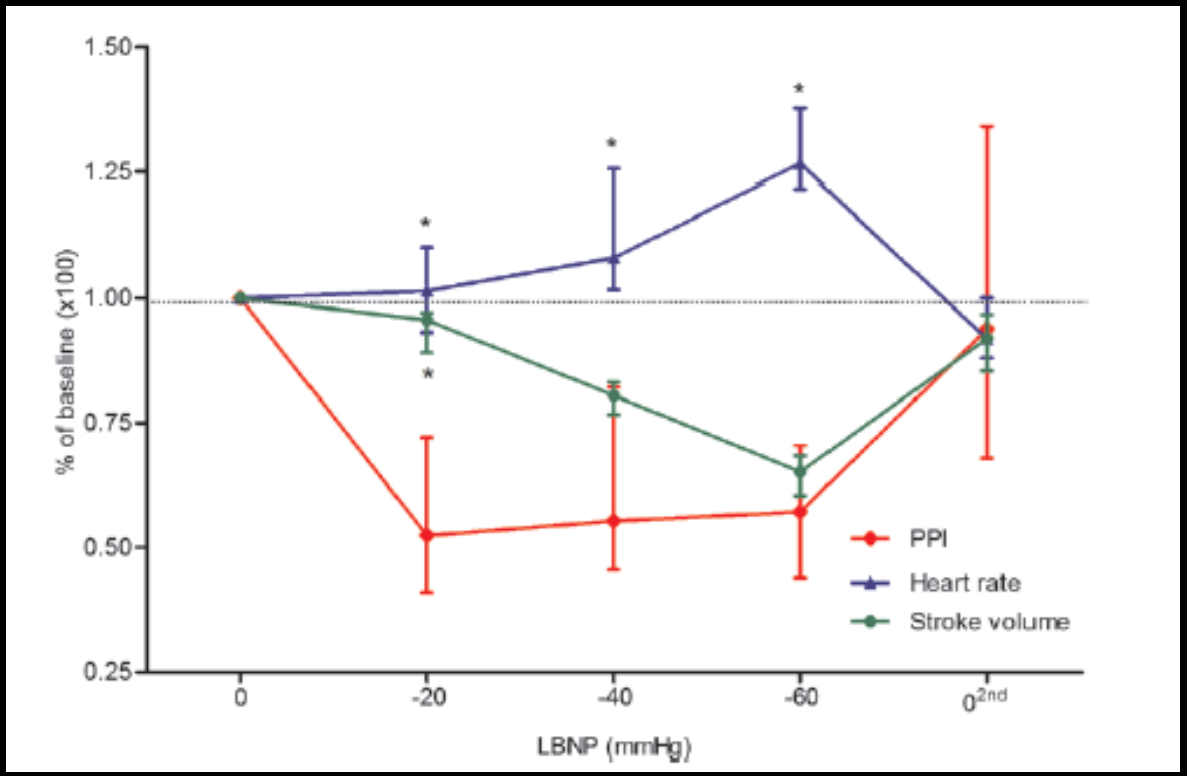
CO = Flow (Speed)

Organ perfusion = Flow + Distribution

Peripheral Perfusion Index as an Early Predictor for Central Hypovolemia in Awake Healthy Volunteers

Michel E. van Genderen, MSc,* Sebastiaan A. Bartels, MD, PhD,*†† Alexandre Lima, MD,*
Rick Bezemer, PhD,*† Can Ince, PhD,*† Jan Bakker, MD, PhD,* and Jasper van Bommel, MD, PhD*





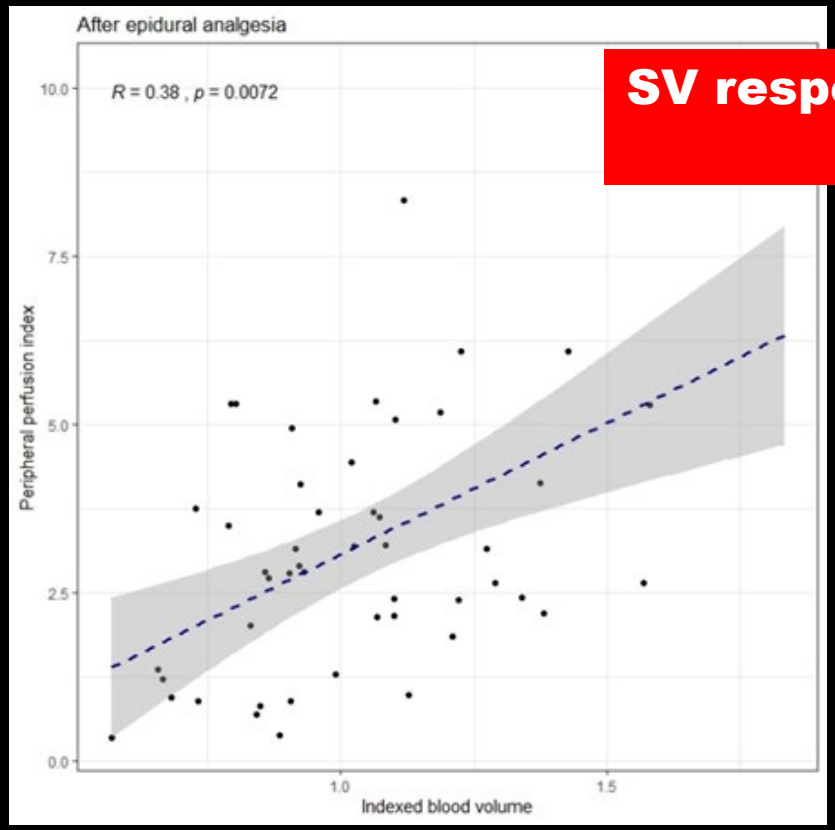
DOI: 10.1111/aas.14070

RESEARCH ARTICLE

acta Anaesthesiologica Scandinavica

Fluid-responsiveness, blood volume and perfusion in preoperative haemodynamic optimisation of hip fracture patients; a prospective observational study

Marianne Agerskov[1] | Henrik Sørensen[2] | Jakob Højlund[1] | Niels H. Secher[2] | Nicolai Bang Foss[1]



SV response to fluid not associated with volume status

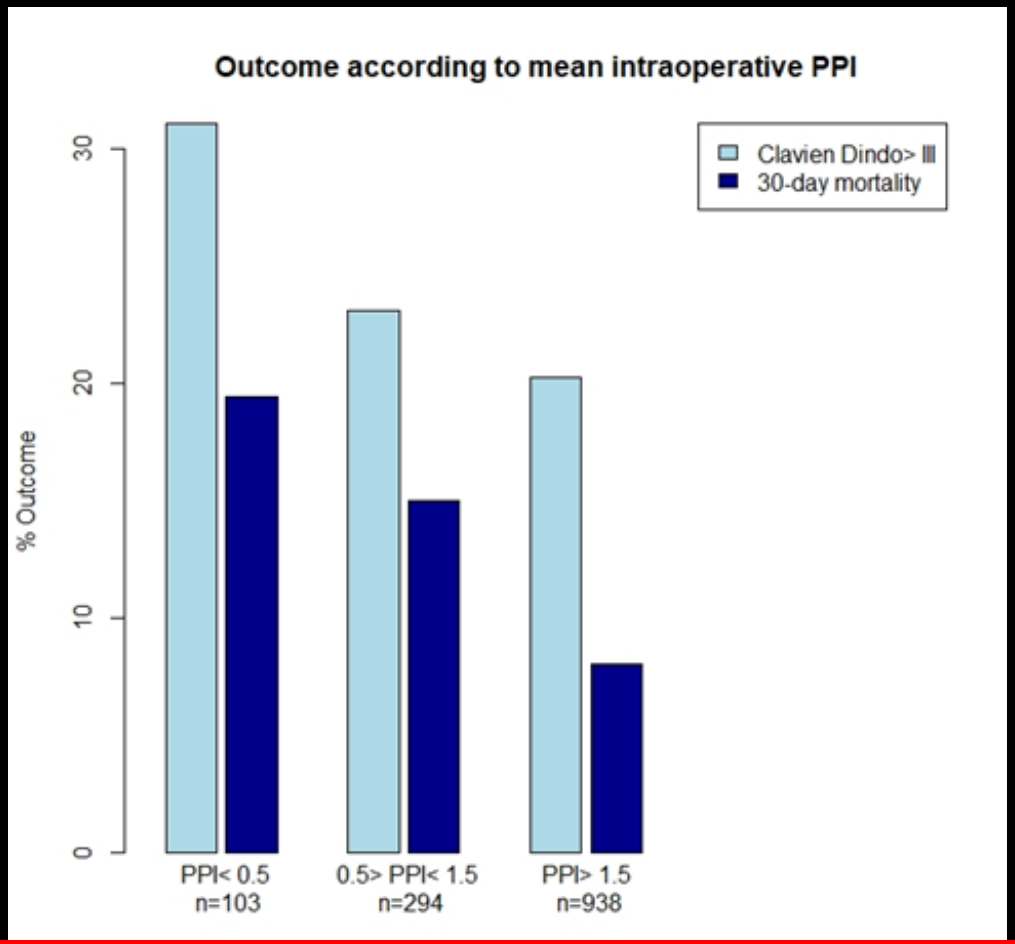
Association between PI and intravascular volume in preoperative hip fracture patients

BJA

British Journal of Anaesthesia, 127 (3): 396–404 (2021)

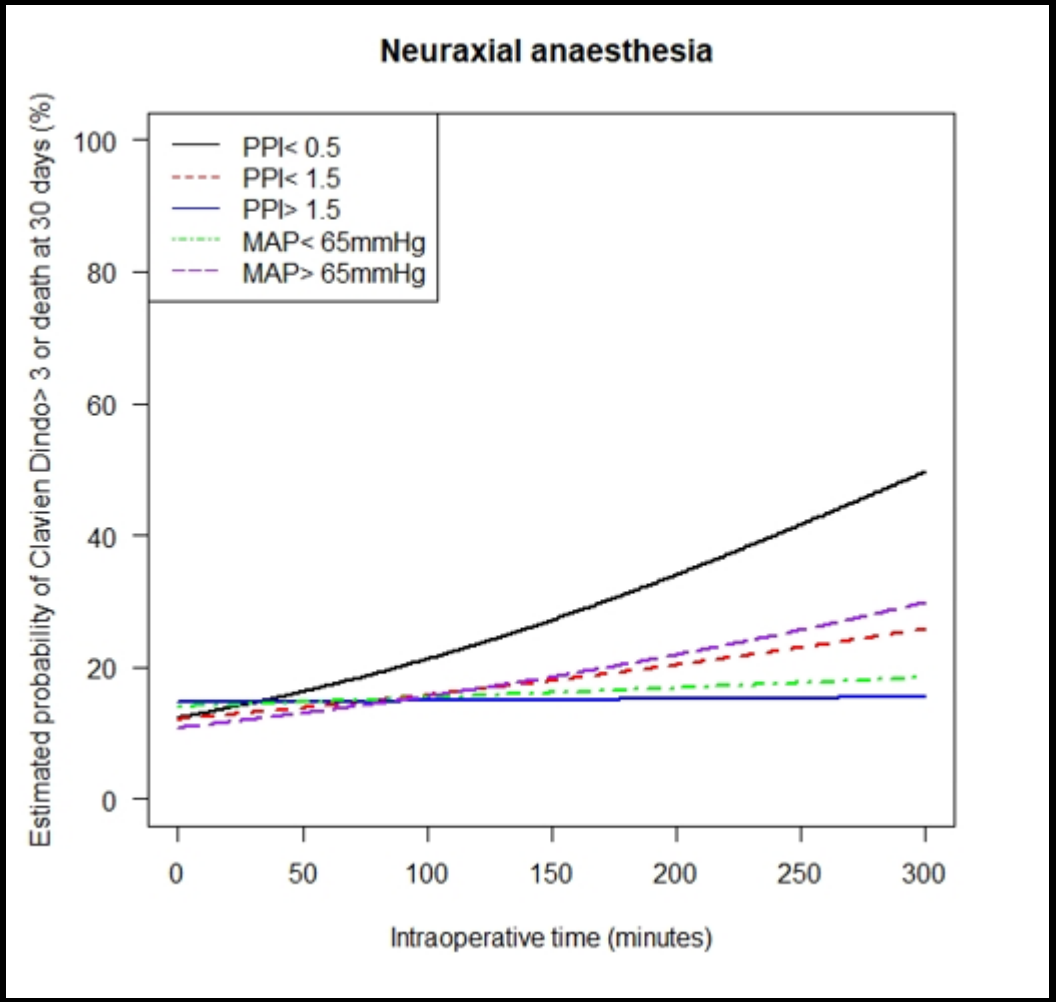
Association of the intraoperative peripheral perfusion index with postoperative morbidity and mortality in acute surgical patients: a retrospective observational multicentre cohort study

Marianne Agerskov[1,*], Anna N. W. Thusholdt[1], Henrik Holm-Sørensen[2], Sebastian Wiberg[1], Christian S. Meyhoff[3], Jakob Højlund[1], Niels H. Secher[4] and Nicolai B. Foss[1]



Significant association between low PI and poor outcome

Intraoperative perfusion index 587 hip fracture patients



Time spend with low PI (<0.5 / <1.5) associated with poor outcome

Journal of Clinical Anesthesia 95 (2024) 111472

Contents lists available at ScienceDirect

Journal of Clinical Anesthesia

journal homepage: www.elsevier.com/locate/jclinane

Original Contribution

Peripheral perfusion index stratifies risk in patients with intraoperative anemia: A multicentre cohort study

Frederik F. Lau [a,*], Marianne Agerskov [a], Anna N.W. Thusholdt [a], Jakob Højlund [a], Christian S. Meyhoff [b,c], Øivind Jans [d], Nicolai B. Foss [a,c]

Anaemic patients with low PI (< 1.5) vs high PI:

OR: 8.6 for mortality

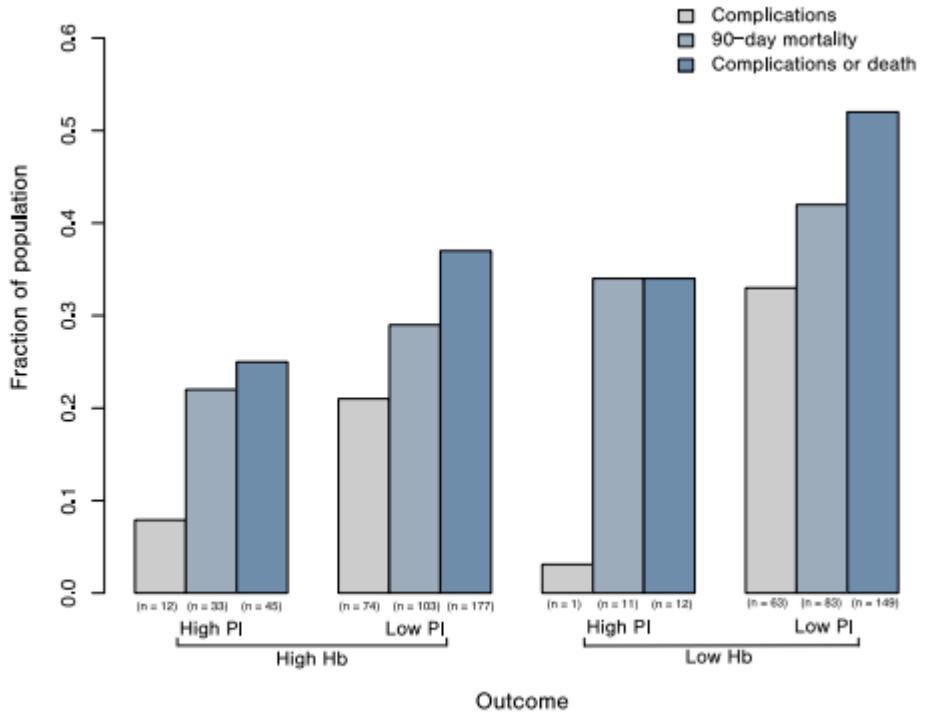
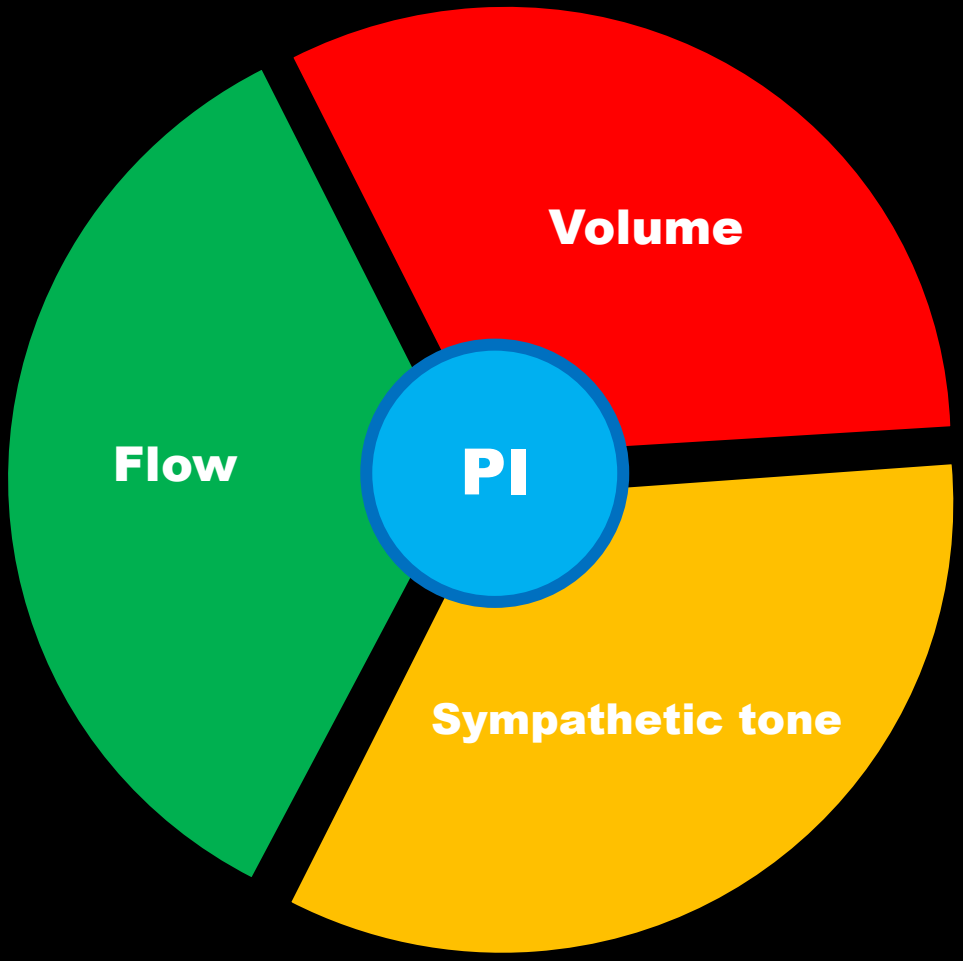


Fig. 2. Distribution of postoperative outcomes among patient groups categorized by their PPI and Hb values.

90-day mortality[1]	Unadjusted OR (95% CI)	Adjusted[2] OR (95% CI)
PPI > 1.5 and Hb < 9.7 ($n = 1$)	0.38 (0.021–2.01)	0.36 (0.019–2.22)
PPI < 1.5 and Hb > 9.7 ($n = 74$)	3.12 (1.70–6.21)	2.35 (1.19–4.95)
PPI < 1.5 and Hb < 9.7 ($n = 66$)	5.75 (3.10–11.61)	3.13 (1.45–7.11)


Volume
Flow
PI
Sympathetic tone

Preoperative haemodynamic optimization in hip fracture patients

Start early Hb monitoring!?

Is GDT viable pre/peri-operatively?

How should we use inotropics/vasopressors?

Avoid hypotension – but how?

Should we use perfusion measures?

Optimization is continuou?

Should preoperative optimization in hip fractures be done in the ortho ward or intermediary care?

A L I E N

In space no one can hear you scream.