

hemodynamika

Prof. MUDr. Jan Beneš, Ph.D.

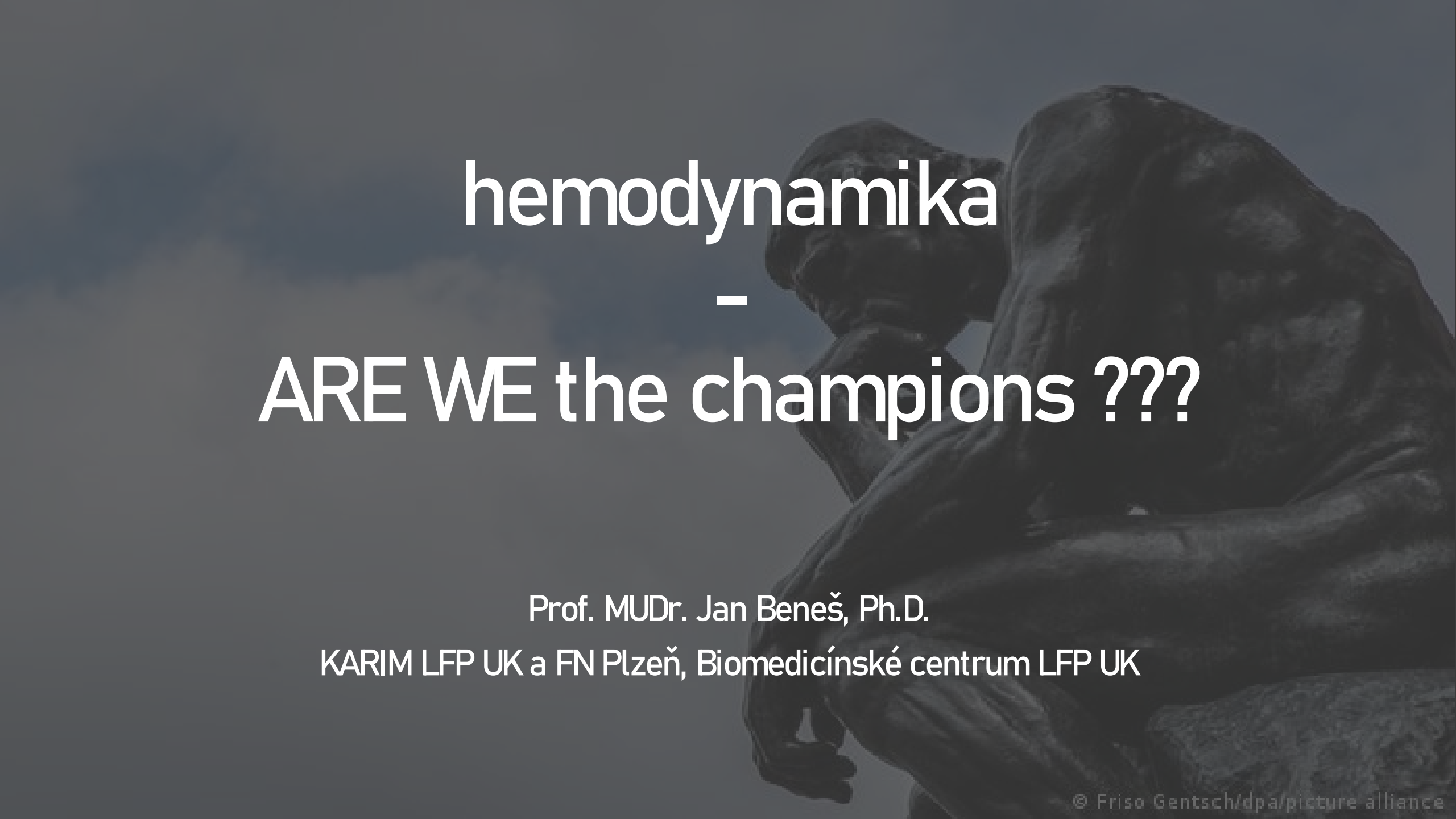
KARIM LFP UK a FN Plzeň, Biomedicínské centrum LFP UK



hemodynamika
–
we are the CHAMPIONS !!!

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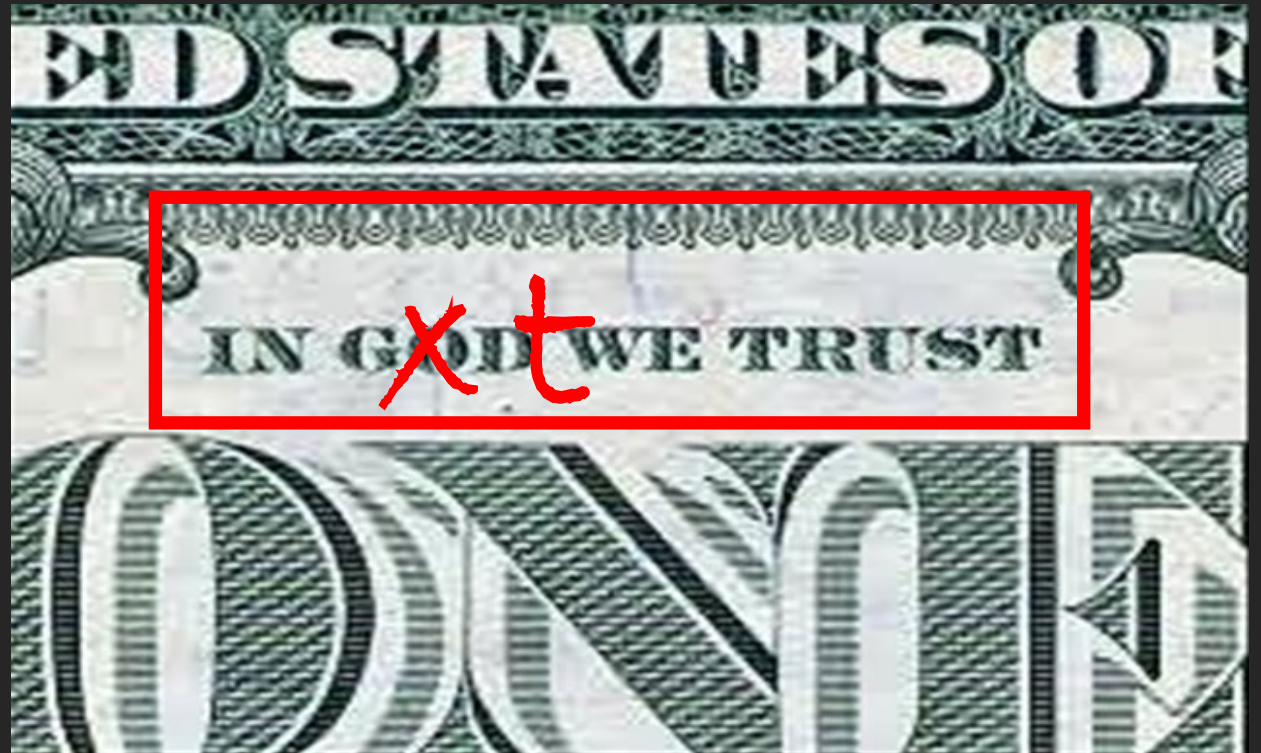
hemodynamika
–
ARE WE the champions ???

Prof. MUDr. Jan Beneš, Ph.D.

KARIM LFP UK a FN Plzeň, Biomedicínské centrum LFP UK

C.O.I.

- DLOUHODOBÁ SPOLUPRÁCE S FIRMAMI VYRÁBĚJÍCÍMI HEMODYNAMICKOU MONITOROVACÍ TECHNIKU
- Edwards Lifesciences Inc.
- CNSystems
- Pulsion – Getinge



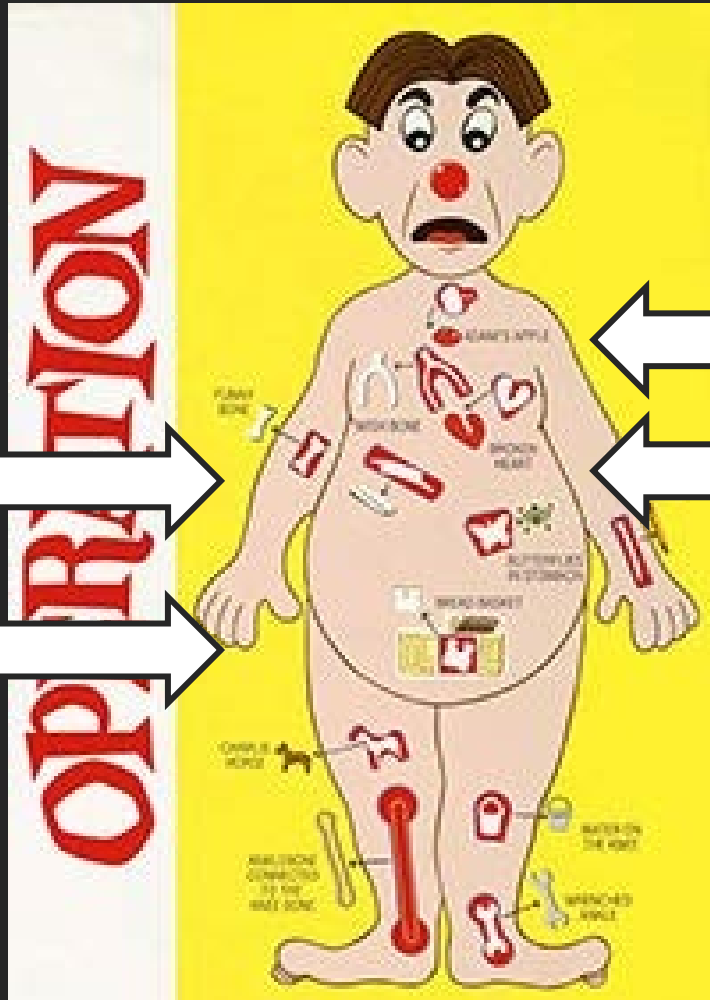
Jaké jsou styčné plochy HD vs OP

CV

- OBLENĚNÍ REFLEXŮ A BALANCE SYMP/PARASYMP
- PŘÍMÝ ÚČINEK LÉČIV
- PŘÍMÉ PŮSOBENÍ NA CV (turnikety, klampy, zástavy)

RŮZNÉ

- PŘETLAKOVÁ VENTILACE
- ATELEKTÁZY PLIC
- POLOHA PACIENTA
- KAPNOPERITONEUM



GIT

- OMEZENÍ P.O. PŘÍJMU
- POOPERAČNÍ ILEUS
- OMEZENÍ CHRONICKÉ LÉČBY

TRAUMA

- ZTRÁTA CIRKULUJÍCÍHO OBJEMU
- ANEMIZACE
- PŘESUNY TEKUTIN
- REAKTIVNÍ HYPERÉMIE
- I/R a SIRS

HD pod bedlivým okem anesteziologa



PROČ v těle proudí krev ???

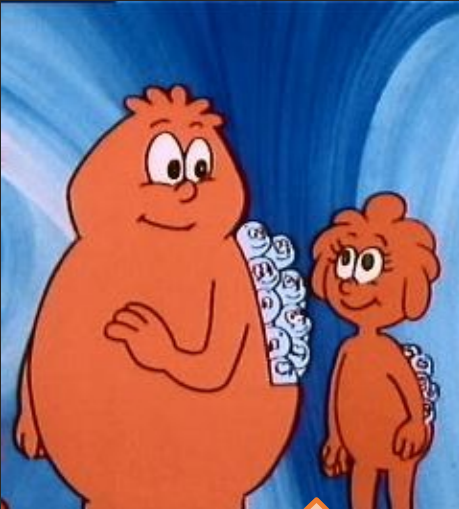
- kvůli CHIRURGŮM to nebude
- aby se dala lépe odlišit ŠLECHTA
- aby měli KOMÁŘI co pít

- že by TRANSPORT ŽIVIN ???



KREV = HLAVNÍ TRANSPORTNÍ SLUŽBA

DODÁVKA



KYSLÍKU

$$DO_2 \approx CO \times Hb \times SaO_2$$

$$CO = SV \times HR$$

$$SV = EF \times EDV$$

$$DO_2 \approx HR \times EF \times EDV \times Hb \times SaO_2$$

TEKUTINA PROUDÍ JEN POD TLAKEM



$$MAP \approx CO \times SVRI + CVP$$

$$CO = SV \times HR$$

$$SV = EF \times EDV$$

$$MAP \approx HR \times EF \times EDV \times SVRI + CVP$$

HD v kostce

$$DO_2 \approx HR \times EF \times EDV \times Hb \times SaO_2$$

$$MAP \approx HR \times EF \times EDV \times SVRI + CVP$$

?? a klinická relevance ???

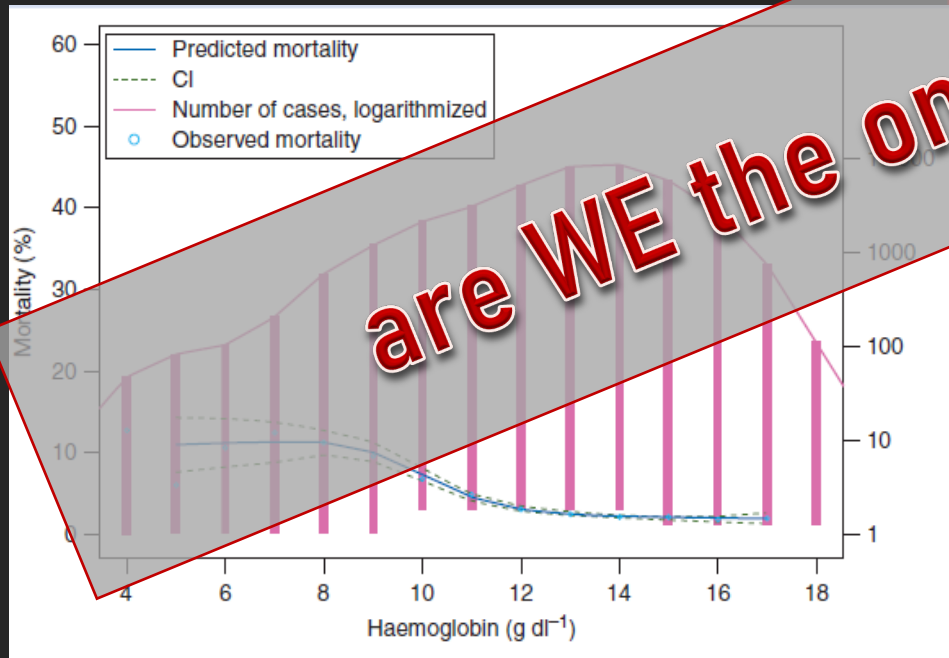
British Journal of Anaesthesia 113 (3): 416–23 (2014)
Advance Access publication 14 May 2014 · doi:10.1093/bja/aeu098

BJA

Preoperative anaemia is associated with poor clinical outcome in non-cardiac surgery patients

D. M. Baron¹, H. Hochrieser², M. Posch², B. Metnitz³, A. Rhodes^{4*}, R. P. Moreno⁵, R. M. Pearse⁶ and P. Metnitz^{1*}, for the European Surgical Outcomes Study (EuSOS) group for the Trials Groups of the European Society of Intensive Care Medicine and the European Society of Anaesthesiology

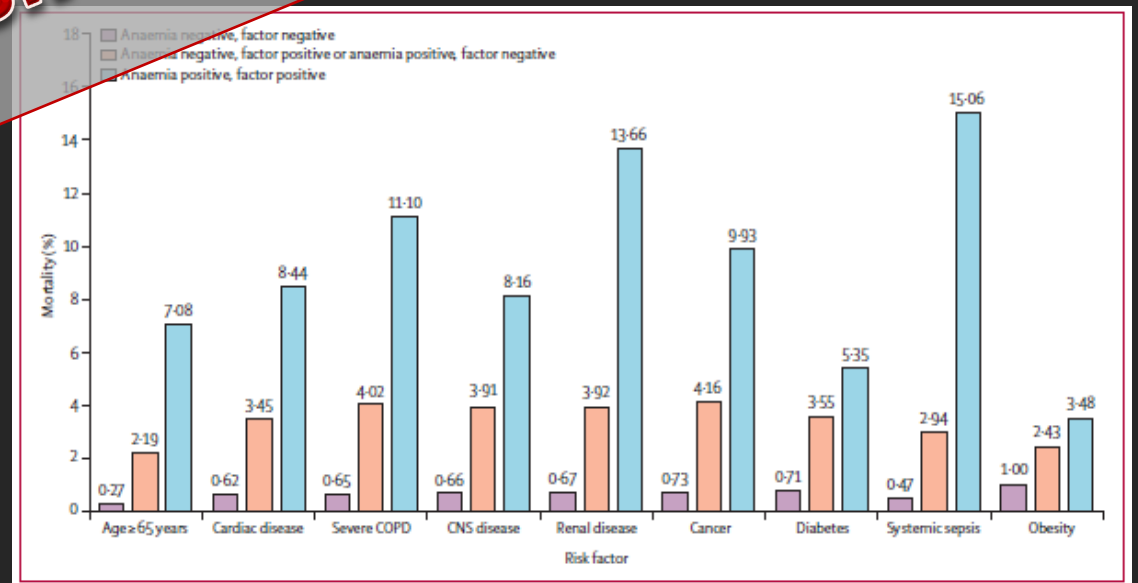
39 309 pacientů
In-hospital mortalita (%)



Preoperative anaemia and postoperative outcomes in non-cardiac surgery: a retrospective cohort study

Khalek M Musallam, Hani M Tamim, Toby Richards, Frits R Rosendaal, Aida Habbal, Mohammad Khreis, Fadi S Dahdaleh, Kaivan Khavandi, Pierre M Sfeir, Assaad Sawalha, Ali T Taher, Faek R Jamal

27 425 pacientů
39 % anemických
30denní mortalita (%)



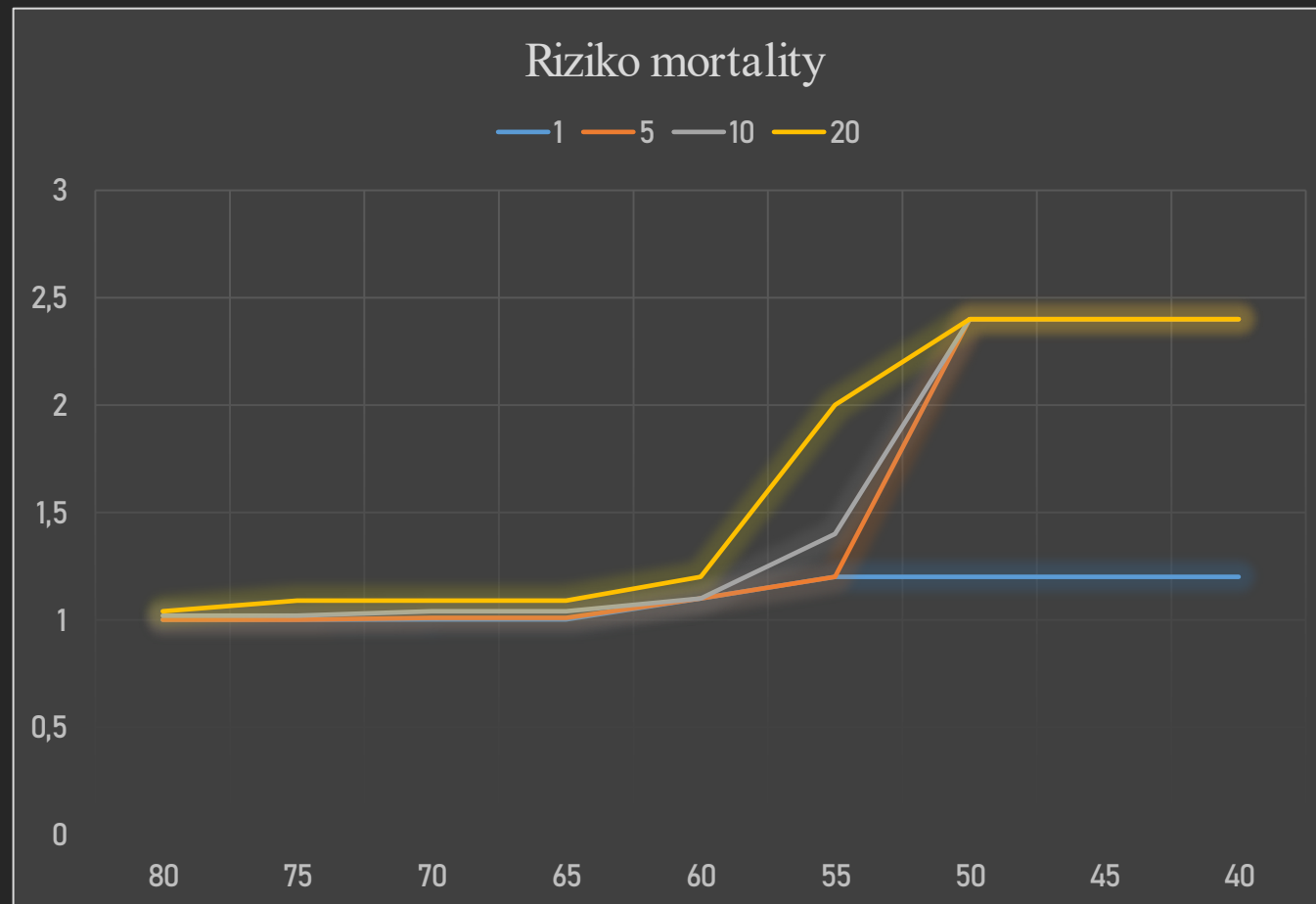
?? a klinická relevance ???

CARDIOVASCULAR

Intraoperative hypotension and the risk of postoperative adverse outcomes: a systematic review

E. M. Wesselink^{1,*}, T. H. Kappen¹, H. M. Torn¹, A. J. C. Slooter² and W. A. van Klei¹

MAP



785 806 pts
42 std

?? a klinická relevance ???

MAP

October 10, 2017

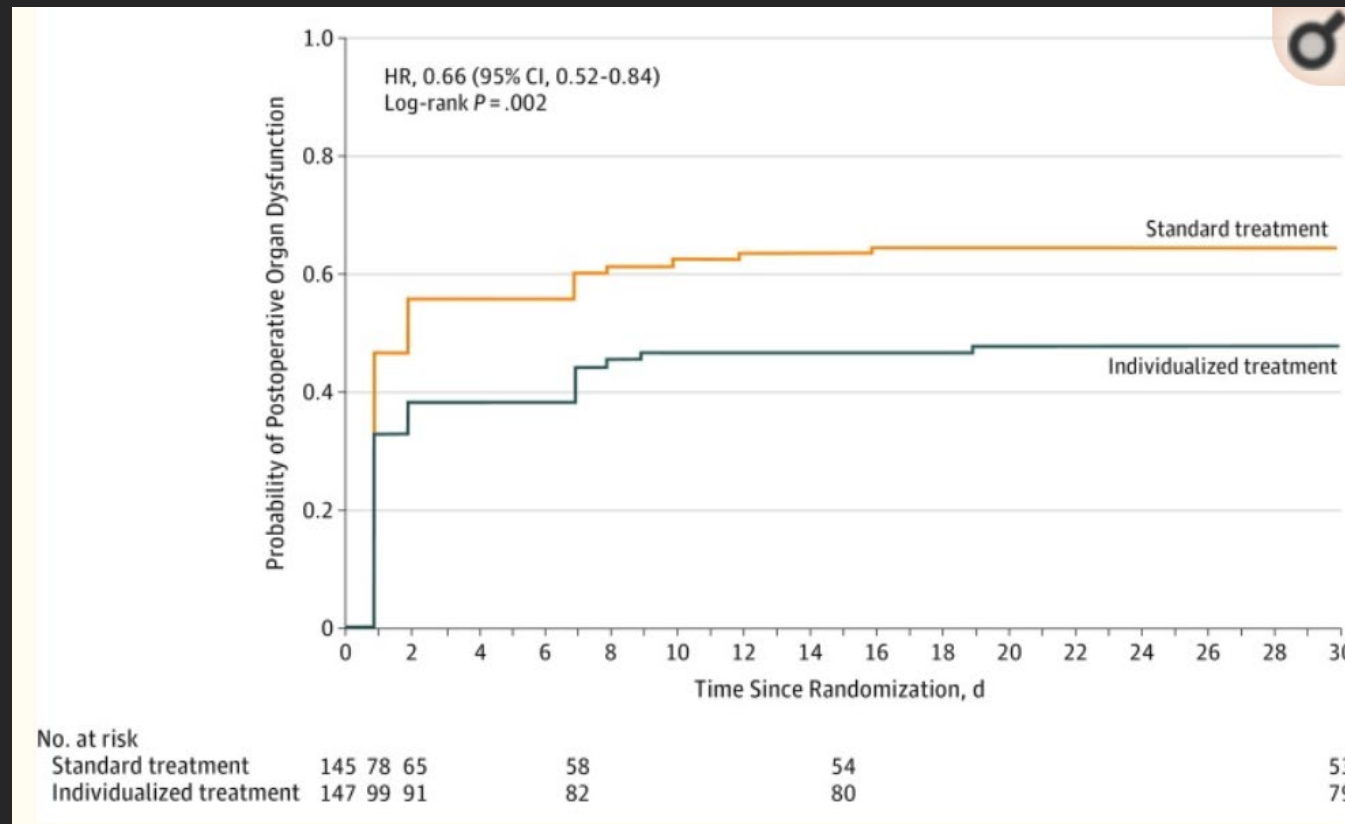
Effect of Individualized vs Standard Blood Pressure Management Strategies on Postoperative Organ Dysfunction Among High-Risk Patients Undergoing Major Surgery

A Randomized Clinical Trial

Emmanuel Futier, MD, PhD¹; Jean-Yves Lefrant, MD, PhD²; Pierre-Gregoire Guinot, MD, PhD³; et al

[» Author Affiliations](#) | [Article Information](#)

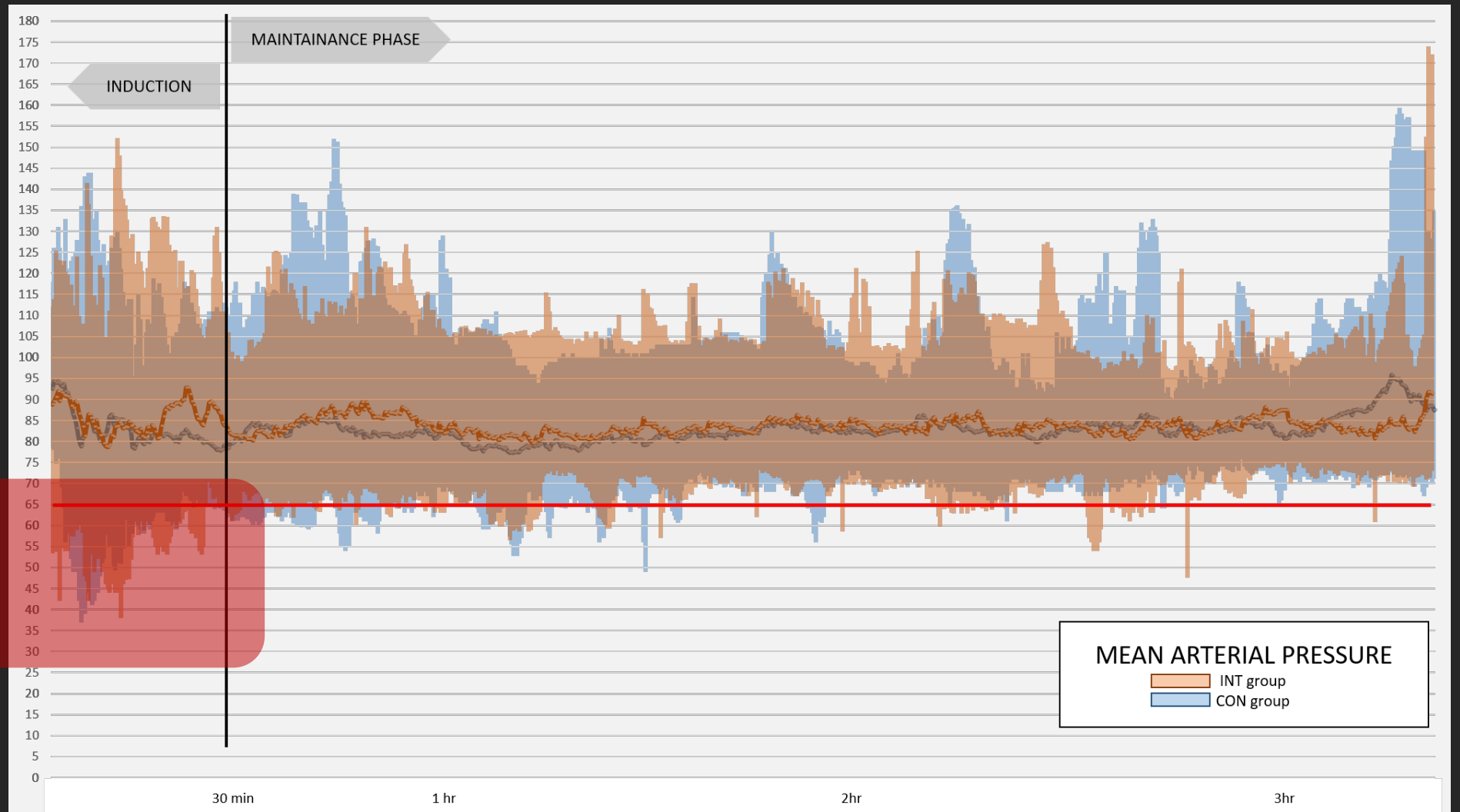
JAMA. 2017;318(14):1346-1357. doi:10.1001/jama.2017.14172



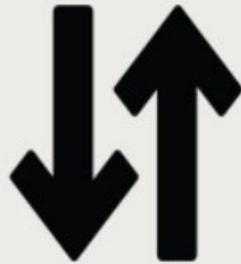
292 pts
+/- 10% BP vs KONTROLA

?? a klinická relevance ???

MAP



?? a klinická



Rates of hypotension and hypertension by continuous monitoring

| MAP threshold and duration in minutes | % patients (95% CI) |
|---------------------------------------|---------------------|
| Less than 70 mmHg \geq 30 min | 24% (35% to 46%) |
| Greater than 110 mmHg \geq 30 min | 42% (37% to 42%) |

MAP



Routine vital-sign assessments missed

- 47% (27 of 57; 95% CI: 34% to 60%) of patients who had MAP $<$ 65 mmHg for at least 15 min
- 98% (40 of 41; 95% CI: 92% to 99%) of patients with MAP $>$ 110 mmHg for at least 30 min

are WE the only champions ???

Postoperative hypotension and hypertension were common, prolonged, profound, and largely undetected by routine vital-sign assessments in a cohort of adults recovering from abdominal surgery.

Turan, et al. ANESTHESIOLOGY. April 2019.

ANESTHESIOLOGY

Trusted Evidence: Discovery to Practice

?? a klinická relevance ???

EDV

RESEARCH

Open Access

The effect of excess fluid balance on the mortality rate of surgical patients: a multicenter prospective study

João M Silva Jr^{1,2,4*}, Amanda Maria Ribas Rosa de Oliveira^{2,3}, Fernando Augusto Mendes Nogueira¹,

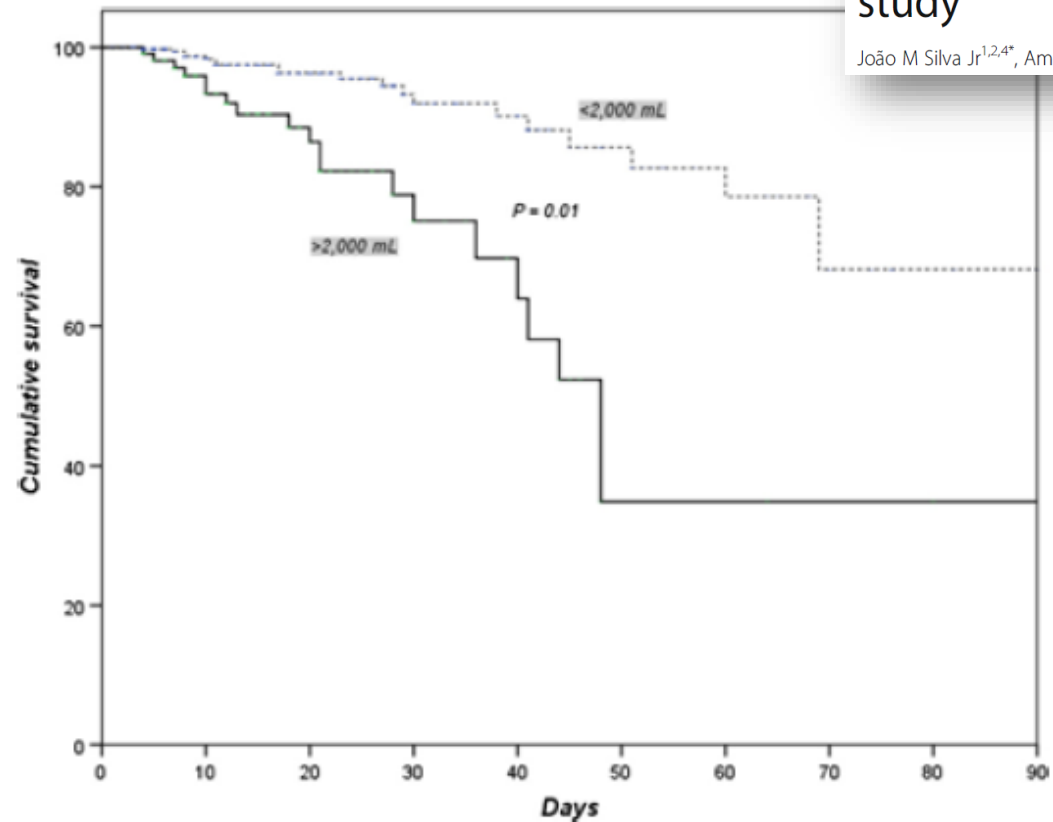


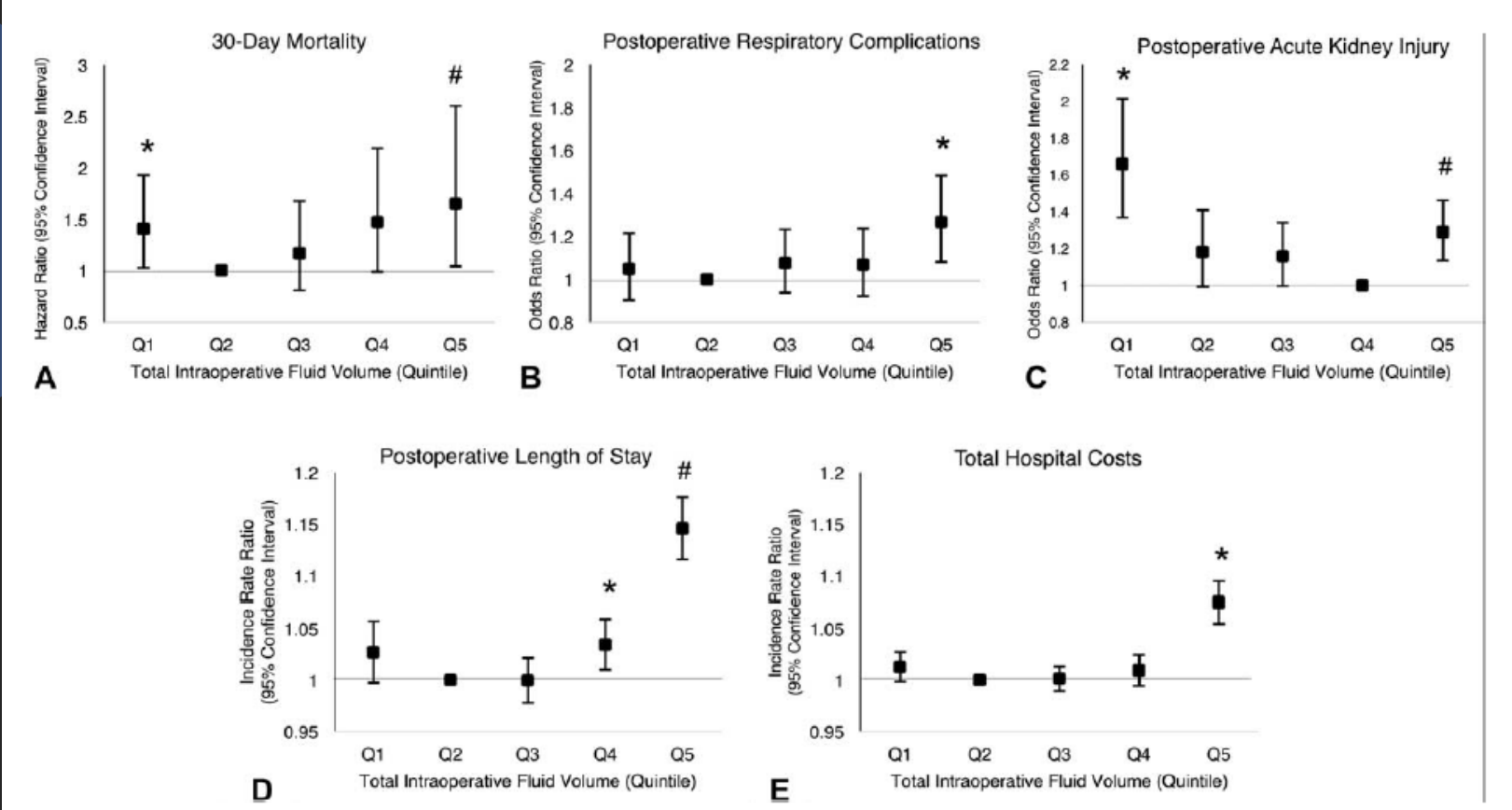
Figure 2 Kaplan-Meier curve among patients with or without excessive fluid balance up to 90 days.

?? a klinická relevance ???

EDV

Effects of Intraoperative Fluid Management on Postoperative Outcomes
 A Hospital Registry Study
 Christina H. Shin, MD,* Dustin R. Long, MD,* Duncan McLean, MBChB,*†
 Stephanie D. Grabitz, Cand. Med,* Karim Ladha, MD, MSc,‡ Fanny P. Timm, Cand. Med,*
 Tharusan Thevathasan, Cand. Med,* Alberto Pieretti, MD,§ Cristina Ferrone, MD,§
 Andreas Hoeft, MD, PhD,¶ Thomas W. L. Scheeren, MD, PhD,|| Boyd Taylor Thompson, MD,**
 Tobias Kurth, MD, ScD,††‡‡ and Matthias Eikermann, MD, PhD*

92 094 pts



≤ 900 mL

900-1100 mL

1100-1750 mL

1750-2700 mL

≥ 2,7 L

Perioperative Fluid Utilization Variability and Association With Outcomes

Considerations for Enhanced Recovery Efforts in Sample US Surgical Populations

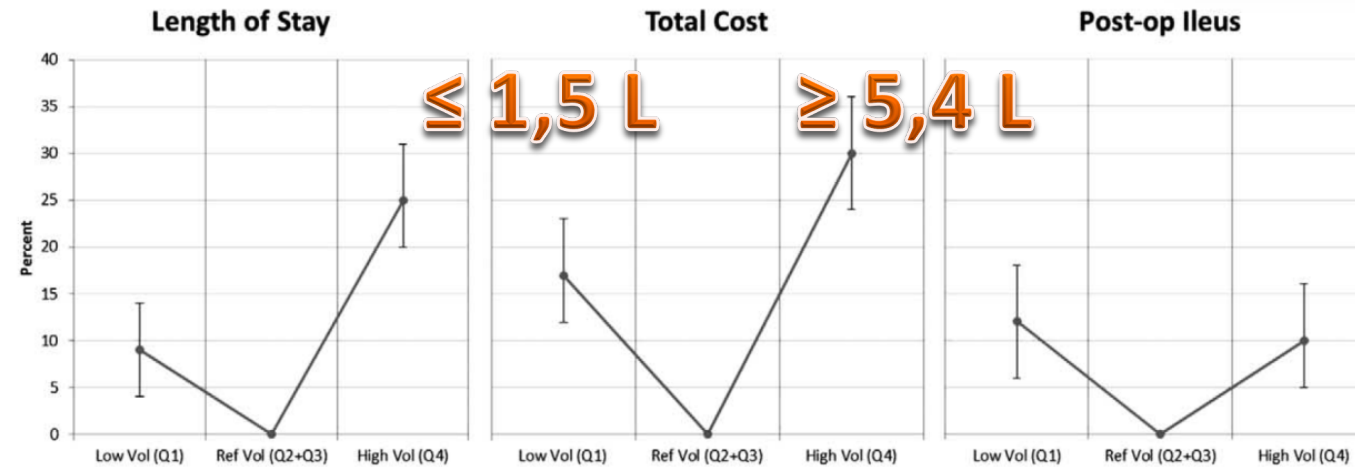
Julie K. M. Thacker, MD,* William K. Mountford, PhD,† Frank R. Ernst, PharmD, MS,‡
Michelle R. Krukus, MA,§ and Michael (Monty) G. Mythen, MBBS, MD, FRCA, FFICM, FCAI (Hon)§

?? a klinická relevance ???

EDV

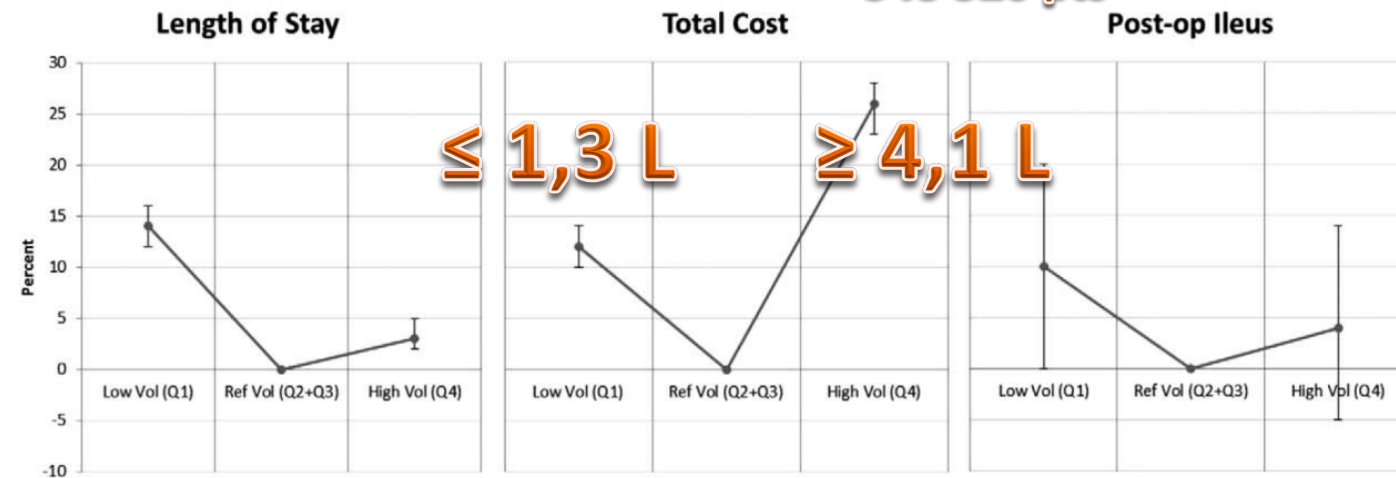
84 722 pts

Colon Surgery



Hip/Knee Surgery

548 526 pts



?? a klinická relevance

Preoperative fasting does not affect haemodynamic status: a prospective, non-inferiority, echocardiography study

L. Muller^{1,3*}, M. Brière^{1,3}, S. Bastide², C. Roger^{1,3}, L. Zoric^{1,3}, G. Seni², J.-E. de La Coussaye^{1,3}, J. Ripart^{1,3} and J.-Y. Lefrant^{1,3}

EDV

| | Day 0 | Day 1 | Δ D0 D1 % (95% CI) |
|-------------------------|-------------|-------------|---------------------|
| SAP (mm Hg) | 132 (19) | 125 (17) | −4.9 (−7.0 to −2.8) |
| DAP (mm Hg) | 77 (11) | 76 (10) | −1.1 (−3.3 to 1.1) |
| HR (bpm) | 76 (11) | 72 (11) | −3.9 (−6.4 to −1.3) |
| VTI before PLR | 17.5 (2.4) | 17.6 (2.6) | 1.0 (−1.0 to 3.0) |
| Δ VTI (%) | 7.9 (7.1) | 6.4 (6.1) | −1.6 (−3.3 to 0.2) |
| Δ IVC (%) | 37 (21) | 33 (20) | −4.2 (−8.9 to 0.5) |
| E (cm s ^{−1}) | 76.8 (14.4) | 74.0 (14.1) | −2.9 (−5.5 to −0.4) |
| EDT (ms) | 202 (34) | 204 (32) | 2.3 (−1.3 to 5.9) |
| E/A | 1.23 (0.34) | 1.22 (0.32) | 1.5 (−2.7 to 5.6) |
| E/Ea | 6.14 (1.58) | 6.13 (1.58) | 1.4 (−2.3 to 5.1) |

Conclusion

In conclusion, the present study shows that 8 h preoperative fasting did not alter TTE dynamic and static preload indices in ASA I–III adult patients with no bowel preparation. This suggests that preoperative fasting does not induce significant hypovolaemia.

?? a klinická relevance ???

Physiologic Effects of Bowel Preparation

Kathrine Holte, M.D.,¹ Kristine Grubbe Nielsen, M.S.,¹
Jan Lysegård Madsen, M.D., Ph.D.,² Henrik Kehlet, M.D., Ph.D.¹

Table 1.
Effects of Bowel Preparation on Fluid Phases

| | Day 1 Before Bowel Preparation | Day 4 After Bowel Preparation | <i>P</i> Value |
|---|-----------------------------------|----------------------------------|----------------|
| Plasma volume (l) | 2.94 (2.44–4.79) | 3.05 (2.52–4.93) | 0.48 |
| Extracellular volume (l) | 18.9 (13.1–25.1) | 20.8 (12.2–25.6) | 0.21 |
| Erythrocyte volume (fraction) | 0.4 (0.35–0.44) | 0.39 (0.36–0.45) | 0.44 |
| Blood volume (l) | 5.08 (3.94–7.48) | 5.18 (4–7.7) | 0.39 |
| Glomerular filtration (l min ⁻¹ 1.73 m ⁻²) | 85.2 (69.6–112) | 87 (69.8–106.9) | 0.27 |

Data are medians with ranges in parentheses.

^a*P* < 0.05

Standard bowel preparation with bisacodyl and sodium phosphate has some adverse physiologic effects, which are small and probably not clinically significant when following recommendations for oral fluid intake in otherwise healthy patients.

EDV

?? a klinická relevance ???



The effects of goal-directed fluid therapy based on dynamic parameters on post-surgical outcome: a meta-analysis of randomized controlled trials

Jan Benes^{1*}, Mariateresa Giglio², Nicola Brienza² and Frederic Richard³

14 studies
 thresholds 9-13%

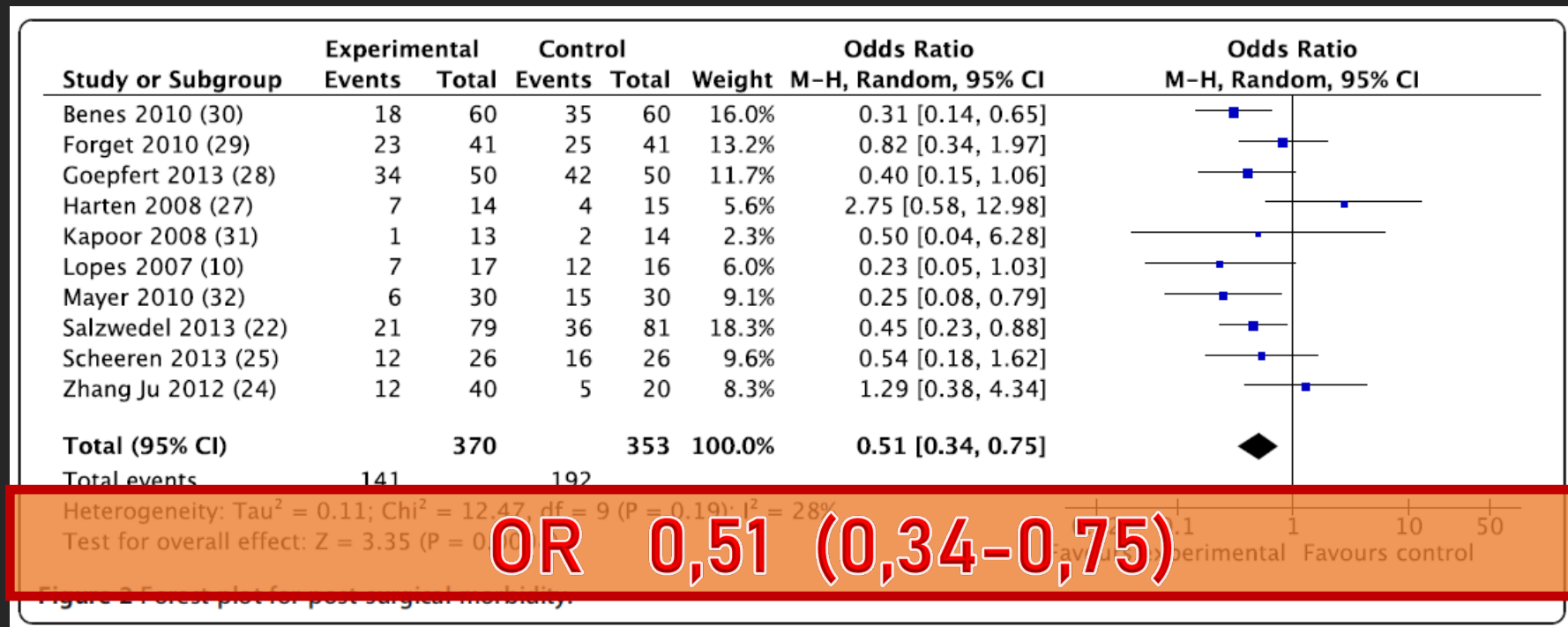


Figure 2 Forest plot for post-surgical morbidity.

?? a klinická relevance ???

British Journal of Anaesthesia 108 (1): 53–62 (2012)
Advance Access publication 26 August 2011 · doi:10.1093/bja/aer273

BJA

Randomized controlled trial of intraoperative goal-directed fluid therapy in aerobically fit and unfit patients having

...d^{2,3}, P. D. Erasmus², N. Mellor¹, K. B. Hosie¹ and G. Minto^{2,3*}



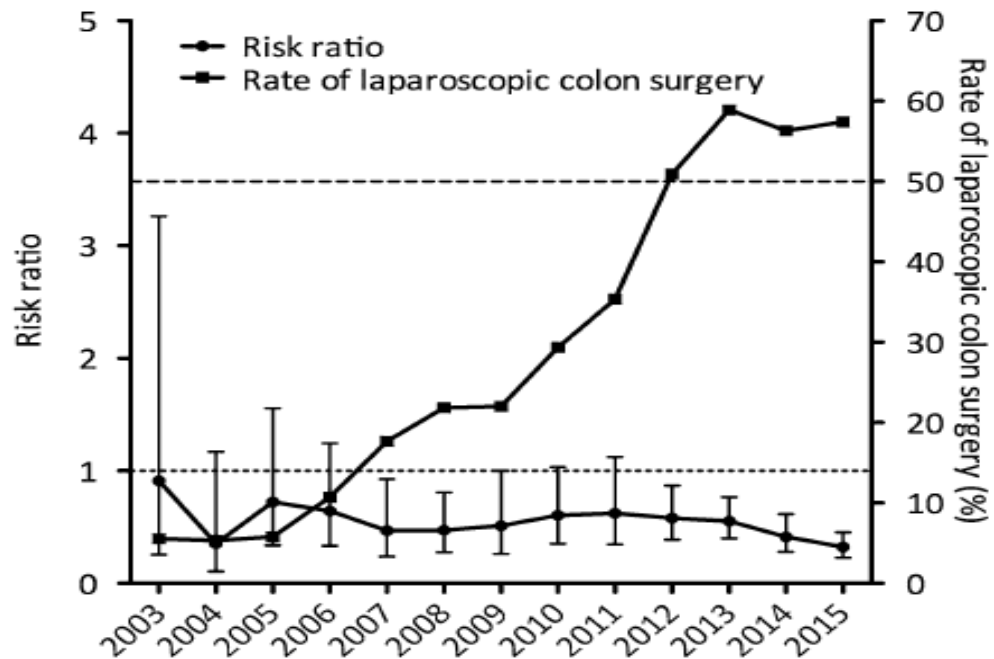
Surgery Today
<https://doi.org/10.1007/s00595-019-1760-1>

ORIGINAL ARTICLE



The association between the increased performance of laparoscopic colon surgery and a reduced risk of surgical site infection

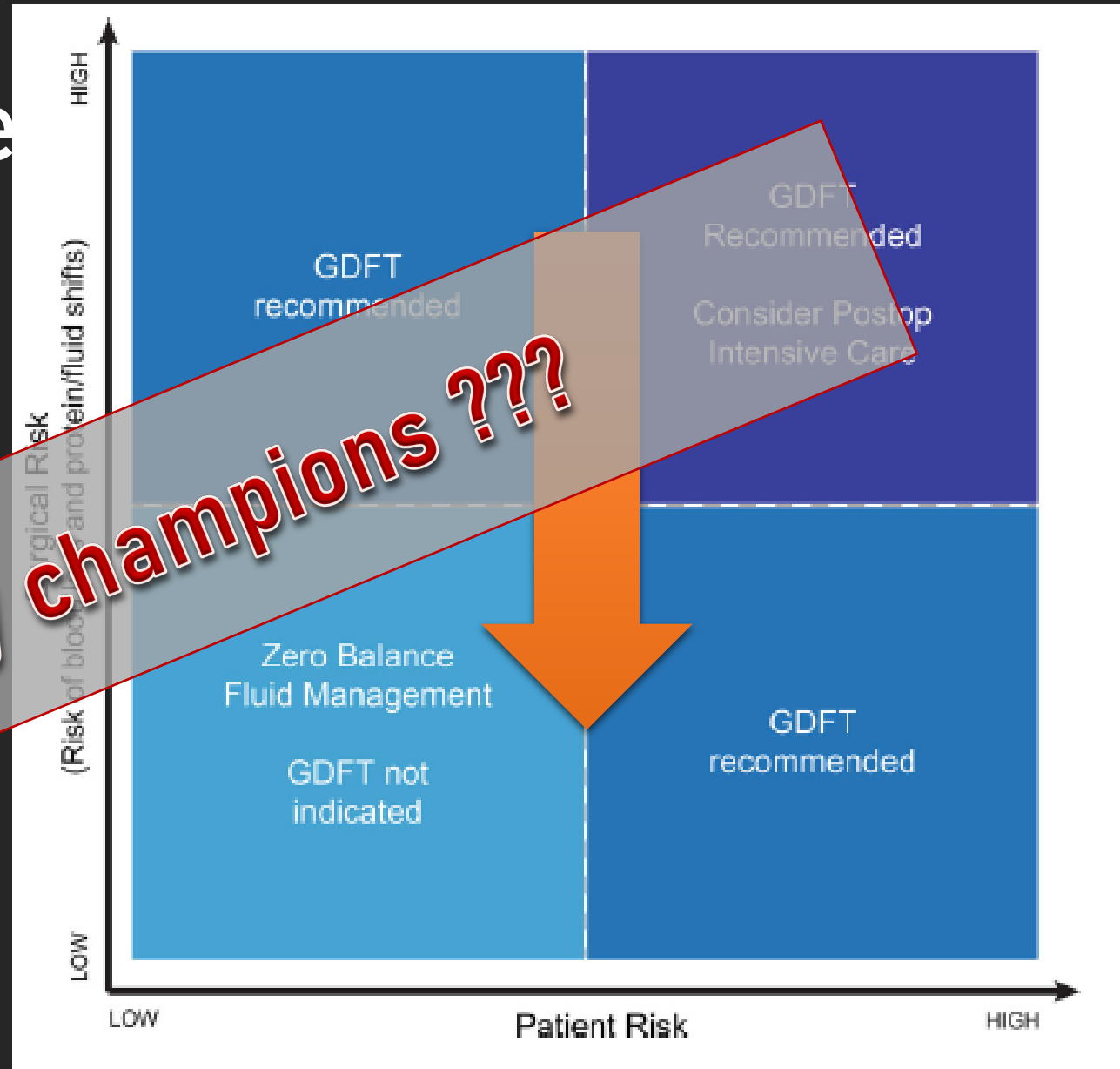
Yoshinori Kagawa^{1,2} · Daisaku Yamada^{2,3} · Makoto Yamasaki² · Atsushi Miyamoto^{2,5} · Tsunekazu Mizushima² · Kazuo Yamabe^{2,6} · Mitsunobu Imazato^{2,7} · Hiroki Fukunaga^{2,8} · Shogo Kobayashi² · Junzo Shimizu^{2,4} · Koji Umeshita² · Toshinori Ito² · Yuichiro Doki² · Masaki Mori²



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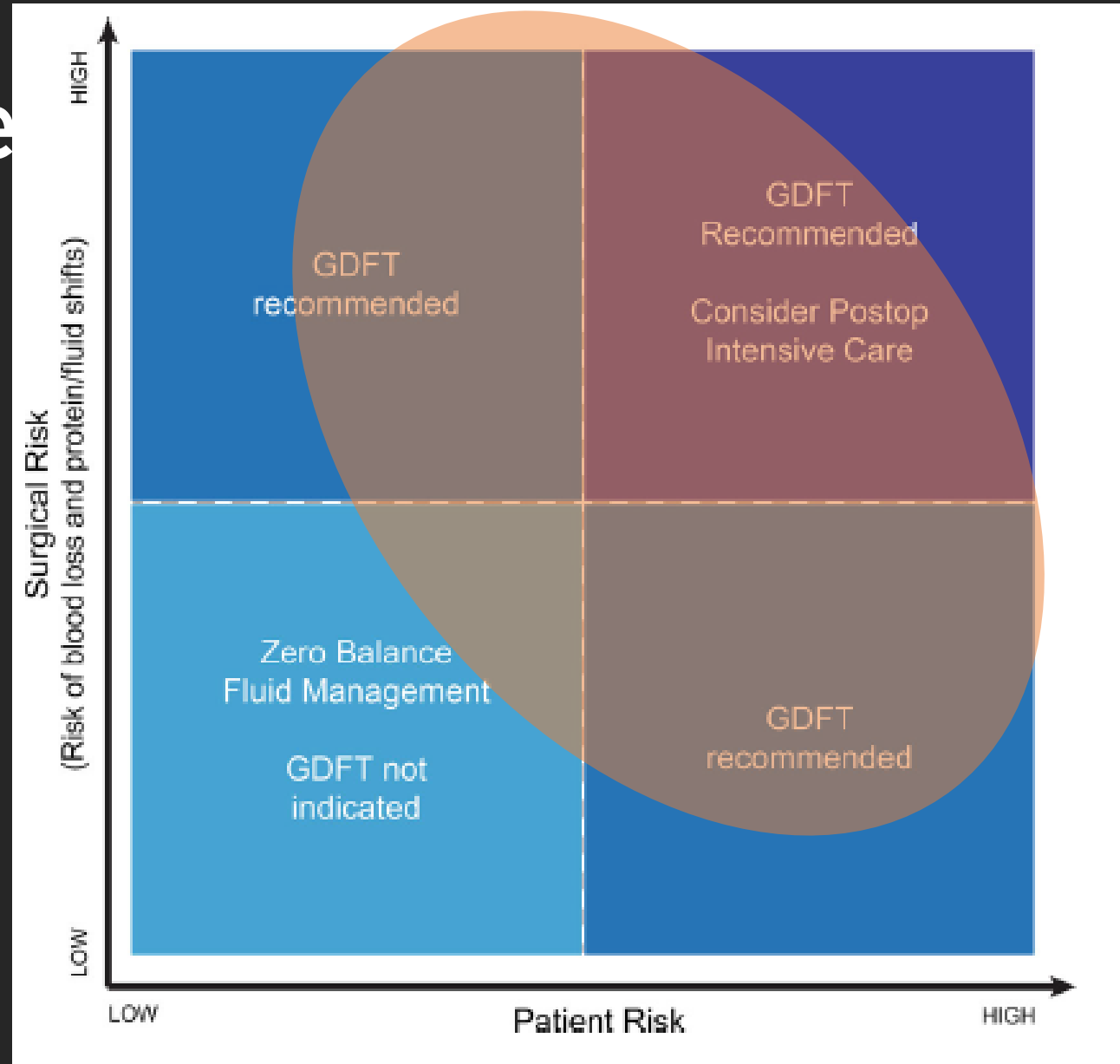
EDV

are WE the only champions ???



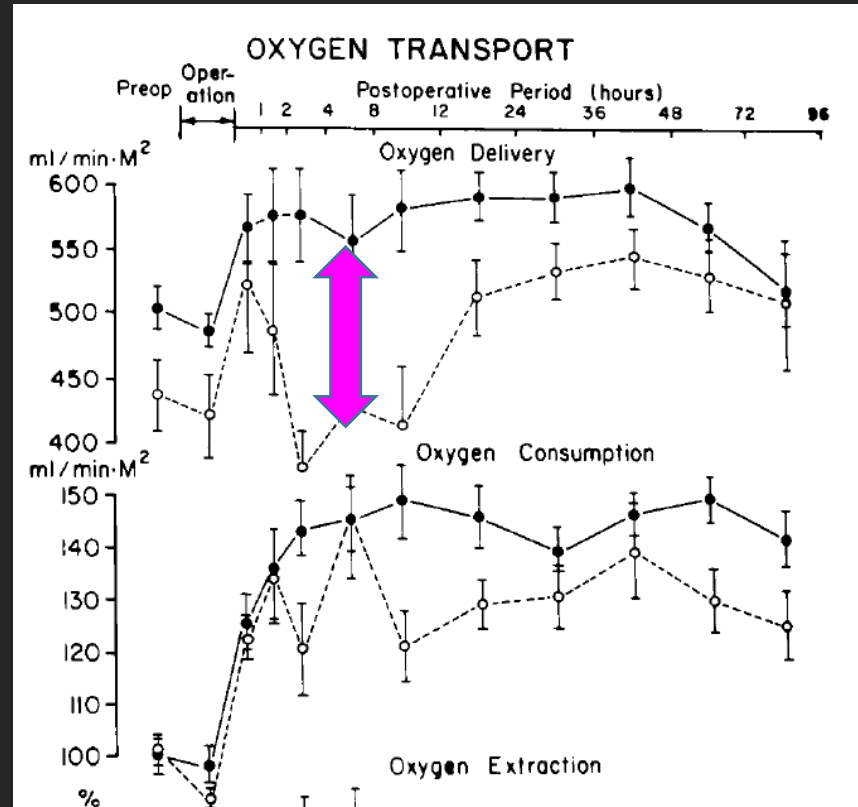
?? a klinická relevance

GDT



?? a klinická relevance ???

GDT



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Hemodynamic and oxygen transport patterns in surviving and nonsurviving postoperative patients

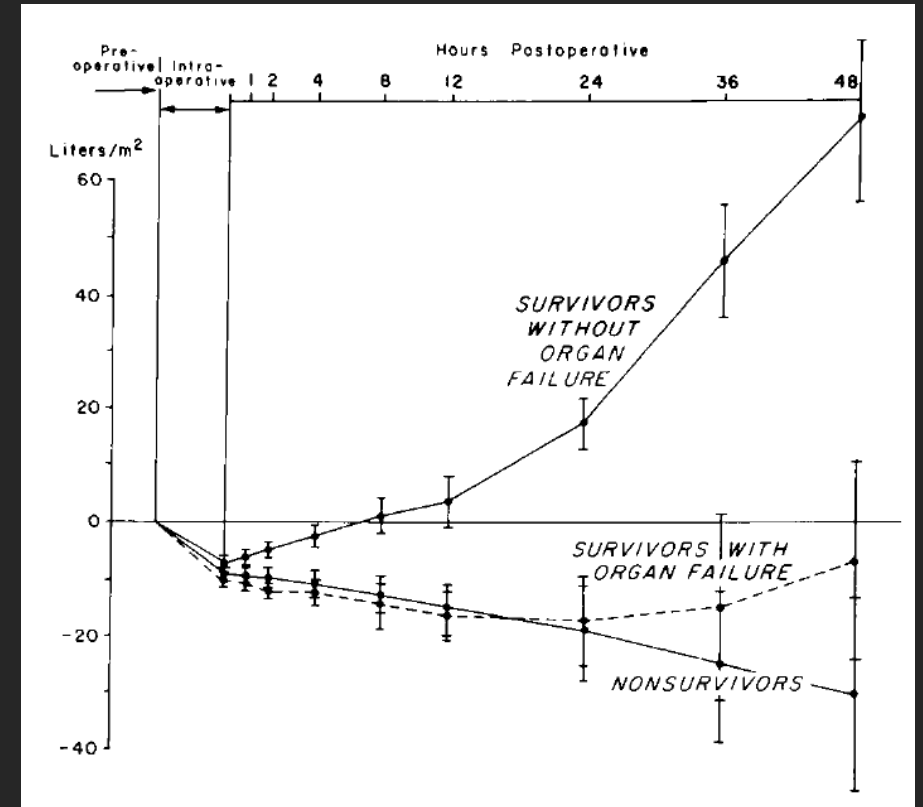
RICHARD D. BLAND, MD; WILLIAM C. SHOEMAKER, MD; EDWARD ABRAHAM, MD;
JUAN CARLOS COBO, MD

0090-3493/88/1611-1117\$02.00/0
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Vol. 16, No. 11
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Tissue oxygen debt as a determinant of lethal and nonlethal postoperative organ failure

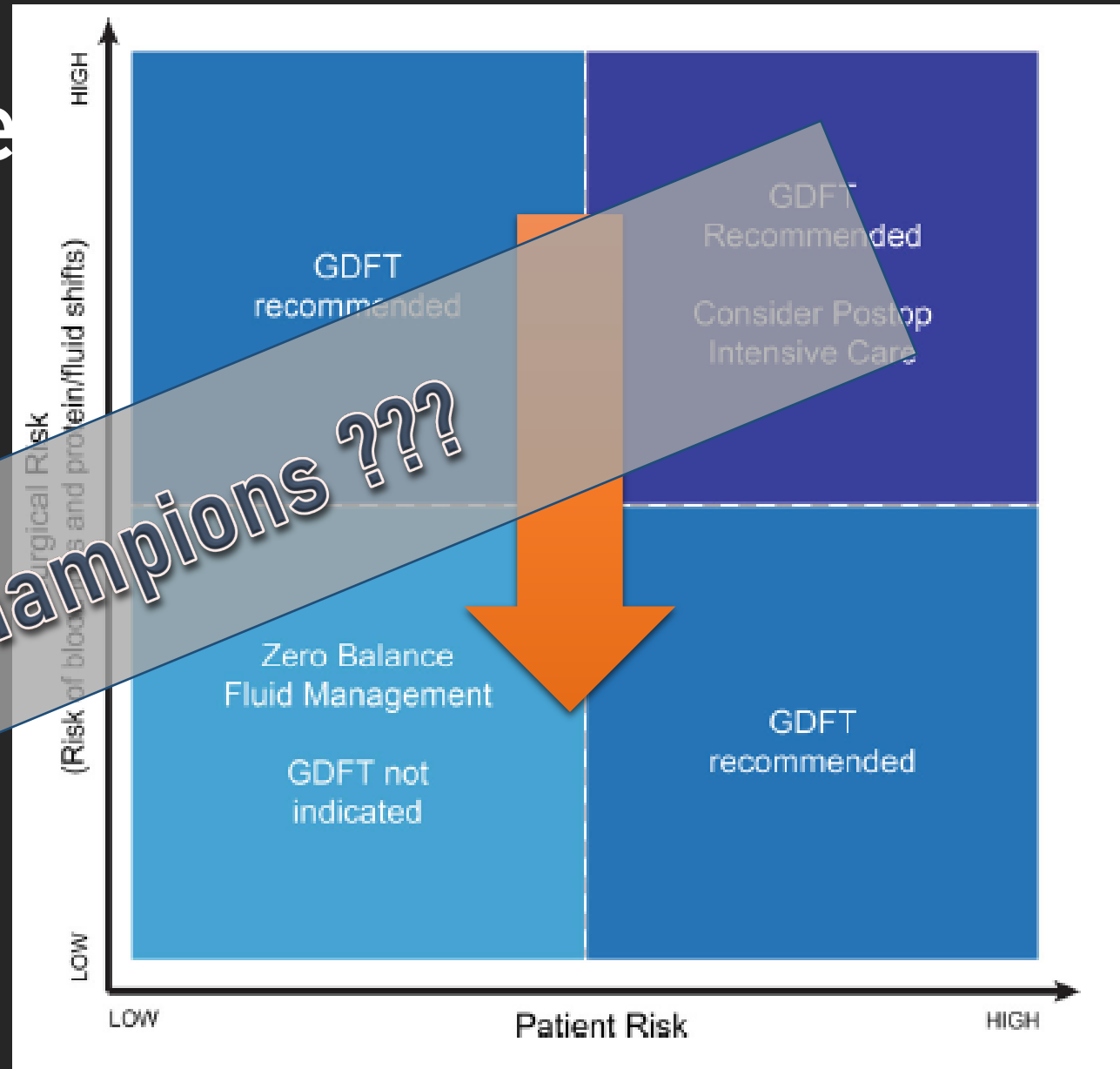
WILLIAM C. SHOEMAKER, MD; PAUL L. APPEL, MPA; HARRY B. KRAM, MD



?? a klinická relevance

GDT

CREATING champions ???



?? a klinická relevance



D. Harari et al.

Age and Ageing 2007; 36: 190–196 © The Author 2007. Published by Oxford University Press on behalf of the British Geriatrics Society.
doi:10.1093/ageing/af1163 All rights reserved. For Permissions, please email: journals.permissions@oxfordjournals.org
Published electronically 27 January 2007

Proactive care of older people undergoing surgery ('POPS'): Designing, embedding, evaluating and funding a comprehensive geriatric assessment service for older elective surgical patients

| Post-operative outcomes | | | |
|---|-------------|-------------|---------|
| Medical complications | | | |
| Delirium [acute change in mental status post-op. with improvement pre-discharge] | 18.5 (10) | 5.6 (3) | 0.036 |
| Pneumonia [radiological report] | 20.4 (11) | 3.7 (2) | 0.008 |
| Cardiac problems | | | |
| - Unstable angina/acute coronary syndrome | 7.4 (4) | 3.7 (2) | |
| - Arrhythmia | 13.0 (7) | 7.4 (4) | 0.263 |
| - Heart failure | 3.7 (2) | 0 | |
| Thrombosis | | | |
| - Deep vein thrombosis | 7.4 (4) | 1.9 (1) | |
| - Pulmonary embolism | 3.7 (2) | 0 | |
| Fluid balance | | | |
| - Dehydration | 11.1 (6) | 7.4 (4) | 0.371 |
| - Overhydration | 5.6 (3) | 0 | |
| Urinary tract infection | 16.7 (9) | 7.4 (4) | 0.118 |
| Wound infection | 22.2 (12) | 3.7 (2) | 0.004 |
| Multidisciplinary issues | | | |
| Uncontrolled pain [routine acute pain service documentation day 3 post-op.] | 29.6 (16) | 1.9 (1) | <0.0001 |
| No food for >= 4 days post-op. | 9.3 (5) | 0 | |
| Urinary catheter for >= 4 days without indication | 20.4 (11) | 7.4 (4) | 0.046 |
| Urinary retention [post-void residual volume >500 mls] | 14.8 (8) | 7.4 (4) | 0.273 |
| Constipation [bowels not open >3 days] | 29.6 (16) | 16.7 (9) | 0.085 |
| Pressure sores | 18.5 (10) | 3.7 (2) | 0.028 |
| Bedridden [not sat out at all during first 48 h] | 27.8 (15) | 9.3 (5) | 0.012 |
| Dependent transfers on day 3 post-op. [requiring personal assistance to transfer] | 14.8 (8) | 0 | 0.003 |
| Process measures | | | |
| Length of stay (days) | | | |
| - Mean±SD | 15.8 ± 13.2 | 11.5 ± 5.2 | 0.028 |
| - Median (range) | 14.5 (2–80) | 10.0 (4–26) | 0.058 |
| Delayed discharge [no surgical indication for patient to remain in hospital based on discussion with ward team] | | | |
| All | 70.4 (38) | 24.1 (13) | <0.0001 |
| - Due to medical complications | 37.0 (20) | 13.0 (7) | |
| - Due to slow rehabilitation | 13.0 (7) | 7.4 (4) | |
| - Due to wait for OT and/or equipment | 20.4 (11) | 3.7 (2) | |
| Readmission within 28 days of discharge | 3.7 (2) | 3.7 (2) | |
| Death within 30 days of surgery | 1.9 (1) | 0 | |

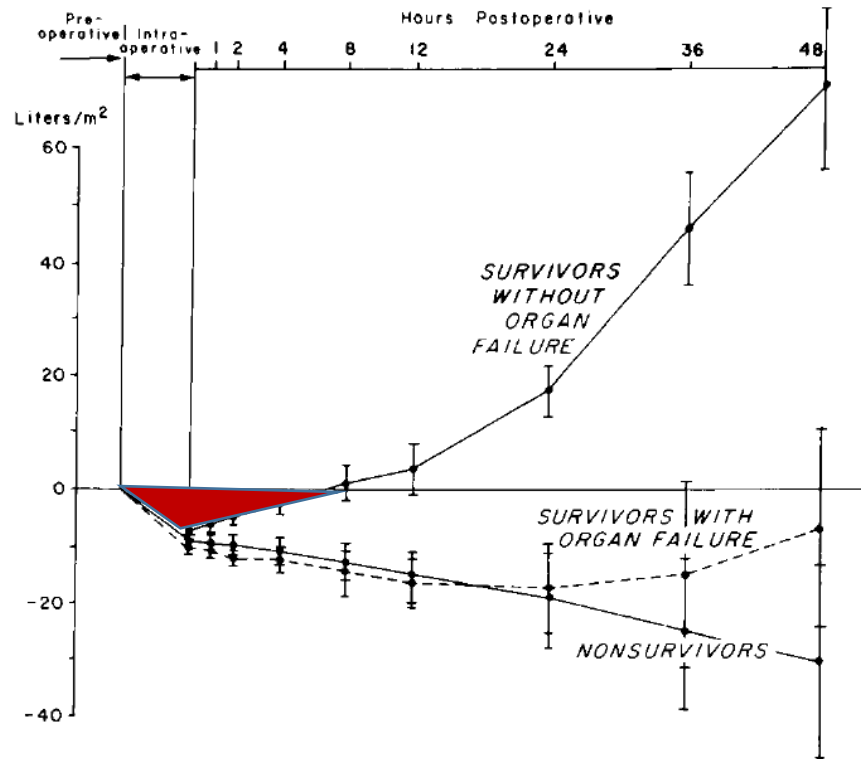
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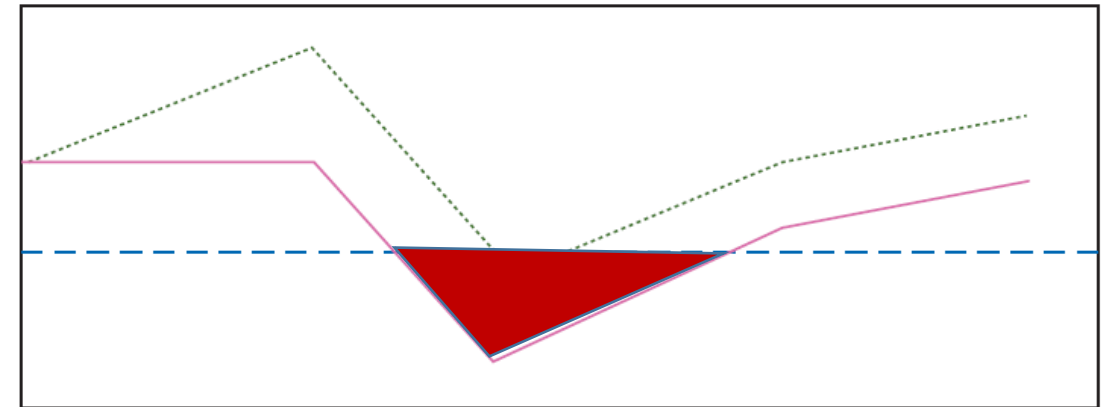
Vol. 16, No. 11
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Tissue oxygen debt as a determinant of lethal and nonlethal postoperative organ failure

WILLIAM C. SHOEMAKER, MD; PAUL L. APPEL, MPA; HARRY B. KRAM, MD



Minimum level of functional ability



Prehabilitation phase

Surgical procedure

Rehabilitation phase

Post-rehabilitation phase

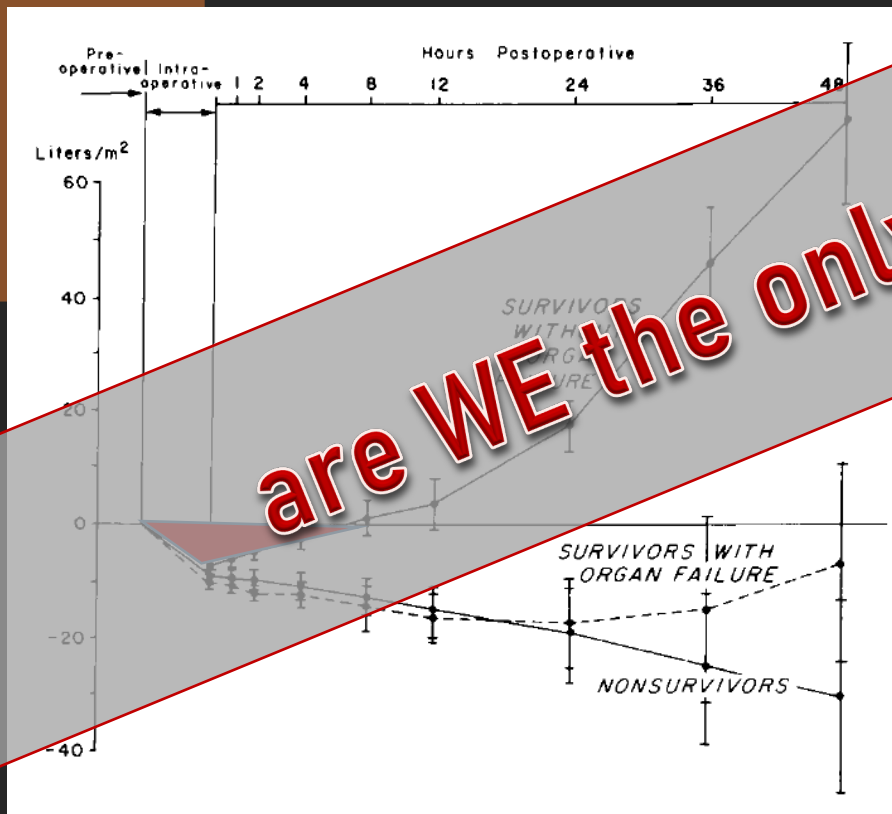
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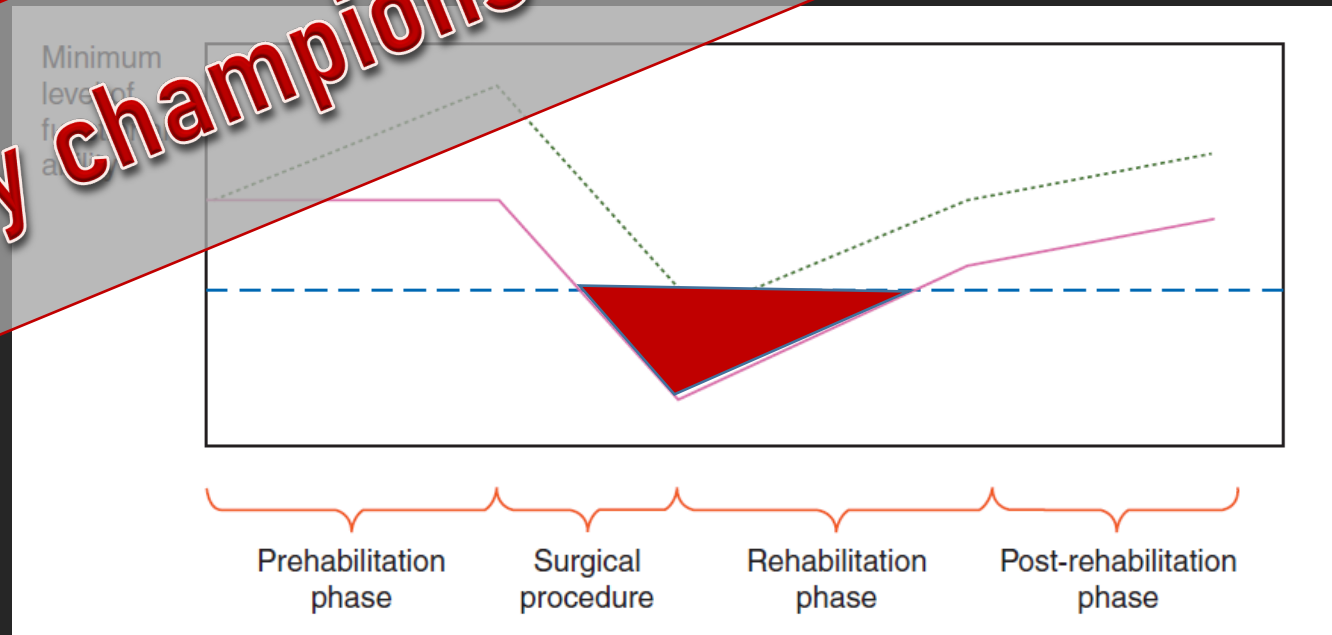
Vol. 16, No. 11
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Tissue oxygen debt as a determinant of lethal and nonlethal postoperative organ failure

WILLIAM C. SHOEMAKER, MD; PAUL L. APPEL, MPA; HARRY B. KRAM, MD



are WE the only champions ???



A v čem jsme tedy ON...



A v čem jsme tedy ON...

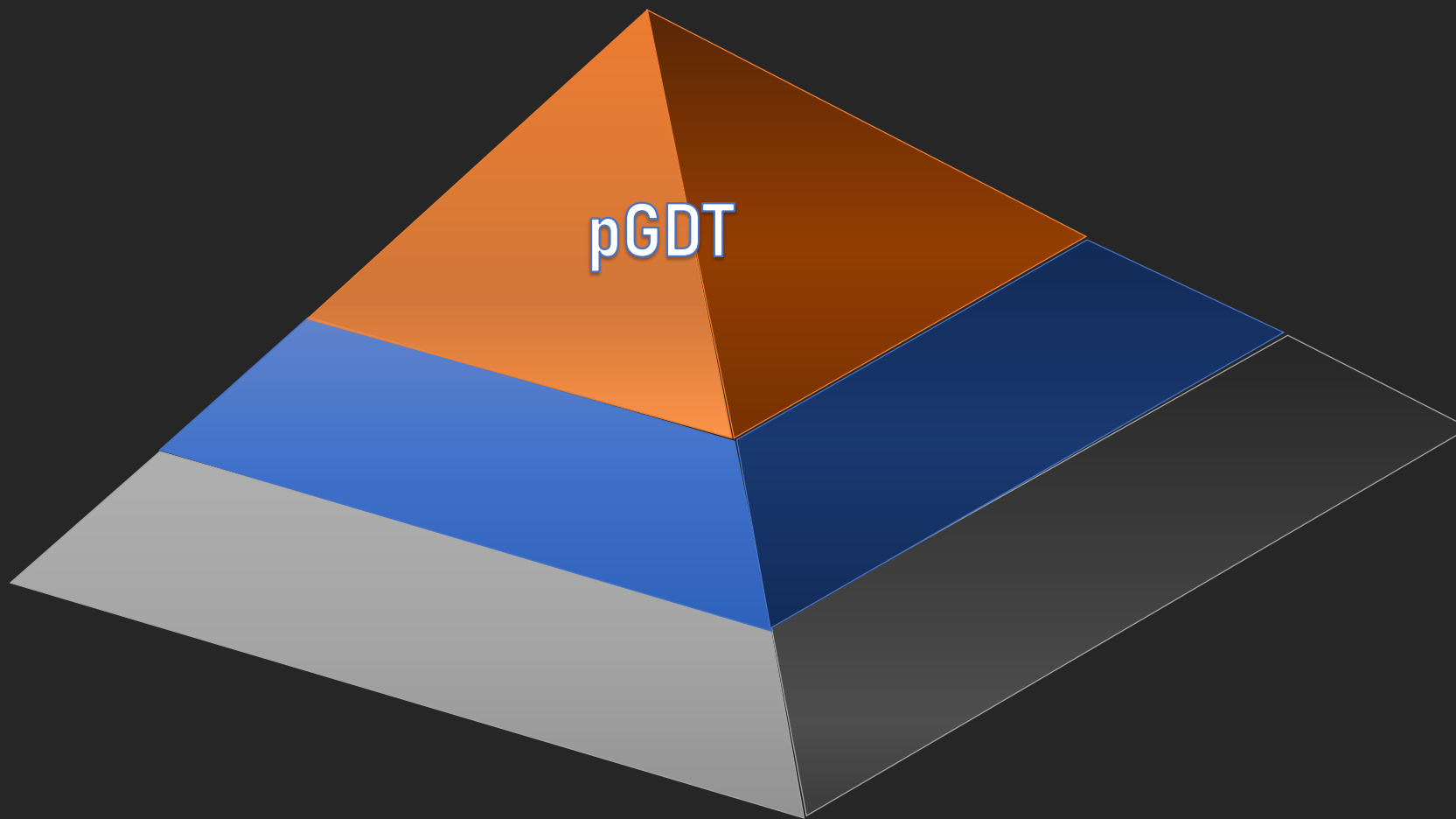


A v čem jsme tedy ON...



pGDFR = perioperative Goal-Directed Fluid RESTRICTION

A v čem jsme tedy ON...



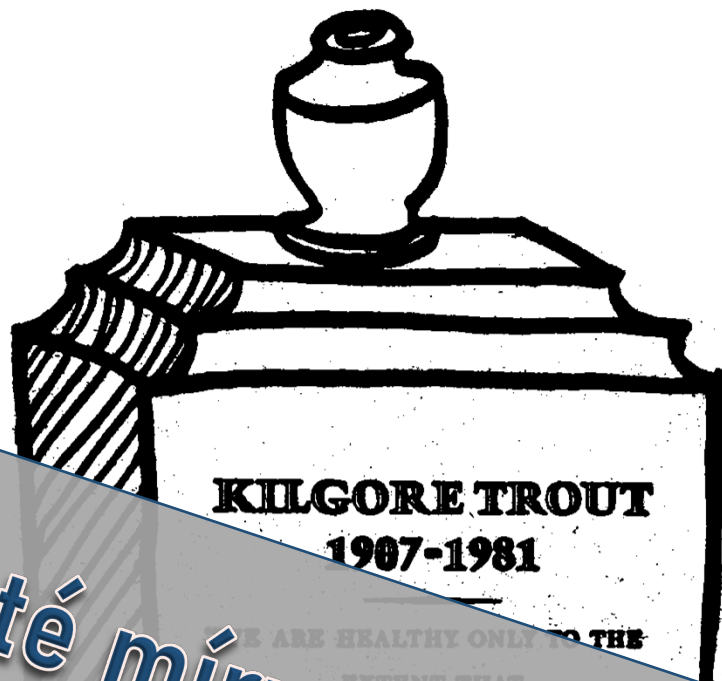
pGDT = perioperative Goal-Directed Therapy

KURT VONNEGUT, JR.

SNÍDANĚ
ČAMPIONŮ



ARGO



KILGORE TROUT
1907-1981

WE ARE HEALTHY ONLY TO THE
EXTENT THAT
OUR IDEAS ARE
HUMANE.

16

*jsme zdraví jen do té míry,
do jaké jsou naše představy lidské*

DÍKY ZA
POZORNOST

benesj@fnplzen.cz