Publikace, které **OPRAVDU** ovlivnily moji praxi
aneb když jde EBM a klinická praxe ruku v ruce

# Monitorace v anestezii

Michal Horáček
KARIM 2. LF UK v FN Motol a katedra AIM IPVZ
Praha

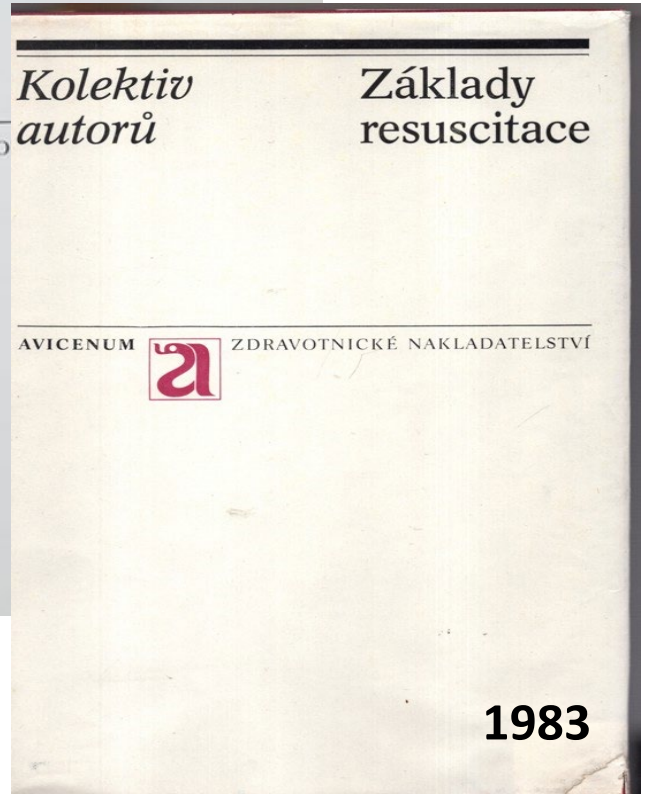
Akutne.cz
19. 11. 2022

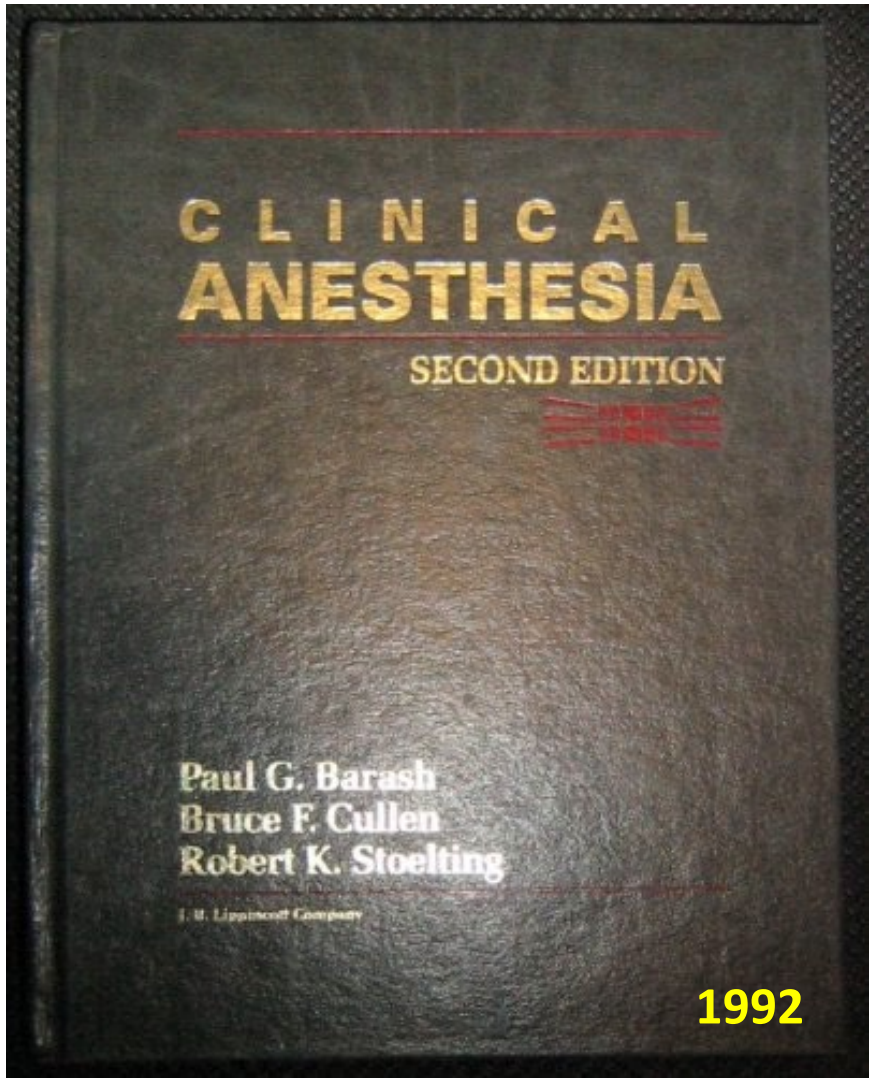
# Publikace nejsou jen studie!

- publikace, které **opravdu** ovlivnily moji praxi
- publikace, které neovlivnily moji praxi, ale přesto to dělám (monitoraci používám)
- **anestezie 3 P**
  - precizní
  - physiologická
  - personalizovaná

# Publikace, které OPRAVDU! ovlivnily moji praxi

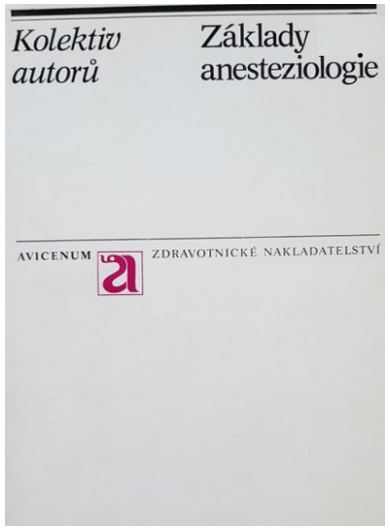




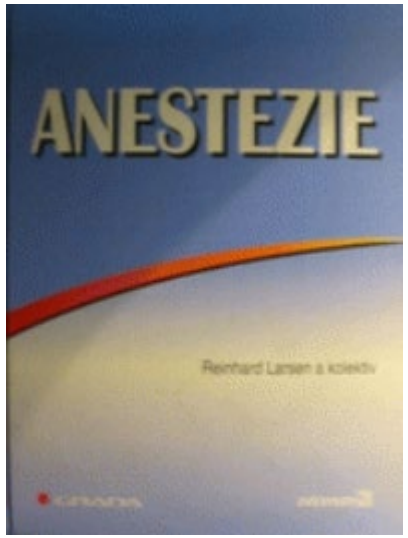



# 2K: změna paradigmatu

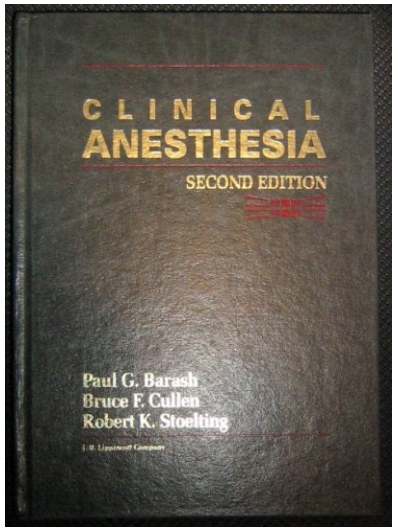
- eminence či experience based medicine
  → **evidence based m. = m. podložená důkazy**
- změna pedagogického přístupu → show, fun



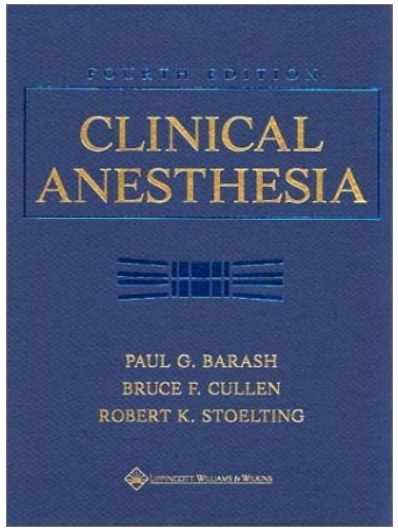

1. vydání 1981



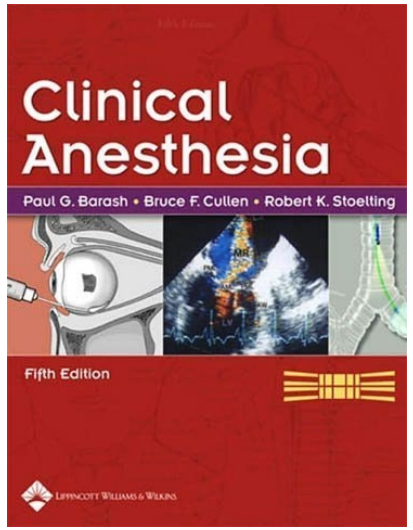

1. vydání 2004



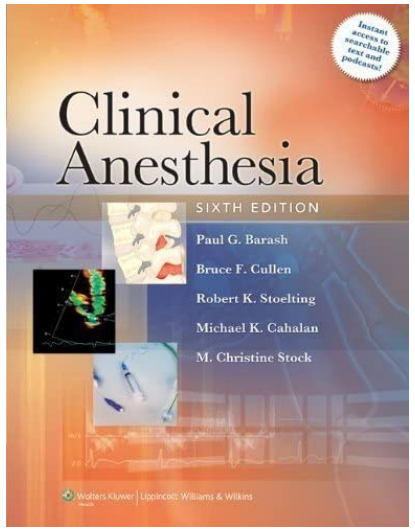

2. vydání 1992



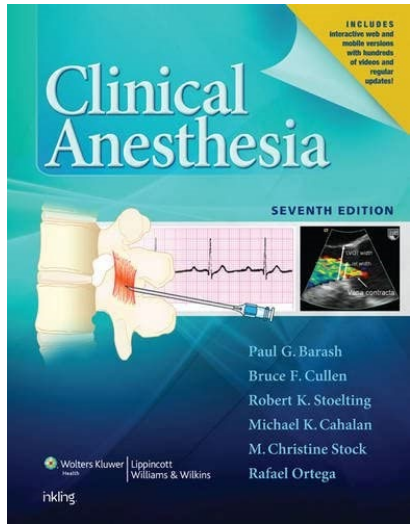

4. vydání 2000



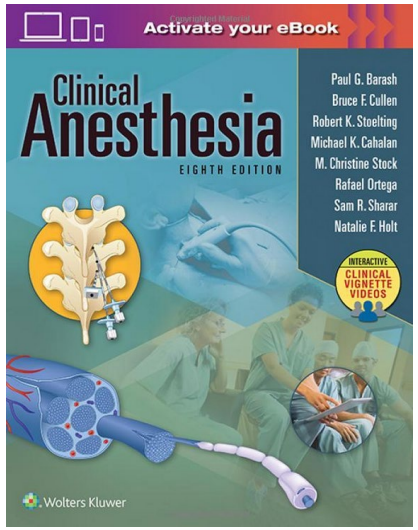

5. vydání 2005




6. vydání 2009



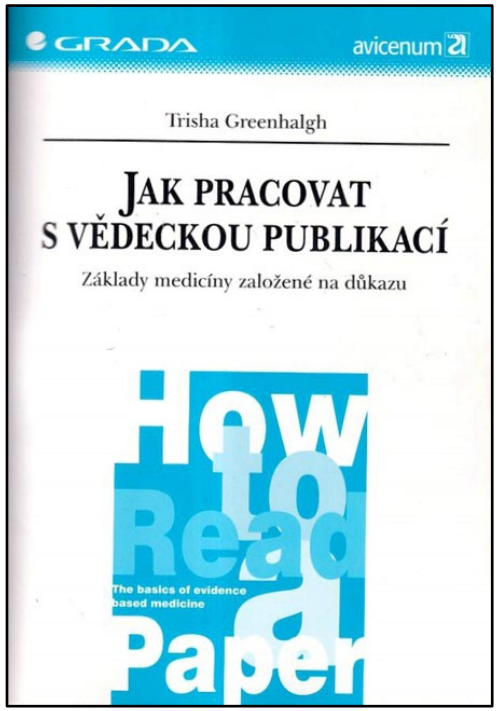

7. vydání 2013



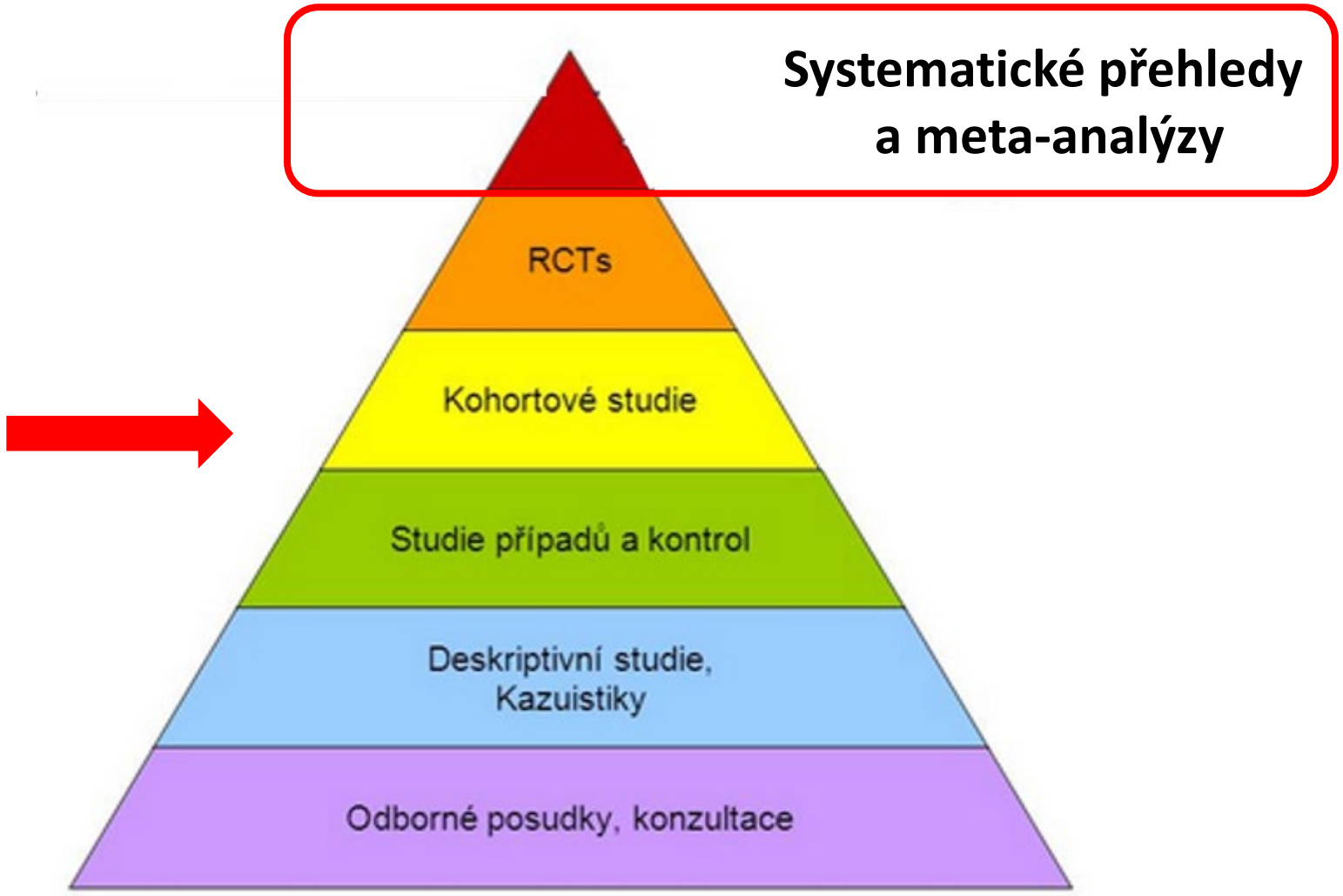

8. vydání 2017

# Hierarchie vědeckých důkazů

## - Heynesova pyramida




**2003**



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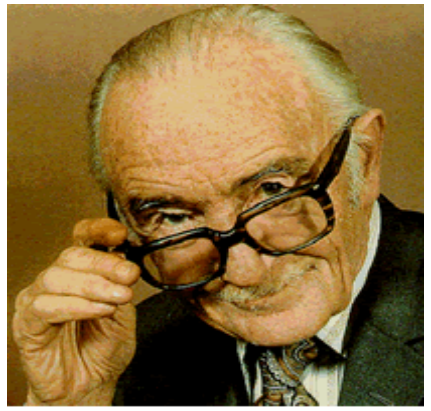


Prof. Archibald Leman Cochrane
1909-1988

**242** Cochrane Reviews matching **anesthesia in Title Abstract Keyword**

Cochrane Database of Systematic Reviews
Issue 10 of 12, October 2022

Select all (242) Export selected citation(s) Show all previews

Order by Publish Date - New To Old Results per page 25

1 **Type of anaesthesia for acute ischaemic stroke endovascular treatment**

Renato Tosello, Rachel Riera, Giuliano Tosello, Caroline NB Clezar, Jorge E Amorim, Vladimir Vasconcelos, Benedito B Joao, Ronald LG Flumignan

Intervention Review 20 July 2022
Show PICOs Show preview

2 **Routine or selective carotid artery shunting for carotid endarterectomy (and different methods of monitoring in selective shunting)**

Busaba Chuatrakoon, Sothida Nantakool, Amaraporn Rerkasem, Saritphat Orrapin, Dominic PJ Howard, Kittipan Rerkasem

Intervention Review 22 June 2022 New search
Show PICOs Show preview

Cochrane Database of Systematic Reviews | Review - Intervention

New search

# Routine or selective carotid artery shunting for carotid endarterectomy (and different methods of monitoring in selective shunting)

Busaba Chuatrakoon, Sothida Nantakool, Amaraporn Rerkasem, Saritphat Orrapin, Dominic PJ Howard, Kittipan Rerkasem Authors' declarations of interest

Version published: 22 June 2022 Version history

https://doi.org/10.1002/14651858.CD000190.pub4

prof. Archibald Leman **Cochrane** 1909-1988

## Abstract:

### Authors' conclusions

This review concluded that the data available were too limited to either support or refute the use of routine or selective shunting in carotid endarterectomy when performed under general anaesthesia. Large-scale randomised trials of routine shunting versus selective shunting are required. No method of monitoring in selective shunting has been shown to produce better outcomes.

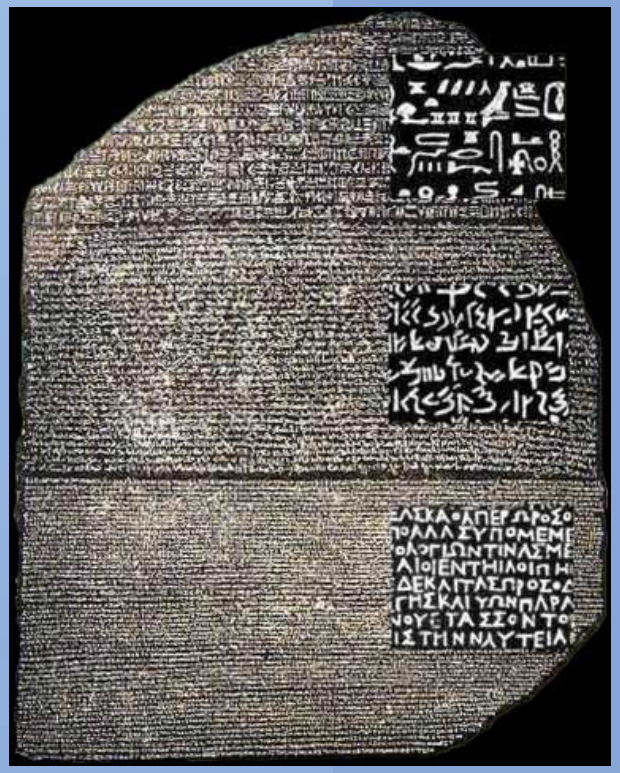
## Plain language summary:

### Key results

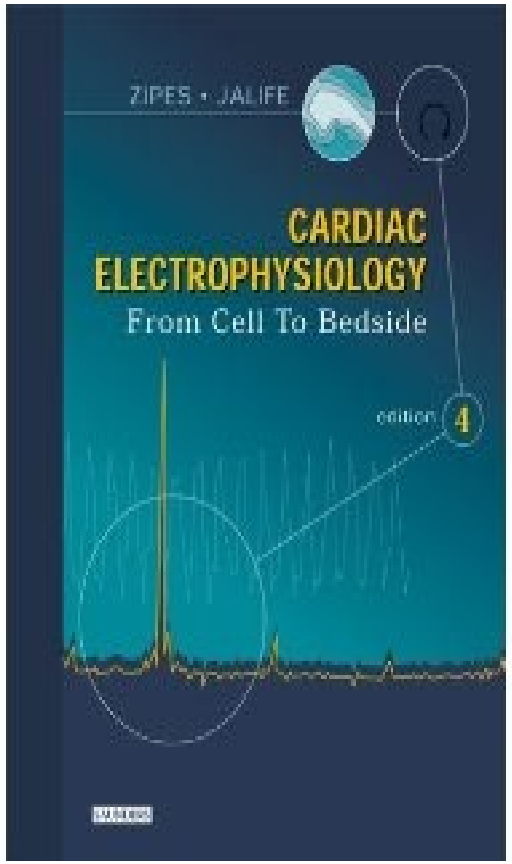
A very limited number of trials suggested that routine shunting compared to no shunting in patients undergoing carotid endarterectomy under general anaesthesia resulted in a lower stroke-related death within 30 days of surgery, less stroke rate within 24 hours of surgery and ipsilateral rate reduction within 30 days of surgery. More trials are needed.

### Quality of the evidence

Low quality of the evidence for all outcomes reduced the reliability of the results. There were significant problems contributing to the low quality, especially in the research methodology.



Rosettská deska




**dnes 8. vydání 2022,**
**1696 str. = +64 %**

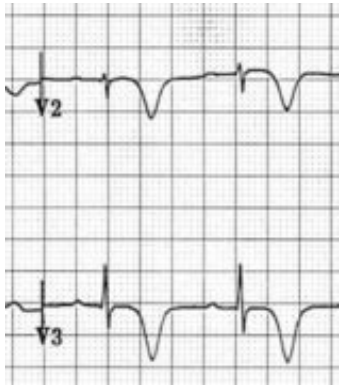
# Book Review

***Cardiac Electrophysiology: From Cell to Bedside, Fourth Edition***

Douglas P. Zipes, Jose Jalife, eds.
1115 pp. Philadelphia, Pa: W.B. Saunders; 2004. $259.00;
ISBN 0721603238

This is the fourth edition of a book that has become *the* reference source for advanced cardiac electrophysiology. The first edition was published in 1990 with the intention of bridging the gap between investigators of basic cardiac electrophysiology and clinicians treating cardiac arrhythmias. At that time, the book had 109 chapters, 221 authors, and 1034 pages. The current edition has 120 chapters, 245 authors, and 1144 pages. It is interesting to note that only 48 (22%) of the authors from the first edition survived to the fourth (I am one of the 78% who did not). This illustrates that in cardiology not only does 50% of our knowledge change every 5 years but so do the people involved in these changes.


Circulation **2004**,
110 (17-26.10.): e453




**Hein J. Wellens (1935-2020)**
Wellensova kritéria kritické stenózy LAD

***„V kardiologii (… i v medicíně) se 50 % našich znalostí mění každých 5 let.“*** H. J. Wellens

Publikace, které **opravdu** ovlivnily moji praxi

# Je EBM „readable“ = čitelná?

palátabilní strava, lék = chutný, stravitelný, požívatelný

Circulation 2022;146:00–00. DOI: 10.1161/CIR.0000000000001095

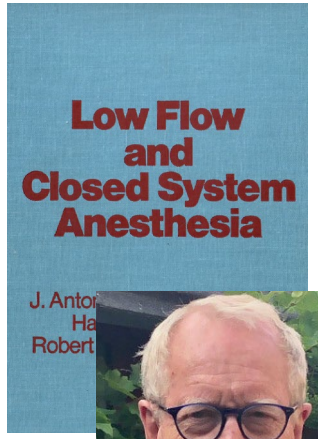
**3.11.2022**

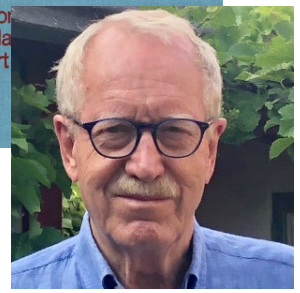
**75 stran!**

**ILCOR SUMMARY STATEMENT**

## 2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces

**Tak které studie**
**OPRAVDU**
**ovlivnily tvou praxi?**



Ola Stenqvist
Sahlgrenska, Göteborg

Jan Jakobsson
Karolinska Inst.
Danderyd

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The online version of this article is located at http://www.minervamedica.it
Minerva Anestesiologica 2016 February;82 (2):180-5

ORIGINAL ARTICLE

# Desflurane and sevoflurane use during low- and minimal-flow anesthesia at fixed vaporizer settings

Maria HORWITZ, Jan G. JAKOBSSON *

- 50 pacientů ASA 1-2 20-65 let k laparoskopii
- i. v. úvod propofol 2,5 mg/kg, remifnt 0,5 ug/kg/min, intubace po 3 min. preoxygenace, rocuronium
- nasycovací fáze:
  - **0,5 – 1/min l FGF ($FiO_2$ 0,5)**
  - sevofluran 6 % (3 x MAC)
  - doba do dosažení 1 MAC s FGF 1 l/min: 6,2 ± 1,3 min
    s FGF 0,5 l/min: 15,2 ± 2,4 min

...a v monitorování?

Special Communications

# Standards for Patient Monitoring During Anesthesia at Harvard Medical School

John H. Eichhorn, MD; Jeffrey B. Cooper, PhD; David J. Cullen, MD; Ward R. Maier, MD; James H. Philip, MD; Robert G. Seeman, MD

JAMA. 1986 Aug 22-29;256(8):1017-20.

**John H. Eichhorn**

Department of Anaesthesia
Harvard Medical School

Standards of Practice—I
Minimal Monitoring
Adopted March 25, 1985
Revised July 3, 1985

These standards apply for any administration of anesthesia involving department of anaesthesia personnel and are specifically referable to preplanned anesthetics administered in designated anesthetizing locations (specific exclusion: administration of epidural analgesia for labor or pain management). In emergency circumstances in any location, immediate life support measures of whatever appropriate nature come first with attention turning to the measures described in these standards as soon as possible and practical. These are minimal standards that may be exceeded at any time based on the judgment of the involved anesthesia personnel. These standards encourage high-quality patient care, but observing them cannot guarantee any specific patient outcome. These standards are subject to revision from time to time, as warranted by the evolution of technology and practice.

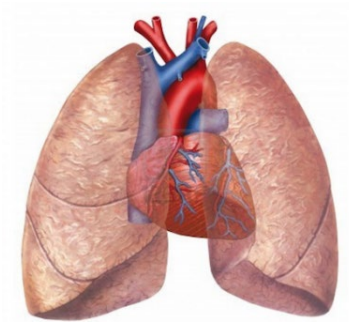
- **Anesthesiologist's or Nurse Anesthetist's Presence in Operating Room**
  For all anesthetics initiated by or involving a member of the department of anaesthesia, an attending or resident anesthesiologist or nurse anesthetist shall be present in the room throughout the conduct of all general anesthetics, regional anesthetics, and monitored intravenous anesthetics. An exception is made when there is a direct known hazard, eg, radiation, to the anesthesiologist or nurse anesthetist, in which case some provision for monitoring the patient must be made.
- **Blood Pressure and Heart Rate**
  Every patient receiving general anesthesia, regional anesthesia, or managed intravenous anesthesia shall have arterial blood pressure and heart rate measured at least every five minutes, where not clinically impractical.*
- **Electrocardiogram**
  Every patient shall have the electrocardiogram continuously displayed from the induction or institution of anesthesia until preparing to leave the anesthetizing location, where not clinically impractical.*
- **Continuous Monitoring**
  During every administration of general anesthesia, the anesthetist shall employ methods of continuously monitoring the patient's ventilation and circulation. The methods shall include, for ventilation and circulation each, at least one of the following or the equivalent†:
  *For Ventilation.*—Palpation or observation of the reservoir breathing bag, auscultation of breath sounds, monitoring of respiratory gases such as end-tidal carbon dioxide, or monitoring of expiratory gas flow. Monitoring end-tidal carbon dioxide is an emerging standard and is strongly preferred.
  *For Circulation.*—Palpation of a pulse, auscultation of heart sounds, monitoring of a tracing of intra-arterial pressure, pulse plethysmography/oximetry, or ultrasound peripheral pulse monitoring.
  It is recognized that brief interruptions of the continuous monitoring may be unavoidable.
- **Breathing System Disconnection Monitoring**
  When ventilation is controlled by an automatic mechanical ventilator, there shall be in continuous use a device that is capable of detecting disconnection of any component of the breathing system. The device must give an audible signal when its alarm threshold is exceeded. (It is recognized that there are certain rare or unusual circumstances in which such a device may fail to detect a disconnection.)
- **Oxygen Analyzer**
  During every administration of general anesthesia using an anesthesia machine, the concentration of oxygen in the patient breathing system will be measured by a functioning oxygen analyzer with a low concentration limit alarm in use. This device must conform to the American National Standards Institute No. Z.79.10 standard.*
- **Ability to Measure Temperature**
  During every administration of general anesthesia, there shall be readily available a means to measure the patient's temperature.
  *Rationale.*—A means of temperature measurement must be available as a potential aid in the diagnosis and treatment of suspected or actual intraoperative hypothermia and malignant hyperthermia. The measurement/monitoring of temperature during *every* general anesthetic is not specifically mandated because of the potential risks of such monitoring and because of the likelihood of other physical signs giving earlier indication of the development of malignant hyperthermia.

# Sledování a monitorování

- Harvardské minimální zásady bezpečnosti v anestezii 1969, 1986
- **Doporučený postup ČSARIM Zásady bezpečné anesteziologické péče 2017**

3.3.2
V průběhu anestezie jsou monitorovány (kontinuálně nebo v pravidelných přiměřených intervalech podle povahy operačního či diagnostického výkonu, sledovaného parametru a stavu pacienta) následující základní ukazatele:

a) EKG,
b) srdeční frekvence,
c) krevní tlak (neinvazivní metoda),
d) saturace hemoglobinu kyslíkem metodou pulzní oxymetrie,
e) dechová frekvence spontánně dýchajících pacientů,
f) nastavení ventilátoru,
g) tělesná teplota (u novorozenců a kojenců vždy, u dospělých a dětí u výkonů s předpokladem doby trvání nad 30 minut),
h) kapnometrie (u všech výkonů, kde jsou zajištěny dýchací cesty tracheální intubací/tracheostomií, laryngeální maskou nebo jinou supraglotickou pomůckou)
i) hloubka nervosvalové blokády (NSB) u všech výkonů s použitím nedepolarizujících svalových relaxancií.




*British Journal of Anaesthesia* 99 (4): 532–7 (2007)
doi:10.1093/bja/aem198 Advance Access publication July 24 2007

BJA

NEUROSCIENCES AND NEUROANAESTHESIA

# Can anaesthetists be taught to interpret the effects of general anaesthesia on the electroencephalogram? Comparison of performance with the BIS and spectral entropy

J. P. Barnard, C. Bennett, L. J. Voss* and J. W. Sleigh

J.W.Sleigh

**Conclusion.** A brief PowerPoint presentation enables anaesthetists to recognize the effects on the EEG of GABA-ergic anaesthetic agents. In the clinical context, it remains likely that the combination of a pEEG monitor that clearly presents the EEG and a clinician who has a good, basic understanding of, and a willingness to look at, the raw EEG will result in more accurate interpretation of the intra-operative EEG.

ARTICLE IN PRESS

BJA

British Journal of Anaesthesia, xxx (xxx): xxx (xxxx)

doi: 10.1016/j.bja.2022.01.006
Advance Access Publication Date: xxx
Review Article

2022 Feb 16;S0007-0912(22)00014-9. doi: 10.1016/j.bja.2022.01.006.

REVIEW ARTICLE

# Processed electroencephalography-guided general anaesthesia to reduce postoperative delirium: a systematic review and meta-analysis

Matthew Sumner[1], Carolyn Deng[1], Lis Evered[2,3,4], Chris Frampton[5], Kate Leslie[4,6,7], Timothy Short[1,8] and Doug Campbell[1,8,*]

Results: Nine studies, which included 4648 eligible subjects, were identified. The incidence of POD in the pEEG-guided general anaesthesia or lighter pEEG target group was 19.0% (440/2310) compared with 23.3% (545/2338) in the usual care or deeper pEEG target group (pooled odds ratio=0.78; 95% confidence interval, 0.60–1.00; $P$=0.054). Significant heterogeneity was detected ($I^2$=53%).

Conclusions: Our primary analysis demonstrated a highly sensitive result with a pooled analysis of trials in which the intervention group adhered to manufacturer's recommended guidelines showing reduced incidence of POD with pEEG guidance. High clinical heterogeneity limits the inferences from this and any future meta-analyses.

Clinical trial registration: CRD42020199404 (PROSPERO).

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Prof. Archibald Leman Cochrane 1909-1988

Cochrane Database of Systematic Reviews | Review - Intervention

New search

# Pulse oximetry for perioperative monitoring 2014

Tom Pedersen, Amanda Nicholson, Karen Hovhannisyan, Ann Merete Møller, Andrew F Smith, Sharon R Lewis
Authors' declarations of interest

Version published: 17 March 2014 Version history
https://doi.org/10.1002/14651858.CD002013.pub3

## Authors' conclusions

5 studies in which a total of 22,992 participants

These studies confirmed that pulse oximetry can detect hypoxaemia and related events. However, we found no evidence that pulse oximetry affects the outcome of anaesthesia for patients. The conflicting subjective and objective study results, despite an intense methodical collection of data from a relatively large general surgery population, indicate that the value of perioperative monitoring with pulse oximetry is questionable in relation to improved reliable outcomes, effectiveness and efficiency. Routine continuous pulse oximetry monitoring did not reduce transfer to the ICU and did not decrease mortality, and it is unclear whether any real benefit was derived from the application of this technology for patients recovering from cardiothoracic surgery in a general care area.

## Plain language summary

at random to be monitored or not monitored with a pulse oximeter. These studies were not similar enough for their results to be combined statistically. Study results showed that although pulse oximetry can detect a deficiency of oxygen in the blood, its use does not affect a person's cognitive function and does not reduce the risk of complications or of dying after anaesthesia. These studies were large enough to show a reduction in complications, and care was taken to ensure that outcomes were assessed in the same way in both groups. The studies were conducted in developed countries, where standards of anaesthesia and nursing care are high. It is possible that pulse oximetry may have a greater impact on outcomes in other geographical areas with less comprehensive provision of health care.

**1991**



Can J Anaesth. 1991 Jul;38(5):619-25.
doi: 10.1007/BF03008199.

# Review Article

# Capnometry and anaesthesia

K. Bhavani-Shankar MD, H. Moseley FFARCS,
A.Y. Kumar MD, Y. Delph DA

**Contents**



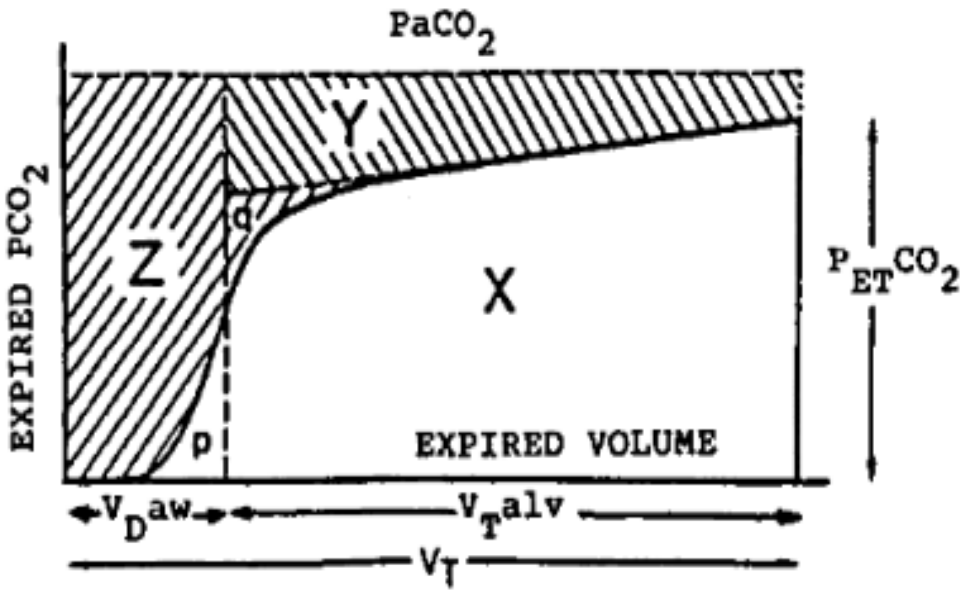



FIGURE 3 Physiological dead space and its subdivisions (modified with permission from author reference 31).

# Proč jsou oxymetrie a kapnometrie tak důležité?

**protože** nové studie využívají

- elektronické záznamy o anestezii
- velké počty pacientů

a prokazují, že…

Br J Anaesth. **2022 Sep 30**:S0007-0912(22)00501-3. doi: 10.1016/j.bja.2022.08.032.

CLINICAL INVESTIGATION

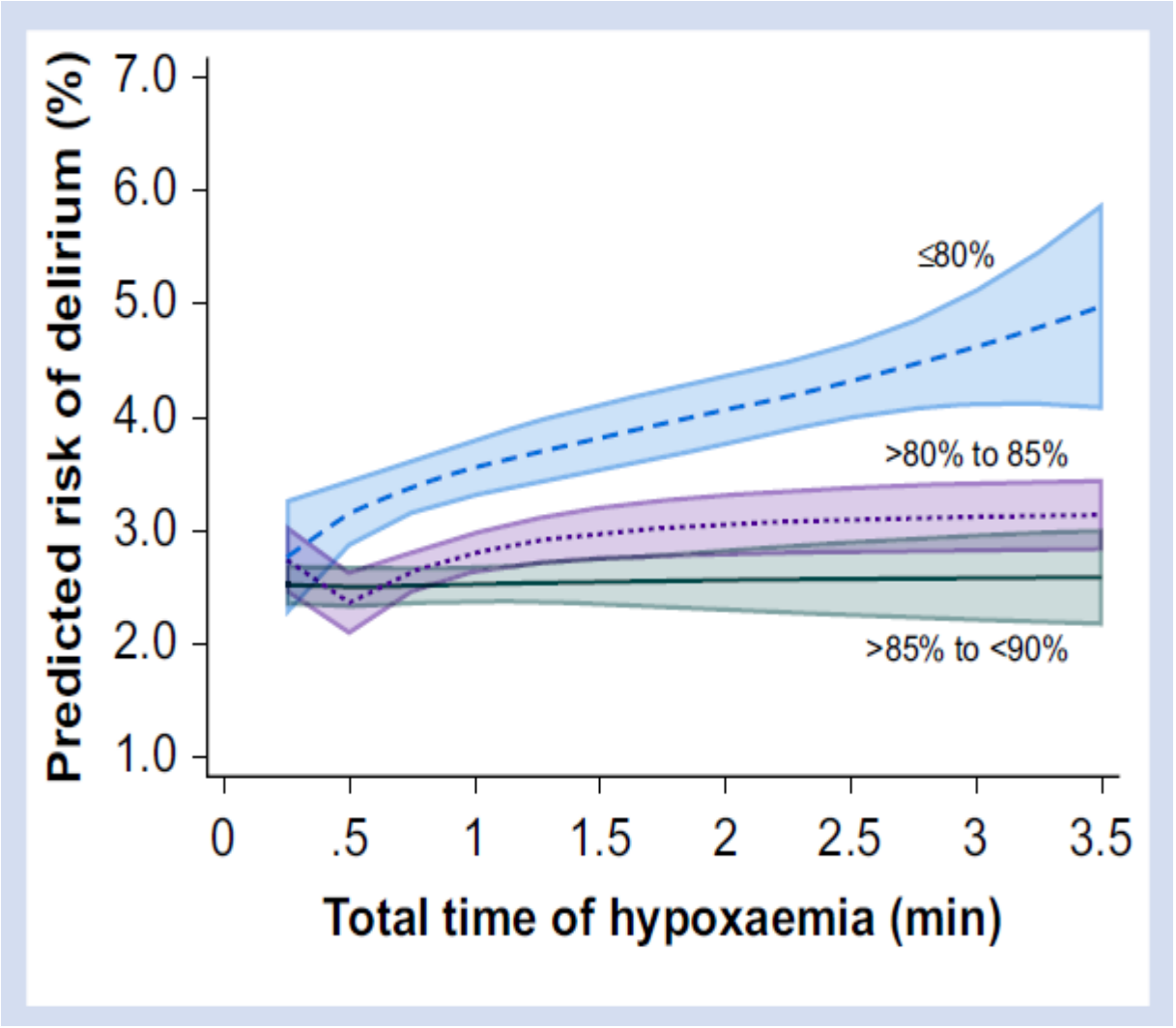
ARTICLE IN PRESS

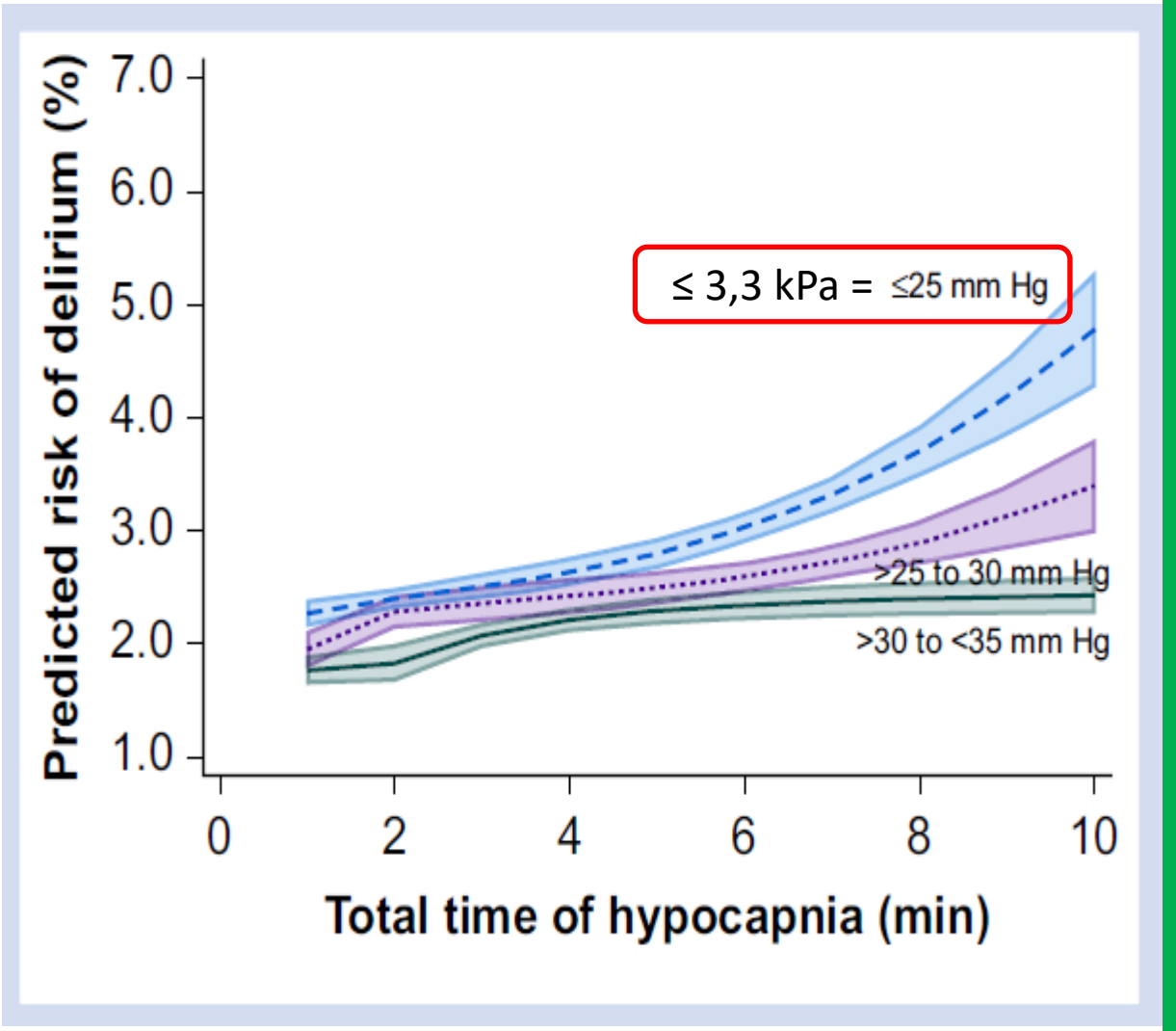
# Dose-dependent relationship between intra-procedural hypoxaemia or hypocapnia and postoperative delirium in older patients

Elena Ahrens[1,2], Tim M. Tartler[1,2], Aiman Suleiman[1,2,3], Luca J. Wachtendorf[1,2,4], Haobo Ma[1], Guanqing Chen[1,2], Samir M. Kendale[1], Peter Kienbaum[5], Balachundhar Subramaniam[1,6], Soeren Wagner[1,7,8] and Maximilian S. Schaefer[1,2,5,*]

- 71 717 pacientů ≥ 60 let, delirium do 7 dnů podle CAM-ICU
- hypoxemie = <90% po > 2 souvislé min: 3,5 %, POD 6 % x 2,2 %
- hypokapnie: $ETCO_2$ ≤ 3,3 kPa (25 mm Hg) po > 5 souvislých min: 1,2 %, POD 13,9 % x 2,2 %

Conclusions: Intra-procedural hypoxaemia and hypocapnia were dose-dependently associated with a higher risk of postoperative delirium. These findings support maintaining normal gas exchange to avoid postoperative neurological disorders.




Ahrens E et al.: Dose-dependent relationship between intra-procedural hypoxaemia or hypocapnia and postoperative delirium in older patients.
Br J Anaesth. **2022 Sep 30**:S0007-0912(22)00501-3. doi: 10.1016/j.bja.2022.08.032.

# Hypotenze

- 140 různých definic
- spojena s negativními důsledky
- měřit!

Thomas W. Scheeren

*British Journal of Anaesthesia*, 129 (4): 464–46
doi: 10.1016/j.bja.2022.07.018
Advance Access Publication Date: 3 Septem


**'If you don't take a temp … r': relevance to continuous arterial pres:**

Felix van Lier[1], R. Arthur Bouwman[2,3] and Thomas W. L. Scheeren[4,*]

- léčit!

**Yes You Can—Cautiously—Infuse Norepinephrine Intraoperatively Through a Peripheral Intravenous Catheter**

Anesth Analg. 2020 Oct;131(4):1057-1059.

**1 mg do 50 ml**

Tjorvi E. Perry, MD, MMSc, and Richard C. Prielipp, MD, MBA, FCCM

See Article, p 1060

ANESTHESIOLOGY

# Carbon Dioxide, Blood Pressure, and Perioperative Stroke: A Retrospective Case–Control Study

Phillip E. Vlisides, M.D., Graciela Mentz, Ph.D., Aleda M. Leis, M.S., Douglas Colquhoun, M.B.Ch.B., M.Sc., M.P.H., Jonathon McBride, M.S., Bhiken I. Naik, M.B.B.Ch., M.S.C.R., Lauren K. Dunn, M.D., Ph.D., Michael F. Aziz, M.D., Kamila Vagnerova, M.D., Clint Christensen, M.D., Nathan L. Pace, M.D., M.Stat., Jeffrey Horn, M.D., Kenneth Cummings III, M.D., Jacek Cywinski, M.D., Annemarie Akkermans, M.D., Sachin Kheterpal, M.D., Laurel E. Moore, M.D., George A. Mashour, M.D., Ph.D.

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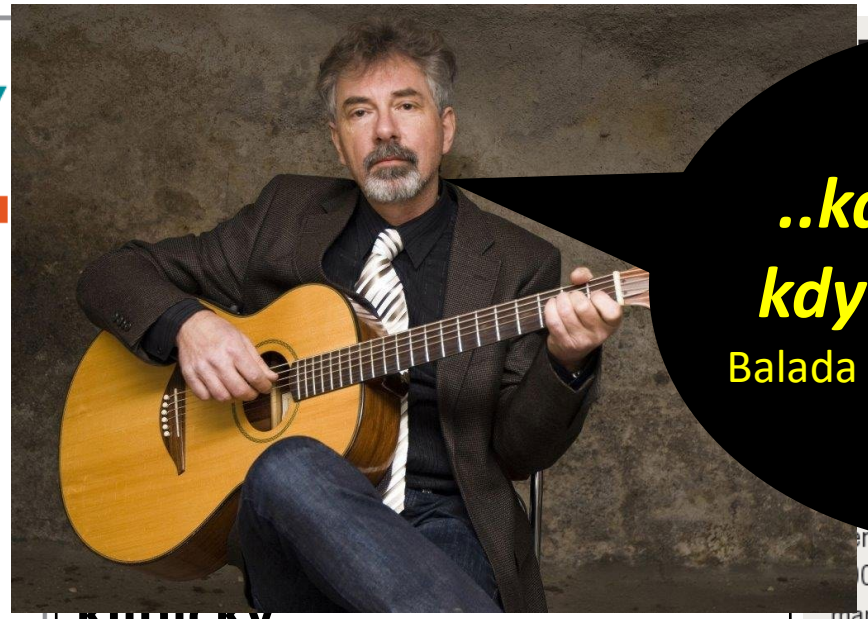

**..kde jsou oni, kdy my budem?**

Balada československá 1989

**Klinicky:**

- 3% high-risk noncardiac surgery

**MRI:**

- 7% older patients after noncardiac surgery

## EDITOR'S PERSPECTIVE

### What We Already Know about This Topic

- There is a high incidence of perioperative stroke in some patients
- Hypotension may lead to cerebral ischemia, and the impact on cerebral perfusion may be greater in the setting of hypercapnia or hypocapnia

### What This Article Tells Us That Is New

- In a case–control study using the Multicenter Perioperative Outcomes Group data, hypocarbia, hypercarbia, and hypotension were each independently associated with postoperative stroke

...en intraoperative physiology ...derstood. Preliminary data ...pled with reduced cere- ... can lead to ischemia. ...bination of intraopera- ...bia is associated with ...

...e, case–control study *via* ...nes Group. Noncardiac, non- ...lar surgical cases (18 yr or older) ...re ... major academic centers between January ...04 and December 2015. Ischemic stroke cases were identified *via* manual chart review and matched to controls (1:4). Time and reduction below key mean arterial blood pressure thresholds (less than 55 mmHg, less than 60 mmHg, less than 65 mmHg) and outside of specific end-tidal carbon dioxide thresholds (30 mmHg or less, 35 mmHg or less, 45 mmHg or greater) were calculated based on total area under the curve. The association between stroke and total area under the curve values was then tested while adjusting for relevant confounders.

**Results:** In total, 1,244,881 cases were analyzed. Among the cases that screened positive for stroke (n = 1,702), 126 were confirmed and successfully matched with 500 corresponding controls. Total area under the curve was significantly associated with stroke for all thresholds tested, with the strongest combination observed with mean arterial pressure less than 55 mmHg (adjusted odds ratio per 10 mmHg-min, 1.17 [95% CI, 1.10 to 1.23], $P < 0.0001$) and end-tidal carbon dioxide 45 mmHg or greater (adjusted odds ratio per 10 mmHg-min, 1.11 [95% CI, 1.10 to 1.11], $P < 0.0001$). There was no interaction effect observed between blood pressure and carbon dioxide.

**Conclusions:** Intraoperative hypotension and carbon dioxide dysregulation may each independently increase postoperative stroke risk.

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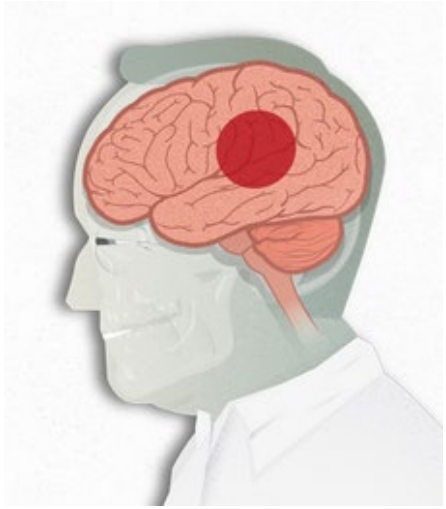

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## ABSTRACT

**Background:** The relationship between intraoperative physiology and postoperative stroke is incompletely understood. Preliminary data suggest that either hypo- or hypercapnia coupled with reduced cerebrovascular inflow (*e.g.*, due to hypotension) can lead to ischemia. This study tested the hypothesis that the combination of intraoperative hypotension and either hypo- or hypercarbia is associated with postoperative ischemic stroke.

**Methods:** We conducted a retrospective, case–control study *via* the Multicenter Perioperative Outcomes Group. Noncardiac, nonintracranial, and nonmajor vascular surgical cases (18 yr or older) were extracted from five major academic centers between January 2004 and December 2015. Ischemic stroke cases were identified *via* manual chart review and matched to controls (1:4). Time and reduction below key mean arterial blood pressure thresholds (less than 55 mmHg, less than 60 mmHg, less than 65 mmHg) and outside of specific end-tidal carbon dioxide thresholds (30 mmHg or less, 35 mmHg or less, 45 mmHg or greater) were calculated based on total area under the curve. The association between stroke and total area under the curve values was then tested while adjusting for relevant confounders.

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**Conclusions:** Intraoperative hypotension and carbon dioxide dysregulation may each independently increase postoperative stroke risk.

# Závěr: 3 P

- **p**recizní
- **p**hysiologická
- **p**ersonalizovaná anestezie

- ***„K tomu mi dopomáhej monitorace“***

- *„K tomu ať mi dopomáhá bůh“*
  *z přísahy amerických prezidentů od dob George Washingtona*