Monitorace selhání oběhu v IP

Jan Beneš
KARIM LFP UK a FN Plzen
Simulační centrum (SIM/PL) - LFP UK
Biomedicínské centrum LFP UK
SepsEast initiative

C-O-I

- Dlouhodobá spolupráce (incl. speaker-fee nebo konzultace) s
  - Edwards Lifesciences Inc.
  - CNSystems Graz
  - Pulsion Munich / Getinge

ARE YOU HAPPY?

Hypovolémie?

Že by moc NEPi

Cévy jako cedník...

We do not always measure blood pressure (BP) because current methods are often invasive, expensive, require specialized expertise, and carry inherent risks. While BP is a useful indicator, it's frequently just an estimate based on algorithms and can vary significantly between different techniques, limiting its accuracy and reliability in clinical practice. Furthermore, focusing solely on BP can be misleading, as a patient's overall hemodynamic status is more complex, and aggressive interventions based on BP alone may delay necessary treatments like antibiotics in critical care settings.

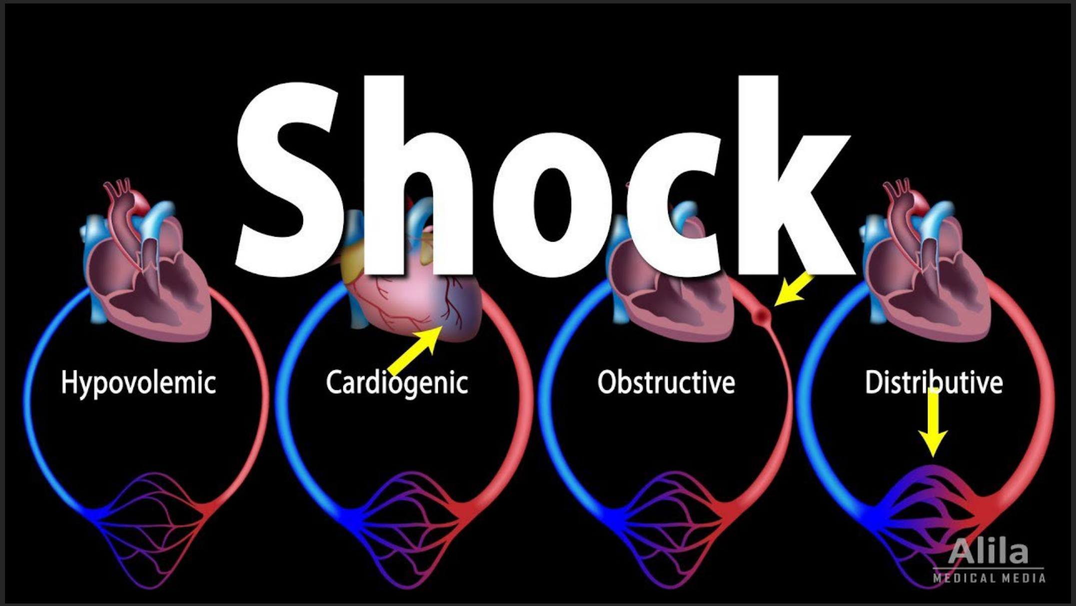
OTÁZKA TIMINGU… (SELHÁNÍ OBĚHU)

OD ZAČÁTKU…

PŘIDALO SE PO CESTĚ…

OTÁZKA PROJEVU… (SELHÁNÍ OBĚHU)

KLINIKA (+ lab.)…



PATOFYZIOLOGIE…

KLINICKY

KLINICKY A STANDARDNÍ MONITORACE

CIRKULACE

KVALITA PULSU
HYPOTENZE
TACHYKARDIE
ŠOKOVÝ INDEX
-
ART.KŘIVKA
CVP

VĚDOMÍ

A – V – P- U
ZMATENOST
DELIRIUM

KŮŽE

TEPLOTA
KAPILÁRNÍ NÁVRAT
MRAMORÁŽ

DIURÉZA

OLIGURIE
ANURIE
HYPERAZOTEMIE

KLINICKY A STANDARDNÍ MONITORACE A LABORATOŘ

LABORATOŘ

ScvO2
pCO2 gap
Hb

CIRKULACE

KVALITA PULSU
HYPOTENZE
TACHYKARDIE
ŠOKOVÝ INDEX
-
ART.KŘIVKA
CVP

VĚDOMÍ

A – V – P- U
ZMATENOST
DELIRIUM

KŮŽE

TEPLOTA
KAPILÁRNÍ NÁVRAT
MRAMORÁŽ

DIURÉZA

OLIGURIE
ANURIE
HYPERAZOTEMIE

KLINICKY
A
STANDARDNÍ
MONITORACE
A
LABORATOŘ
A
SONO

LABORATOŘ

ScvO2
pCO2 gap
Hb

CIRKULACE

KVALITA PULSU
HYPOTENZE
TACHYKARDIE
ŠOKOVÝ INDEX
-
ART.KŘIVKA
CVP

VĚDOMÍ

A – V – P- U
ZMATENOST
DELIRIUM

SONO

ECHO
RUSH
eFAST
VEXUS

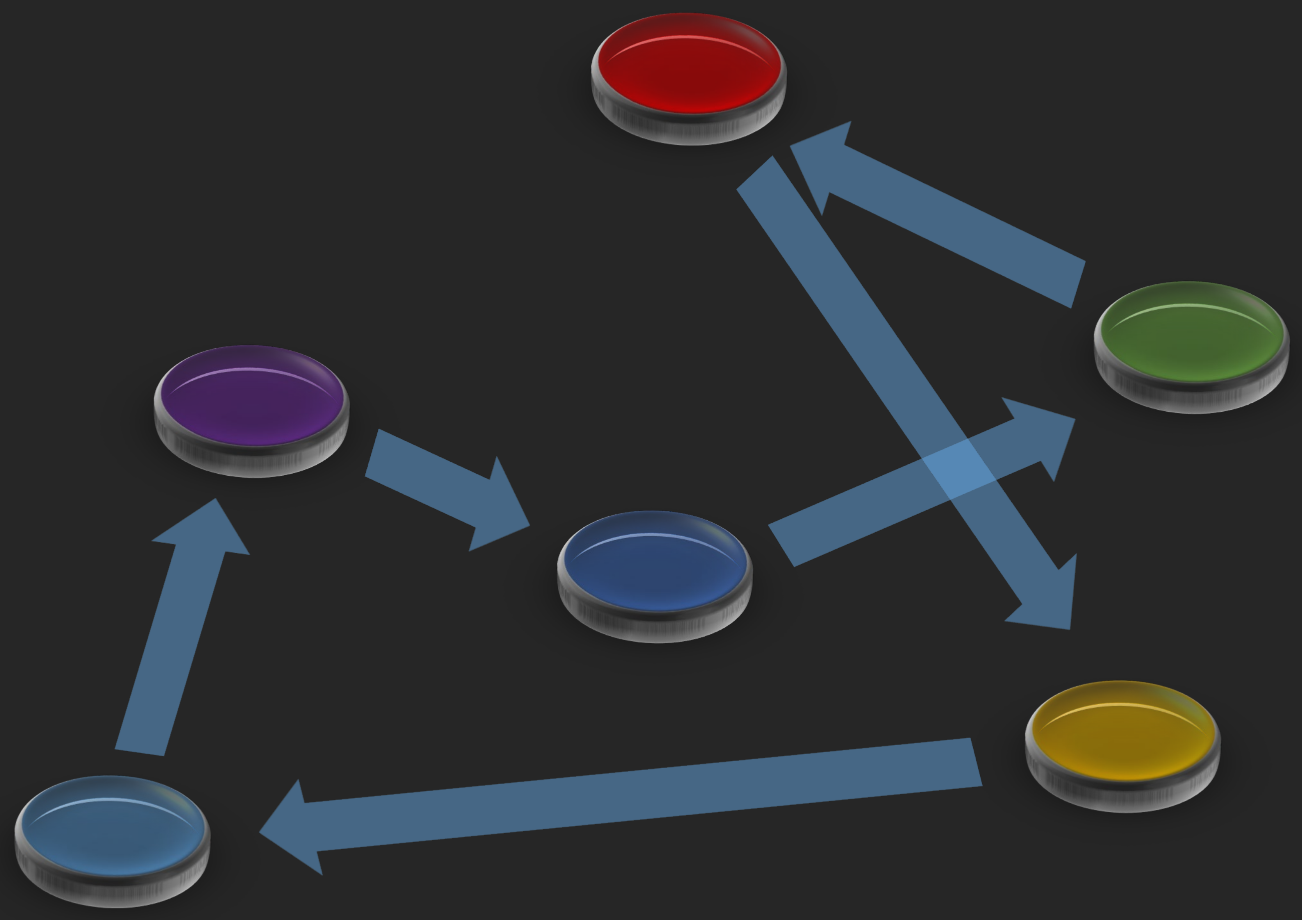
KŮŽE

TEPLOTA
KAPILÁRNÍ NÁVRAT
MRAMORÁŽ

DIURÉZA

OLIGURIE
ANURIE
HYPERAZOTEMIE


FOR DEVICES WITH ANDROID
VALID FOR 1 YEAR
ROUTE 66
ROUTE 66 NAVIGATION
The most comfortable way how to drive or ride historic Route 66
VALID FOR 1 YEAR
ROUTE 66
ROUTE 66 NAVIGATION



POKUD MÁME ŘEŠIT „MONITORING“

- PŘESNÉ A V ČASE STABILNÍ ZHODNOCENÍ SRDEČNÍHO VÝDEJE / AKTUÁLNÍHO PRŮTOKU
- TRENDING ZMĚNY V REÁLNÉM (CO NEJKRATŠÍM) ČASE
- SPECIFICKÉ INFORMACE O JEDNOTLIVÝCH DETERMINANTÁCH VÝDEJE (PRELOAD, KONTRAKTILITA...)
- POKUD BY TO ŠLO NEINVAZIVNĚ...

POKUD MÁME ŘEŠIT „MONITORING“

BLODY INVASIVE
but fully accurate

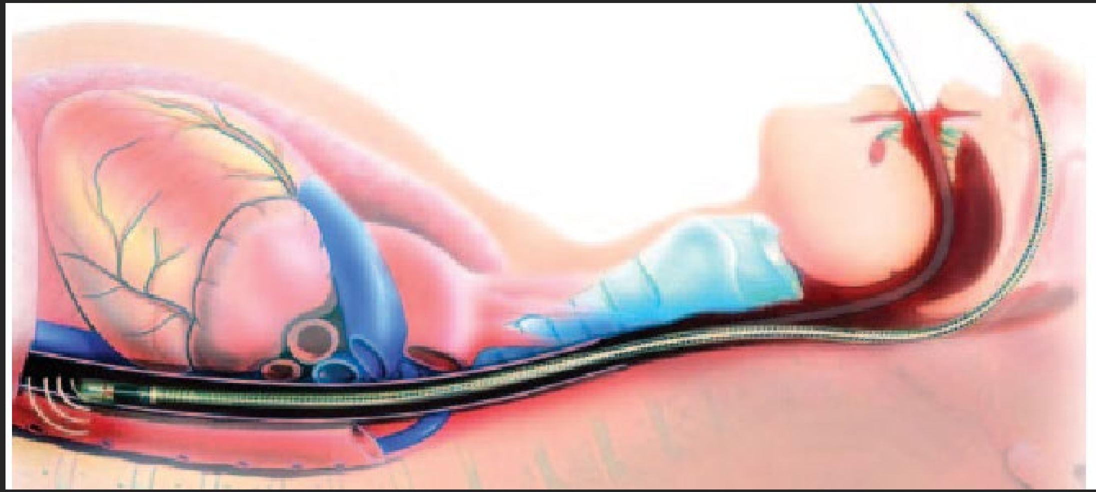
LESS INVASIVE
but PLUG and PLAY

NON- INVASIVE
but TRENDY...

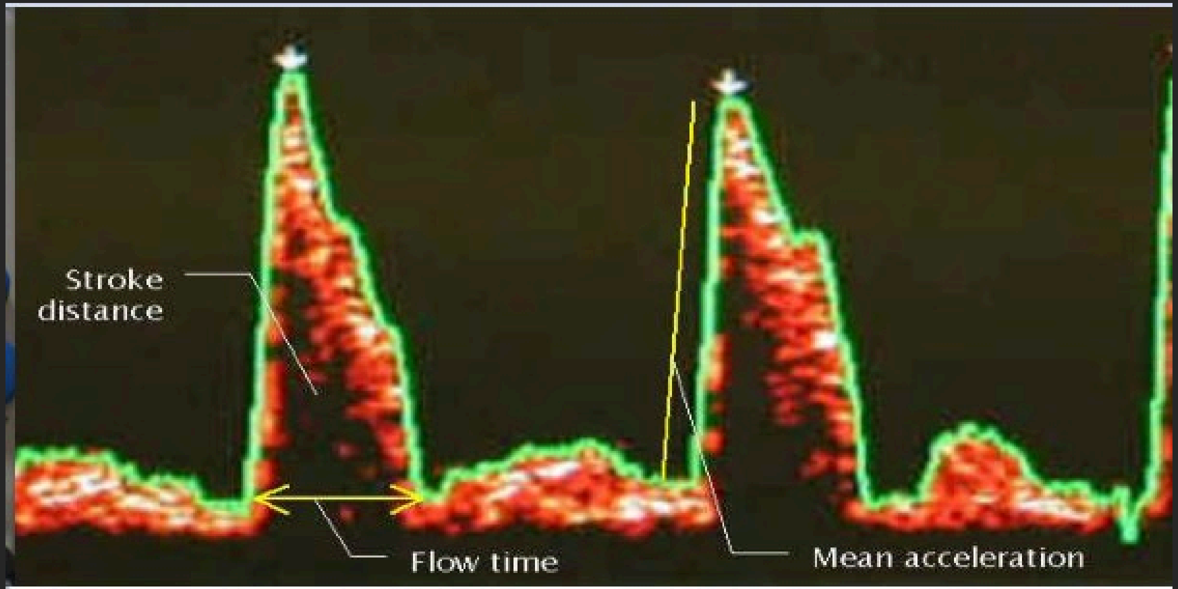
NON- INVASIVE

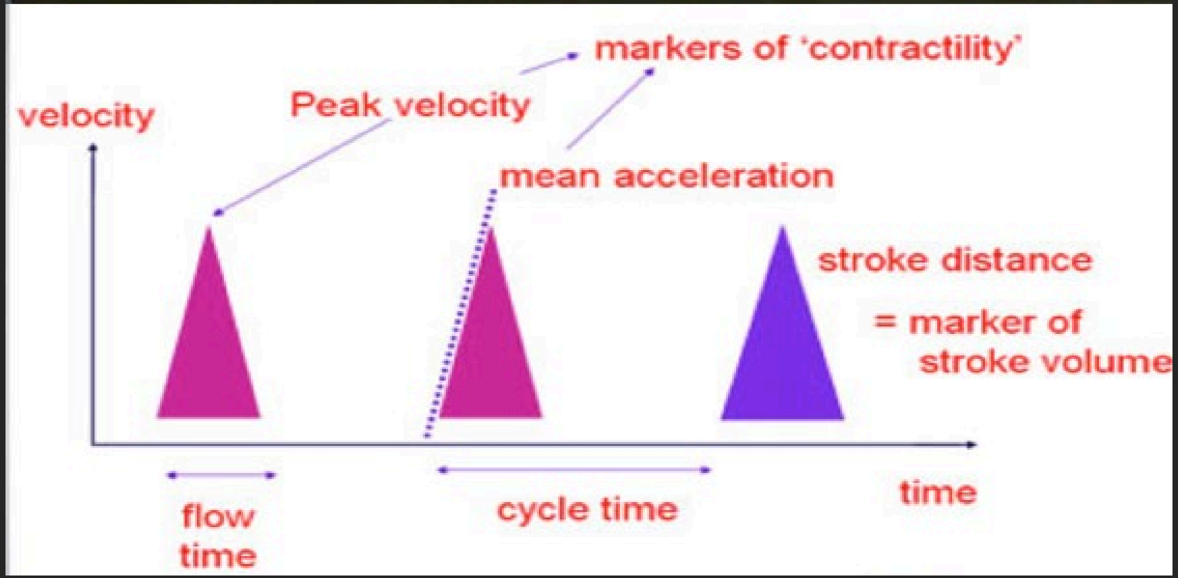
but TRENDY...

ESOPHAGEAL DOPPLER



$$V = \frac{c \times f_{\mathrm{d}}}{2 \times f_{\mathrm{T}} \times \cos\theta}$$





Anesthesiology 2010; 113:1220–35

Minimally Invasive Measurement of Cardiac Output during Surgery and Critical Care

A Meta-analysis of Accuracy and Precision

Philip J. Peyton, M.D., M.B.B.S., F.A.N.Z.C.A.,* Simon W. Chong, M.B.B.S.†

PLOS | ONE

RESEARCH ARTICLE

Cardiac output measurements via echocardiography versus thermodilution: A systematic review and meta-analysis

Yun Zhang[1], Yan Wang[2], Jing Shi[1], Zhiqiang Hua[1], Jinyu Xu[1]*

1 Department of Emergency Medicine, Wuxi People's Hospital Affiliated to Nanjing Medical University, Wuxi, Jiangsu, China, 2 Education Department, Wuxi People's Hospital Affiliated to Nanjing Medical University, Wuxi, Jiangsu, China

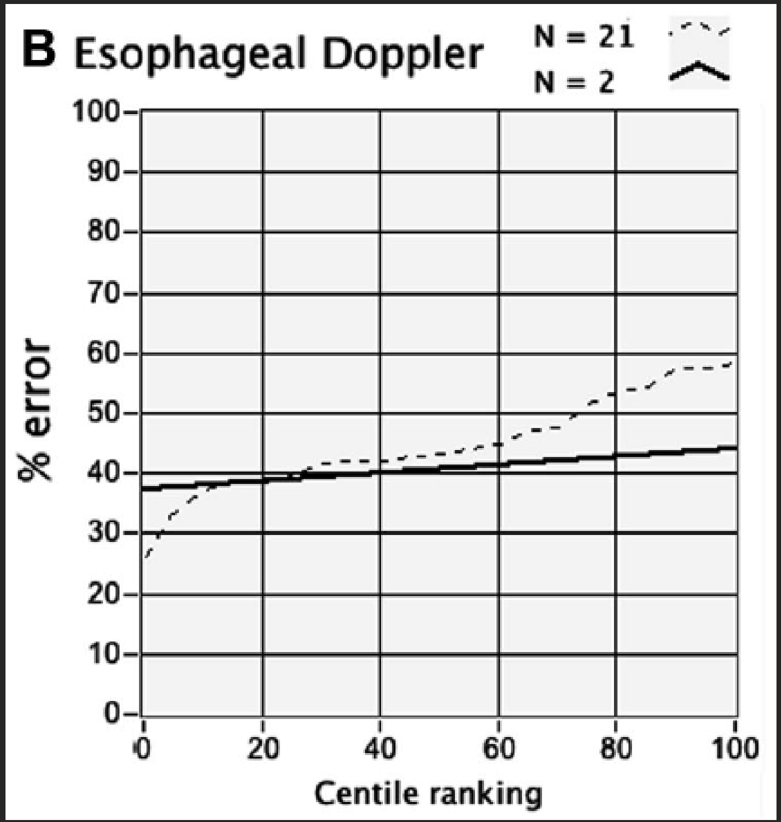


Table 2. Meta-analyses of the cardiac output measurement by echocardiography (US) vs. thermodilution (TD).

Outcome or Subgroup	Studies	Participants	Heterogeneity		Meta-analysis model	Effect Estimate	
			I^2	*P*		MD (95%CI)	*P*
1 All	43	1522	67	<0.01	IV, Random	-0.14 [-0.30, 0.02]	0.08
1.1 TTE	12	290	85	<0.01	IV, Random	-0.28 [-0.71, 0.15]	0.20
1.2 TEE	13	606	0	0.98	IV, Random	0.00 [-0.12, 0.11]	0.98
1.3 USCOM	10	356	71	0.001	IV, Random	-0.16 [-0.61, 0.28]	0.47
1.4 UD	4	113	0	1.00	IV, Random	0.00 [-0.43, 0.44]	0.99
1.5 Others types	4	157	73	0.01	IV, Random	-0.56 [-1.25, 0.14]	0.12

Conclusions

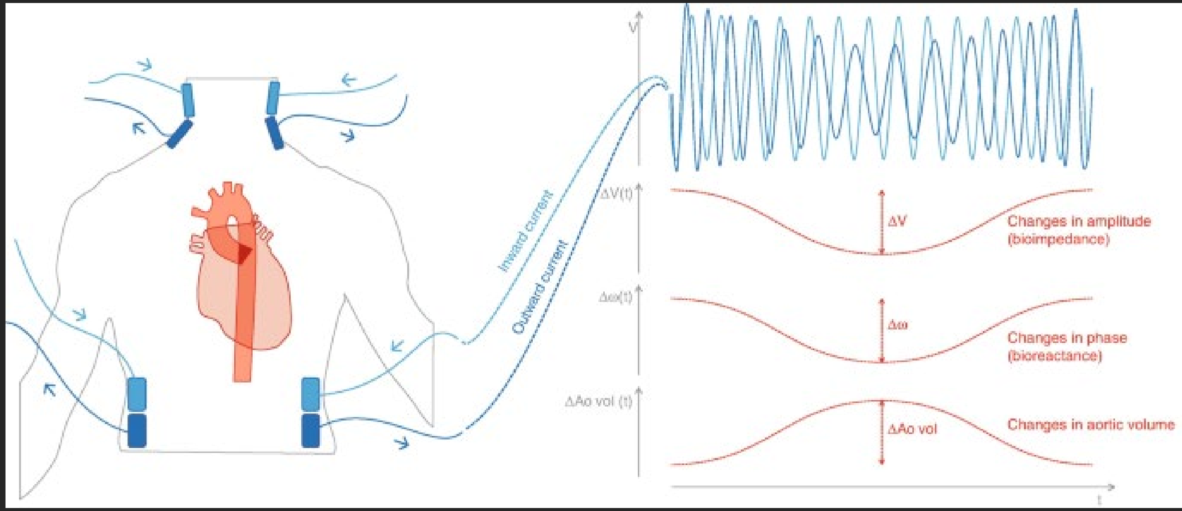
This systematic review and meta-analysis showed that the overall effect of the CO measurements by echocardiography or TD has no significant difference. TEE can be the preferred method with accurate results and USCOM can be a good choice for its noninvasiveness

ULTRASOUND BASED SYSTÉMY
(CardioQ, USCOM and others)

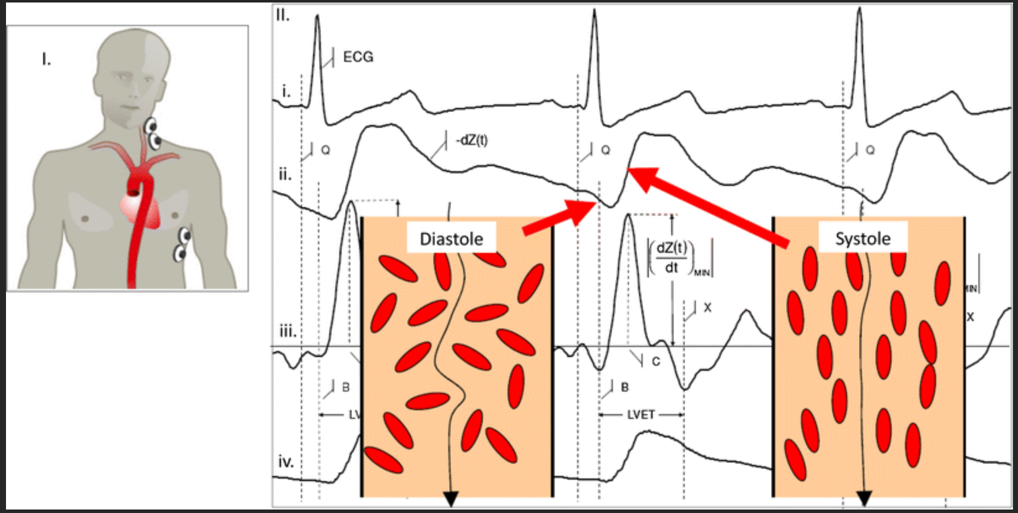
PLUSY
- MĚŘÍ SKUTEČNÝ PRŮTOK
- DOBRÁ „TRENDING ABILITY“
- DOPROVODNÉ PARAMETRY (PRELOAD, KONTRAKTILITA)
- V ZÁSADĚ NEINVAZIVNÍ

MÍNUSY
- JÍCEN V IP = BUSY PLACE
- EXTRÉMNÍ CITLIVOST NA POLOHU
- MĚŘÍ PRŮTOK DESCENDETNÍ AORTOU

BIOIMPEDANCE / BIOREACTANCE



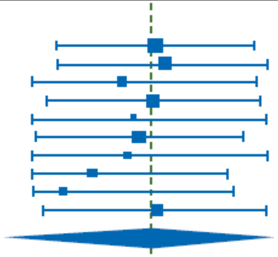
ELECTRIC CARDIOMETRY



Accuracy and precision of non-invasive cardiac output monitoring devices in perioperative medicine: a systematic review and meta-analysis†

A. Joosten[1,*], O. Desebbe[2], K. Suehiro[3], L. S.-L. Murphy[4], M. Essiet[5], B. Alexander[6], M.-O. Fischer[7,8], L. Barvais[1], L. Van Obbergh[1], D. Maucort-Boulch[9] and M. Cannesson[10]

Bioimpedeance		
Zoremba (2007)	50	0.05 [−1.60, 1.70]
Square (2009)	20	0.22 [−1.59, 2.03]
Simon (2009)	13	−0.50 [−2.73, 1.73]
Sharma (2011)	46	0.02 [−1.78, 1.82]
Raue (2009)	30	−0.30 [−3.00, 2.40]
Mekis (2008)	16	−0.21 [−1.94, 1.52]
Heringlake (2007)	29	−0.40 [−3.06, 2.26]
Engoren (2005)	46	−1.00 [−3.26, 1.26]
Critchley (2000)	24	−1.49 [−4.34, 1.36]
Bernstein (2005)	106	0.10 [−1.80, 2.00]
Heterogeneity: Q=43.4 (P<0.001), I^2=79.2%		−0.22 [−2.43, 1.99]

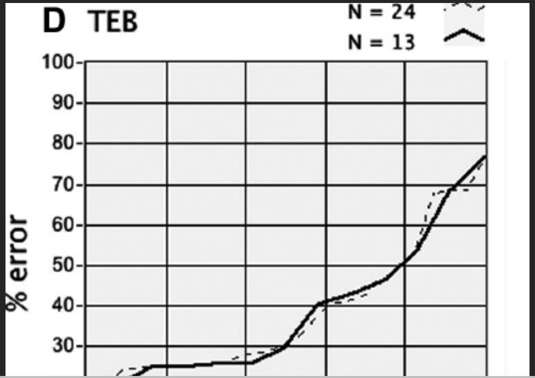


Bias 0,22 (-2,43 to 1,99)
PE 42 %

Minimally Invasive Measurement of Cardiac Output during Surgery and Critical Care

A Meta-analysis of Accuracy and Precision

Philip J. Peyton, M.D., M.B.B.S., F.A.N.Z.C.A.,* Simon W. Chong, M.B.B.S.†



Journal of Clinical Monitoring and Computing (2020) 34:433–460
https://doi.org/10.1007/s10877-019-00330-y

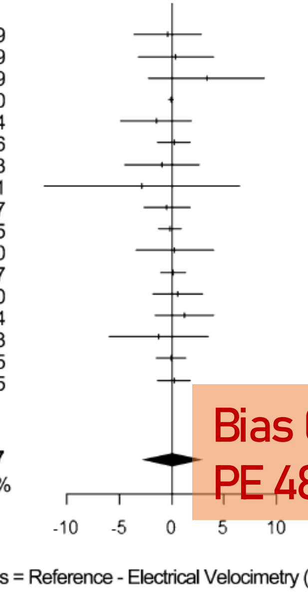
REVIEW PAPER

Accuracy and precision of non-invasive cardiac output monitoring by electrical cardiometry: a systematic review and meta-analysis

M. Sanders[1] · S. Servaas[1] · C. Slagt[1]

Study	N	Bias	LoA	MPE (%)
Heringlake [30] [a]	29	-0.40	-3.59; 2.79	78.0
Heringlake [30] [b]	29	0.40	-3.21; 4.01	69.9
Magliocca [31]	19	3.30	-2.19; 8.79	77.0
Malik [29]	60	-0.08	-0.28; 0.12	4.7
Martin [32]	44	-1.47	-4.82; 1.88	47.9
Mekis [33]	16	0.21	-1.32; 1.74	40.0
Petter [34] [c]	33	-0.90	-4.45; 2.65	63.9
Petter [34] [d]	11	-2.84	-12.11; 6.43	88.2
Petter [34] [e]	7	-0.44	-2.60; 1.72	43.0
Rajput [28]	25	-0.18	-1.26; 0.90	25.1
Raue [35]	30	0.30	-3.42; 4.02	54.0
Schmidt [36]	37	0.18	-0.98; 1.34	29.0
Trinkmann [38]	120	0.60	-1.75; 2.95	50.0
Trinkmann [37]	134	1.20	-1.54; 3.94	53.9
Wang [39]	23	-1.26	-5.94; 3.42	60.0
Zoremba [40] [f]	25	-0.05	-1.44; 1.34	26.5
Zoremba [40] [g]	25	0.22	-1.31; 1.75	26.4
Random effects model for all	667	0.03	-2.78; 2.84	48.0

Heterogeneity: Q=238.5 (p<0.0001) I^2=93%



Bias 0,03 (-2,78 to 2,84)
PE 48 %

To znamená, že pokud skutečný CO je 5 L/min, pak nová metoda by mohla naměřit cokoli mezi cca 2.6 a 7.4 L/min

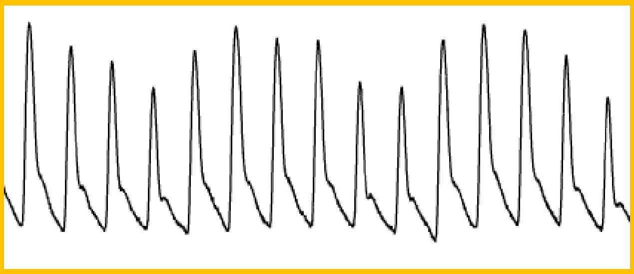
ELECTRICITY BASED SYSTÉMY

PLUSY
- TOTÁLNĚ NEINVAZIVNÍ
- JEDNODUCHÁ APLIKACE
- DOPROVODNÉ PARAMETRY (PRELOAD, KONTRAKTILITA)

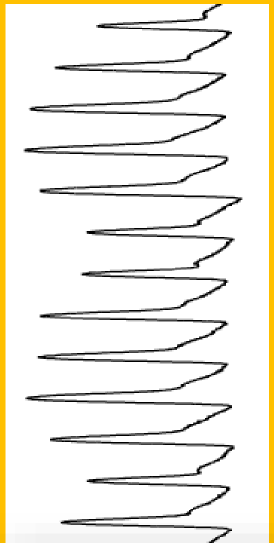
MÍNUSY
- NEPŘESNOST - HIGH PERCENTAGE ERROR
- ELEKTRICKÁ INTERFERENCE
- VYŽADUJE PULSATILNÍ TOK

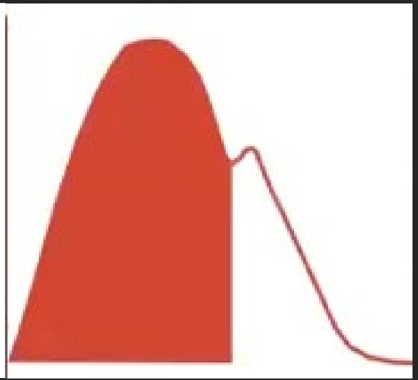
LESS INVASIVE

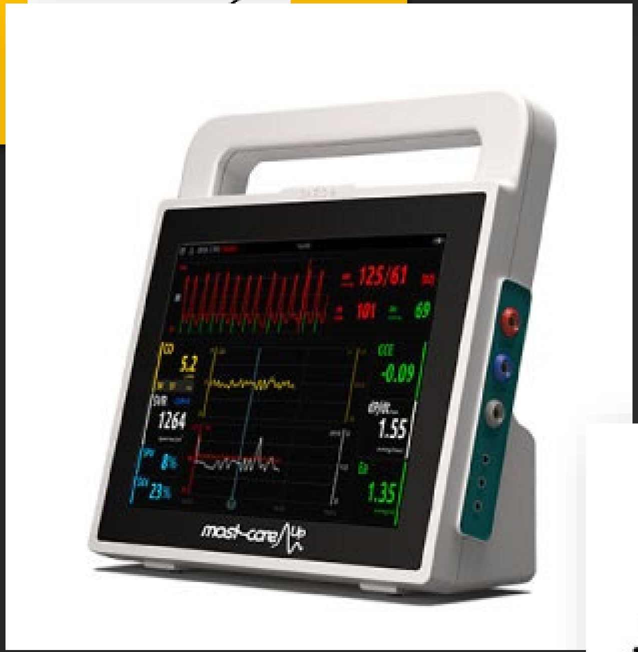
but PLUG and PLAY

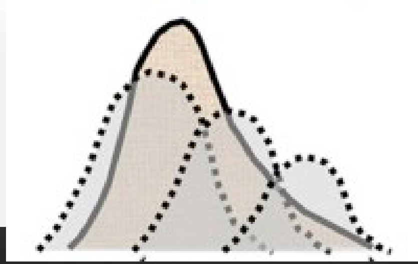


LESS INVASIVE
but PLUG and PLAY









Five algorithms that calculate cardiac output from the arterial waveform: a comparison with Doppler ultrasound

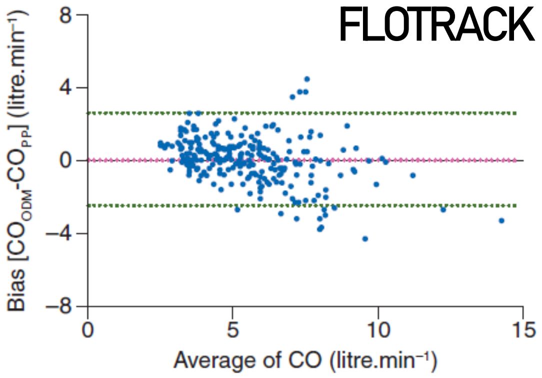
J. Zhang[1], L. A. H. Critchley[2,*] and L. Huang[3]

British Journal of Anaesthesia, 2015, 392–402

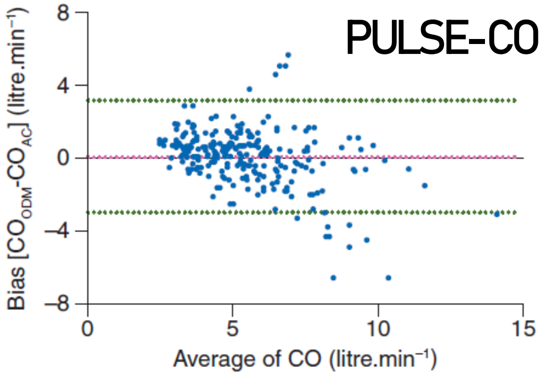
doi: 10.1093/bja/aev254
Advance Access Publication Date: 4 August 2015
Cardiovascular

Algorithm	Formula (CO = SV × HR)	Commercial use*
Mean arterial pressure (CO_{MAP})[9]	$SV = k \times MAP$	N/A
Pulse pressure (CO_{PP})[10]	$SV = k \times PP$	FloTrac-Vigileo
Liljestrander-Zander (CO_{LZ})[6]	$SV = k \times (PP/(SBP + DBP))$	CardioQ-ODM+
Alternating current power (CO_{AC})[11]	$SV = k \times \sqrt{\int_T (ABP(t) - MAP)^2 dt}$	LiDCO
Systolic area with correction (CO_{SA})[12 13]	$SV = k \times (1 + (T_{sys}/T_{dia})) \times \int_{systole} ABP(t)dt$	PiCCO

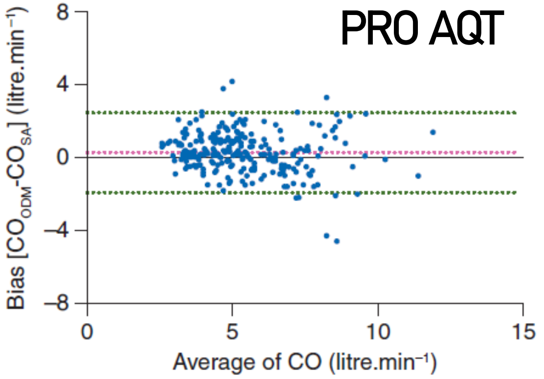
Method	Bland-Altman plot (*n*=255)				Four quadrant plot (*n*=235)	Polar plot (*n*=235)
	Bias (litre min^{-1})	Lower LOA (litre min^{-1})	Upper LOA (litre min^{-1})	PE (%)	Concordance rate (%)	Angle (SD) (°)
CO_{US}	0.4	−1.1	1.8	26.4	92	−2.7 (21.1)
CO_{MAP}	0.5	−1.8	2.7	41.5	66	+3.8 (28.8)
CO_{PP}	0.1	−2.5	2.6	45.5	66	+17.6 (25.0)
CO_{LZ}	0.2	−1.7	2.2	35.2	71	+4.7 (26.6)
CO_{AC}	0.1	−3.0	3.2	56.3	65	+19.6 (25.4)
CO_{SA}	0.3	−1.9	2.5	40.7	64	+8.1 (29.0)



Bias 0,1 (-2,5 to 2,6)
PE 45,5 %
Conc. 66%



Bias 0,1 (-3,0 to 3,2)
PE 56,3 %
Conc. 65%



Bias 0,3 (-1,9 to 2,5)
PE 40,7 %
Conc. 64%

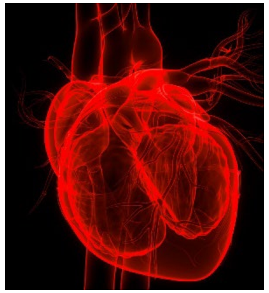
British Journal of Anaesthesia 112 (4): 626–37 (2014)
Advance Access publication 14 January 2014 · doi:10.1093/bja/aet429

BJA

REVIEW ARTICLES

Systematic review of uncalibrated arterial pressure waveform analysis to determine cardiac output and stroke volume variation

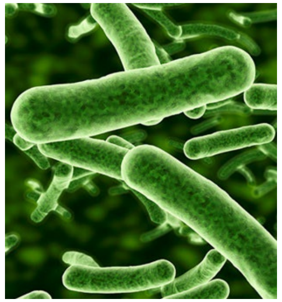
C. Slagt[1*], I. Malagon[2] and A. B. J. Groeneveld[3]



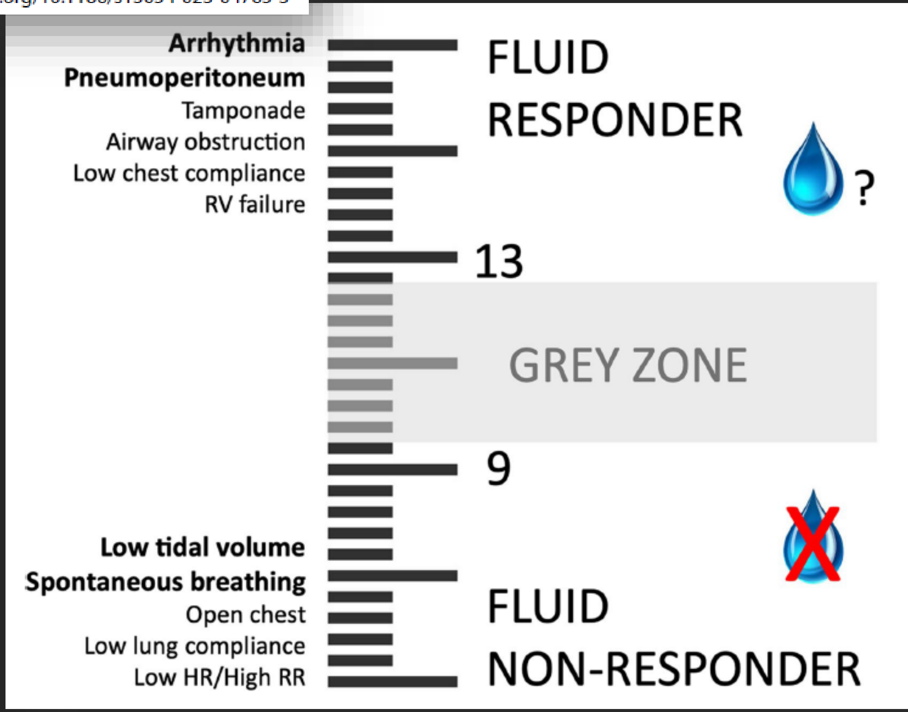
Weighted average for third generation				
Patients	5.7	−0.50	0.77	28
95% confidence interval	5.4–6.0	−0.59 to −0.41	0.70–0.83	25–31
Data	5.6	−0.46	0.81	30
95% confidence interval	5.4–5.7	−0.50 to −0.42	0.78–0.83	29–32

Weighted average for third generation				
Patients	4.7	−0.02	0.58	25
95% confidence interval	4.6–4.8	−0.02 to −0.01	0.57–0.59	24–26
Data	4.7	−0.01	0.58	25
95% confidence interval	4.7–4.7	−0.01 to −0.01	0.58–0.59	25–25

Weighted average for third generation				
Patients	6.4	−0.12	1.71	51
95% confidence interval	6.3–6.5	−0.22 to 0.02	1.65–1.77	49–53
Data	6.5	−0.70	2.19	66
95% confidence interval	6.5–6.5	−0.71 to −0.68	2.18–2.21	66–67



Michard *et al.* *Critical Care* (2023) 27:482
https://doi.org/10.1186/s13054-023-04765-3



PPV…SVV…

Alvarado Sánchez *et al.* *Ann. Intensive Care* (2021) 11:28
https://doi.org/10.1186/s13613-021-00817-5

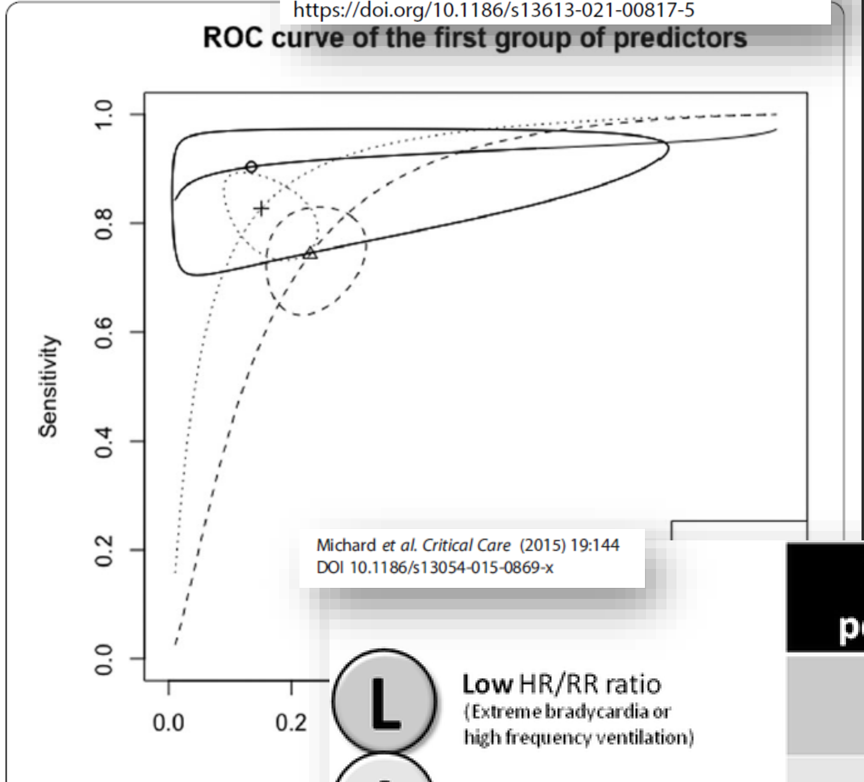


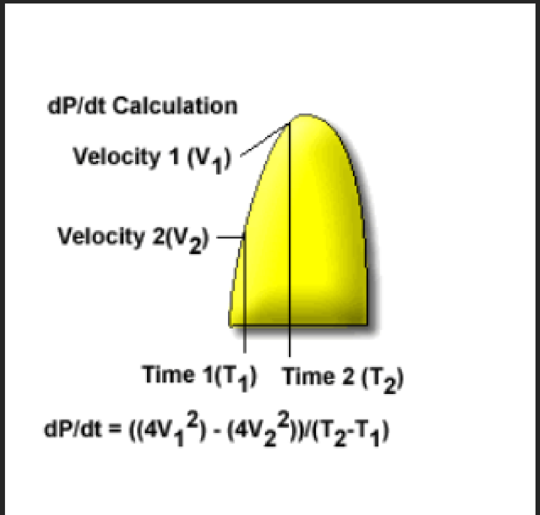
Fig. 2 Summary ROC curv… responsiveness. SVV, stroke… variation; VtC, tidal volume… region

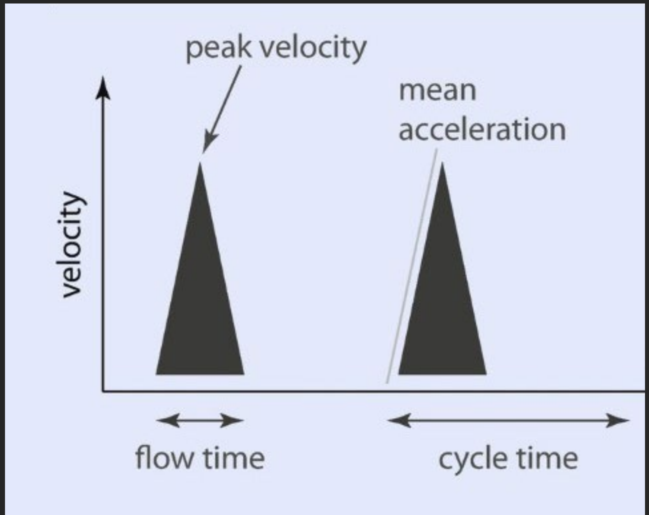
Michard *et al.* *Critical Care* (2015) 19:144
DOI 10.1186/s13054-015-0869-x

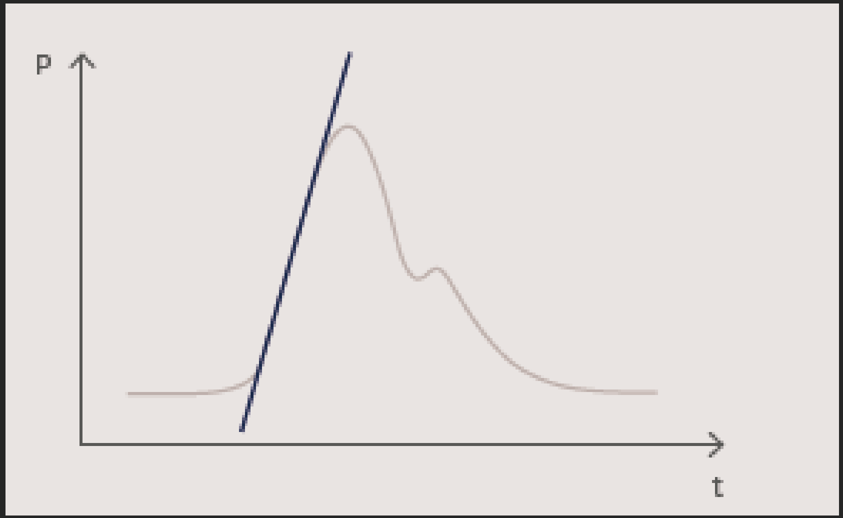
		False positive	False negative
L	**Low** HR/RR ratio (Extreme bradycardia or high frequency ventilation)		✔
I	**Irregular** heart beats	✔	
M	**Mechanical** ventilation with low tidal volume		✔
I	**Increased** abdominal Pressure (Pneumoperitoneum)	✔	
T	**Thorax** open		✔
S	**Spontaneous** breathing	✔	✔

NORMAL	> 1200 mmHg/s
BOARDER- LINE	800-1200 mmHg/s
DECREASED	< 800 mmHg/s

dPmax = dP/dT



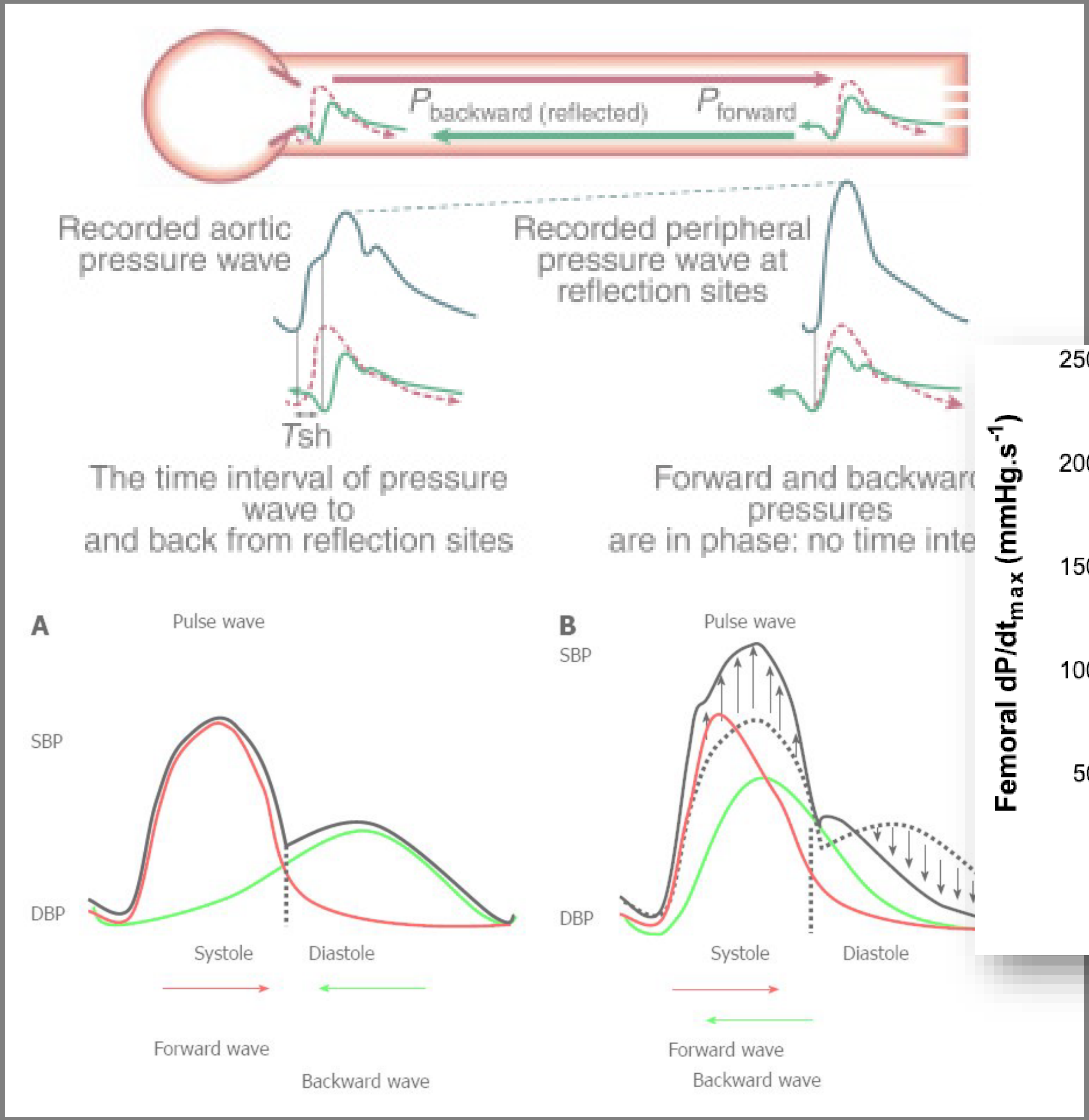


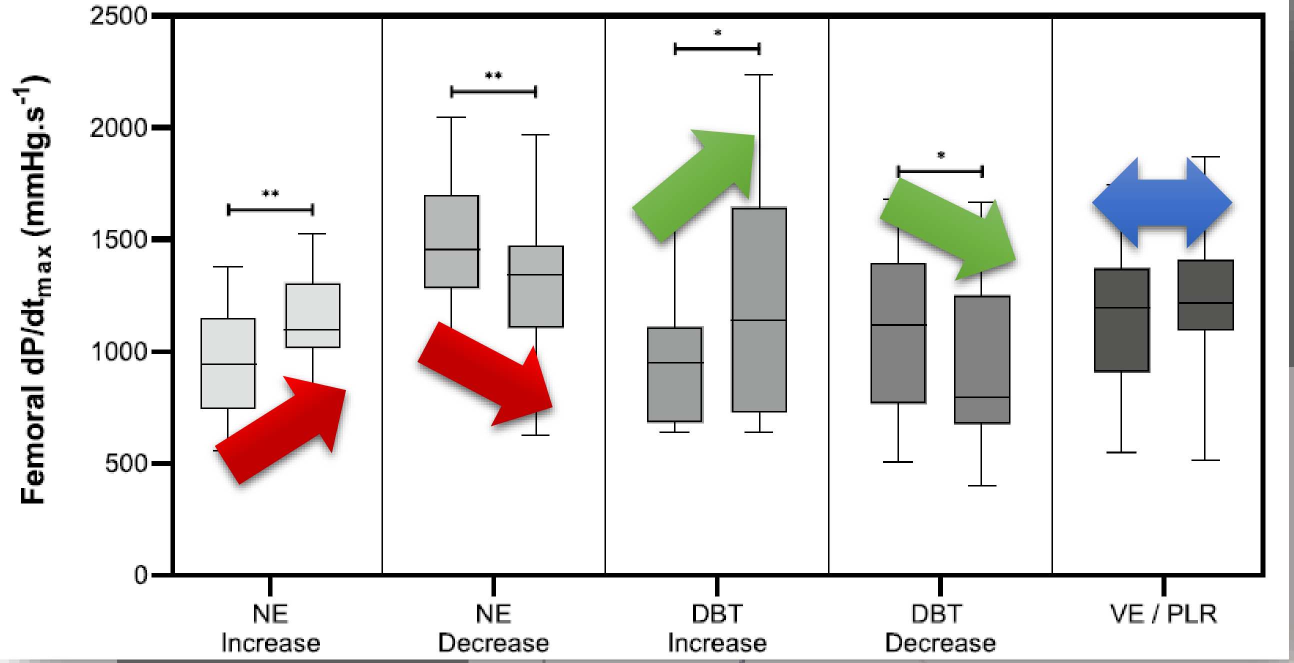


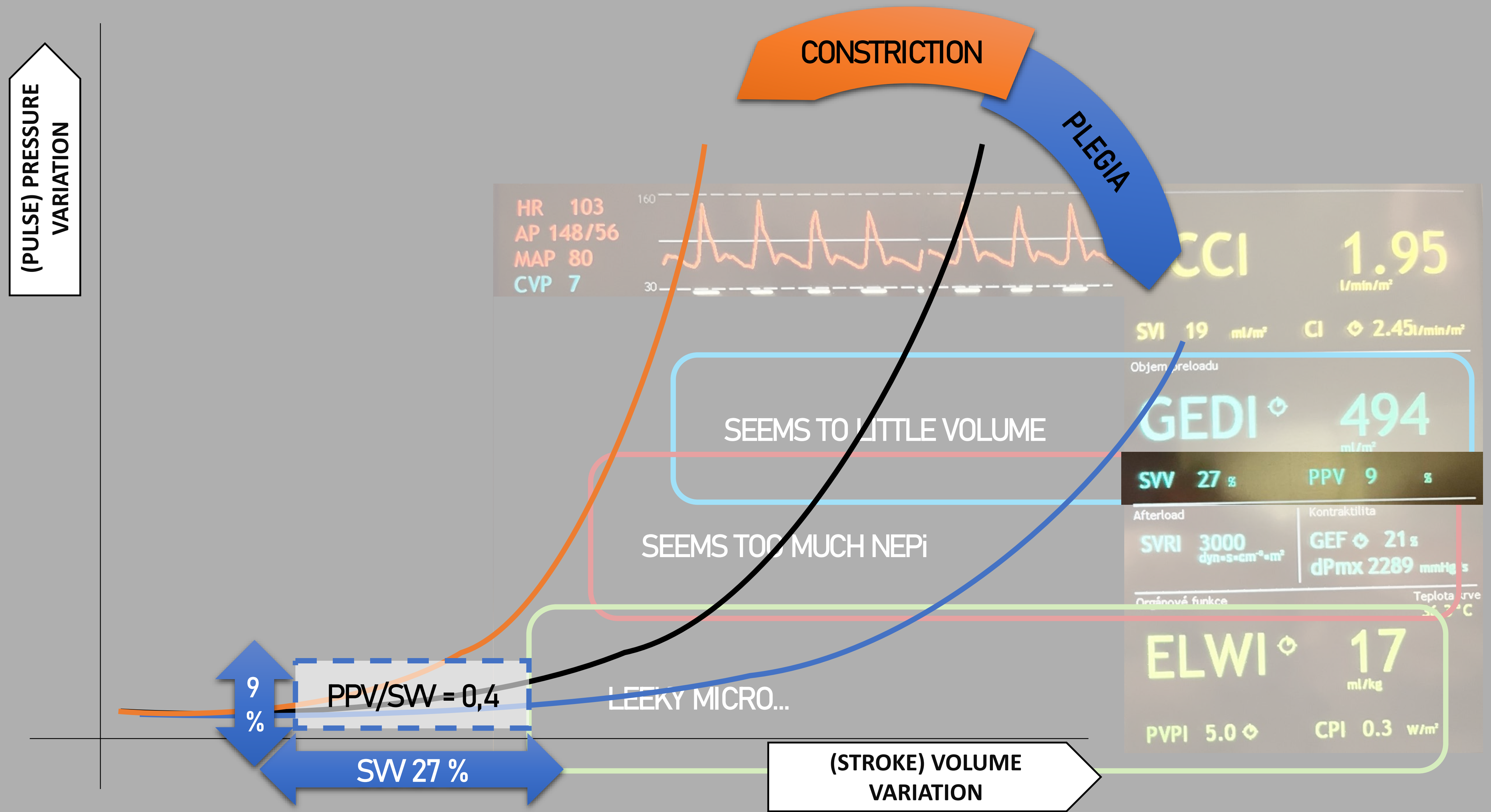
Vaquer et al. Ann. Intensive Care (2019) 9:61
https://doi.org/10.1186/s13613-019-0537-4
Annals of Intensive Care

RESEARCH Open Access

Influence of changes in ventricular systolic function and loading conditions on pulse contour analysis-derived femoral dP/dt_{max}



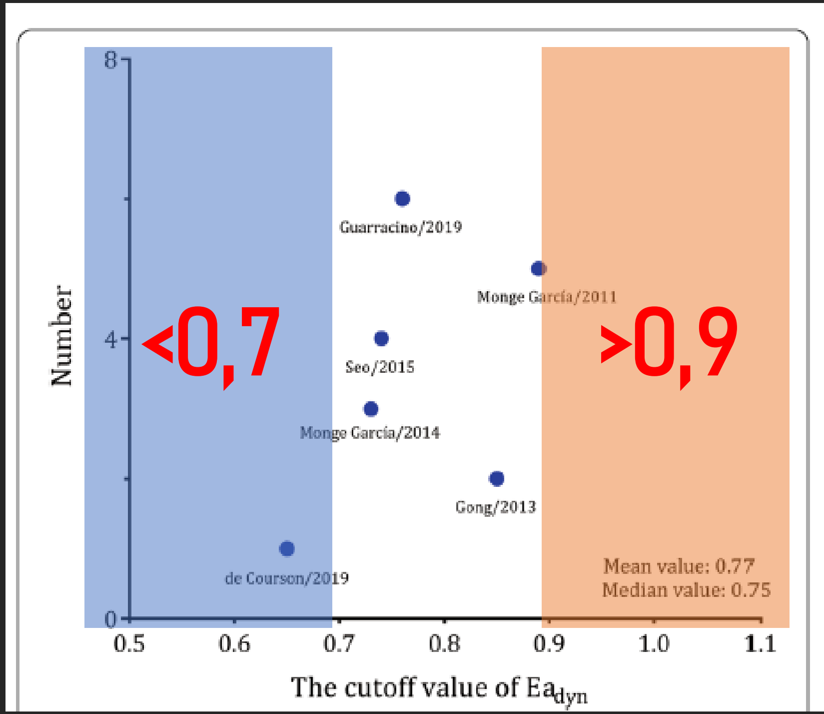


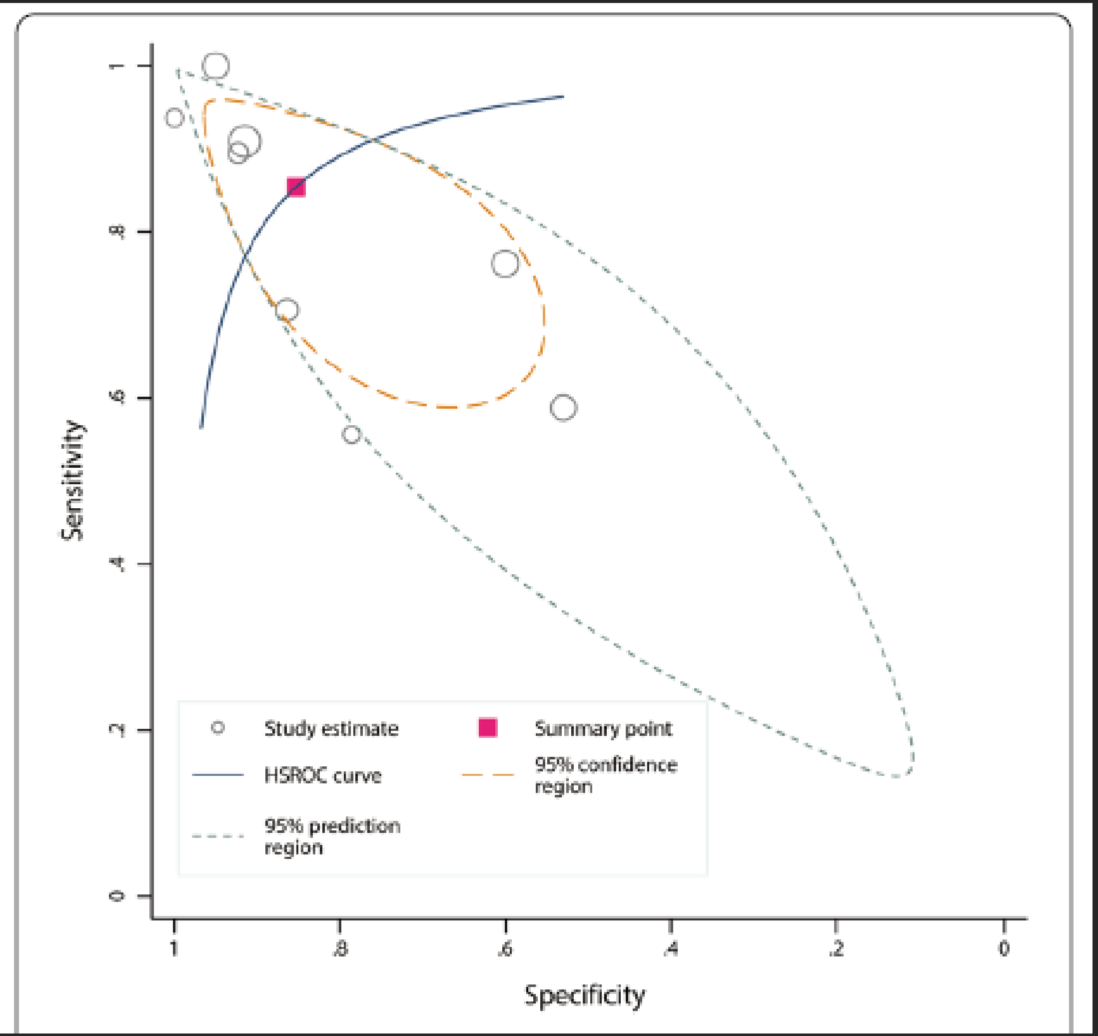


(PULSE) PRESSURE VARIATION
CONSTRICTION
PLEGIA
HR 103
AP 148/56
MAP 80
CVP 7
CCI 1.95
SVI 19
CI 2.45
GEDI 494
SVV 27
PPV 9
SVRI 3000
GEF 21
dPmx 2289
ELWI 17
PVPI 5.0
CPI 0.3
SEEMS TO LITTLE VOLUME
SEEMS TOO MUCH NEPi
LEEKY MICRO...
9 %
PPV/SVV = 0,4
SVV 27 %
(STROKE) VOLUME VARIATION

Pressure response to fluid bolus

Zhou *et al. Ann. Intensive Care* (2021) 11:119
https://doi.org/10.1186/s13613-021-00909-2





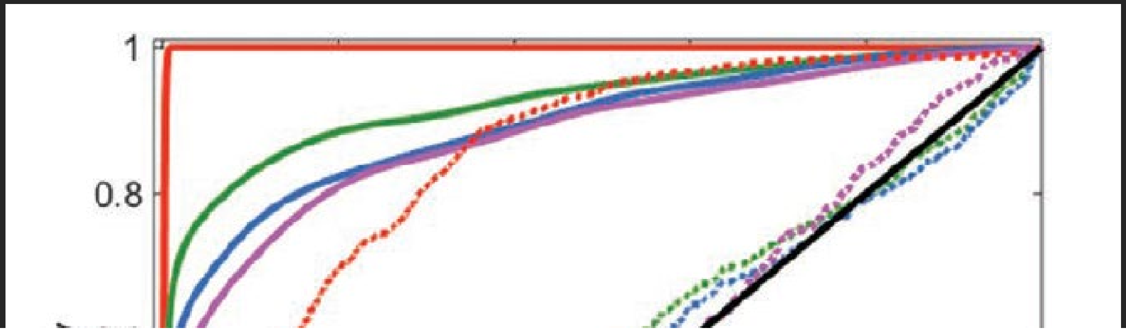
PREDIKCE HYPOTENZE

Perioperative Medicine

ORIGINAL CLINICAL RESEARCH REPORT

Ability of an Arterial Waveform Analysis–Derived Hypotension Prediction Index to Predict Future Hypotensive Events in Surgical Patients

Simon James Davies, MD,* Simon Tilma Vistisen, PhD,† Zhongping Jian, PhD,‡
Feras Hatib, PhD,‡ and Thomas W. L. Scheeren, MD, PhD§



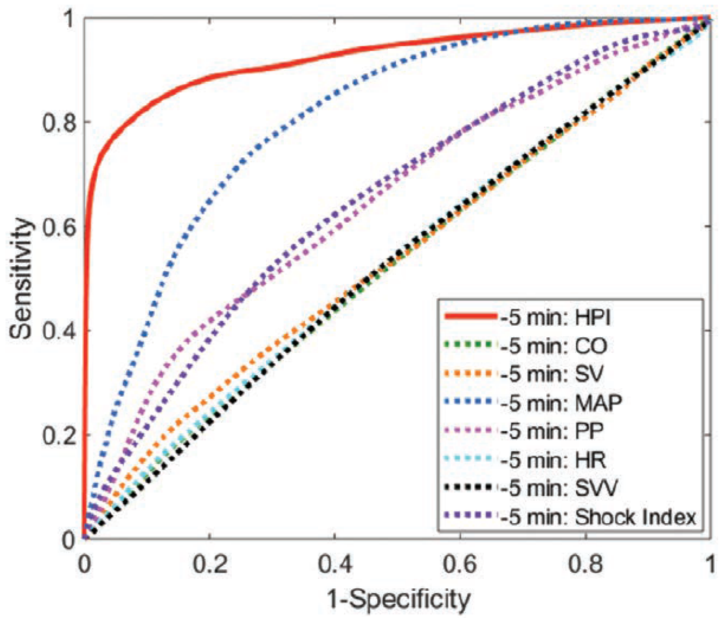


Figure 2. Receiver operating characteristic curves for HPI, CO, SV, MAP, PP, HR, SVV, and the shock index for prediction hypotension 5 min before the event. CO indicates cardiac output; HPI, Hypotension Prediction Index; HR, heart rate; MAP, mean arterial pressure; PP, pulse pressure; SV, stroke volume; SVV, stroke volume variation.

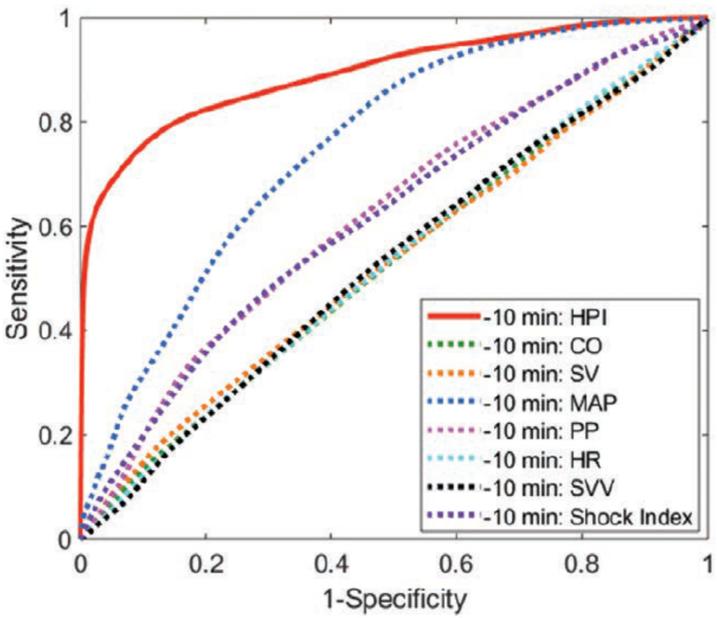


Figure 3. Receiver operating characteristic curves for HPI, CO, SV, MAP, PP, HR, SVV, and the shock index for prediction hypotension 10 min before the event. CO indicates cardiac output; HPI, Hypotension Prediction Index; HR, heart rate; MAP, mean arterial pressure; PP, pulse pressure; SV, stroke volume; SVV, stroke volume variation.

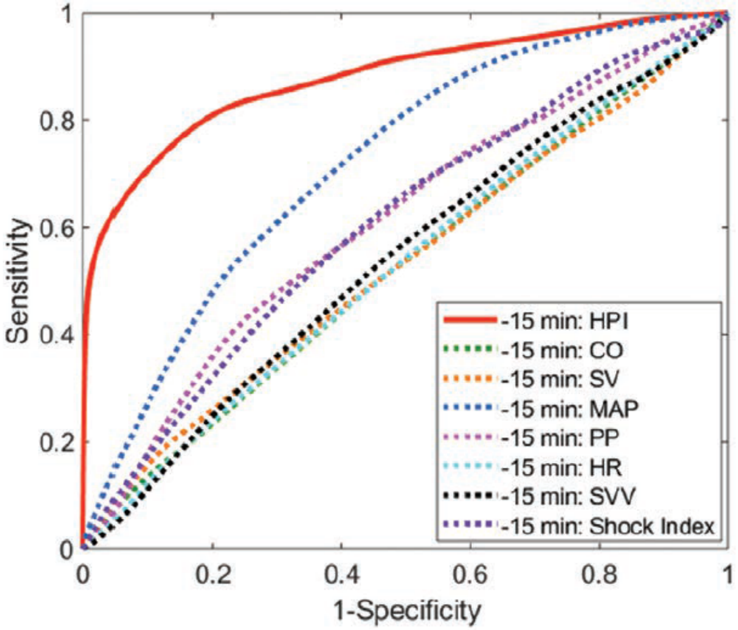


Figure 4. Receiver operating characteristic curves for HPI, CO, SV, MAP, PP, HR, SVV, and the shock index for prediction hypotension 15 min before the event. CO indicates cardiac output; HPI, Hypotension Prediction Index; HR, heart rate; MAP, mean arterial pressure; PP, pulse pressure; SV, stroke volume; SVV, stroke volume variation.

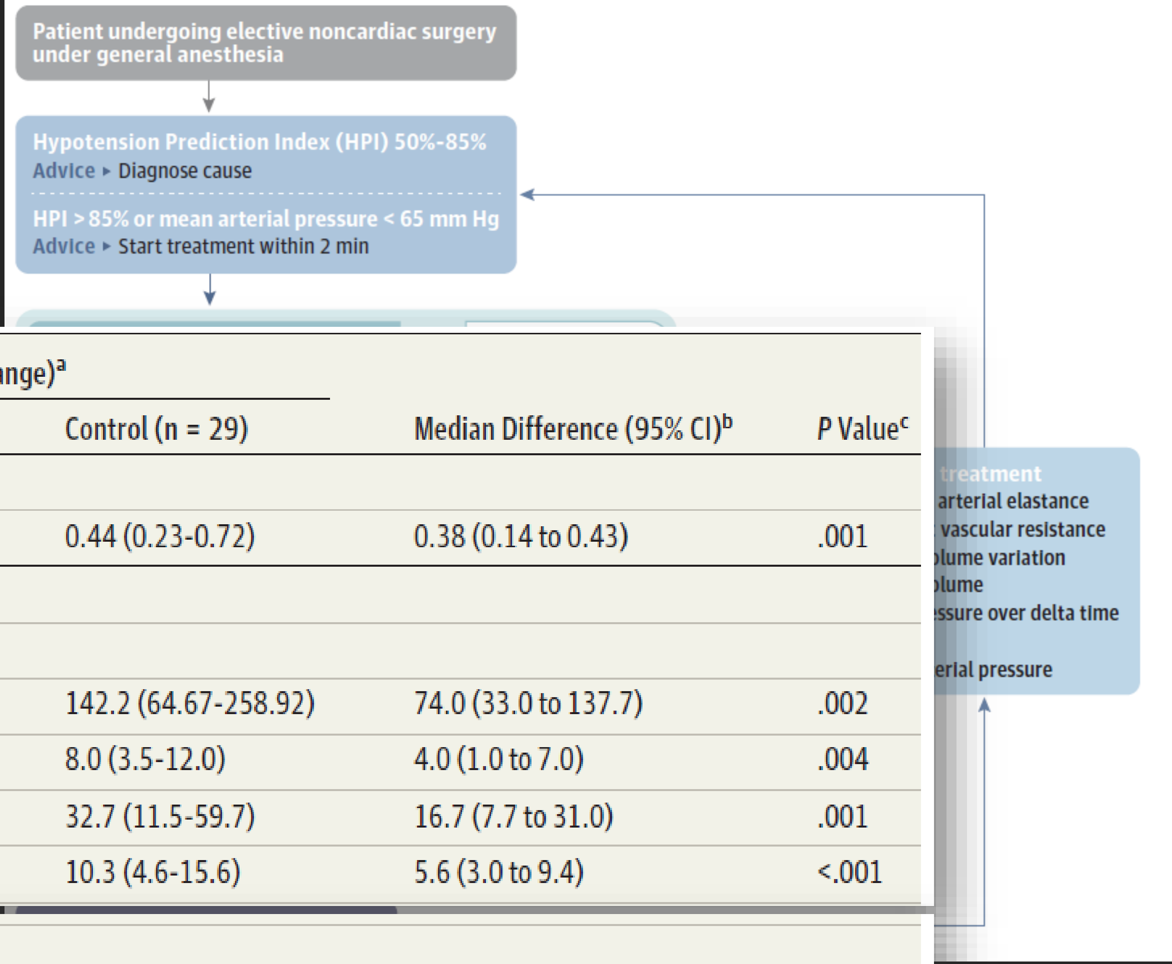
PREVENCE HYPOTENZE NA SÁLE

JAMA | Preliminary Communication | CARING FOR THE CRITICALLY ILL PATIENT

Effect of a Machine Learning–Derived Early Warning System for Intraoperative Hypotension vs Standard Care on Depth and Duration of Intraoperative Hypotension During Elective Noncardiac Surgery

The HYPE Randomized Clinical Trial

Marije Wijnberge, MD; Bart F. Geerts, MD, PhD, MSc, MBA; Liselotte Hol, MD; Nikki Lemmers, MD;
Marijn P. Mulder, BSc; Patrick Berge, MD; Jimmy Schenk, MSc; Lotte E. Terwindt, MD;
Markus W. Hollmann, MD, PhD; Alexander P. Vlaar, MD, PhD, MBA; Denise P. Veelo, MD, PhD



	Median (Interquartile Range)[a]			
	Intervention (n = 31)	Control (n = 29)	Median Difference (95% CI)[b]	P Value[c]
Primary End Point				
Time-weighted average of hypotension, mm Hg	0.10 (0.01-0.43)	0.44 (0.23-0.72)	0.38 (0.14 to 0.43)	.001
Secondary End Points				
Hypotension				
Area under the threshold, mm Hg/min[d]	20.0 (2.2-148.3)	142.2 (64.67-258.92)	74.0 (33.0 to 137.7)	.002
Incidence	3.0 (1.0-8.0)	8.0 (3.5-12.0)	4.0 (1.0 to 7.0)	.004
Total time, min	8.0 (1.3-26.0)	32.7 (11.5-59.7)	16.7 (7.7 to 31.0)	.001
Surgery time, %	2.8 (0.8-6.6)	10.3 (4.6-15.6)	5.6 (3.0 to 9.4)	<.001
Treatment behavior				
Reaction time, s[e]	53.0 (24.0-99.0)	87.3 (53.0-172.5)	34.3 (22.8 to 47.3)	<.001

PREVENCE HYPOTENZE NA SÁLE

RESEARCH **Open Access**

Hypotension prediction index guided versus conventional goal directed therapy to reduce intraoperative hypotension during thoracic surgery: a randomized trial

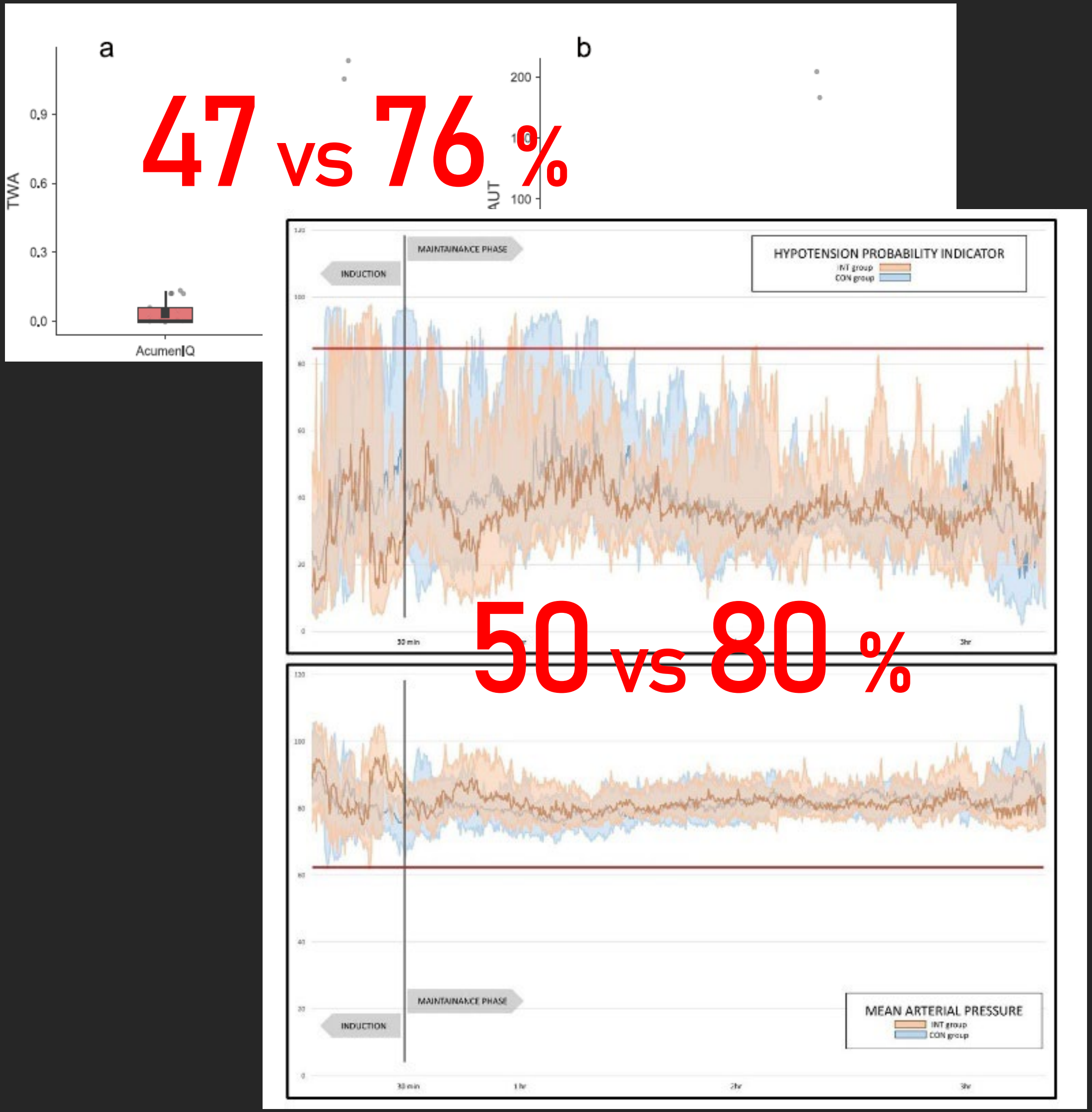
Andrej Šribar[1,2], Irena Soković Jurinjak[1], Hani Almahariq[1], Ivan Bandić[1], Jelena Matošević[1], Josip Pejić[3] and Jasminka Peršec[1,2*]

Online version at https://www.minervamedica.it
Minerva Anestesiologica 2023 June;89(6):510-9
DOI: 10.23736/S0375-9393.23.17197-5

ORIGINAL ARTICLE

A protocol based on hypotension probability indicator *vs.* standard care to prevent intraoperative hypotension during supratentorial brain surgery: a prospective randomized pilot trial

Jiri POUSKA [1,2], Jakub KLETECKA [1,2], Jan ZATLOUKAL [1,2], Vaclav CERVENY [1], Jan BENES [1,2,3] *



PULSE WAVE ANALYSIS SYSTÉMY

PLUSY
- PLUG AND PLAY
- MOŽNOST KALIBRACE KALIBRACI (NĚKTERÉ)
- VELMI USPOKOJIVÝ TRENDING
- ŘADA DOPROVODNÝCH PARAMETRŮ (??)

MÍNUSY
- VYŠŠÍ CHYBOVIST V ABSOLUTNÍCH HODNOTÁCH
- HLAVNĚ U STAVŮ SE SNÍŽENOU REZISTENCÍ
- VYŽADUJÍ PULSATILITU
- NĚCO STOJÍ...

Intensive Care Med (2014) 40:1795–1815
DOI 10.1007/s00134-014-3525-z

CONFERENCE REPORTS AND EXPERT PANEL

Maurizio Cecconi
Daniel De Backer
Massimo Antonelli
Richard Beale
Jan Bakker
Christoph Hofer
Roman Jaeschke
Alexandre Mebazaa
Michael R. Pinsky
Jean Louis Teboul
Jean Louis Vincent
Andrew Rhodes

Consensus on circulatory shock and hemodynamic monitoring. Task force of the European Society of Intensive Care Medicine

BLODY INVASIVE

but fully accurate

ICM Cecconi 2014

–We recommend further hemodynamic assessment (such as assessing cardiac function) to determine the type of shock if the clinical examination does not lead to a clear diagnosis. *Ungraded best practice*

–In complex patients we suggest to additionally use pulmonary artery catheterization or transpulmonary thermodilution to determine the type of shock. Level 2; QoE low (C)

–We do not recommend routine measurement of cardiac output for patients with shock responding to the initial therapy. Level 1; QoE low (C)

–We recommend measurements of cardiac output and stroke volume to evaluate the response to fluids or inotropes in patients that are not responding to initial therapy. Level 1; QoE low (C)

evaluation of cardiac function in shock. *Statement of fact*

–We do not recommend the routine use of the pulmonary artery catheter for patients in shock. Level 1; QoE high (A)

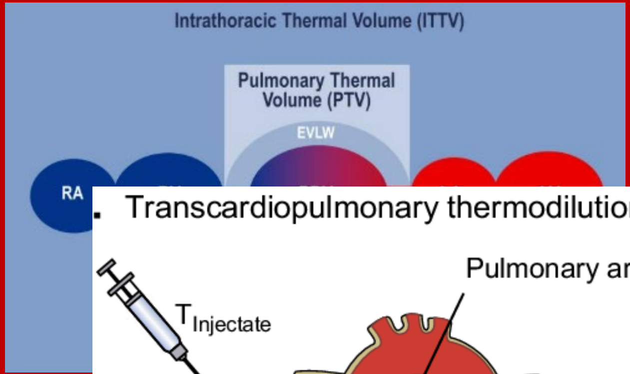
–We suggest pulmonary artery catheterization in patients with refractory shock and right ventricular dysfunction. Level 2; QoE low (C)

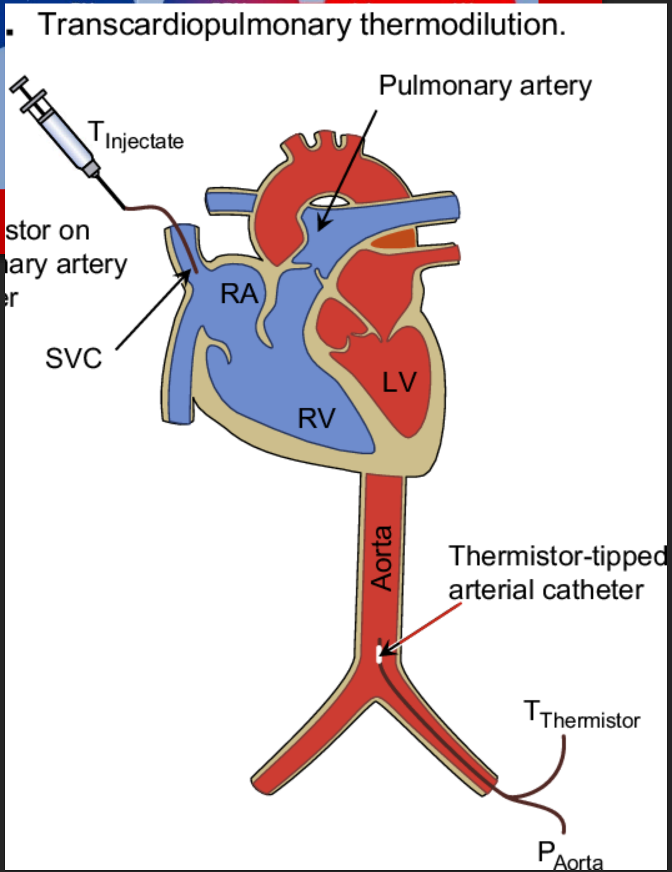
–We suggest the use of transpulmonary thermodilution or pulmonary artery catheterization in patients with severe shock especially in the case of associated acute respiratory distress syndrome. Level 2; QoE low (C)

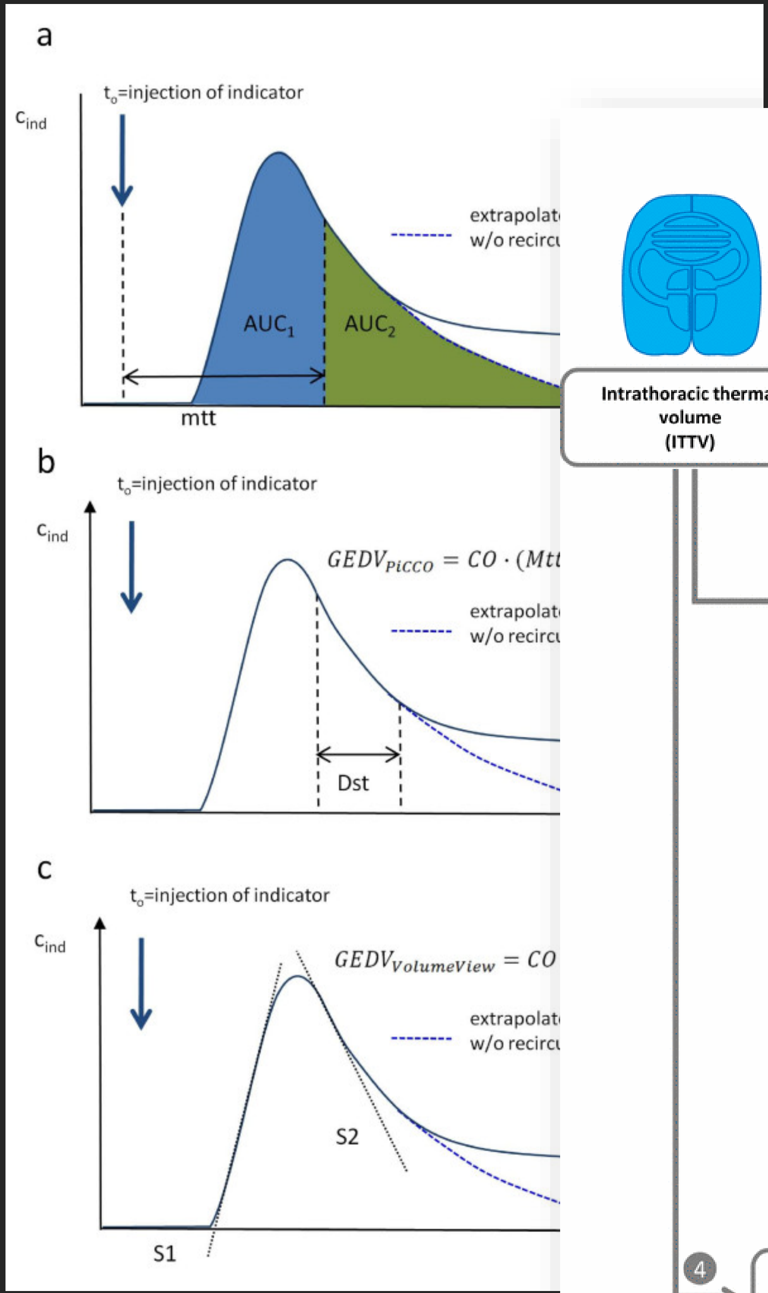
–We recommend that less invasive devices are used, instead of more invasive devices, only when they have been validated in the context of patients with shock. *Ungraded best practice*

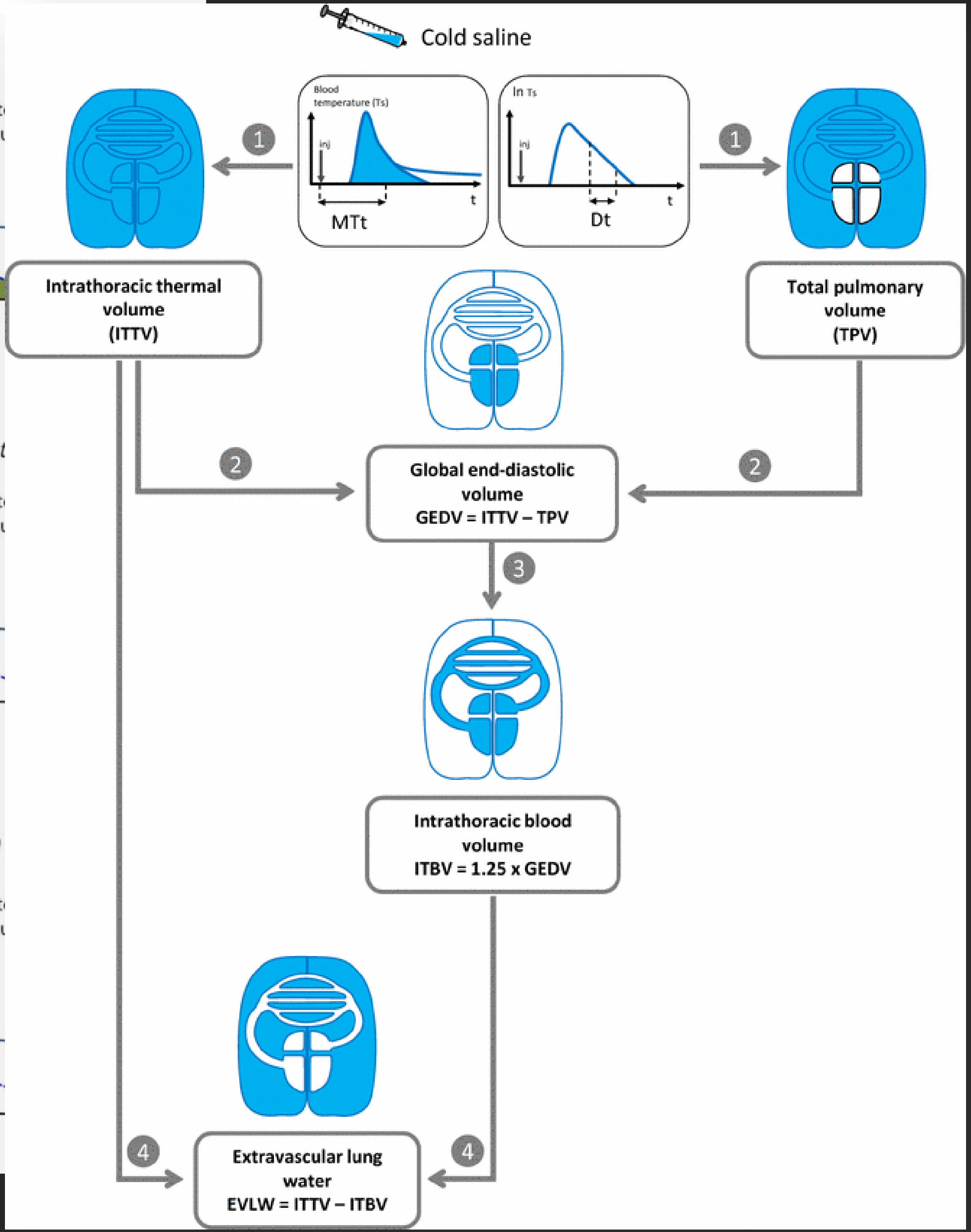
BLODY INVASIVE

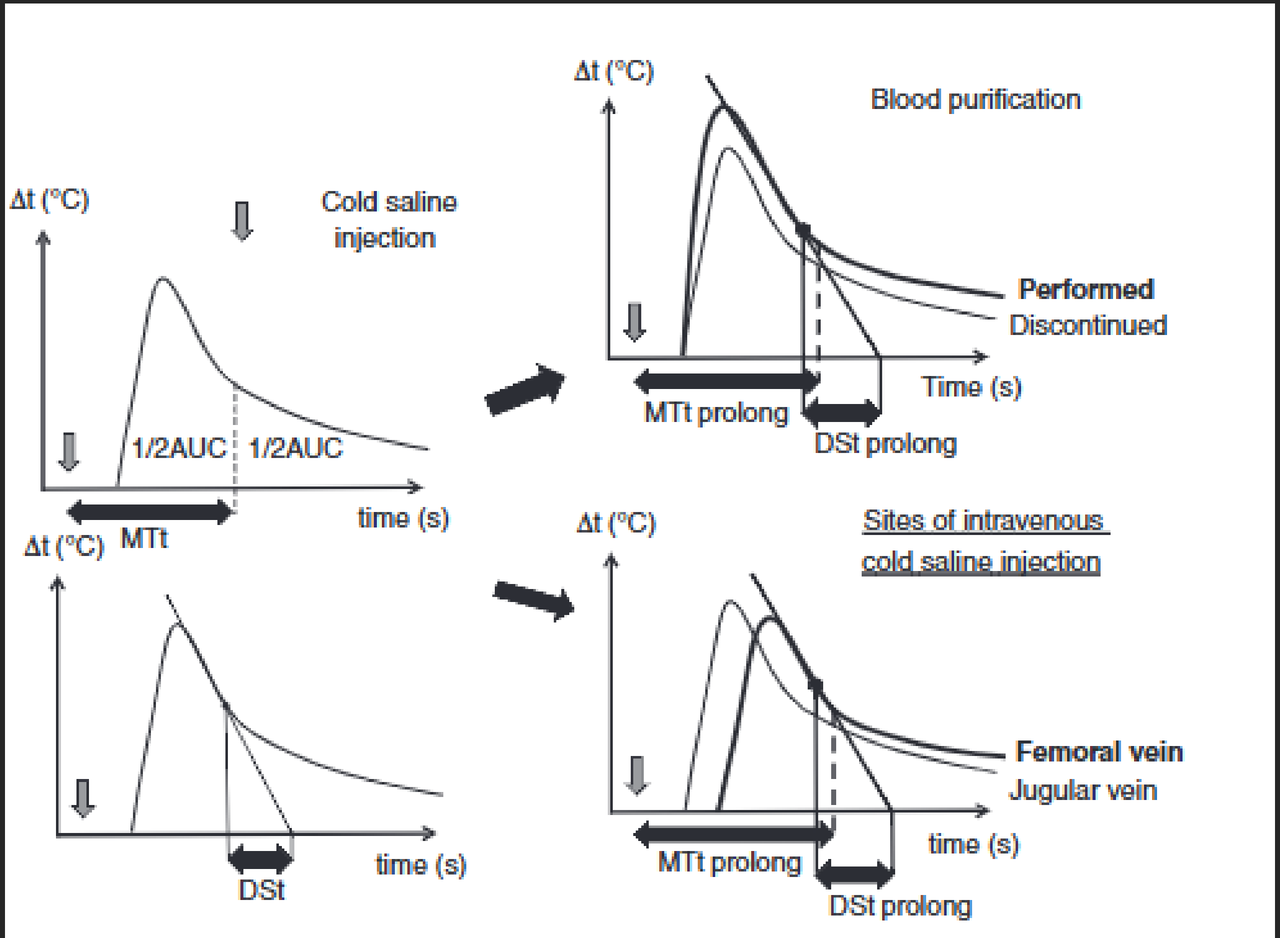
but fully accurate



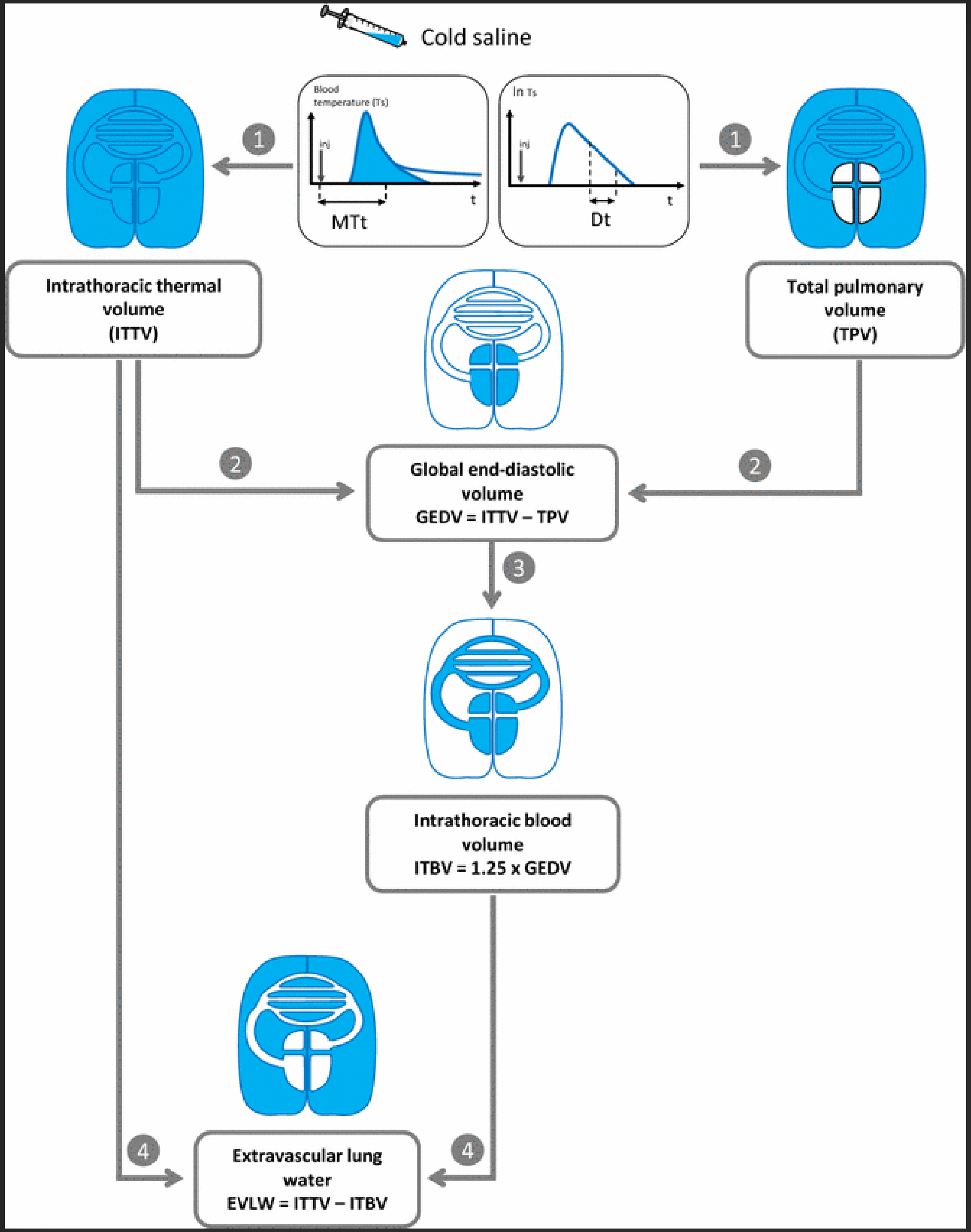




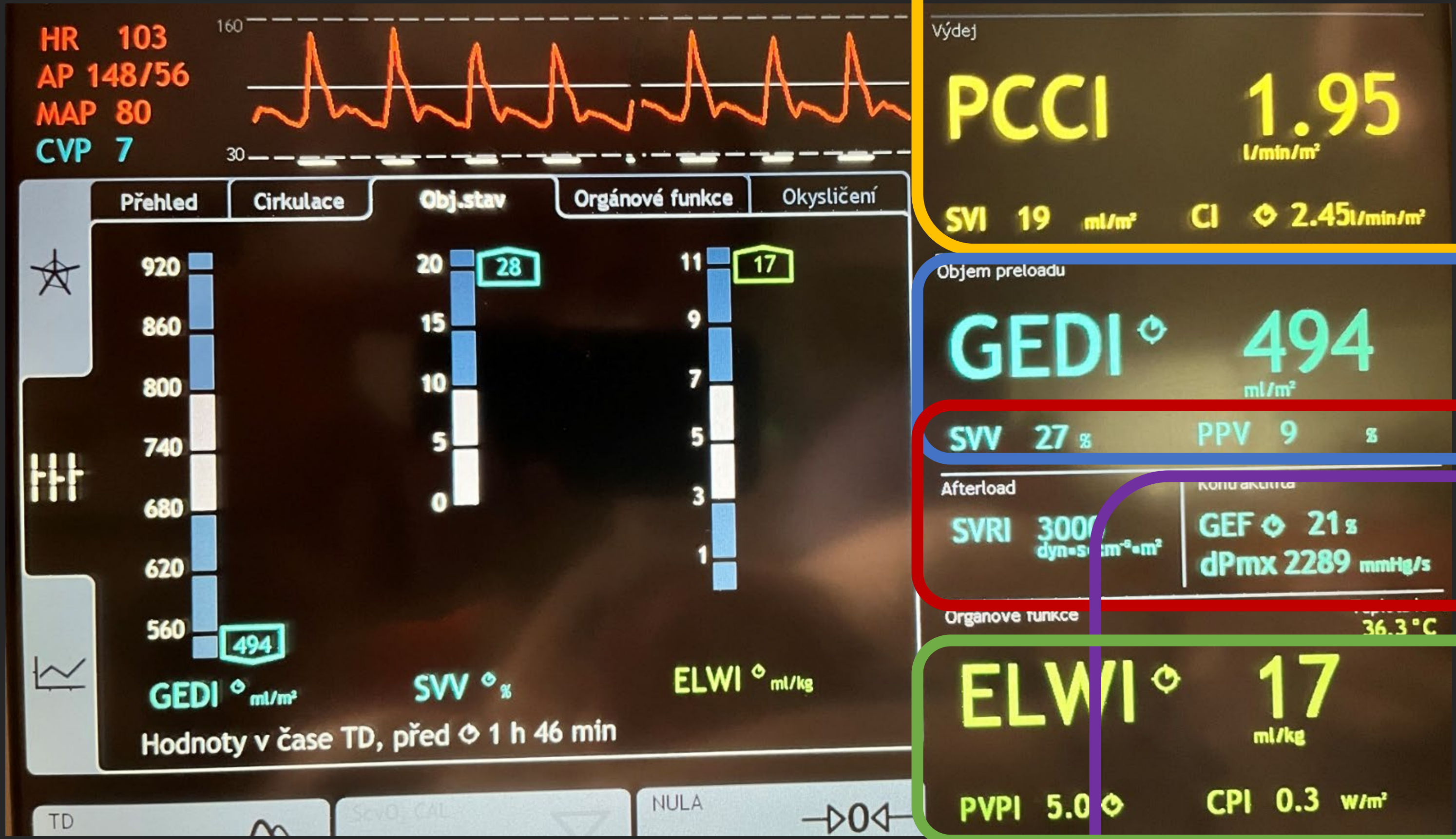




Δt (°C)
Cold saline injection
1/2AUC
1/2AUC
time (s)
MTt
Δt (°C)
time (s)
DSt
Δt (°C)
Blood purification
Performed
Discontinued
Time (s)
MTt prolong
DSt prolong
Δt (°C)
Sites of intravenous cold saline injection
Femoral vein
Jugular vein
time (s)
MTt prolong
DSt prolong



Cold saline
Blood temperature (Ts)
MTt
ln Ts
Dt
Intrathoracic thermal volume (ITTV)
Total pulmonary volume (TPV)
Global end-diastolic volume
GEDV = ITTV – TPV
Intrathoracic blood volume
ITBV = 1.25 x GEDV
Extravascular lung water
EVLW = ITTV – ITBV



FLOW (TD+CCO)

PRELOAD

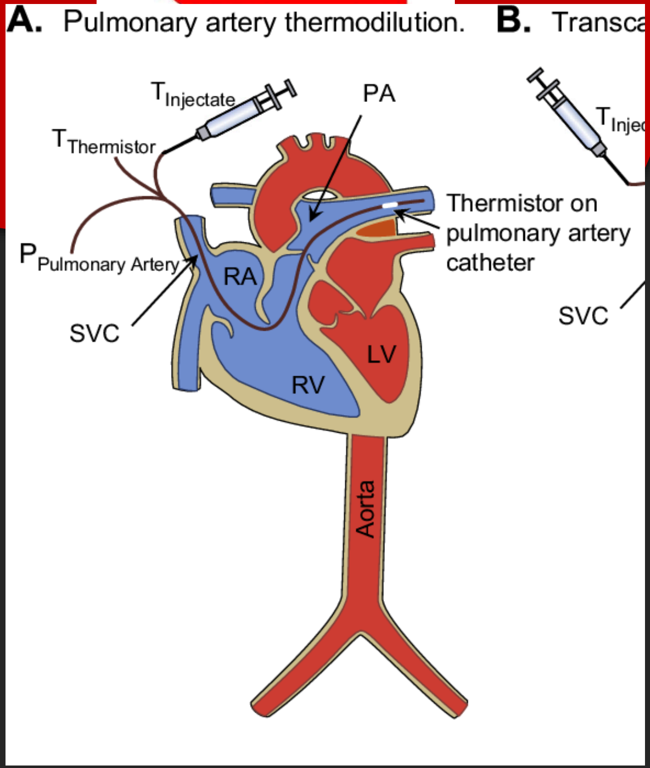
AFTERLOAD

PLICNÍ OTOK A PERMEABILITA

SRDEČNÍ FUNKCE

BLODY INVASIVE

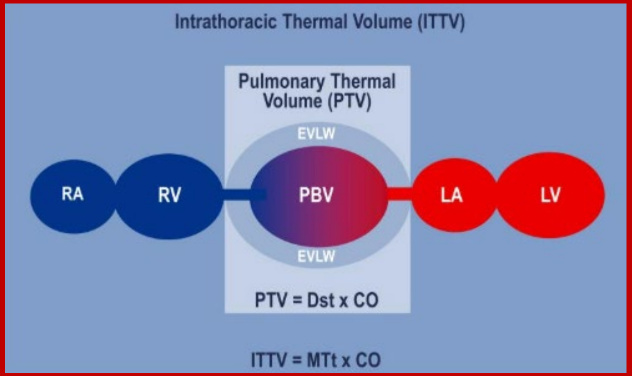
but fully accurate



- SRDEČNÍ VÝDEJ
- TLAKY V PLICNÍM ŘEČIŠTI
- TLAK V ZAKLÍNĚNÍ

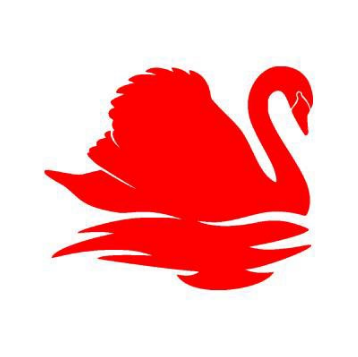
BLODY INVASIVE

but fully accurate



BLODY INVASIVE

but fully accurate



- PŘESNÉ A V ČASE STABILNÍ ZHODNOCENÍ SRDEČNÍHO VÝDEJE / AKTUÁLNÍHO PRŮTOKU
- TRENDING ZMĚNY V REÁLNÉM (CO NEJKRATŠÍM) ČASE
- SPECIFICKÉ INFORMACE O JEDNOTLIVÝCH DETERMINANTÁCH VÝDEJE (PRELOAD, KONTRAKTILITA...)
- ~~POKUD BY TO ŠLO NEINVAZIVNĚ...~~

SUMMING UP

ZELENO-ŽLUTÉ
OKNO POZITIVNÍ
(VPU/OLIGURIA)

MOŽNÁ

MODRÉ
OKNO POZITIVNÍ
(TEMP / CRT / MOTTLING)

PRAVDĚPODOBNĚ

ČERVENÉ
OKNO POZITIVNÍ
(SHOCK INDEX / HYPOTENZE)

TÉMĚŘ JISTĚ

ECHO
(POCUS)

CENTRALNÍ ŽILNÍ
& ARTERIÁLNÍ ABG
(ScvO2 , Pcv_aCO2)

ARTERIÁLNÍ ABG
(LAKTÁTE)

SUMMING UP

ZELENO-ŽLUTÉ

HD MONITORACE

NÁ

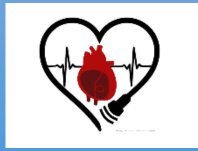
MODRÉ
OKNO POZITIVNÍ
(TEMP / CRT / MOTTLING)

PRAVDĚPODOBNĚ

ČERVENÉ
OKNO POZITIVNÍ
(SHOCK INDEX / HYPOTENZE)

TÉMĚŘ JISTĚ

VÍCE PATOLOGIÍ
/ NEJDE VYŘEŠIT JEDNODUŠE



ECHO
(POCUS)

CENTRALNÍ ŽILNÍ
& ARTERIÁLNÍ ABG
(ScvO2 , Pcv_aCO2)

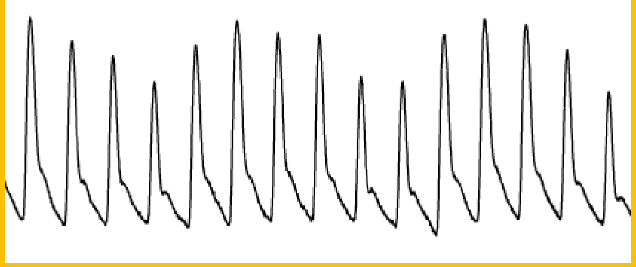
ARTERIÁLNÍ ABG
(LAKTÁTE)

SUMMING UP

HYPOVOLÉMIE

LESS INVASIVE

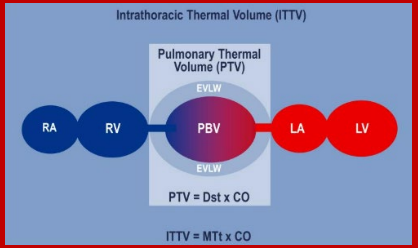
but PLUG and PLAY



PORUCHA PERMEABILITY (TRAUMA, SEPSE, I/R)

BLODY INVASIVE

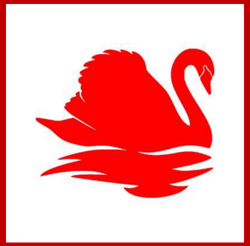
but fully accurate **TPTD**



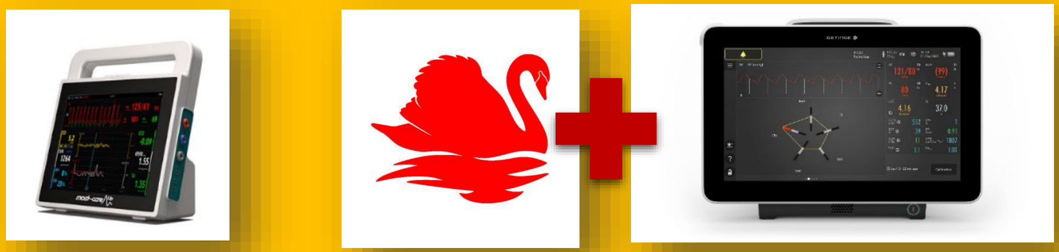
SRDCE NEBO PRAVÁ STRANA

BLODY INVASIVE

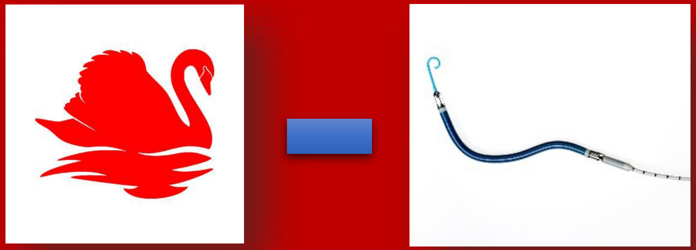
but fully accurate **SWG**



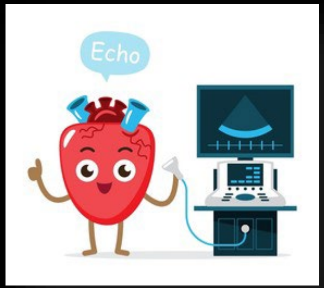
VV ECMO / IABC



IMPELLA



VA ECMO



ESICM HEMODYNAMIC PATHWAY

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Onsite at LIVES

10–11 PROSINEC 2025

Česká anesteziologická cesta 2025

- Od posledního průzkumu uplynulo 15 let.
- Léky, přístroje i postupy se změnily — pojďme zjistit jak!
- Zapojte se do nového celonárodního průzkumu.
- Vyplňte krátký dotazník a pomozte ukázat, jak dnes opravdu podáváme anestezii.

Mockrát děkujeme

Výbor ČSARIM