INSTITUT FÜR ANÄSTHESIOLOGIE UND SCHMERZTHERAPIE

Symposium
Stellenwert der inhalativen Anästhetika

Dienstag, 4. Februar 2014
16.15–20.00 Uhr
Kantonsspital Winterthur, Aula U1

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Liebe Kolleginnen, liebe Kollegen

Ist die Narkose mit inhalativen Anästhetika veraltet? Man hätte es lange Zeit meinen können, stellt doch Propofol eine sehr verlockende Alternative dazu dar. Aber auch hier gilt: Totgeglaubte leben länger, und dies mit gutem Grund! Die aktuelle Forschung beleuchtet vorteilhafte Eigenschaften der inhalativen Anästhetika, die deren Aufschwung mehr als rechtfertigen.

Wir freuen uns, Sie zu diesem Thema in Winterthur begrüssen zu dürfen, und sind überzeugt, mit Ihnen und den Referenten in eine spannende nächste Runde «Anästhesiesymposien Winterthur» starten zu können.

Herzliche Grüsse

Dr. med. Daniel Borer
Leitender Arzt
Institut für Anästhesiologie
und Schmerztherapie
Kantonsspital Winterthur

PD Dr. med. Michael Ganter
Direktor
Institut für Anästhesiologie
und Schmerztherapie
Kantonsspital Winterthur

Referentin und Referenten

Prof. Dr. med. Beatrice Beck-Schimmer
Leitende Ärztin Anästhesiologie
Universitätsspital Zürich

Prof. Dr. med. Manfred Seeberger
Leitender Arzt Anästhesiologie
Universitätsspital Basel

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Assistenzarzt Institut für Anästhesiologie und Schmerztherapie
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Dr. med. Daniel Button
Leitender Arzt Institut für Anästhesiologie und Schmerztherapie
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Moderation

Dr. med. Daniel Borer
Leitender Arzt Institut für Anästhesiologie und Schmerztherapie
Kantonsspital Winterthur

Symposium

Stellenwert der inhalativen Anästhetika

Datum	**Dienstag, 4. Februar 2014**
Ort	**Kantonsspital Winterthur, Aula U1**
Zeit	**16.15 bis 20.00 Uhr**

16.15–16.20 Uhr	**Eröffnung des Symposiums** PD Dr. med. Michael Ganter
16.20–17.05 Uhr	**Organprotektive Effekte von volatilen Anästhetika** Prof. Dr. med. Beatrice Beck-Schimmer
17.05–17.50 Uhr	**Inhalative Anästhetika auf der Intensivstation** Dr. med. Martin Urner
17.50–18.20 Uhr	**Pause mit Apéro**
18.20–19.05 Uhr	**Volatile vs. intravenöse Anästhesie bei nicht kardiochirurgischen Patienten** Prof. Dr. med. Manfred Seeberger
19.05–19.50 Uhr	**Propofol – die bessere Alternative?** Dr. med. Daniel Button
19.50–20.00 Uhr	**Diskussion**

Die Veranstaltung wird von der SGAR mit 3,5 Credits anerkannt.

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CH-8401 Winterthur
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www.ksw.ch

Save the Date

Symposien 2014
am Institut für Anästhesiologie und Schmerztherapie

Dienstag, 3. Juni 2014
Anästhesiologische Überlegungen bei Laparoskopie in Extrempositionen

Dienstag, 21. Oktober 2014
Kinderanästhesie

jeweils 16.15–20.00 Uhr

Kontakt

Institut für Anästhesiologie und Schmerztherapie

Organisation
Dr. med. Daniel Borer
Leitender Arzt

PD Dr. med. Michael Ganter
Direktor

Information und Anmeldung
Regina Broger
Chefsekretariat
Tel. 052 266 27 92

Anmeldung bis spätestens 2. Februar 2014 an anaesthesiologie@ksw.ch

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Propofol – die bessere Alternative?

Daniel Button, 4. Februar 2014

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Interessenkonflikte

Es bestehen (leider) keine monetären Beziehungen zwischen dem Vortragenden und der Industrie zu Inhalten aus diesem Referat

INHALT

- Propofol – volatiler als man denkt…
- TIVA oder TCI – wo ist die Evidenz
- Kostendruck – weniger Anästhesisten dank Propofol
- Propofol versus Inhalationsanästhetika – ein kritischer Blick in die Literatur
- Ist Propofol die bessere Alternative?

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INHALT

- **Propofol – volatiler als man denkt…**
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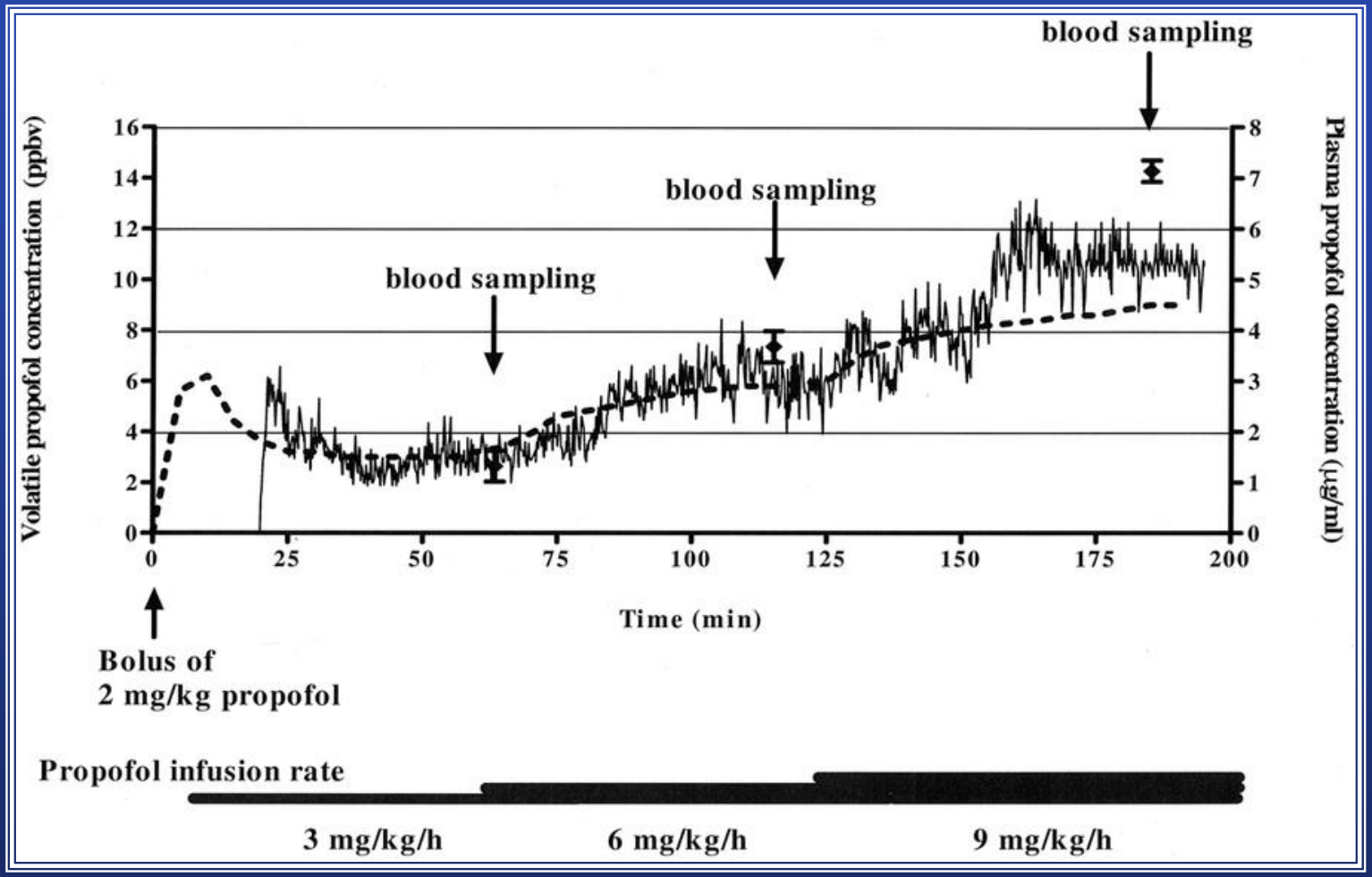

On-line monitoring of end-tidal propofol concentration in anesthetized patients.
Takita A et al. Anesthesiology. 2007 Apr;106(4):659-64.

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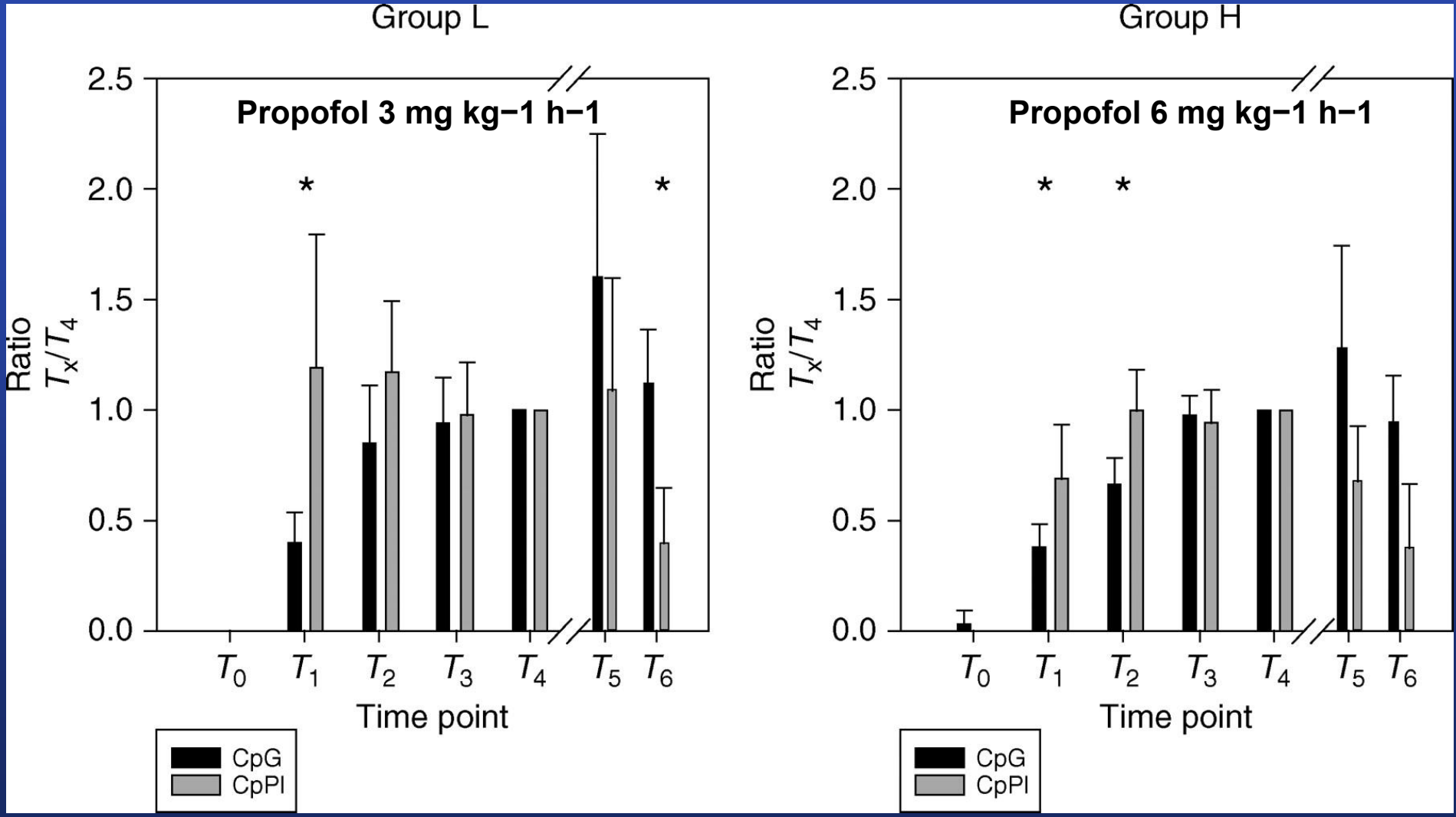

Grossherr M et al. Br. J. Anaesth. 2009;102:608-613

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CONCLUSIONS:

Propofol can be measured in exhaled gas from the beginning until the end of propofol anaesthesia. The different time courses of c(P)PL and c(P)G have to be considered when interpreting c(P)G.

⟶ **Arbeitsplatzkonzentration?**

Grossherr M et al. Br. J. Anaesth. 2009;102:608-613

A prospective controlled study to determine the blood propofol concentration in anesthesiologists exposed to propofol vapor in the expired gases of patients receiving propofol-based intravenous sedation.

Xiong M. J Clin Anesth. 2011 Nov;23(7):549-51

MAIN RESULTS:

„None of the anesthesiologists had detectable blood propofol concentration in either the pre-exposure or post-exposure sample. The positive control and the negative control had detectable and non-detectable blood propofol concentration, respectively“

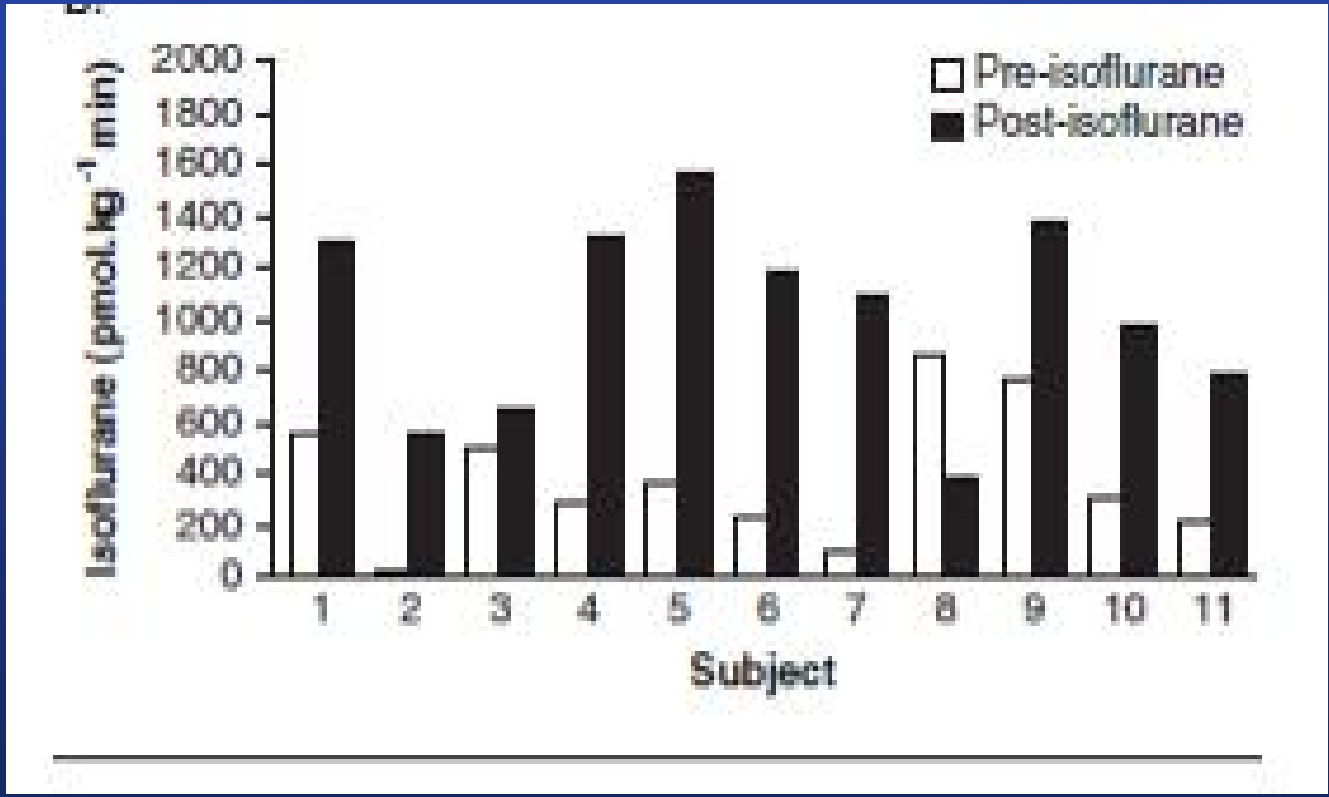
Occupational exposure to anaesthetic gases: a role for TIVA.
Irwin MG et al.; Expert Opin Drug Saf. 2009 Jul;8(4):473-83.

„Levels of inhalational anaesthetics in the ambient air of operating theatres and recovery rooms often exceed those stated in national guidelines.

Such contamination could be avoided with the use of total intravenous anaesthesia.“

Isofluran bei Wachsaalpflegepersonal

Irwin MG et al.; Expert Opin Drug Saf. 2009 Jul;8(4):473-83



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Kongenitale Anomalien nach Anästhesie-Gas-Exposition?

DESIGN:
Retrospektive Cohortenstudie 1990-2000 in Kanada

RESULTS:
15,317 live-borne children of 9,433 mothers, 1,079 had congenital anomalies (heart and integument)
Anomalies were associated with maternal exposure to halogenated gases (ORs: 1.49, 95% CI: 1.04-2.13) and nitrous oxide (ORs: 1.42, 95% CI: 1.05-1.94)
Gases most frequently associated with anomalies were halothane (predominantly used early in the study period), isoflurane, and sevoflurane (predominantly used later in the period).

CONCLUSIONS:
In this study, exposure and outcome was assessed objectively, certain congenital anomalies were associated with estimated anesthetic gas exposure.

Teschke K et al. Am J Ind Med. 2011 Feb;54(2):118-27.

INHALT

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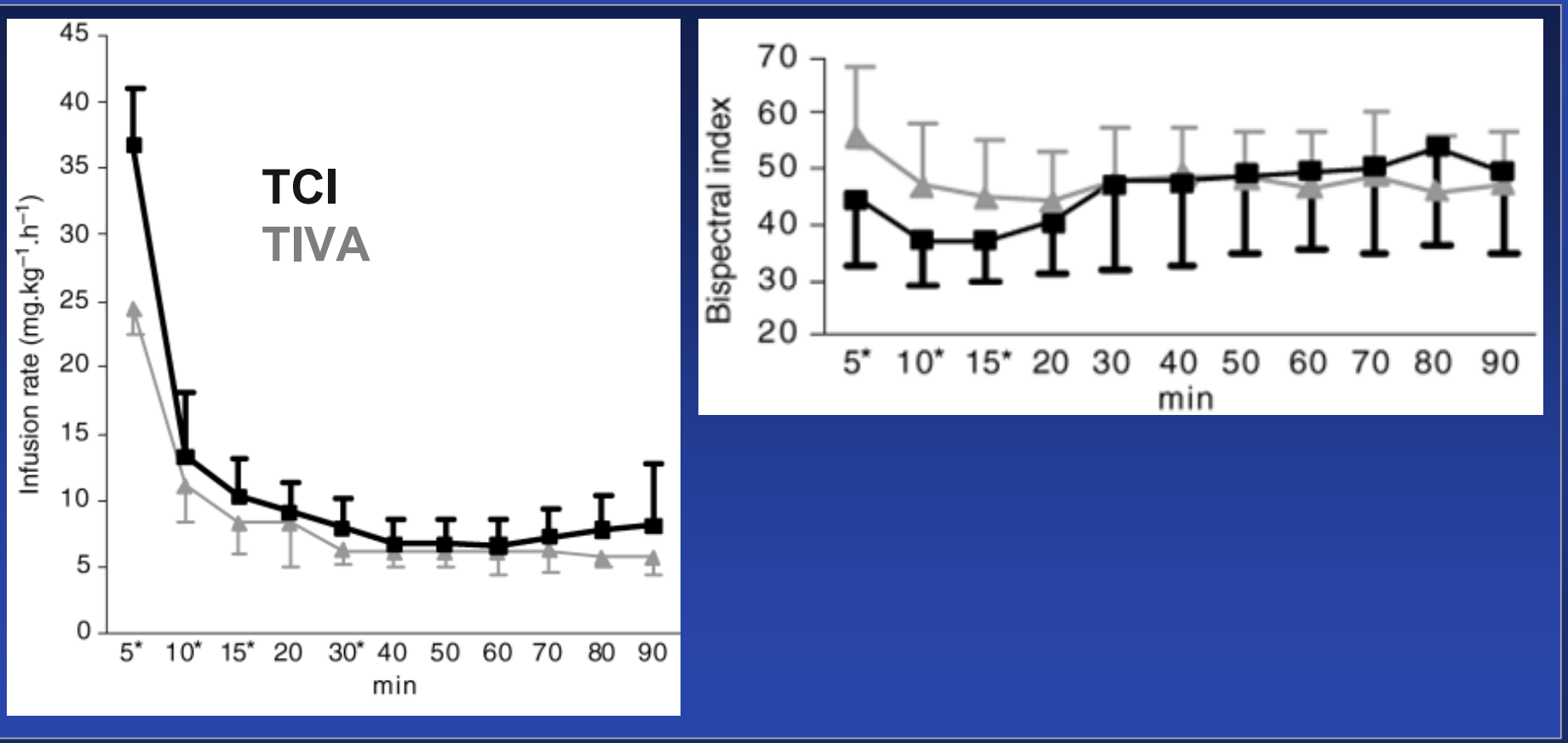
TIVA oder TCI spielt keine Rolle!

RICHTIG oder FALSCH?

Propofolbedarf



Breslin DS et al.; Anaesthesia 2004 Nov;59(11):1059-63.

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Use of a target-controlled infusion system for propofol does not improve subjective assessment of anaesthetic depth by inexperienced anaesthesiologists.
Rehberg B
Eur J Anaesthesiol. 2007 Nov;24(11):920-6. Epub 2007 Jun 22.

Prospektive randomisierte Studie
96 ASA I-III Patienten mit minor surgery
Blinde Aufzeichnung vom BIS

Identischer Verbrauch an Propofol
Signifikanter Unterschied in der Hypnose (Manuell deutlich «oberflächlichere» Narkoseführung gegenüber TCI)

Target-controlled infusion anesthesia with propofol and remifentanil compared with manually controlled infusion anesthesia in mastoidectomy surgeries.
Yeganeh N
Middle East J Anesthesiol. 2010 Oct;20(6):785-93.

The hemodynamic variability, recovery profile, postoperative nausea and vomiting (PONV), surgeons satisfaction were assessed

TCI is capable to induce and maintain anesthesia as well as MCI. Recovery profile and complication rate and surgeon's satisfactions are more acceptable in the TCI than in the MCI Group.

A comparison of target controlled versus manually controlled infusion of propofol in elderly patients.
Li M et al. Zhonghua Yi Xue Za Zhi. 2011 Mar 8;91(9):600-3.
[Article in Chinese]

Conclusion:
Although target infusion system is easy to use and requires less time of adjustment, it fails to show added benefit on propofol consumption, hemodynamic stability, anesthesia depth and recovery in elderly patients.

Induktionsdosis

Analysis 2.1. Comparison 2 Induction dose, Outcome 1 Target controlled infusion versus manually controlled infusion.

Review: Target-controlled infusion versus manually-controlled infusion of propofol for general anaesthesia or sedation in adults

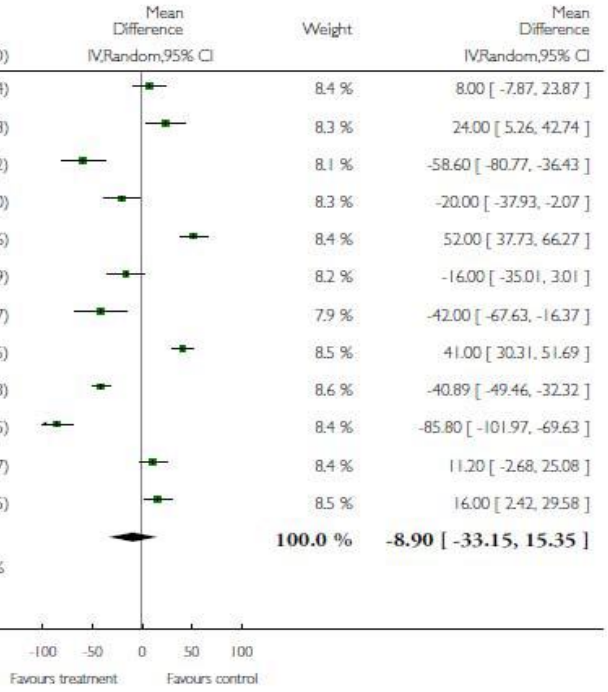
Comparison: 2 Induction dose

Outcome: 1 Target controlled infusion versus manually controlled infusion

Study or subgroup	TCI N	Mean(SD)	MCI N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Breslin 2001	25	118 (22)	25	110 (34)		8.4 %	8.00 [-7.87, 23.87]
Breslin 2004	25	131 (29)	25	107 (38)		8.3 %	24.00 [5.26, 42.74]
Gale 2001	20	94.4 (27.9)	20	153 (42.2)		8.1 %	-58.60 [-80.77, -36.43]
Hunt-Smith 1999	49	140 (50)	49	160 (40)		8.3 %	-20.00 [-37.93, -2.07]
Lugo-Goytia 2005	45	169 (33)	45	117 (36)		8.4 %	52.00 [37.73, 66.27]
Matsumoto 2000	10	42 (10)	10	58 (29)		8.2 %	-16.00 [-35.01, 3.01]
Passot 2002	27	127 (57)	27	169 (37)		7.9 %	-42.00 [-67.63, -16.37]
Russell 1995	79	201 (42.5)	80	160 (23.5)		8.5 %	41.00 [30.31, 51.69]
Servin 1998	283	117.01 (40.34)	279	157.9 (61.08)		8.6 %	-40.89 [-49.46, -32.32]
Struys 1997	31	84.2 (28.3)	29	170 (35)		8.4 %	-85.80 [-101.97, -69.63]
Struys 1997	31	84.2 (28.3)	30	73 (27)		8.4 %	11.20 [-2.68, 25.08]
Triem 2006	25	133 (24)	25	117 (25)		8.5 %	16.00 [2.42, 29.58]
Total (95% CI)	**650**		**644**			**100.0 %**	**-8.90 [-33.15, 15.35]**

Heterogeneity: $Tau^2 = 1762.98$; $Chi^2 = 356.23$, df = 11 ($P<0.00001$); $I^2 = 97\%$

Test for overall effect: $Z = 0.72$ ($P = 0.47$)



Leslie K et al.; Cochrane Database Syst Rev. 2008 Jul 16;(3):CD006059

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Analysis 4.1. Comparison 4 Recovery time, Outcome 1 Target controlled infusion versus manually controlled infusion.

Review: Target-controlled infusion versus manually-controlled infusion of propofol for general anaesthesia or sedation in adults

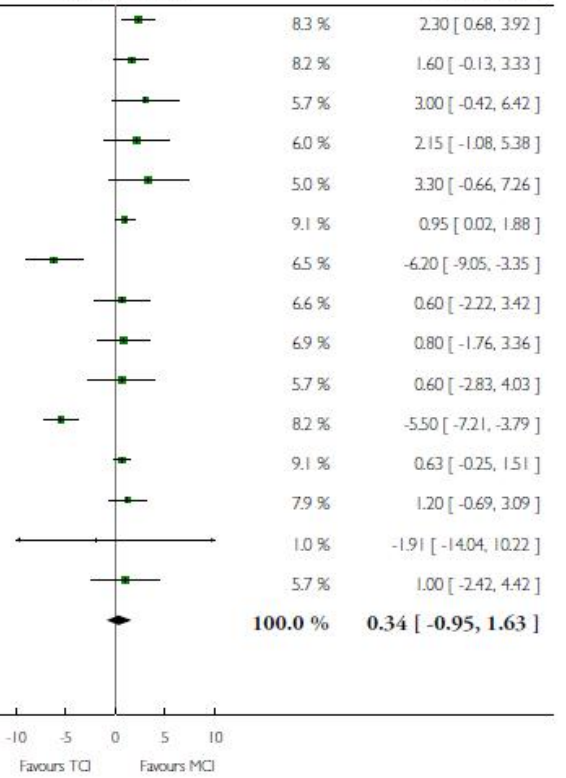
Comparison: 4 Recovery time

Outcome: 1 Target controlled infusion versus manually controlled infusion

Study or subgroup	TCI N	Mean(SD)	MCI N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Russell 1995	79	8.5 (6.49)	80	6.2 (3.48)		8.3 %	2.30 [0.68, 3.92]
Servin 1998	283	15.4 (10.7)	279	13.8 (10.2)		8.2 %	1.60 [-0.13, 3.33]
Hunt-Smith 1999	49	14 (10)	49	11 (7)		5.7 %	3.00 [-0.42, 6.42]
Gale 2001	20	11.35 (5.2)	20	9.2 (5.23)		6.0 %	2.15 [-1.08, 5.38]
Lehmann 2001	10	12.6 (5.4)	10	9.3 (3.4)		5.0 %	3.30 [-0.66, 7.26]
Struys 1997	31	6.23 (1.88)	29	5.28 (1.8)		9.1 %	0.95 [0.02, 1.88]
Passot 2002	27	4.6 (2)	27	10.8 (7.3)		6.5 %	-6.20 [-9.05, -3.35]
Lehmann 2002	20	11.5 (3.8)	20	10.9 (5.2)		6.6 %	0.60 [-2.22, 3.42]
Breslin 2004	25	10.3 (4.2)	25	9.5 (5)		6.9 %	0.80 [-1.76, 3.36]
Weninger 2004	17	8.2 (5.8)	17	7.6 (4.3)		5.7 %	0.60 [-2.83, 4.03]
Lugo-Goytia 2005	45	7.2 (2.7)	45	12.7 (5.2)		8.2 %	-5.50 [-7.21, -3.79]
Struys 1997	31	6.23 (1.88)	30	5.6 (1.6)		9.1 %	0.63 [-0.25, 1.51]
Breslin 2001	25	8.4 (3.2)	25	7.2 (3.6)		7.9 %	1.20 [-0.69, 3.09]
Passot 2005	18	17.55 (13.32)	16	19.46 (21.34)		1.0 %	-1.91 [-14.04, 10.22]
Velghe-Lenelle 1996	20	14 (6)	20	13 (5)		5.7 %	1.00 [-2.42, 4.42]
Total (95% CI)	**700**		**692**			**100.0 %**	**0.34 [-0.95, 1.63]**

Heterogeneity: $Tau^2 = 4.56$; $Chi^2 = 81.35$, df = 14 ($P<0.00001$); $I^2 = 83\%$

Test for overall effect: $Z = 0.52$ ($P = 0.61$)



Leslie K et al.; Cochrane Database Syst Rev. 2008 Jul 16;(3):CD006059

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Propofol Gesamtdosis

Study or subgroup	TCI N	Mean(SD)	MCI N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Breslin 2001	25	737 (287)	25	784 (260)		5.8 %	-47.00 [-198.80, 104.80]
Breslin 2004	25	962 (427)	25	791 (300)		4.8 %	171.00 [-33.56, 375.56]
Gale 2001	20	947 (530)	20	883 (495)		3.2 %	64.00 [-253.83, 381.83]
Hunt-Smith 1999	49	830 (410)	49	870 (470)		5.4 %	-40.00 [-214.63, 134.63]
Lehmann 2001	10	1011 (237)	10	584 (251)		4.7 %	427.00 [213.04, 640.96]
Lehmann 2002	20	943 (263)	20	609 (238)		5.7 %	334.00 [178.55, 489.45]
Lugo-Goytia 2005	45	1360 (412)	45	1368 (410)		5.5 %	-8.00 [-177.82, 161.82]
Matsumoto 2000	10	267 (48)	10	373 (116)		7.1 %	-106.00 [-183.81, -28.19]
Passot 2002	27	391 (165)	27	383 (186)		6.8 %	8.00 [-85.79, 101.79]

(. . . Continued)

Study or subgroup	TCI N	Mean(SD)	MCI N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
Passot 2005	18	532 (314)	16	289 (88)		5.8 %	243.00 [91.67, 394.33]
Russell 1995	79	732 (315)	80	516 (199)		7.0 %	216.00 [133.98, 298.02]
Servin 1998	283	1178 (754.6)	279	1017 (648.8)		6.5 %	161.00 [44.70, 277.30]
Struys 1997	31	1017 (230)	30	892 (100)		6.9 %	125.00 [36.48, 213.52]
Struys 1997	31	1017 (230)	29	1030 (141)		6.8 %	-13.00 [-108.86, 82.86]
Triem 2006	25	816 (114)	25	915 (205)		6.9 %	-99.00 [-190.95, -7.05]
Velghe-Lenelle 1996	20	889 (485)	20	765 (410)		3.7 %	124.00 [-154.33, 402.33]
Weninger 2004	17	885 (72)	17	675 (55)		7.5 %	210.00 [166.93, 253.07]
Total (95% CI)	**735**		**727**			**100.0 %**	**98.06 [24.04, 172.09]**

Heterogeneity: Tau^2 = 18586.48; Chi^2 = 116.88, df = 16 (P<0.00001); I^2 =86%

Test for overall effect: Z = 2.60 (P = 0.0094)

Leslie K et al.; Cochrane **Database** Syst Rev. 2008 Jul 16;(3):CD006059

Target-controlled infusion versus manually-controlled infusion of propofol for general anaesthesia or sedation in adults.
Leslie K et al.; Cochrane Database Syst Rev. 2008 Jul 16;(3):CD006059.

OBJECTIVES:
To assess whether TCI of propofol is as effective as MCI of propofol with respect to quality of anaesthesia or sedation, adverse events and propofol drug cost.

MAIN RESULTS:
Twenty trials of **poor quality** that involved 1759 patients were included.

TCI was associated with higher total doses of propofol than was MCI resulting in marginally higher propofol drug costs. (?)

However, fewer interventions were required by the anaesthetist during the use of TCI compared with MCI. **No clinically significant differences were demonstrated in terms of quality of anaesthesia or adverse events.**

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Target-controlled infusion versus manually-controlled infusion of propofol for general anaesthesia or sedation in adults.
Leslie K et al.; Cochrane Database Syst Rev. 2008 Jul 16;(3):CD006059.

Einziger systematischer Review!

CONCLUSION:

“This systematic review does not provide sufficient evidence for us to make firm recommendations about the use of TCI versus MCI in clinical anaesthetic practice.”

TIVA oder TCI spielt keine Rolle!

RICHTIG!

INHALT

- Propofol – volatiler als man denkt…
- TIVA oder TCI – wo ist die Evidenz
- **Kostendruck – weniger Anästhesisten dank Propofol**
- Propofol versus Inhalationsanästhetika – ein kritischer Blick in die Literatur
- Ist Propofol die bessere Alternative?

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The SEDASYS® System is the first Computer-Assisted Personalized Sedation (CAPS) system. It is designed to enable physician-led teams to administer minimal-to-moderate propofol sedation by integrating comprehensive patient monitoring and drug delivery personalized to the needs of each patient. The System minimizes the risks associated with oversedation by continually detecting and responding to patient vital signs.

Contact us by clicking below.
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For more information now:
1-800-SEDASYS (1-800-733-2797)
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The SEDASYS® System is indicated for the intravenous administration of 1% (10 mg/mL) propofol injectable emulsion for the initiation and maintenance of minimal-to-moderate sedation, as defined by the American Society of Anesthesiologists (ASA) Continuum of Depth of Sedation, in ASA physical status I and II patients ≥18 years old undergoing colonoscopy and esophagogastroduodenoscopy (EGD) procedures.

In introducing this first-of-its-kind technology, the SEDASYS® System will only be offered to facilities where an anesthesia professional is immediately available to the user for assistance or consultation as needed. In addition to receiving device-specific training, the member of the physician-led team who is administering sedation must have training in the management of cardiorespiratory effects of propofol when administered using computer-assisted personalized sedation systems including: pharmacology of propofol, identification of high risk patients, recognition of progression of levels of sedation and actions necessary to return a patient to intended levels of sedation, use of

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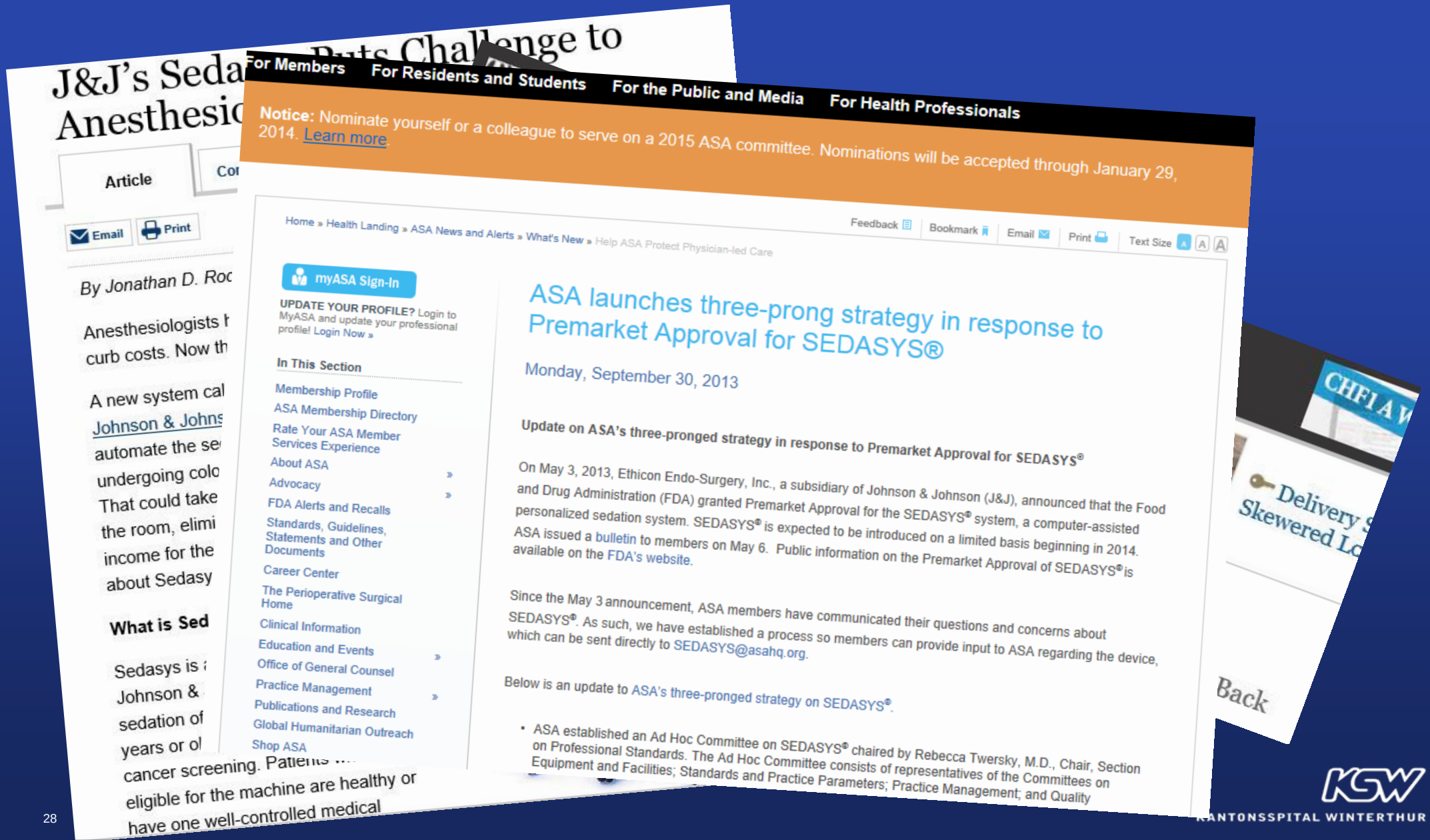
SEDASYS Propofol Sedation System

Ethicon Endo-Surgery, a **Johnson & Johnson** company, announced that the FDA granted PMA approval for its SEDASYS device, the first computer-assisted personalized sedation (CAPS) system for use by clinicians in the endoscopy suites.

In other words, the system aims to replace anesthesiologists and CRNAs with computerized technology to administer propofol and to monitor minimal-to-moderate sedation in patients undergoing upper and lower endoscopies.



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ASA launches three-prong strategy in response to Premarket Approval for SEDASYS®
Monday, September 30, 2013
Update on ASA's three-pronged strategy in response to Premarket Approval for SEDASYS®
On May 3, 2013, Ethicon Endo-Surgery, Inc., a subsidiary of Johnson & Johnson (J&J), announced that the Food and Drug Administration (FDA) granted Premarket Approval for the SEDASYS® system, a computer-assisted personalized sedation system. SEDASYS® is expected to be introduced on a limited basis beginning in 2014. ASA issued a bulletin to members on May 6. Public information on the Premarket Approval of SEDASYS® is available on the FDA's website.
Since the May 3 announcement, ASA members have communicated their questions and concerns about SEDASYS®. As such, we have established a process so members can provide input to ASA regarding the device, which can be sent directly to SEDASYS@asahq.org.
Below is an update to ASA's three-pronged strategy on SEDASYS®.
• ASA established an Ad Hoc Committee on SEDASYS® chaired by Rebecca Twersky, M.D., Chair, Section on Professional Standards. The Ad Hoc Committee consists of representatives of the Committees on Equipment and Facilities; Standards and Practice Parameters; Practice Management; and Quality
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KSW
KANTONSSPITAL WINTERTHUR

U.S. Department of Health & Human Services

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SEARCH

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SEDASYS® Computer-Assisted Personalized Sedation System - P080009

This is a brief overview of information related to FDA's approval to market this product. See the links below to the Summary of Safety and Effectiveness Data (SSED) and product labeling for more complete information on this product, its indications for use, and the basis for FDA's approval.

Product Name: SEDASYS ® Computer-Assisted Personalized Sedation System
PMA Applicant: Ethicon Endo-Surgery, Inc.
Address: 4545 Creek Road, Mail Location #110, Cincinnati, Ohio 45242
Approval Date: May 3, 2013
Approval Letter: http://www.accessdata.fda.gov/ cdrh_docs/pdf8/p080009a.pdf

What is it? The SEDASYS System is a computer-assisted personalized sedation device that delivers the drug propofol for minimal-to-moderate sedation. The device provides comprehensive patient monitoring and limits the depth of sedation by adjusting drug delivery accordingly.

How does it work? The SEDASYS System is a computer-assisted device that administers the prescription drug propofol into the blood stream via intravenous IV infusion. The device can detect signs associated with oversedation and can automatically modify or stop infusion.

The four piece system includes:

- Bedside Monitoring Unit (BMU) designed to stay with the patient from before the procedure, through the procedure and post-procedure recovery.
- Procedure Room Unit (PRU) designed to stay in the procedure room and provides additional patient monitoring. It also contains the propofol infusion pump controller.
- Display monitors and connectors.
- Disposable devices for single patient use.

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Es geht ohne Anästhesisten!

....aber auch ohne Sedasys!!

Unsedated colonoscopy: patient characteristics and satisfaction in a community-based endoscopy unit.
Petrini JL et al.; Gastrointest Endosc. 2009 Mar;69(3 Pt 1):567-72.

2100 Patienten für elektive Kolonoskopie
576 verzichten « freiwillig » auf Sedation / Analgesie → 81.1% (470) beenden Prozedur ohne Medikation

„A total of 458 of the 470 unsedated patients (97.4%, 95% CI, 95.6%-98.5%) were satisfied with their comfort level during the procedure and **are willing to have their next colonoscopies without sedation.**“
Conclusions: Colonoscopy without sedation is feasible, effective, and well tolerated in a typical U. S. population.

INHALT

- Propofol – volatiler als man denkt…
- TIVA oder TCI – wo ist die Evidenz
- Kostendruck – weniger Anästhesisten dank Propofol
- **Propofol versus Inhalationsanästhetika – ein kritischer Blick in die Literatur**
- Ist Propofol die bessere Alternative?

KSW
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Sevofluran versus Propofol in Mammachirurgie bei Frauen

	TIVA (n=42)	Sevo (n=42)	p value
PONV	6 (14.3)	21 (50.0)	<0.001
Nausea	3 (7.1)	15 (35.7)	0.001
Vomiting	5 (11.9)	14 (33.3)	0.019
Required NSAID analgesic at PACU	4 (9.5)	3 (7.1)	0.697

All values are presented as the number (%) of occurrences, These data were analyzed using Pearson's Chi-square test, Abbreviations: PONV: Postoperative nausea and vomiting; NSAID: Nonsteroidal anti-inflammatory drug; PACU: Post-anesthetic care unit; TIVA group: Total intravenous anesthesia with propofol; SEVO group: Inhalational anesthesia with sevoflurane and propofol induction

Chen HP et al.; Biomed J. 2013 May-Jun;36(3):125-31.

Chen HP et al.; Biomed J. 2013 May-Jun;36(3):125-31.

Drug acquisition costs		NTD
Propofol 1% (20 ml)		57
Sevoflurane (250 ml)		4305
Fentanyl (10 ml)		98
Cisatracurium (5 ml)		92
Cost analysis	TIVA (*n*=42)	Sevo (*n*=42)
Cost of propofol (NTD) Including wastage	439±185	57
Cost of Sevoflurane (NTD)	-	567±197
Total cost (NTD)	648±185	850±197

CONCLUSION:

We observed that when compared with sevoflurane, propofol given for the maintenance of general anesthesia improves the postoperative patient well-being and reduces the incidence of PONV. Furthermore, total intravenous anesthesia with propofol resulted in significant cost reductions.

Target-controlled infusion (Propofol) versus inhaled anaesthetic (Sevoflurane) in patients undergoing shoulder arthroscopic surgery

Tantry TP et al.; Indian J Anaesth. 2013 Jan;57(1):35-40

AIM:

This study aimed to compare the efficacy and convenience of target controlled infusion (TCI) of propofol and inhalational agent sevoflurane in patients undergoing shoulder arthroscopic surgery after preliminary inter-scalene blockade.

Sichtverhältnisse für den Operateur?

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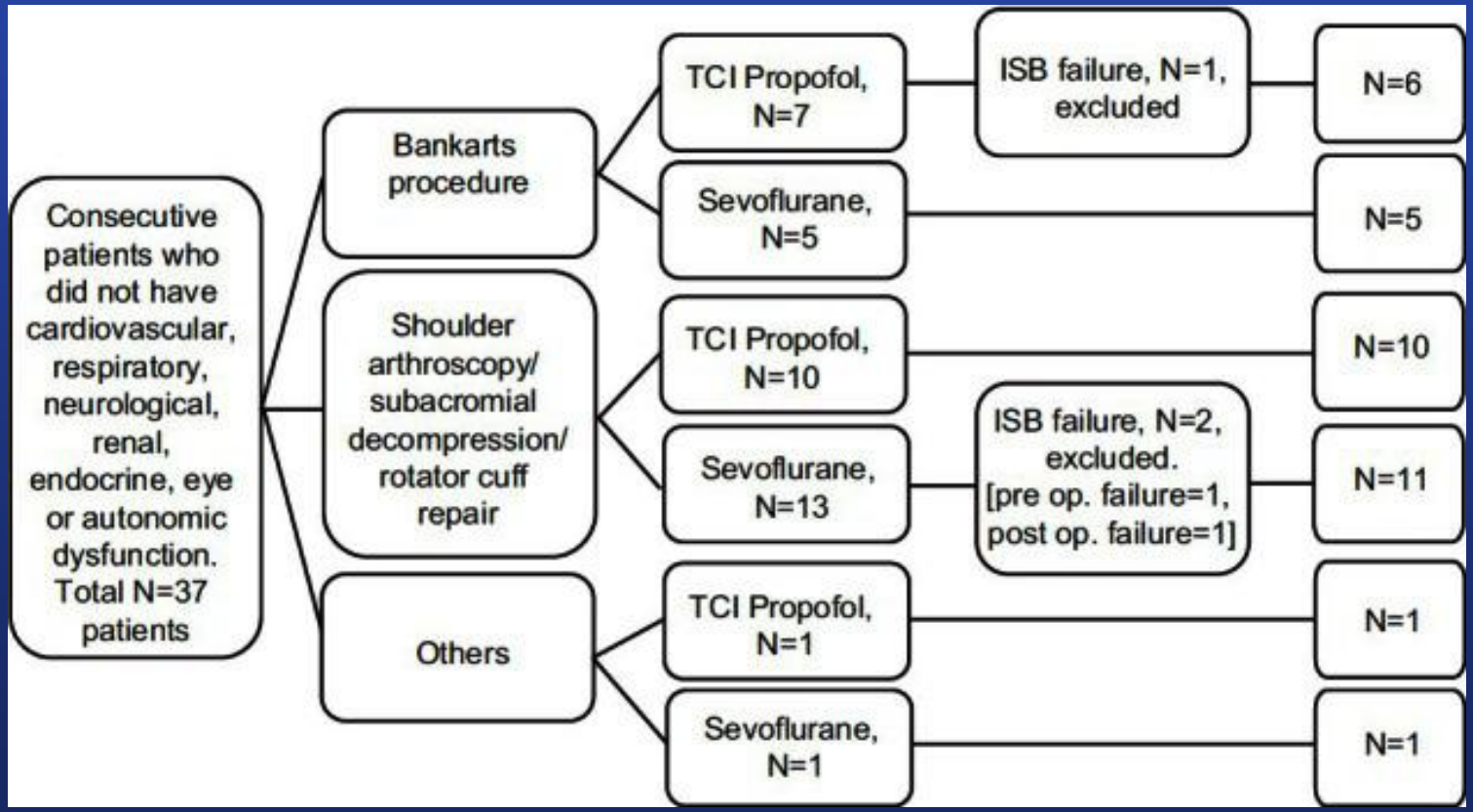
Target-controlled infusion (Propofol) versus inhaled anaesthetic (Sevoflurane) in patients undergoing shoulder arthroscopic surgery

Tantry TP et al.; Indian J Anaesth. 2013 Jan;57(1):35-40



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Target-controlled infusion (Propofol) versus inhaled anaesthetic (Sevoflurane) in patients undergoing shoulder arthroscopic surgery

Tantry TP et al.; Indian J Anaesth. 2013 Jan;57(1):35-40

CONCLUSION:

TCI propofol appears to be superior to and more convenient than sevoflurane anaesthesia in inter-scalene blocked patients undergoing shoulder arthroscopy.

Intravenous versus inhalation anaesthesia for one-lung ventilation
Modolo NS et al.; Cochrane Database Syst Rev. 2013 Jul 11;7

OBJECTIVES:
The objective of this review was to evaluate the effectiveness and safety of intravenous versus inhalation anaesthesia for one-lung ventilation.

MAIN RESULTS:
We included in this updated review 20 studies that enrolled 850 participants. The methodological quality of the included studies was difficult to assess as it was reported poorly, so the predominant classification of bias was 'unclear'.

AUTHORS' CONCLUSIONS:

Very little evidence from randomized controlled trials suggests differences in participant outcomes with anaesthesia maintained by intravenous versus inhalational anaesthesia during one-lung ventilation.

If researchers believe that the type of drug used to maintain anaesthesia during one-lung ventilation is important, they should design randomized controlled trials with appropriate participant outcomes, rather than report temporary fluctuations in physiological variables.

Modolo NS et al.; Cochrane Database Syst Rev. 2013 Jul 11;7:CD006313

…und bei Kindern?

DESIGN:
Randomized, prospective, double-blind study

SUBJECTS:
The subjects were 88 premedicated children, aged 3-6 years, Hernia repair

RESULTS / CONCLUSION:
In children, anesthesia maintenance with propofol was associated with a significantly lower incidence of postoperative pain than with sevoflurane.

Postoperative analgesia in children after propofol versus sevoflurane anesthesia. Hasani A et al.; Pain Med. 2013 Mar;14(3):442-6.

Mit Gas oder Propofol - Anästhesie ist sicher…

„…reported an anaesthesia-related death rate of 1.1 per million population per year and 8.2 per million hospital surgical discharges. The authors estimated that the mortality risk of anaesthesia for surgical inpatients was 0.82 in 100 000 cases.“

Li G. et al.; Anesthesiology 2009; 110:759–765

Helsinki-Deklaration

According to the Declaration of Helsinki, published by the European Society of Anesthesiology (ESA) in 2010, the speciality of Anesthesiology and Intensive Care guards the patient's safety and their quality of life after the surgery and anesthesia.

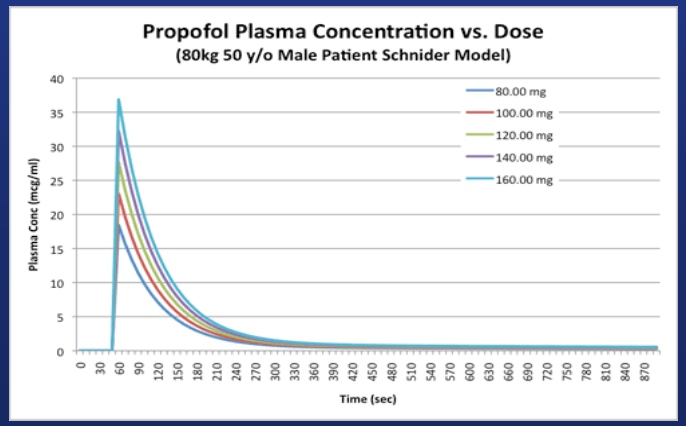
In view of that fact, the Declaration by itself emphasises the role of education and the need to improve anesthesiologists' knowledge and qualifications in order to reduce perioperative morbidity and mortality.

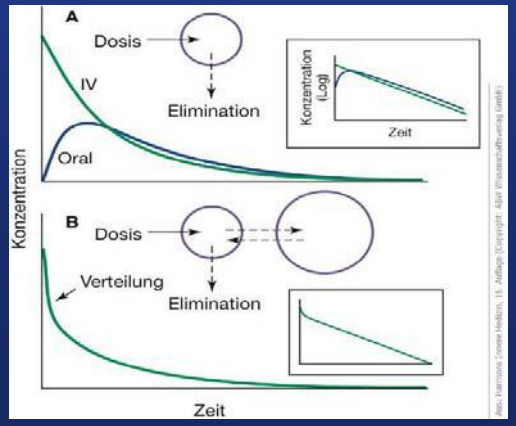
Jannicke MO et al.; Eur J Anaesthesiol, 2010, 27, 592–597.

TCI ist mehr als Perfusorprogrammierung

„The algorithms guiding TCI pumps are based on pharmacological data obtained from a relatively small number of healthy volunteers, which are then extrapolated, on the basis of sophisticated pharmacokinetic and pharmacodynamic modeling, to predict plasma concentrations of the drug and its effect on general population.“

Bienert A. et al.; Pharmacol Rep. 2012;64(4):782-95. Review





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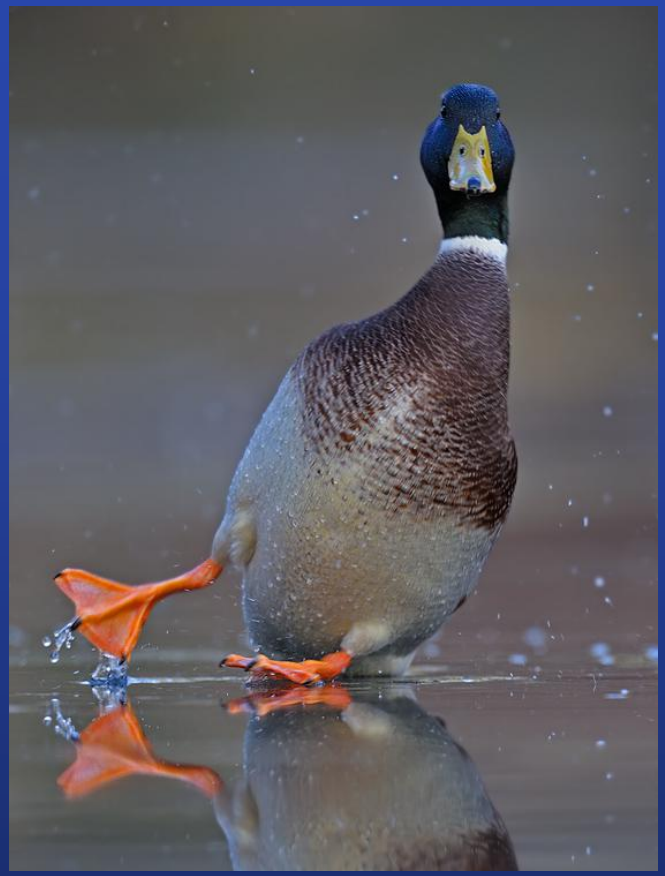
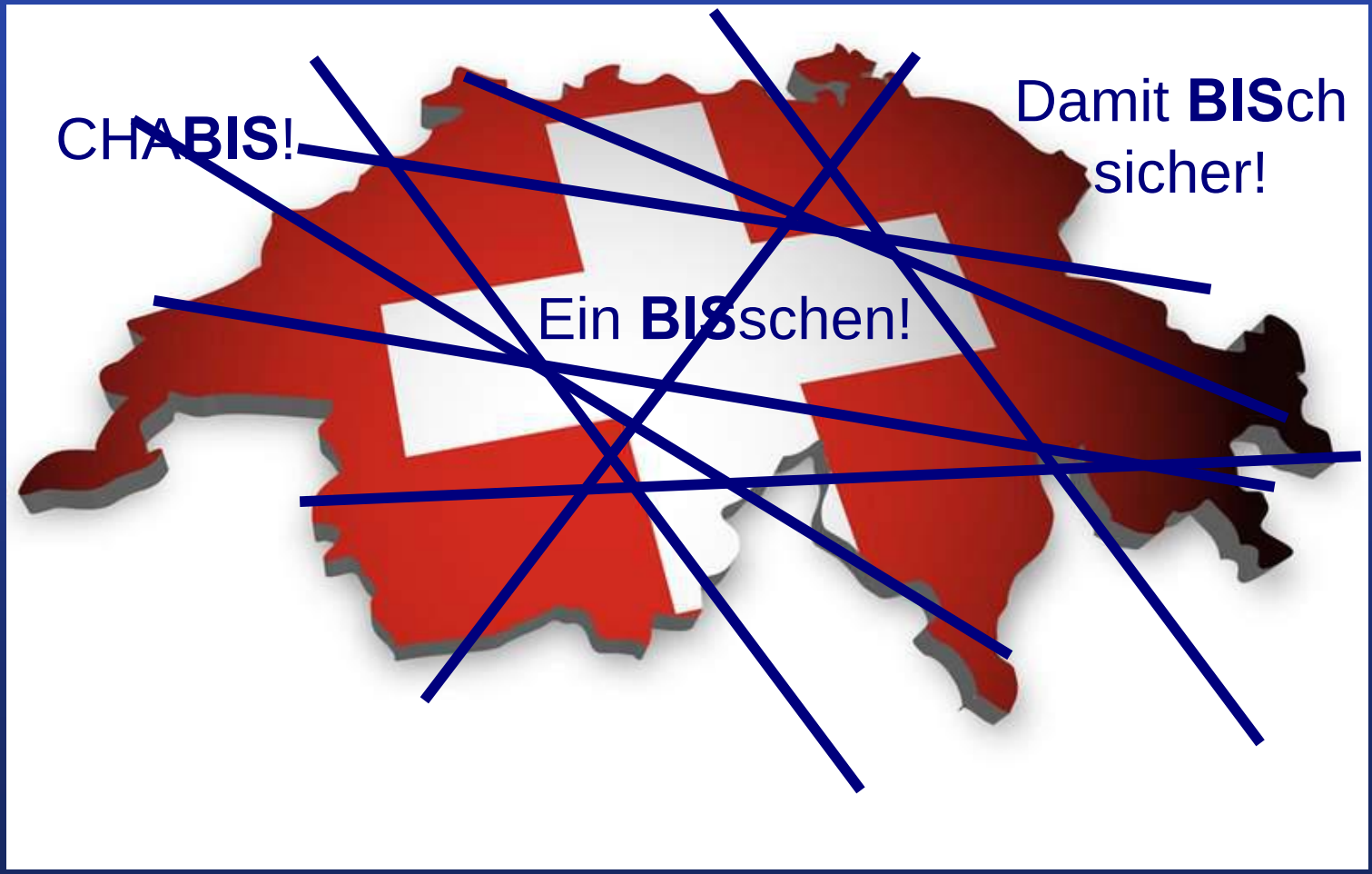


Ein Wort zum BIS…

Braucht‘s ein BIS für eine Allgemeinanästhesie?



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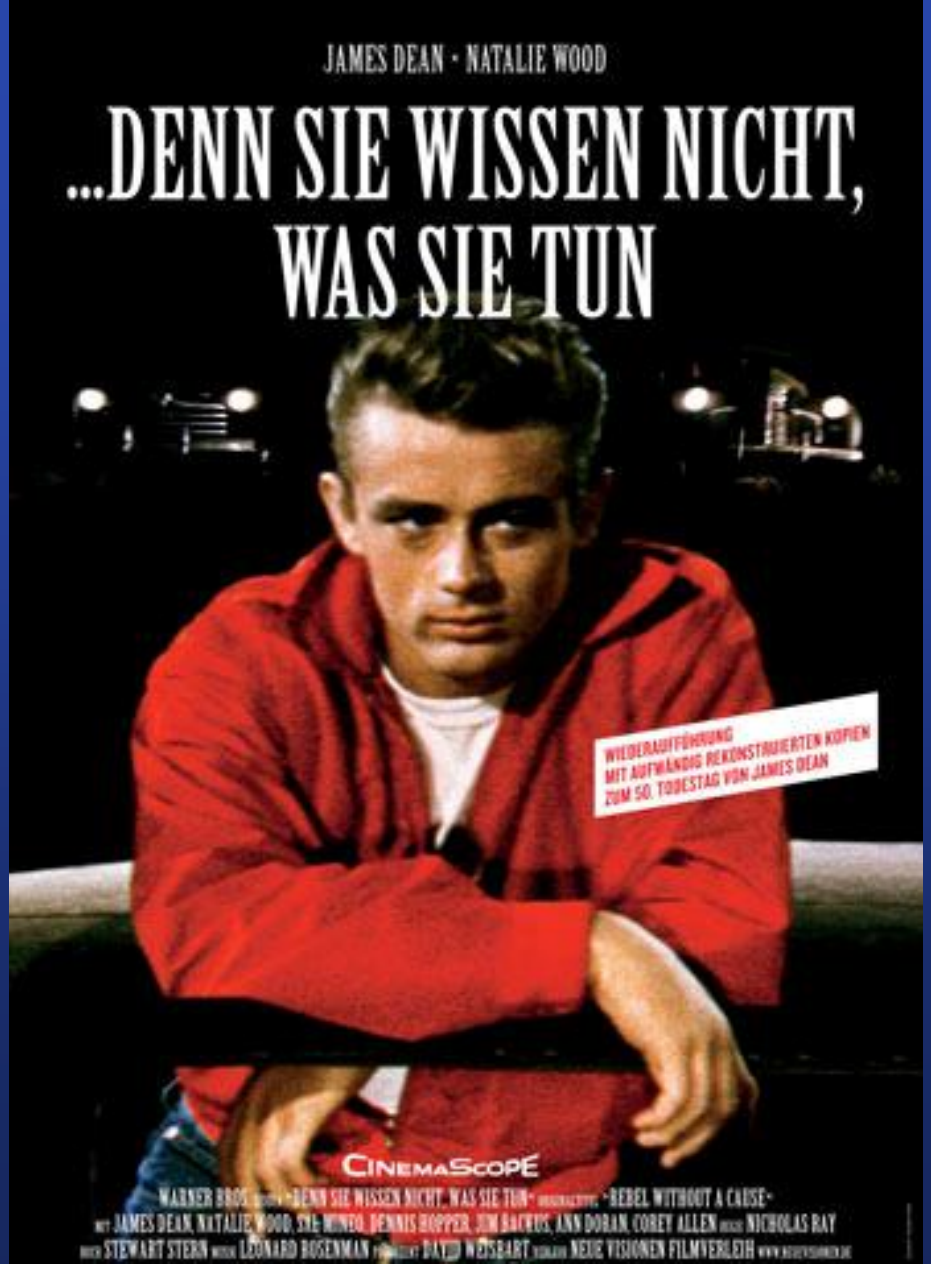
Awareness bei inhalativer Anästhesie

At present, there is no medical evidence that the routine use of devices to monitor the depth of anesthesia (BIS, entropy, SFX, AEP – auditory evoked potential) is a reliable protection from intraoperative awareness

Avidan MS; N Engl J Med. 2008 Mar 13;358(11):1097-108

….doch wie und durch wen erfolgte die Interpretation?



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INHALT

- Propofol – volatiler als man denkt…
- TIVA oder TCI – wo ist die Evidenz
- Kostendruck – weniger Anästhesisten dank Propofol
- Propofol versus Inhalationsanästhetika – ein kritischer Blick in die Literatur
- **Ist Propofol die bessere Alternative?**

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Was sagt die Literatur?

Was sagt die Literatur?

- TCI oder TIVA? → Keine Evidenz
- Braucht‘s ein BIS? → Daten widersprüchlich
- Propofol oder Gas? → Einzelne Patientenkollektive profitieren eventuell vom einen oder anderen Verfahren in Abhängigkeit von:
  - ➢ Patientenfaktoren
  - ➢ Operationsverfahren
  - ➢ Anwenderkenntnisse

Sie fahren von Zürich nach Bern…

- Seit Jahren bewährt
- Hinten kommt Gas raus…
- Organprotektiv?
- Möglicherweise Aufregung bis zur Ankunft
- Übelkeit nach Kurvenfahrt häufig

- Schnell und sicher
- Voll automatisierte Leitstelle
- Hohe Fahrqualität (Kaffee, Schlafen möglich)

KSW KANTONSSPITAL WINTERTHUR

Danke für Ihre Aufmerksamkeit!

daniel.button@ksw.ch

INSTITUT FÜR ANÄSTHESIOLOGIE UND SCHMERZTHERAPIE

Symposium
Stellenwert der inhalativen Anästhetika

KANTONSSPITAL WINTERTHUR

Dienstag, 4. Februar 2014

Volatile Anästhetika vs. TIVA bei nicht kardiochirurgischen Patienten

Manfred Seeberger
Departement Anästhesie & operative Intensivbehandlung

Universitätsspital Basel

UNI BASEL

Declaration of interests

Support from Abbott and Roche for the study:

Randomized Comparison of Sevoflurane Versus Propofol to Reduce Perioperative Myocardial Ischemia in Patients Undergoing Noncardiac Surgery

Giovanna A.L. Lurati Buse, Philippe Schumacher, Esther Seeberger, Wolfgang Studer, Regina M. Schuman, Jens Fassl, Jorge Kasper, Miodrag Filipovic, Daniel Bolliger and Manfred D. Seeberger

Circulation 2012;126:2696-2704

Abstract Submission:
March 1 – April 30, 2014

Prizes for best abstracts

High Morbidity and Mortality

in patients at high cardiac risk

who undergo noncardiac surgery

Populations at high cardiac risk who undergo major noncardiac surgery

30-day mortality

~ 1/30 JACC 2003; 42:1767

~ 1/20 Acta Anaesth Belg 2008; 42:1767

One-year mortality

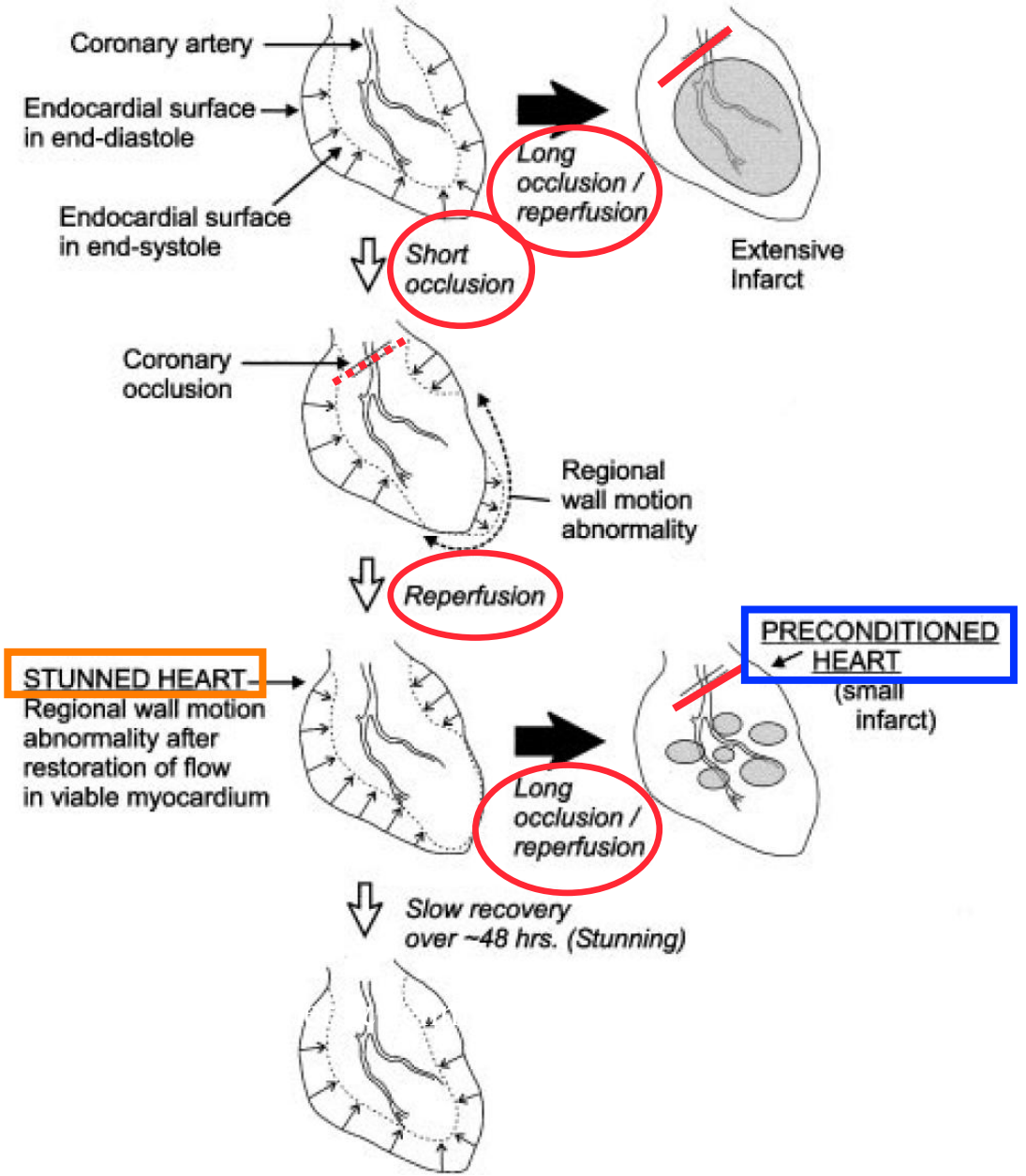
~ 1/6 (50% cardiac deaths) JACC 2003; 42:1767

~ 1/8 (21% cardiac deaths) Circulation 2012; 126:2696

Can we protect our patients by using volatile anesthetics?

Anesthetic preconditioning

Ischaemic Preconditioning



Preconditioning

1986

Detection of ischaemic preconditioning in myocardium of rabbits

1997

Detection of a preconditioning effect of isoflurane

Volatile Anaesthetic Preconditioning

In vitro and animal studies

- ↓ Troponins
- ↓ Infarct zones in myocardium at risk

Studies in elective CABG patients

- ↓ Troponins
- ↑ Cardiac function (e.g., higher CO)
- ↓ LOS ICU, LOS hospital
- ↑ Outcome?

British Journal of Anaesthesia Page 1 of 11
doi:10.1093/bja/aet231

BJA

Anaesthetic drugs and survival: a Bayesian network meta-analysis of randomized trials in cardiac surgery

G. Landoni[1*], T. Greco[1], G. Biondi-Zoccai[2], C. Nigro Neto[3,4], D. Febres[1], M. Pintaudi[1], L. Pasin[1], L. Cabrini[1], G. Finco[5] and A. Zangrillo[1]

- **38 RCT 1991-2012, 3‘642 pts** (TIVA – Sevo, Iso, Des)
- **Mostly standard CPB & CABG**

British Journal of Anaesthesia Page 1 of 11
doi:10.1093/bja/aet231

BJA

Anaesthetic drugs and survival: a Bayesian network meta-analysis of randomized trials in cardiac surgery

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Outcome: Volatile vs. TIVA

- **Mortality**

  1.3% vs. **2.6**%

  NNT = 74, OR 0.42 (0.31-0.59), p=0.004

- **Myocardial infarction**

  2.3% vs. **4.7**%

  NNT = 42, OR 0.42 (0.31-0.59), p=0.003

- **Volatile anaesthetics seem to be beneficial in patients who undergo CABG surgery**

ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery)

Developed in Collaboration With the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery

Lee A. Fleisher, Joshua A. Beckman, Kenneth A. Brown, Hugh Calkins, Elliott Chaikof, Kirsten E. Fleischmann, William K. Freeman, James B. Froehlich, Edward K. Kasper, Judy R. Kersten, Barbara Riegel, John F. Robb, ACC/AHA TASK FORCE MEMBERS, Sidney C. Smith, Jr, Alice K. Jacobs, Cynthia D. Adams, Jeffrey L. Anderson, Elliott M. Antman, Christopher E. Buller, Mark A. Creager, Steven M. Ettinger, David P. Faxon, Valentin Fuster, Jonathan L. Halperin, Loren F. Hiratzka, Sharon A. Hunt, Bruce W. Lytle, Rick Nishimura MD, Joseph P. Ornato, Richard L. Page, Barbara Riegel, Lynn G. Tarkington and Clyde W. Yancy

Circulation 2007;116;1971-1996; originally published online Sep 27, 2007;

Recommendations for Use of Volatile Anesthetic Agents

Class IIa

1. **It can be beneficial to use volatile anesthetic agents during noncardiac surgery for the maintenance of general anesthesia in hemodynamically stable patients at risk for myocardial ischemia. (*Level of Evidence: B*)**

	Class IIa ***Benefit >> Risk*** ***Additional studies with focused objectives needed*** **IT IS REASONABLE to perform procedure/administer treatment**
Level B ***Limited (2-3) population risk strata evaluated****	• **Recommendation in favor of treatment or procedure being useful/effective** • **Some conflicting evidence from single randomized trial or non-randomized studies**

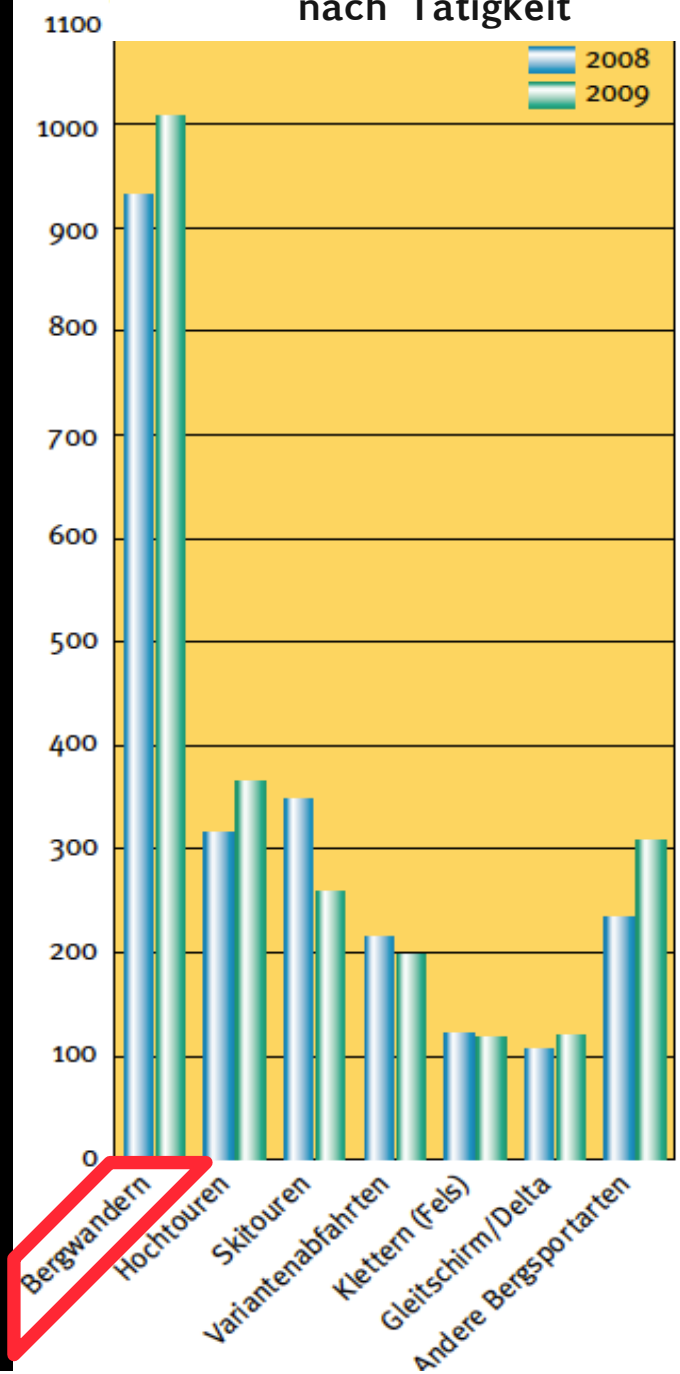
Sicherheit, Medizin, Rettungswesen

Bergnotfälle Schweiz 2009

Wieder Zunahme der Anzahl Notfälle und Bergtote

DIE ALPEN 6/2010

Alpine Notfälle aufgeschlüsselt nach Tätigkeit



ACC/AHA Guidelines for Increasing Safety in the Mountains

- ACC = Association of Cable Cars
- AHA = Alpine Hotels‘ Association

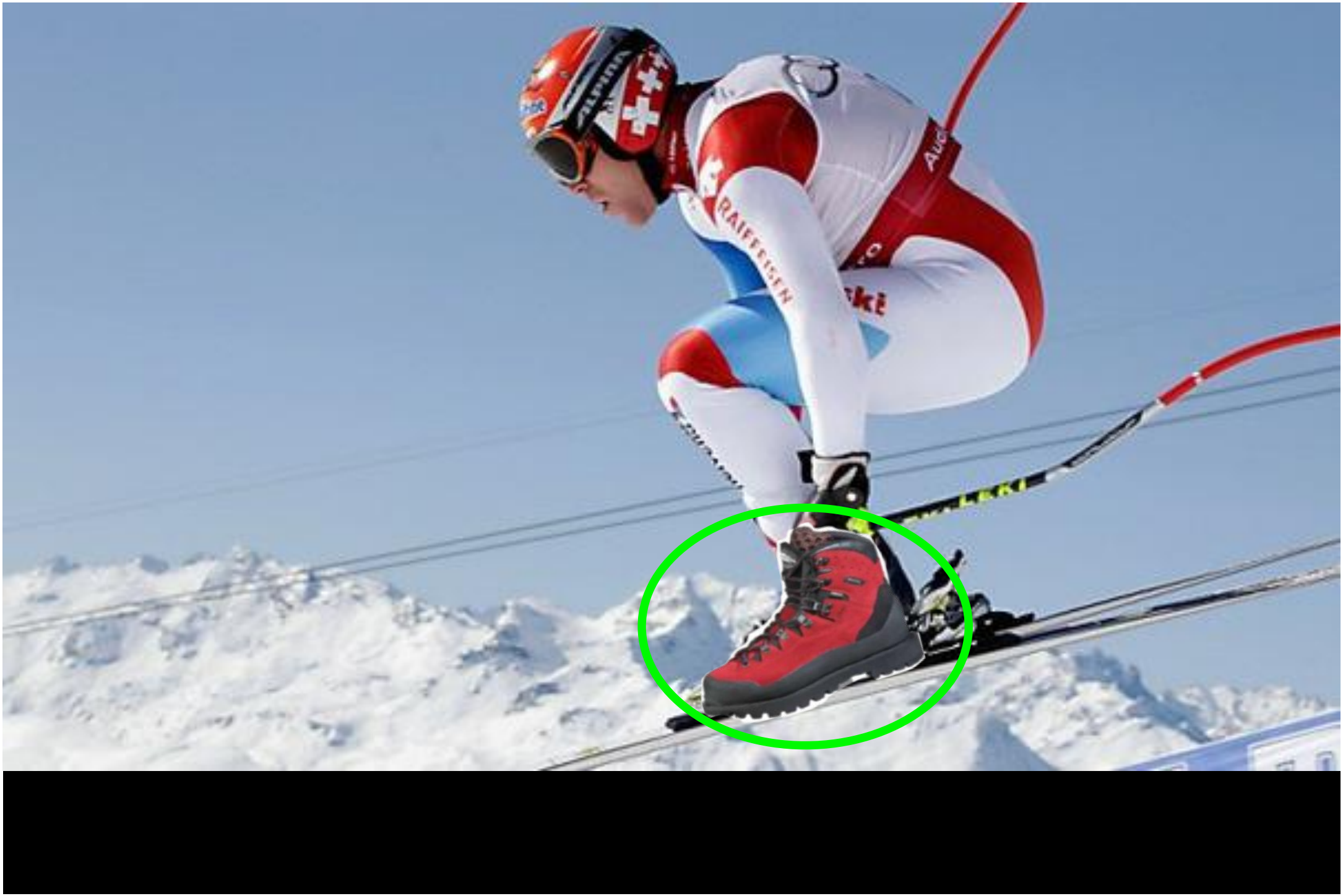
ACC/AHA Guidelines for Increasing Safety in the Mountains

- **People without hiking boots must not be transported into alpine areas by cable cars**

- **Alpine hotels with a panorama platform must use sufficiently high fences to keep guests with „sneakers“ in a safe area**

www.AHA-ACC.com

Photo: Oliver C. Ritz -- http://photo.zermatt.ch


RAIFFEISEN

Recommendations for Use of Volatile Anesthetic Agents

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Class IIa

Benefit >> Risk
Additional studies with focused objectives needed

IT IS REASONABLE to perform procedure/administer treatment

Level B

Limited (2-3) population risk strata evaluated*

- **Recommendation in favor of treatment or procedure being useful/effective**
- **Some conflicting evidence from single randomized trial or non-randomized studies**

Volatile Anaesthetic Preconditioning
-
Studies outside cardiac surgery

Volatile Anaesthetic Preconditioning
-
Studies outside cardiac surgery

(Acta Anaesth. Belg., 2008, 59, 19-25)

Does the use of a volatile anesthetic regimen attenuate the incidence of cardiac events after vascular surgery ?

S. G. De Hert (*), D. Longrois (**), H. Yang (***) and L. A. Fleisher (****)

- **Retrospective analysis of data collected for a drug study**
- **784 vascular surgical patients with/at riks for CAD**
  - **Volatile anaesthetics: 319 patients**
  - **TIVA: 465 patients**

(Acta Anaesth. Belg., 2008, 59, 19-25)

Does the use of a volatile anesthetic regimen attenuate the incidence of cardiac events after vascular surgery ?

S. G. De Hert (*), D. Longrois (**), H. Yang (***) and L. A. Fleisher (****)

Cardiac outcome data

	Volatile anesthetic regimen (n = 319)	Non-volatile anesthetic regimen (n = 465)
all surgery	n = 319	n = 465
mortality	17 (5%)	24 (5%)
myocardial infarction	36 (11%)	52 (12%)
congestive heart failure	24 (8%)	35 (8%)
arrhythmias	30 (9%)	27 (6%)
composite endpoint	70 (22%)	84 (18%)
aortic surgery	n = 62	n = 43
mortality	3 (5%)	2 (5%)
myocardial infarction	13 (21%)	10 (23%)
congestive heart failure	7 (11%)	6 (14%)
arrhythmias	8 (13%)	3 (7%)
composite endpoint	18 (29%)	12 (28%)
infra inguinal surgery	n = 257	n = 422
mortality	14 (5%)	22 (5%)
myocardial infarction	23 (9%)	42 (10%)
congestive heart failure	17 (7%)	29 (7%)
arrhythmias	22 (9%)	24 (6%)
composite endpoint	52 (20%)	72 (17%)

Volatile Agents for Cardiac Protection in Noncardiac Surgery: A Randomized Controlled Study

Alberto Zangrillo, MD,* Valentina Testa, MD,* Valeria Aldrovandi, MD,* Antonio Tuoro, MD,† Giuseppina Casiraghi, MD,* Francesca Cavenago, MD,* Melissa Messina, MD,* Elena Bignami, MD,* and Giovanni Landoni, MD*

J Cardiothorac Vasc Anaesth 2011

- **Prospective, randomized study of 88 noncardiac surgical patients**

Table 3. Postrandomization Data of 88 Patients Who Received Sevoflurane (SEVO) or Propofol-Based TIVA for Noncardiac Surgery

Characteristics	SEVO (44 Patients)	TIVA (44 Patients)	*p* Value
Cardiac events at 30 days, n (%)	0	0	—
Other complications at 30 days, n (%)	3 (6.8)	6 (13.6)	0.2
Cardiac death at 30 days, n (%)	0	0	—
Noncardiac death at 30 days, n (%)	0	1 (2.3)	0.5
Cardiac events at 1 year, n (%)	3 (6.8)	1 (2.3)	0.3
Other complications at 1 year, n (%)	5 (11.4)	11 (25)	0.2

Sample size??

Volatile anaesthetics for all patients at cardiac risk...

...without advantage at worst!

Volatile anaesthetics

–

free of disadvantages and risks?

Volatile Anaesthesia vs. Propofol TIVA

Gupta et al, Anesth Analg 2004 (systematic review)

Postoperative side effects:

	Isofluran	Desfluran	Sevofluran
Nausea	↑	↑	↑
Vomiting	↑	↑	↑
Use of antiemetics	↑	↑	↑

Nausea – a Problem?

- **Absence of nausea is more important for patients than absence of pain**

  Eberhart et al, Br J Anaesth 2002

- **Medical personnel tends to underestimate the morbidity caused by PONV**

  Lee et al, Anesth Analg. 2005

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

Randomized Comparison of Sevoflurane Versus Propofol to Reduce Perioperative Myocardial Ischemia in Patients Undergoing Noncardiac Surgery

Giovanna A.L. Lurati Buse, Philippe Schumacher, Esther Seeberger, Wolfgang Studer, Regina M. Schuman, Jens Fassl, Jorge Kasper, Miodrag Filipovic, Daniel Bolliger and Manfred D. Seeberger

Circulation 2012;126:2696-2704

Study centers: Basel, Solothurn, Liestal

Study question 1

Does anesthesia maintenance with sevoflurane compared to propofol

- **Reduce incidence of periop. myocardial ischemia**

  Troponin T, Holter ECG (48h each)

- **Impact postoperative NT-proBNP release**
- **Affect the incidence of MACE & mortality at 1 year**

…in patients undergoing major noncardiac surgery?

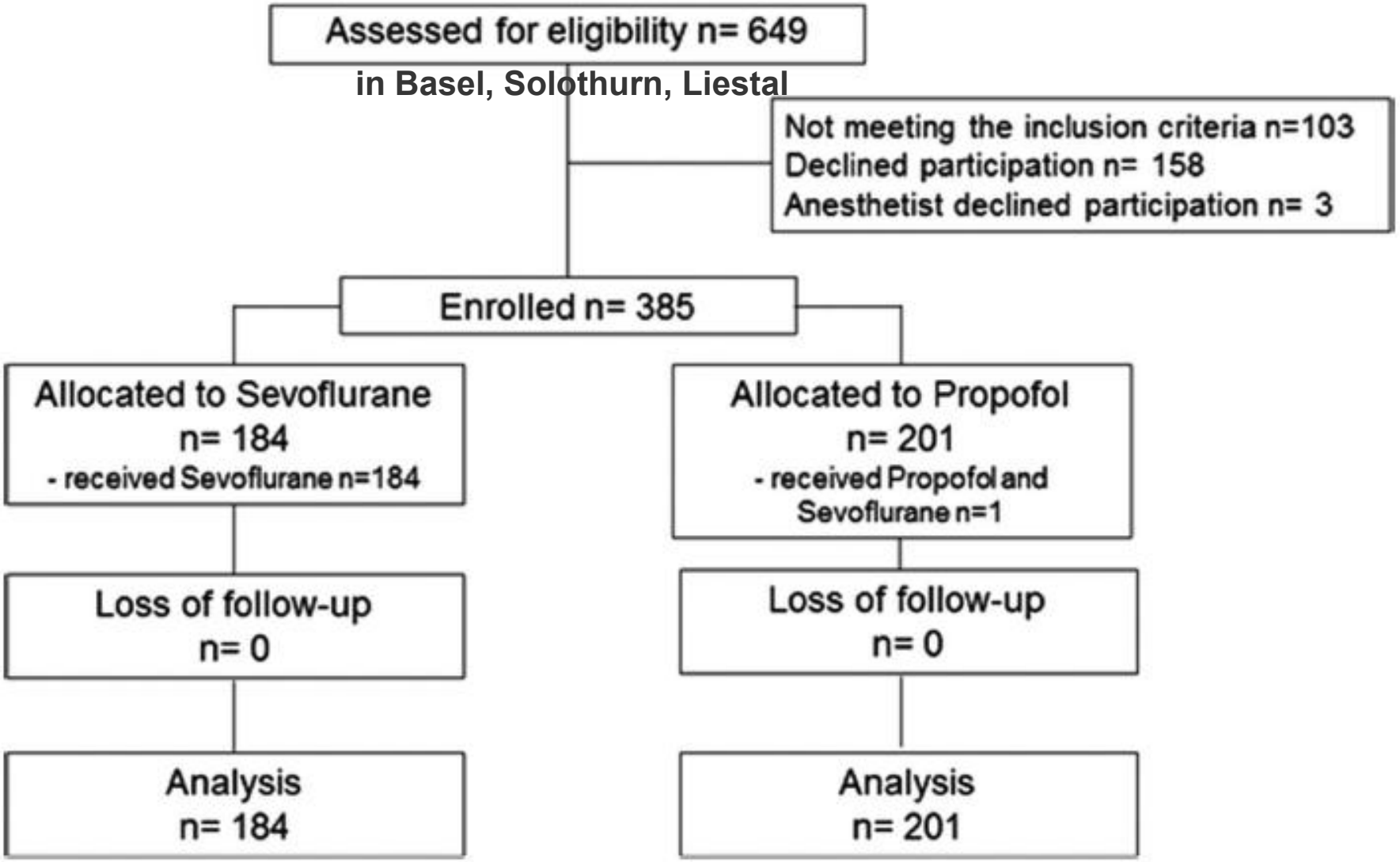
Methods: population

- **Patients with known CAD undergoing major noncardiac surgery**

OR

- **Vascular surgical patients with ≥ 2 of the following risk factors:**

  age > 70 years; diabetes mellitus requiring treatment;
  arterial hypertension; history of stroke,
  functional capacity < 4 MET, ECG abnormality



Lurati Buse G A et al. Circulation 2012;126:2696-2704

Results: Patient Characteristics

	Sevoflurane n (%)	Propofol n (%)
Age (SD), years	72 (8)	73 (8)
Men	138 (75)	156 (78)
ASA III	155 (84)	160 (80)
History of CAD	128 (70)	156 (78)
History of TIA/stroke	21 (11)	24 (12)

Results: Patient Characteristics

	Sevoflurane n (%)	**Propofol** n (%)
History of CHF	4 (2)	9 (5)
History of diabetes	42 (23)	41 (20)
Creatinin >170 mmol/L	5 (3)	7 (4)

Results: Type of Surgery

	Sevoflurane n (%)	Propofol n (%)
Major vascular	111 (60)	114 (57)
Major orthopedic	46 (25)	55 (27)
Major general	24 (13)	31 (15)

Results: Ischemia and MACE

Results: Ischemia and MACE

	Sevoflurane	Propofol	RR (95%CI)
Ischemia	**75 (41)**	**81 (40)**	**1.01** (0.78-1.30)
MACE	14 (8)	17 (9)	0.90 (0.43-1.87)
Cardiac mortality	5 (3)	5 (3)	1.10 (0.28-4.30)
All-cause mortality	25 (14)	23 (11)	1.22 (0.67-2.10)

Circulation 2012;126:2696-2704

Results: Postoperative NTproBNP

Results: Postoperative NTproBNP

	Sevoflurane	Propofol	p-value
Day 1	**526** (257-1032)	**559** (238-1235)	0.71
Day 2	**933** (451-1671)	**929** (418-2069)	0.77

Median (interquartile range)

Circulation 2012;126:2696-2704

Neurological Effects of Sevoflurane

Neurological Effects of Sevoflurane

- Animal studies suggest neuroprotection
- Some evidence supporting a neuroprotective effect of sevoflurane in patients undergoing cardiac surgery

Study question 2

Does sevoflurane compared to propofol reduce the incidence of delirium up to 7 days after major noncardiac surgery?

➔ *Confusion assessment method (CAM) on postoperative days 1,2, and 7 or discharge*

Results: Postoperative delirium

Sevoflurane	Propofol	RR (95%CI)
21 (11)	29 (14)	0.79 (0.45-1.38)

Number of patients (%)

Circulation 2012;126:2696-2704

Study question 3

Does sevoflurane compared to propofol affect

- **The incidence of PONV?**
- **Patient satisfaction?**

Measurements: Numeric rating scale (0-10)

Incidence of PONV

	Sevoflurane n= 184	Propofol n= 201	p-value
	PONV		
POD 1	29 (16.1)	18 (9.2)	0.042
POD 2	17 (9.4)	15 (7.7)	0.544
POD 7	6 (3.6)	6 (3.5)	0.983

Patient Satisfaction

	Sevoflurane n= 137	Propofol n=143	p-value
NRS POD 1	8 (5-8)	7 (5-8)	0.173
NRS POD 2	7 (5-8)	7 (5-8)	0.734
NRS POD 7	8 (6-9)	7 (5-9)	0.122

Conclusions

Conclusions

Sevoflurane compared to **propofol** did **not** reduce

- **Perioperative myocardial ischemia**
- **NTproBNP release**
- **MACE or mortality at 1 year**
- **Postoperative delirium**

Conclusions

Sevoflurane compared to **propofol**

- **increased PONV on POD 1**
- **did NOT affect patient satisfaction**

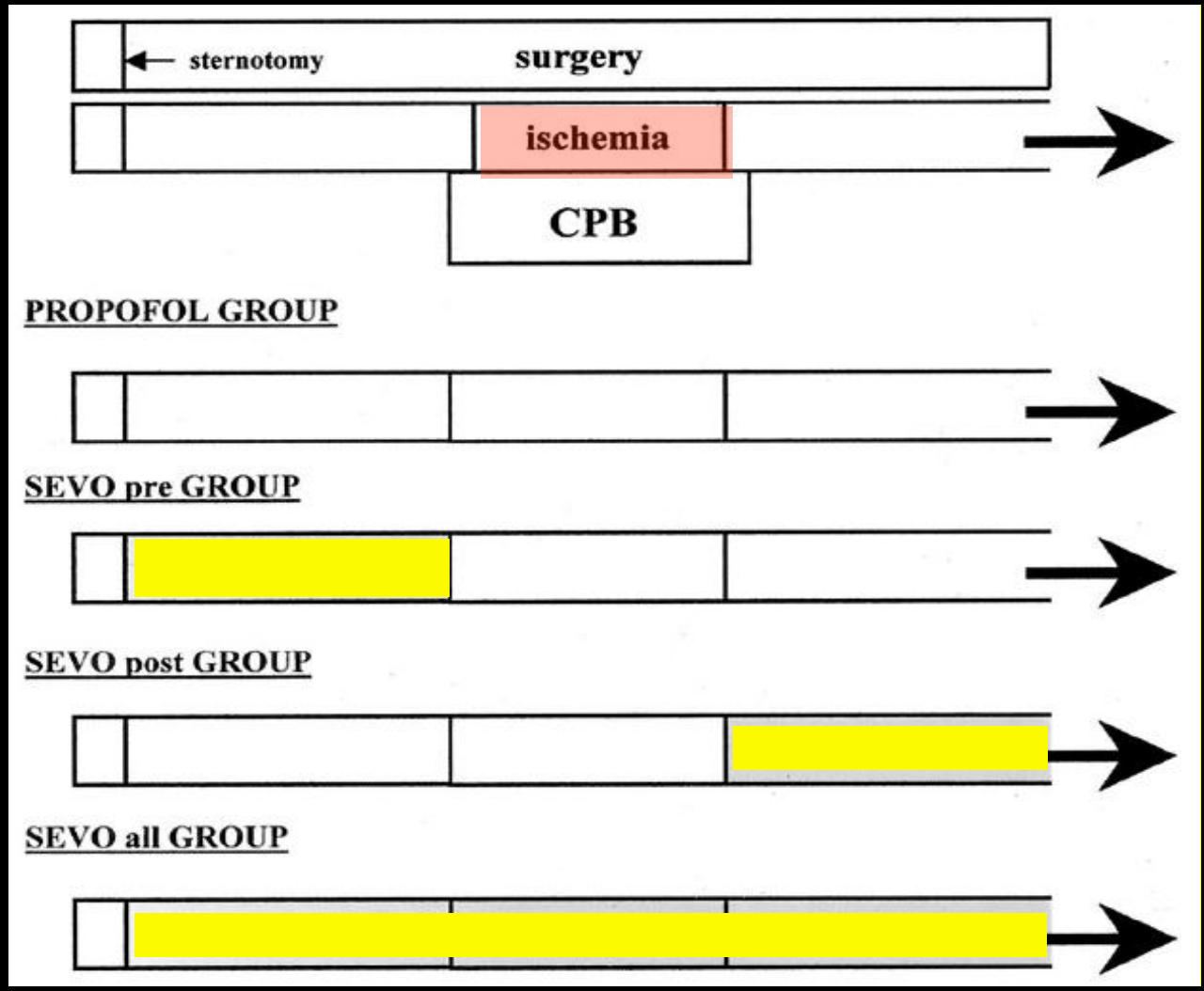
La potion magique...

Take-home message

- "volatile preconditioning" is no reason to prefer sevoflurane to propofol in patients who undergo noncardiac surgery

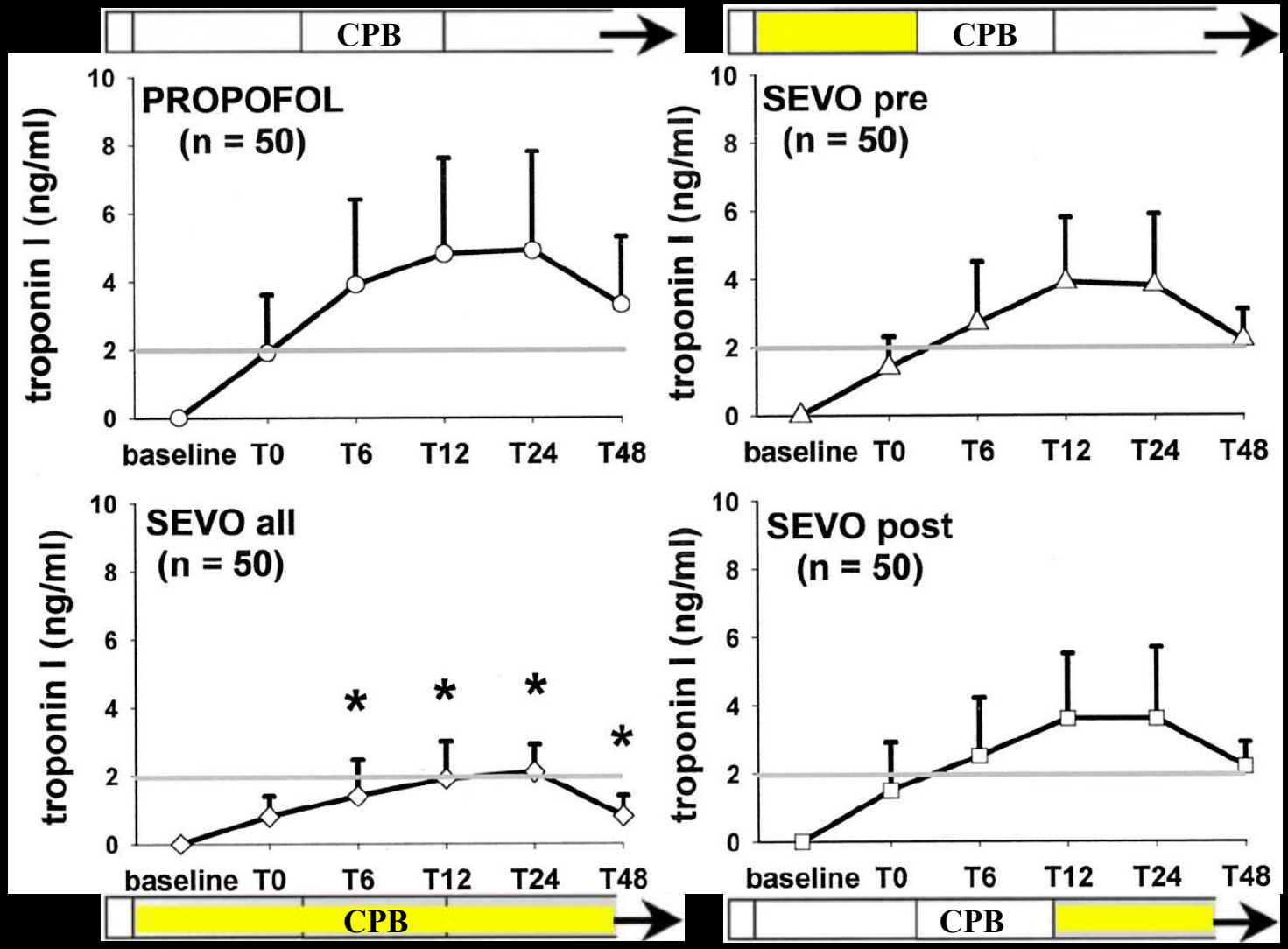
Thank you for your attention

Cardioprotective Properties of Sevoflurane in Patients Undergoing Coronary Surgery with Cardiopulmonary Bypass Are Related to the Modalities of Its Administration



De Hert et al, Anesthesiology 2004

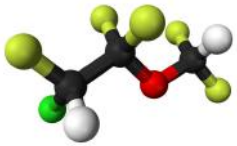
Preconditioning - Reperfusion

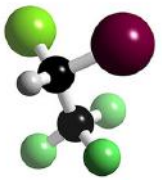


De Hert et al, Anesthesiology 2004

Symposium Stellenwert der inhalativen Anästhetika

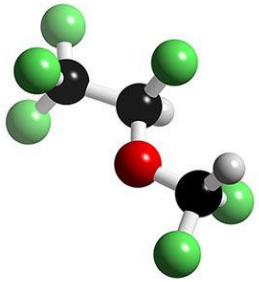
Kantonsspital Winterthur, 4. Februar 2014

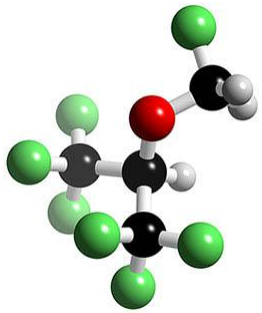


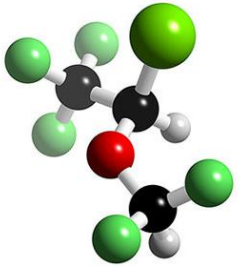


Organprotektive Effekte von volatilen Anästhetika

Prof. Dr. Beatrice Beck Schimmer, MD, DESA







UniversityHospital Zurich

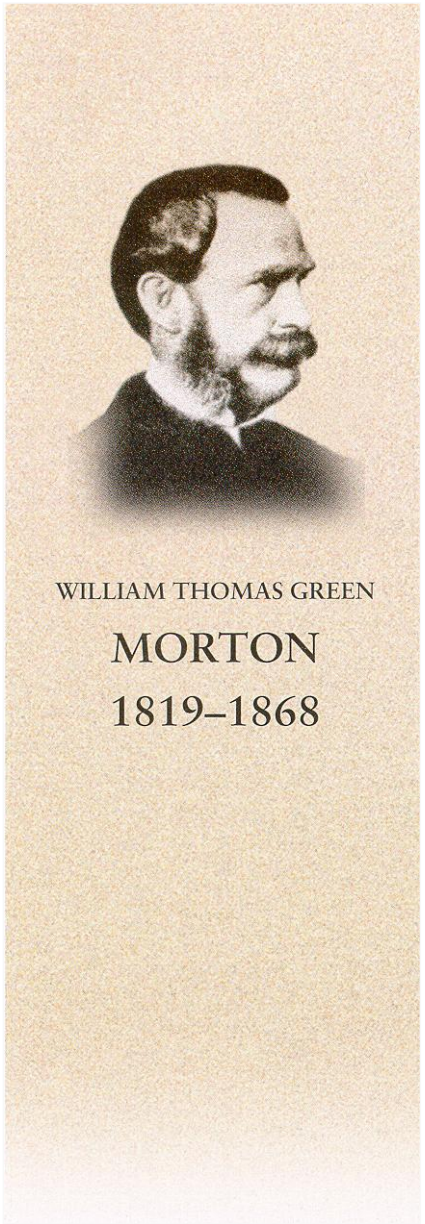
University of Zurich[UZH]

Disclosure

- **Abbott and Baxter:**
  - **Participant: Advisory board meetings**
  - **Recipient: Research funding**

- **Council Member of the Swiss National Science Foundation**

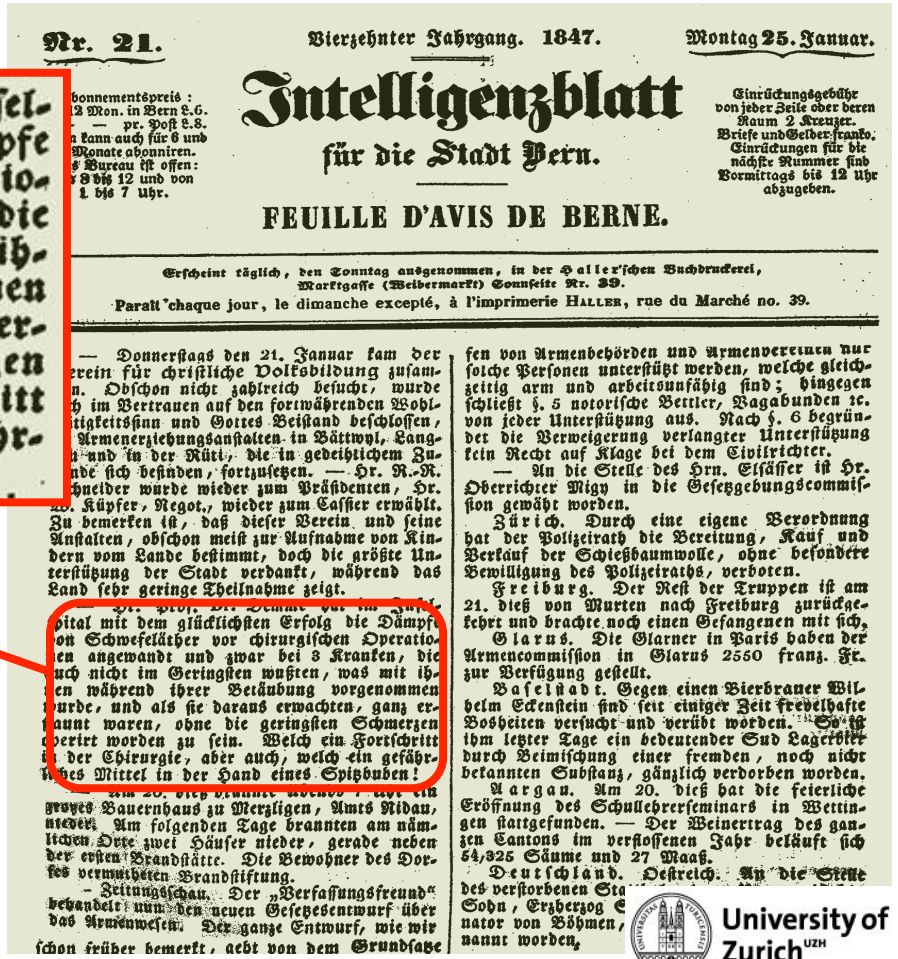
- **Associate Editor ‘Anesthesiology’**



16. Oktober 1846

25. Januar 1847

— Hr. Prof. Dr. Demme hat im Inselspital mit dem glücklichsten Erfolg die Dämpfe von Schwefeläther vor chirurgischen Operationen angewandt und zwar bei 3 Kranken, die auch nicht im Geringsten wußten, was mit ihnen während ihrer Betäubung vorgenommen wurde, und als sie daraus erwachten, ganz erstaunt waren, ohne die geringsten Schmerzen operirt worden zu sein. Welch ein Fortschritt in der Chirurgie, aber auch, welch ein gefährliches Mittel in der Hand eines Spitzbuben!



Nr. 21. Vierzehnter Jahrgang. 1847. Montag 25. Januar.

Intelligenzblatt für die Stadt Bern.

FEUILLE D'AVIS DE BERNE.

Erscheint täglich, den Sonntag ausgenommen, in der Haller'schen Buchdruckerei, Marktgasse (Weibermarkt) Sonnseite Nr. 39.

Paraît chaque jour, le dimanche excepté, à l'imprimerie Haller, rue du Marché no. 39.

— Donnerstags den 21. Januar kam der ...verein für christliche Volksbildung zusam... Obschon nicht zahlreich besucht, wurde ...h im Vertrauen auf den fortwährenden Wohl...tigkeitssinn und Gottes Beistand beschlossen, ...Armenerziehungsanstalten in Bättwyl, Lang... und in der Rüti, die in gedeihlichem Zu...nde sich befinden, fortzusetzen. — Hr. R.-R. ...hneider wurde wieder zum Präsidenten, Hr. ...Küpfer, Negot., wieder zum Cassier erwählt. Zu bemerken ist, daß dieser Verein und seine Anstalten, obschon meist zur Aufnahme von Kindern vom Lande bestimmt, doch die größte Unterstützung der Stadt verdankt, während das Land sehr geringe Theilnahme zeigt.

...pital mit dem glücklichsten Erfolg die Dämpf... von Schwefeläther vor chirurgischen Operatio...en angewandt und zwar bei 3 Kranken, die ...uch nicht im Geringsten wußten, was mit ih...en während ihrer Betäubung vorgenommen ...urde, und als sie daraus erwachten, ganz er...staunt waren, ohne die geringsten Schmerzen ...perirt worden zu sein. Welch ein Fortschritt ...der Chirurgie, aber auch, welch ein gefähr...liches Mittel in der Hand eines Spitzbuben!

...große Bauernhaus zu Merzligen, Amts Nidau, ...nieder. Am folgenden Tage brannten am näm...lichen Orte zwei Häuser nieder, gerade neben der ersten Brandstätte. Die Bewohner des Dor...fes vermutheten Brandstiftung.

— Zeitungsschau. Der „Verfassungsfreund“ ...behandelt nun den neuen Gesetzesentwurf über das Armenwesen. Der ganze Entwurf, wie wir ...schon früher bemerkt, hebt von dem Grundsatze

...fen von Armenbehörden und Armenvereinen nur ...solche Personen unterstützt werden, welche gleichzeitig arm und arbeitsunfähig sind; hingegen ...schließt §. 5 notorische Bettler, Vagabunden ꝛc. von jeder Unterstützung aus. Nach §. 6 begründet die Verweigerung verlangter Unterstützung kein Recht auf Klage bei dem Civilrichter.

— An die Stelle des Hrn. Elsässer ist Hr. Oberrichter Migy in die Gesetzgebungscommission gewählt worden.

Zürich. Durch eine eigene Verordnung hat der Polizeirath die Bereitung, Kauf und Verkauf der Schießbaumwolle, ohne besondere Bewilligung des Polizeiraths, verboten.

Freiburg. Der Rest der Truppen ist am 21. dieß von Murten nach Freiburg zurückgekehrt und brachte noch einen Gefangenen mit sich.

Glarus. Die Glarner in Paris haben der Armencommission in Glarus 2550 franz. Fr. zur Verfügung gestellt.

Baselstadt. Gegen einen Bierbrauer Wilhelm Eckenstein sind seit einiger Zeit frevelhafte Bosheiten versucht und verübt worden. So ist ihm letzter Tage ein bedeutender Sud Lagerbier durch Beimischung einer fremden, noch nicht bekannten Substanz, gänzlich verdorben worden.

Aargau. Am 20. dieß hat die feierliche Eröffnung des Schullehrerseminars in Wettingen stattgefunden. — Der Weinertrag des ganzen Cantons im verflossenen Jahr beläuft sich 54,325 Säume und 27 Maaß.

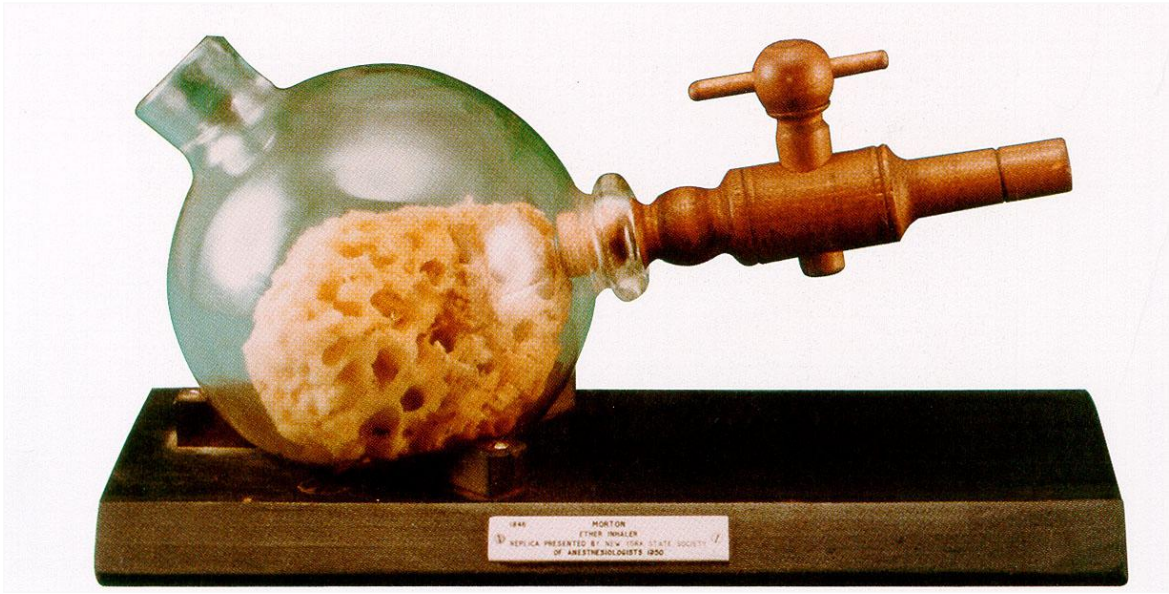
Deutschland. Oestreich. An die Stelle des verstorbenen Sta... Sohn, Erzherzog E... nator von Böhmen, ...nannt worden.

Einrückungsgebühr von jeder Zeile oder deren Raum 2 Kreuzer. Briefe und Gelder franko. Einrückungen für die nächste Nummer sind Vormittags bis 12 Uhr abzugeben.

...bonnementspreis: ...12 Mon. in Bern 2.6. ... — pr. Post 2.8. ...kann auch für 6 und ...Monate abonniren. ...Bureau ist offen: ...8 bis 12 und von ...1 bis 7 Uhr.

UniversityHospital Zurich

University of Zurich[UZH]


1846
MORTON
ETHER INHALER
REPLICA PRESENTED BY NEW YORK STATE SOCIETY
OF ANESTHESIOLOGISTS 1950

Agenda

- **Studies: Volatile anaesthetics protect parenchymatous organs** 
- **Studies: No benefit with volatile anaesthetics** 
- **Speculation: Why protection in which situation**

Ischemic preconditioning

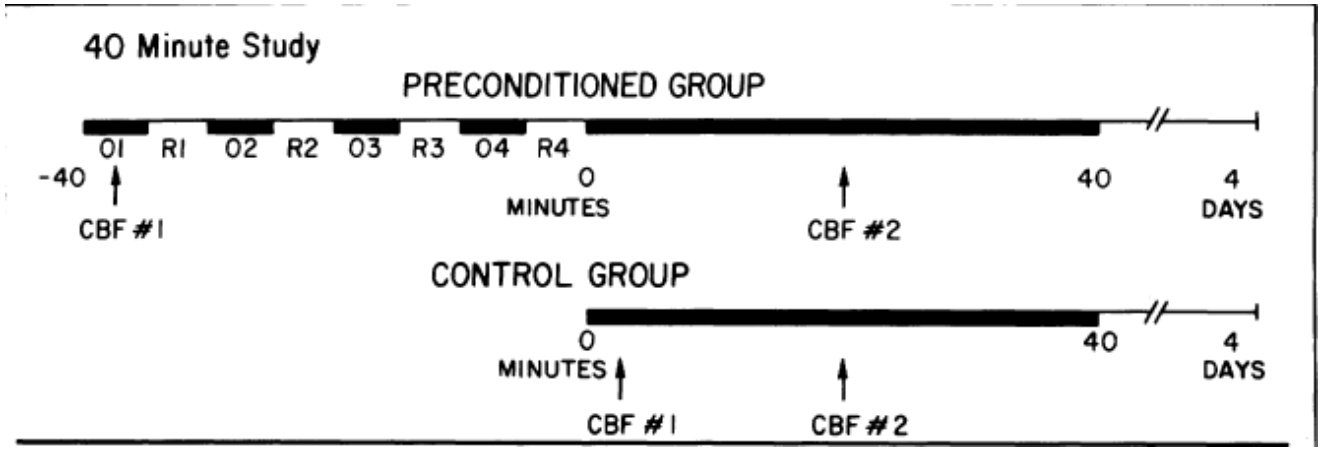
Preconditioning with ischemia: a delay of lethal cell injury in ischemic myocardium

Murry CE, Jennings RB, Reimer KA

***Circulation*, 1986**

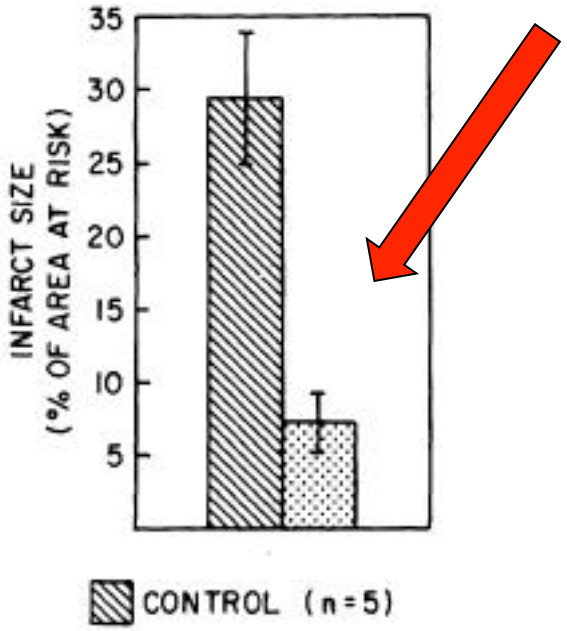
Ischemic preconditioning

Dog heart:



Murry et al., *Circulation*, 1986

Ischemic preconditioning

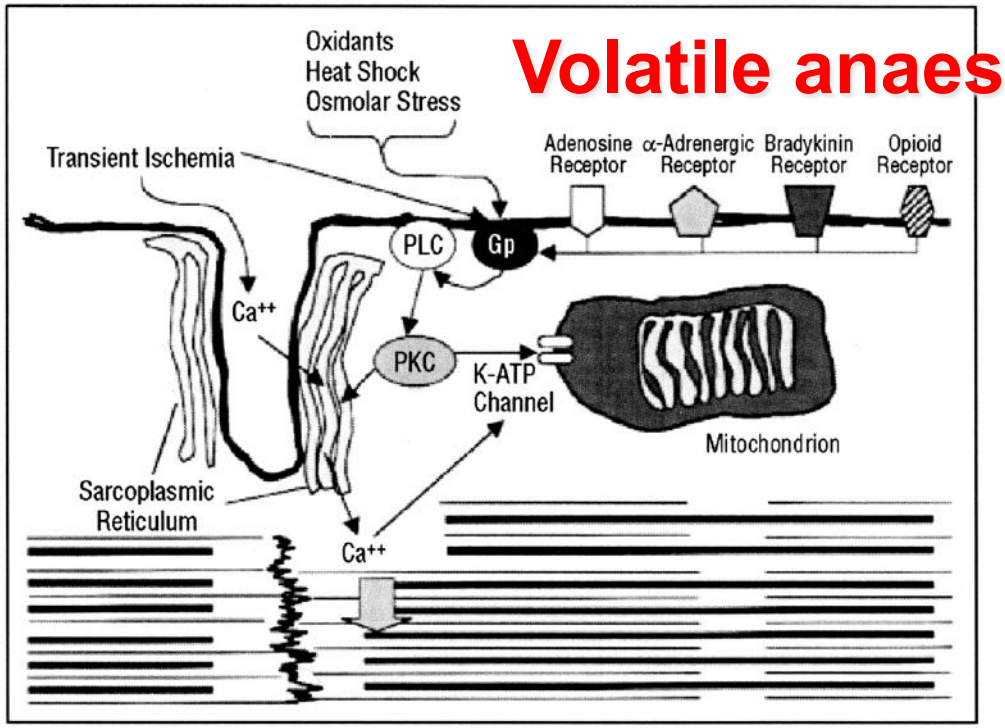


- decreased myocardial infarction size
- improved wall motion
- less arrhythmia

Murry et al., *Circulation*, 1986

Preconditioning

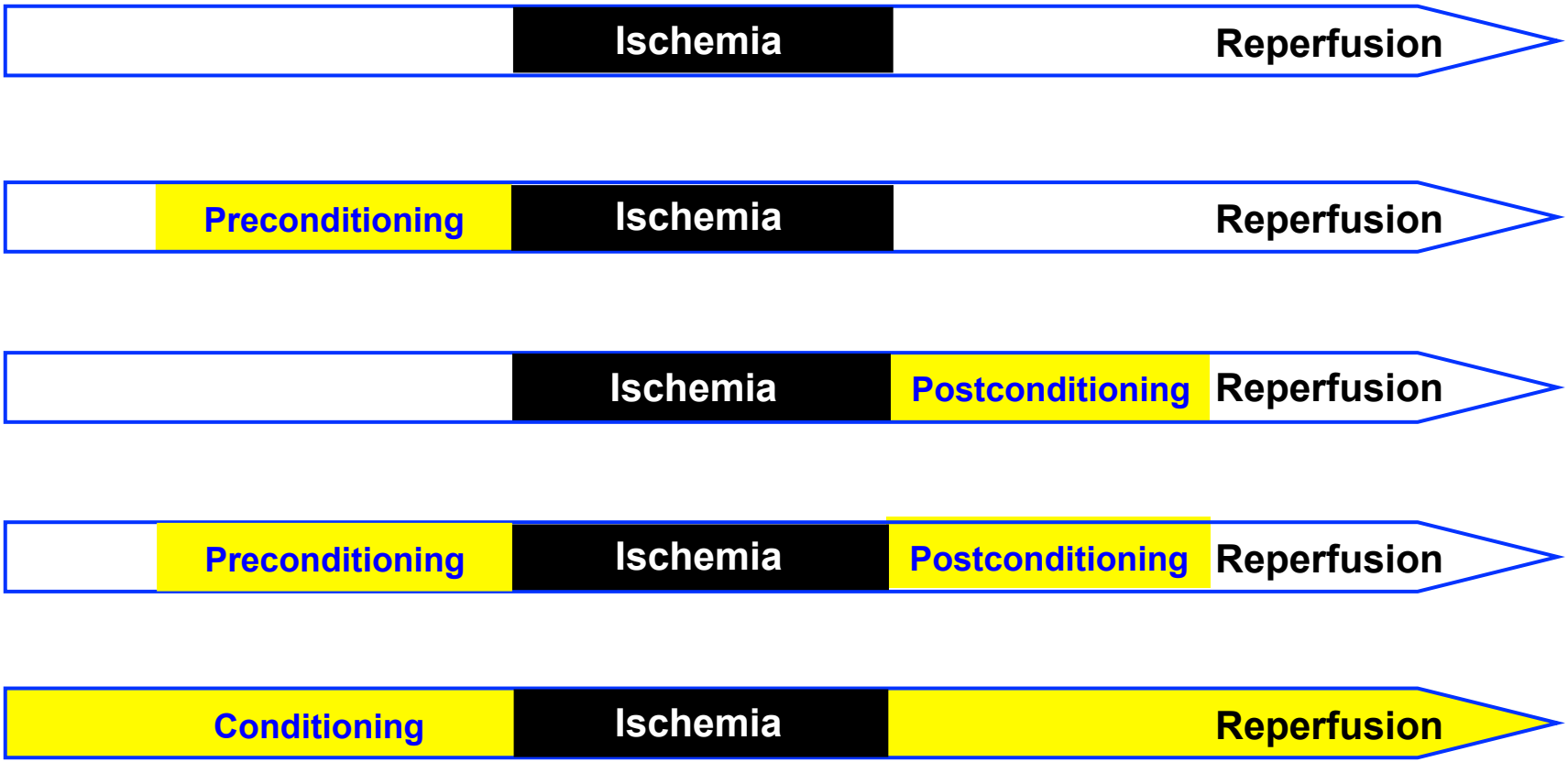
Preconditioning heart: cellular signaling



Volatile anaesthetics

Raeburn et al., *Arch Surg*, 2001

Protective procedures



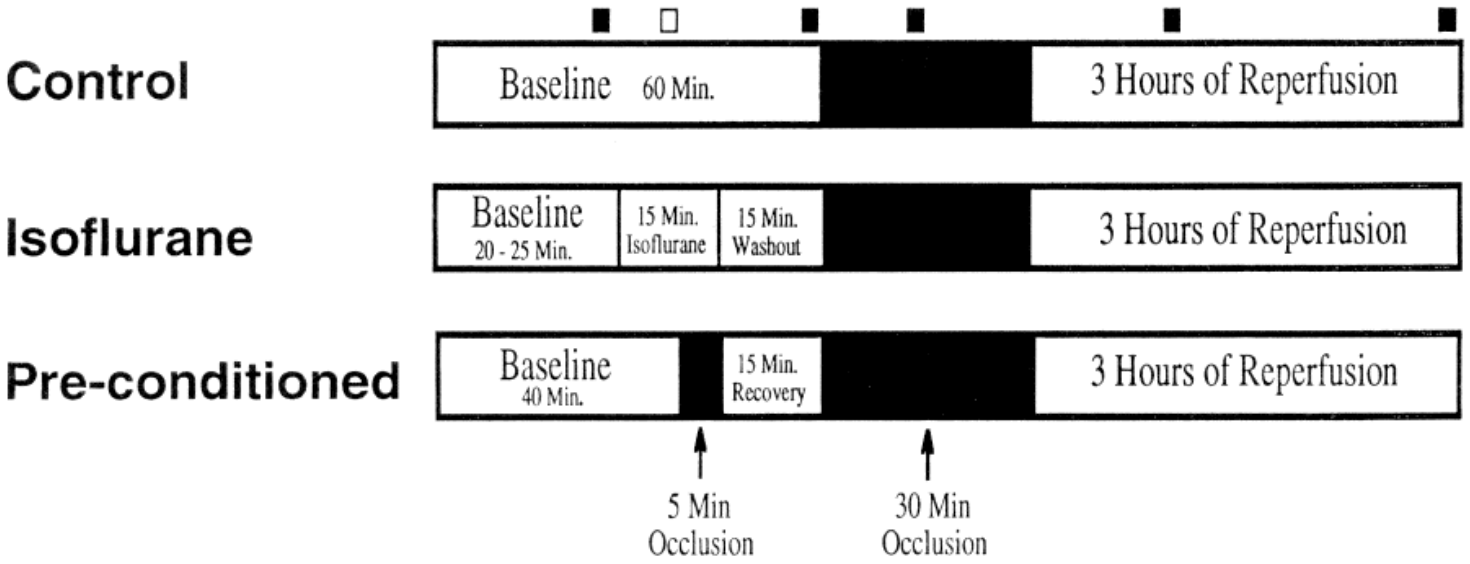
Heart and volatile anaesthetics

Anesthetic-induced Preconditioning: Previous Administration of Isoflurane Decreases Myocardial Infarct Size in Rabbits

Cason, Brian A. MD; Gamperl, A. Kurt PhD; Slocum, Robert E. BS; Hickey, Robert F. MD

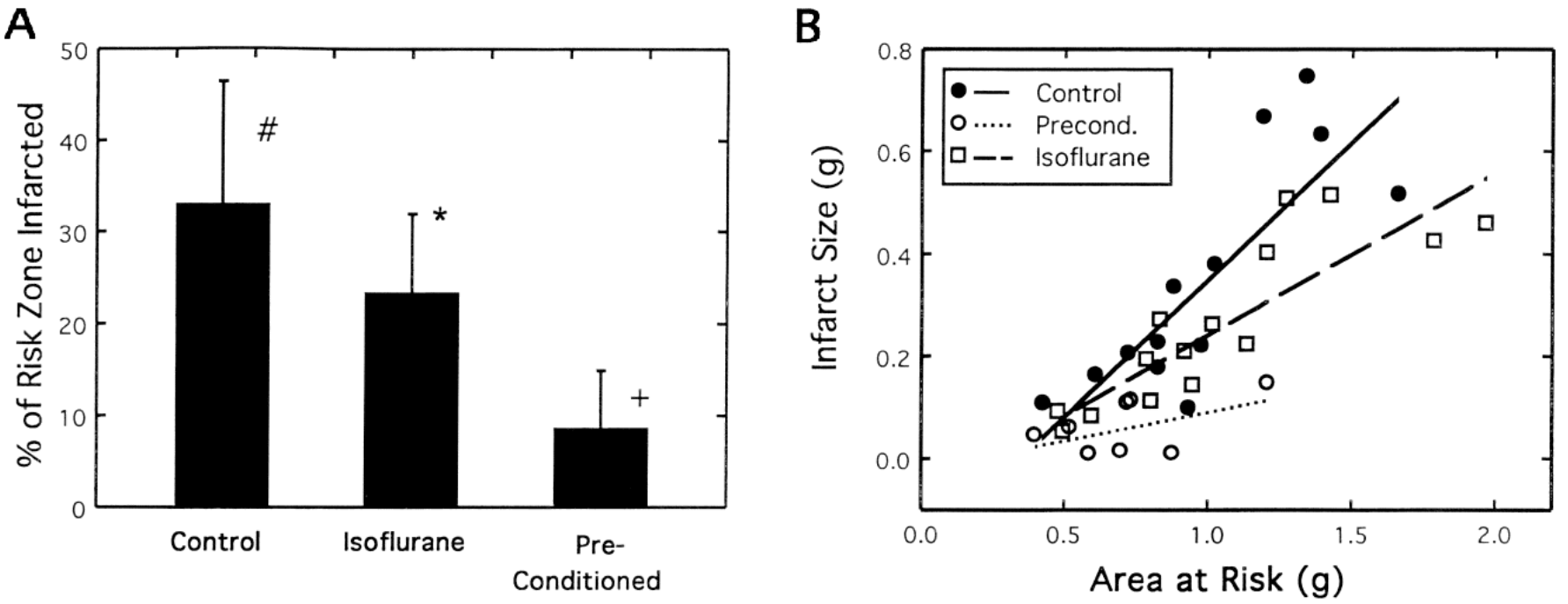
Anesthesiology, 1997

Heart and volatile anaesthetics



Cason et al., *Anesthesiology*, 1997

Heart and volatile anaesthetics



Cason et al., *Anesthesiology*, 1997

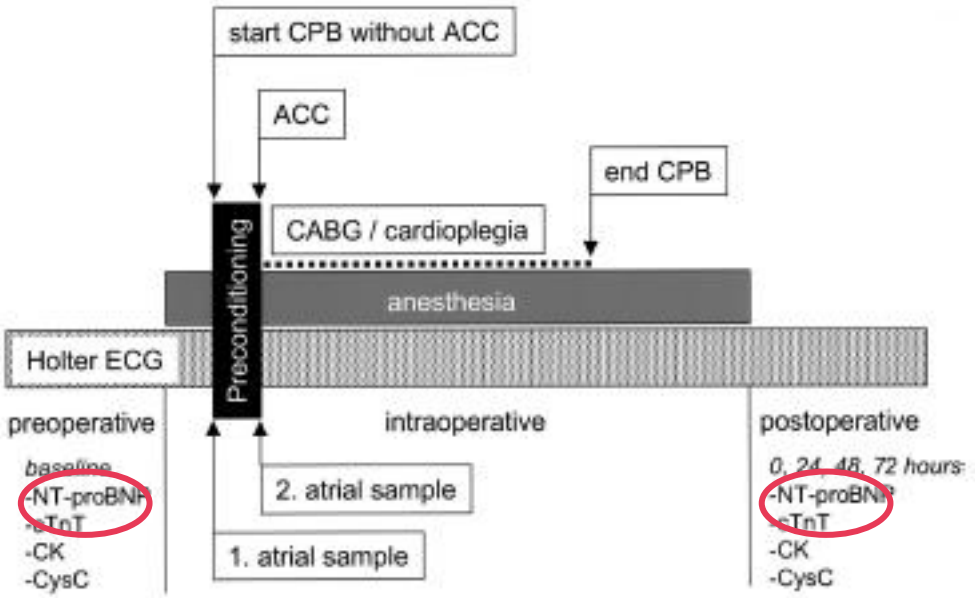
Heart and volatile anaesthetics

Preconditioning by Sevoflurane Decreases Biochemical Markers for Myocardial and Renal Dysfunction in Coronary Artery Bypass Graft Surgery: A Double-blinded, Placebo-controlled, Multicenter Study

Karine Julier, M.D., Rafaela da Silva, M.S.,† Carlos Garcia, M.D.,‡ Lukas Bestmann, Ph.D.,§ Philippe Frascarolo, Ph.D.,‖ Andreas Zollinger, M.D.,# Pierre-Guy Chassot, M.D.,** Edith R. Schmid, M.D.,†† Marko I. Turina, M.D.,‡‡ Ludwig K. von Segesser, M.D.,§§ Thomas Pasch, M.D.,‖‖ Donat R. Spahn, M.D.,## Michael Zaugg, M.D., D.E.A.A.****

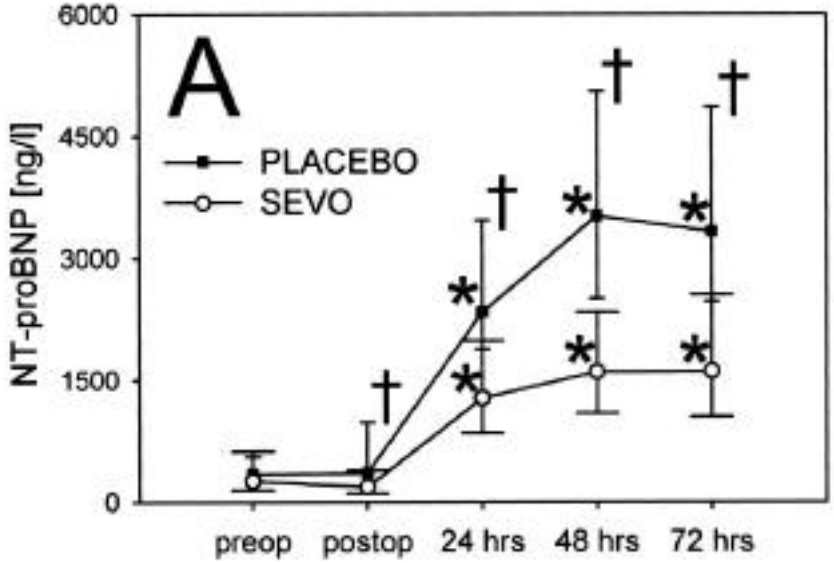
***Anesthesiology*, 2003**

Heart and volatile anaesthetics



Julier, *Anesthesiology*, 2003

Heart and volatile anaesthetics



Julier, *Anesthesiology*, 2003

Heart and volatile anaesthetics

Myocardial Damage Prevented by Volatile Anesthetics: A Multicenter Randomized Controlled Study

Fabio Guarracino, MD,* Giovanni Landoni, MD,† Luigi Tritapepe, MD,‡ Francesca Pompei, MD,‡
Albino Leoni, MD,† Giacomo Aletti, PhD,§ Anna Mara Scandroglio, MD,† Daniele Maselli, MD,*
Monica De Luca, MD,† Chiara Marchetti, MD,† Giuseppe Crescenzi, MD,† and Alberto Zangrillo, MD†

J Cardiothorac Vasc Anesth, 2006

Heart and volatile anaesthetics

- Prospective randomized study
- Multicenter study (3 University hospitals)
- CABG surgery, off-pump
- 112 patients
- Primary endpoint: desflurane (0.5 – 2 MAC) vs. propofol
    - Postoperative cardiac troponin release
    - Mechanical ventilation, ICU stay, hospitalisation

Heart and volatile anaesthetics

Table 1. Pre- and Intraoperative Variables: Baseline Demographic and Clinical Characteristics of 112 Patients Receiving Either Volatile Anesthetics or Total Intravenous Anesthesia (TIVA) to Prevent Perioperative Myocardial Damage

Variables	Volatile Anesthetics (n = 57)	TIVA (n = 55)
Age (y)	69 ± 9.0	69 ± 8.0
Height (cm)	169 ± 8.5	169 ± 9.7
NYHA		
I-II, n (%)	38 (66.6)	36 (65.5)
III-IV, n (%)	19 (33.4)	19 (34.5)
Female sex, n (%)	8 (14.0)	12 (21.8)
Weight (kg)	74 ± 13.1	73 ± 13.5
Chronic obstructive pulmonary disease, n (%)	11 (19.3)	6 (10.9)
Diabetes mellitus on insulin, n (%)	14 (24.6)	13 (23.6)
Stroke, n (%)	3 (5.3)	4 (7.3)
Previous cardiac surgery, n (%)	2 (3.5)	2 (3.6)
Ejection fraction (%)	46 ± 10.2	46 ± 10.0
Creatinine (mg/dL)	1.3 ± 0.36	1.3 ± 0.80
Preoperative cTnI (ng/dL)	0.04 ± 0.15	0.02 ± 0.09
Non-measurable cTnI, n (%)	47 (82.5)	49 (89.1)
Number of grafts		
1	13 (22.8)	9 (16.4)
2	10 (17.5)	10 (18.2)
3	29 (50.9)	28 (50.9)
4	5 (8.8)	7 (12.7)

Guarracino et al., *J Cardiothorac Vasc Anesth*, 2006

Heart and volatile anaesthetics

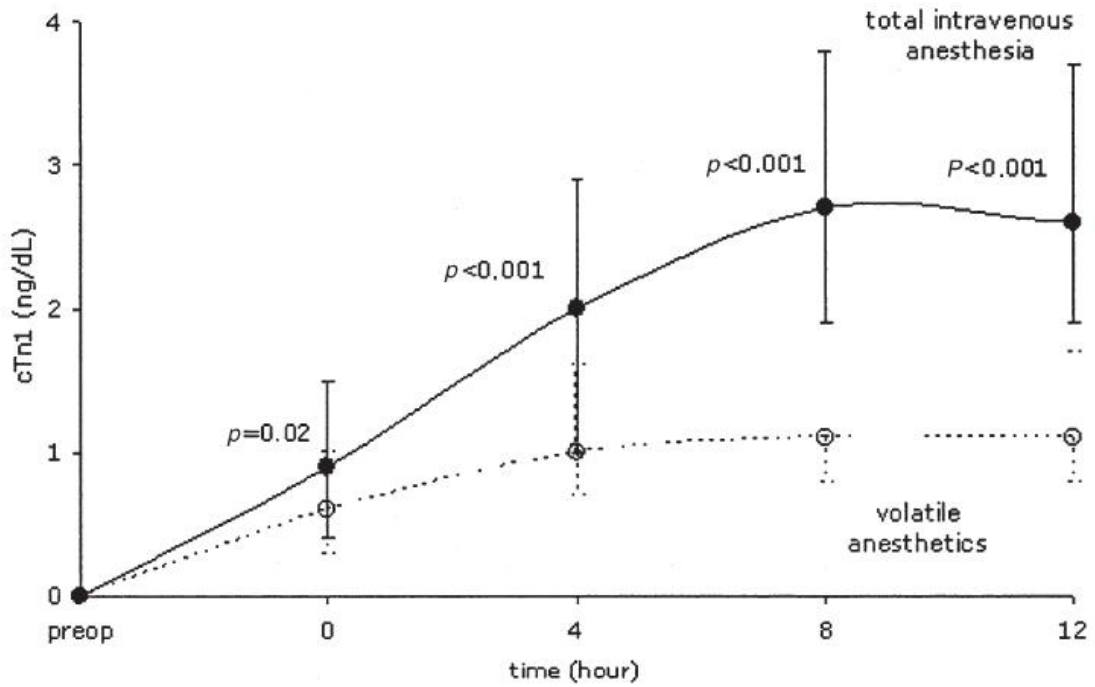


Fig 2. Median (25th-75th percentiles) of troponin I after off-pump coronary artery bypass grafting in patients receiving either volatile anesthetics or total intravenous anesthesia.

Guarracino et al., *J Cardiothorac Vasc Anesth*, 2006

Heart and volatile anaesthetics

Table 2. Postoperative Variables: Postoperative Data of Patients Who Received Either Volatile Anesthetics or Total Intravenous Anesthesia (TIVA) to Prevent Myocardial Damage for Coronary Artery Bypass Grafting

Variables	Volatile Anesthetics (n = 57)	TIVA (n = 55)	*p*	Median/Percentage Difference (95% CI)
Postoperative inotropes, n (%)	20 (35.1)	31 (56.4)	0.04	−21.3% (−37.7, −2.8)
Q-wave myocardial infarction, n (%)	3 (11.1)	5 (17.2)	0.8	−6.2% (−15.0, 6.8)
Acute renal failure (100% creatinine increase), n (%)	3 (5.3)	4 (7.3)	0.5	−2% (−12.8, 8.3)
Excessive bleeding requiring surgical revision, n (%)	2 (3.5)	1 (1.8)	0.5	1.7% (−6.9, 10.6)
Pneumonia, n (%)	1 (1.8)	1 (1.8)	0.7	0% (−8.4, 8.0)
Neurologic event type I	—	1 (1.8)	0.5	−1.8% (−10.2, 5.3)
Neurologic event type II	1 (1.8)	1 (1.8)	0.7	0% (−8.4, 8.0)
Prolonged mechanical ventilation (≥12 h), n (%)	9 (15.8)	14 (25.5)	0.3	−9.7% (−24.4, 5.5)
Mechanical ventilation hours, median (25th and 75th percentiles)	3.5 (3-8)	5 (4-13)	<0.001	−1.0 h (−2.0, −0.9)
Prolonged ICU stay (>72 h), n (%)	4 (7.0)	6 (10.9)	0.7	−3.9% (−15.7, 7.5)
ICU stay, hours, median (25th and 75th percentiles)	19 (16-24)	21 (19-24)	0.01	−2 h (−4, −0.1)
Prolonged hospitalization (≥7 days), n (%)	7 (12.3)	20 (36.4)	0.005	−24.1% (−38.6, −8.1)
Length of hospitalization, days median (25th and 75th percentiles)	5.5 (4-9)	6.5 (6-7)	<0.001	−0.5 days (−1.2, −0.2)
Death at 30 days, n (%)	0/56	1/54 (1.8)	0.5	−1.8% (−10.4%, 5.4)

Guarracino et al., *J Cardiothorac Vasc Anesth*, 2006

Lung and volatile anaesthetics

Effects of Volatile and Intravenous Anesthesia on the Alveolar and Systemic Inflammatory Response in Thoracic Surgical Patients

Thomas Schilling, M.D., Ph.D., D.E.A.A.,* Alf Kozian, M.D., Ph.D.,* Mert Senturk, M.D.,†
Christof Huth, M.D.,‡ Annegret Reinhold, Ph.D.,§ Göran Hedenstierna, M.D., Ph.D.,‖
Thomas Hachenberg, M.D., Ph.D.#

Anesthesiology, 2011

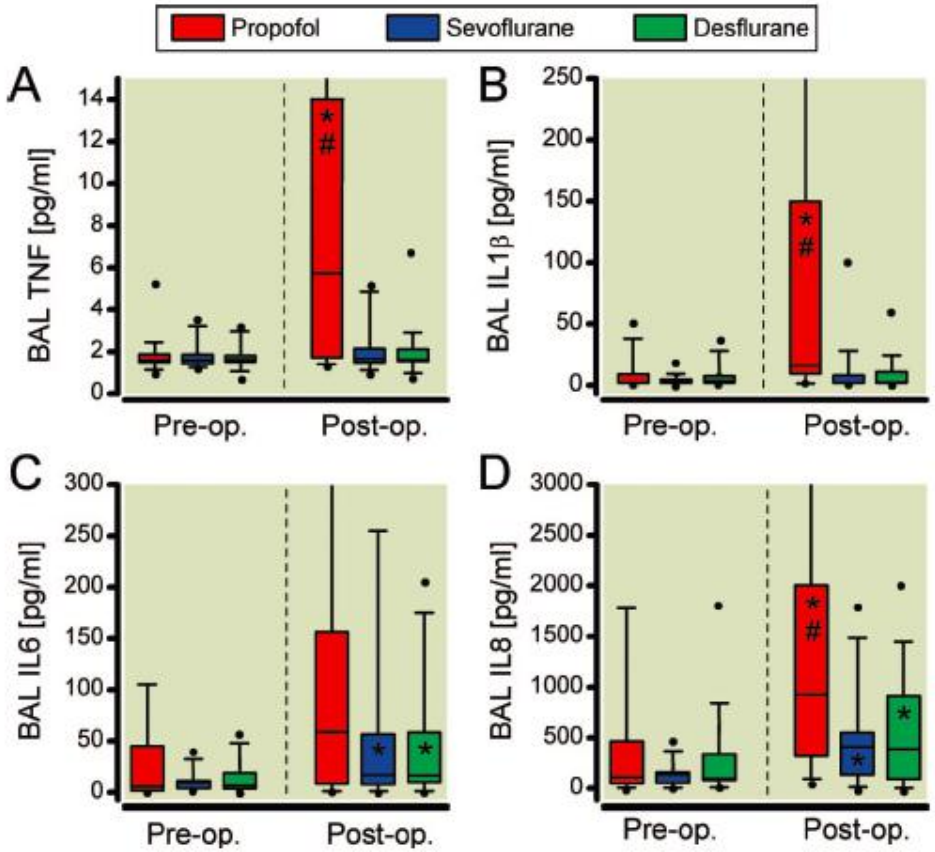
Lung and volatile anaesthetics

- 3 groups: propofol vs desflurane and sevoflurane anaesthesia (each group n=21)

- Bronchoalveolar lavage of ventilated lung after intubation, before thoracotomy and 30 min after surgical procedure

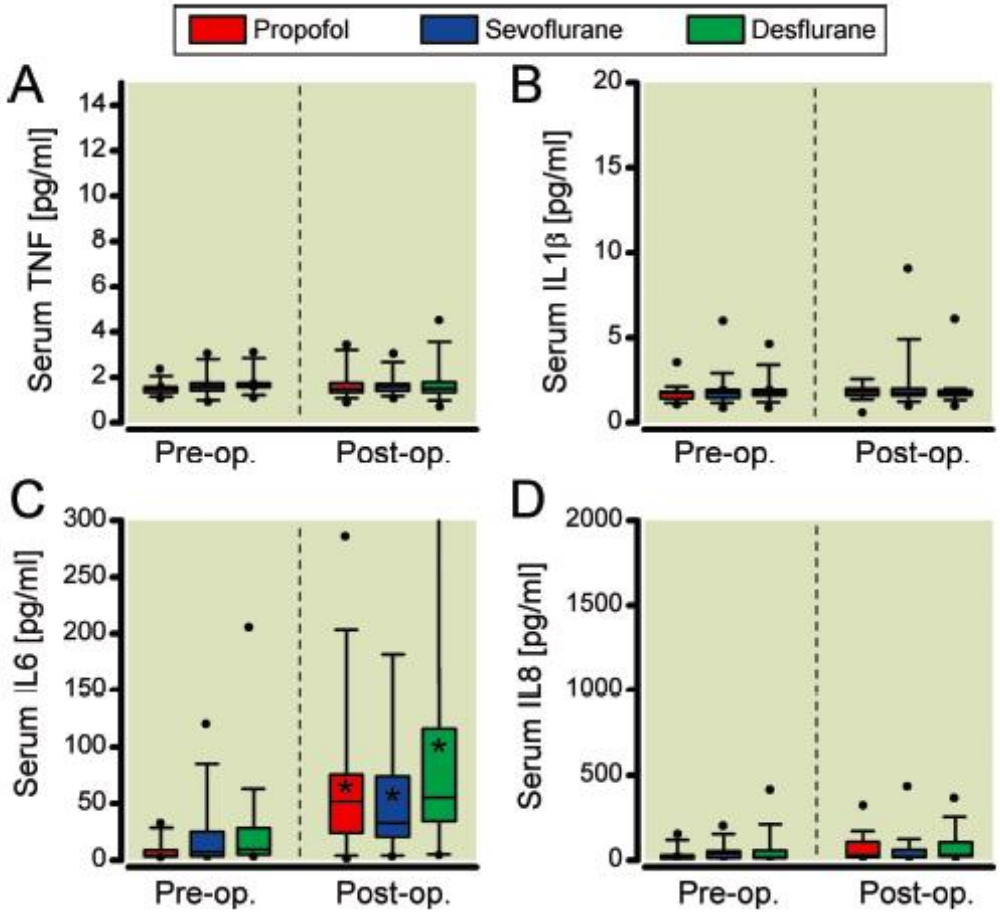
Schilling et al., *Anesthesiology*, 2011

Lung and volatile anaesthetics



Schilling et al., *Anesthesiology*, 2011

Lung and volatile anaesthetics



Schilling et al., *Anesthesiology*, 2011

Lung and volatile anaesthetics

Anesthetic-induced Improvement of the Inflammatory Response to One-lung Ventilation

Elisena De Conno, M.D.,* Marc P. Steurer, M.D.,* Moritz Wittlinger, M.D.,† Marco P. Zalunardo, M.D.,‡ Walter Weder, M.D.,§ Didier Schneiter, M.D.,‖ Ralph C. Schimmer, M.D.,# Richard Klaghofer, Ph.D.,** Thomas A. Neff, M.D.,* Edith R. Schmid, M.D.,†† Donat R. Spahn, M.D.,‡‡ Birgit Roth Z'graggen, Ph.D.,§§ Martin Urner, M.D.,† Beatrice Beck-Schimmer, M.D.‖‖

Anesthesiology, 2009

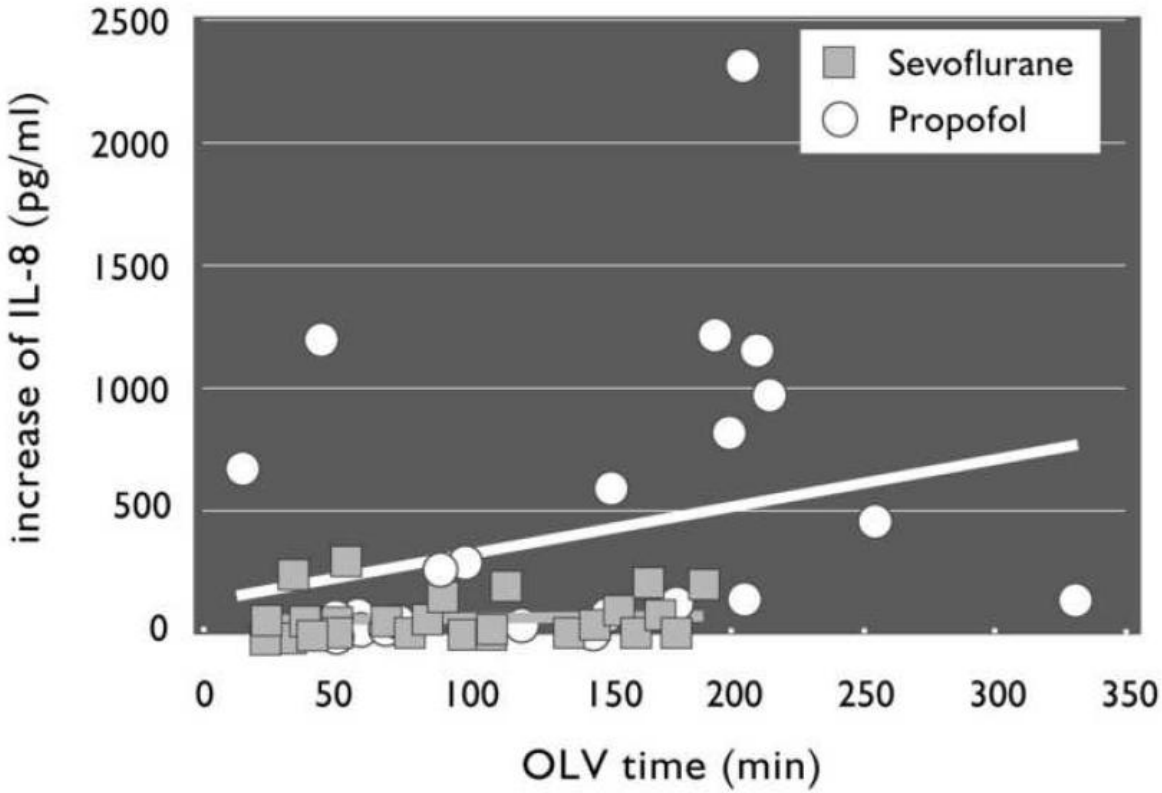
Lung and volatile anaesthetics

- **Propofol vs sevoflurane anesthesia (each group n=27)**

- **Bronchoalveolar lavage of non-ventilated lung before and after OLV**

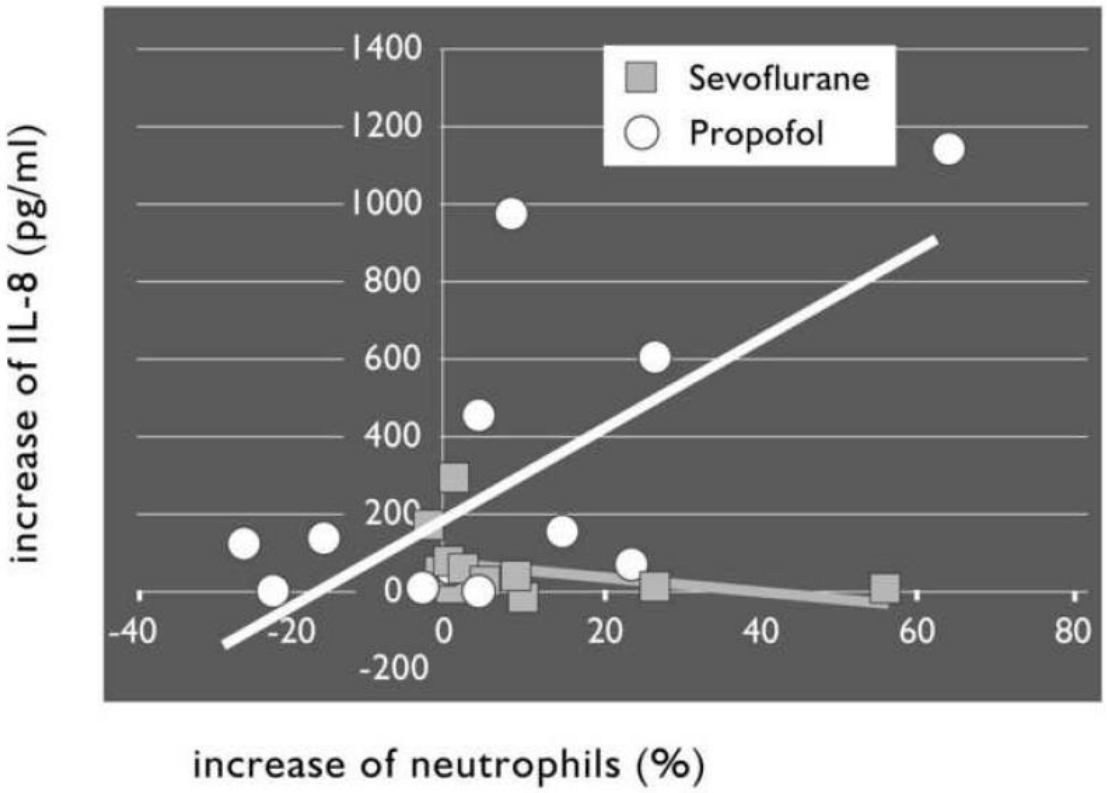
De Conno et al., *Anesthesiology*, 2009

Lung and volatile anaesthetics



De Conno et al., *Anesthesiology*, 2009

Lung and volatile anaesthetics



De Conno et al., *Anesthesiology*, 2009

Lung and volatile anaesthetics

Table 6. Adverse Events

	Events	
	Propofol	Sevoflurane
Prolonged antibiosis	7	4
Pneumonia	3	2
Atelectasis	5	1
Fistula	3	1
Effusion	15	10
Reintubation	1	0
SIRS	1	0
Sepsis	1	0
ARDS	0	0
Surgical revision	4	0
Death	0	0
Total	40	18

De Conno et al., *Anesthesiology*, 2009

Liver and volatile anaesthetics

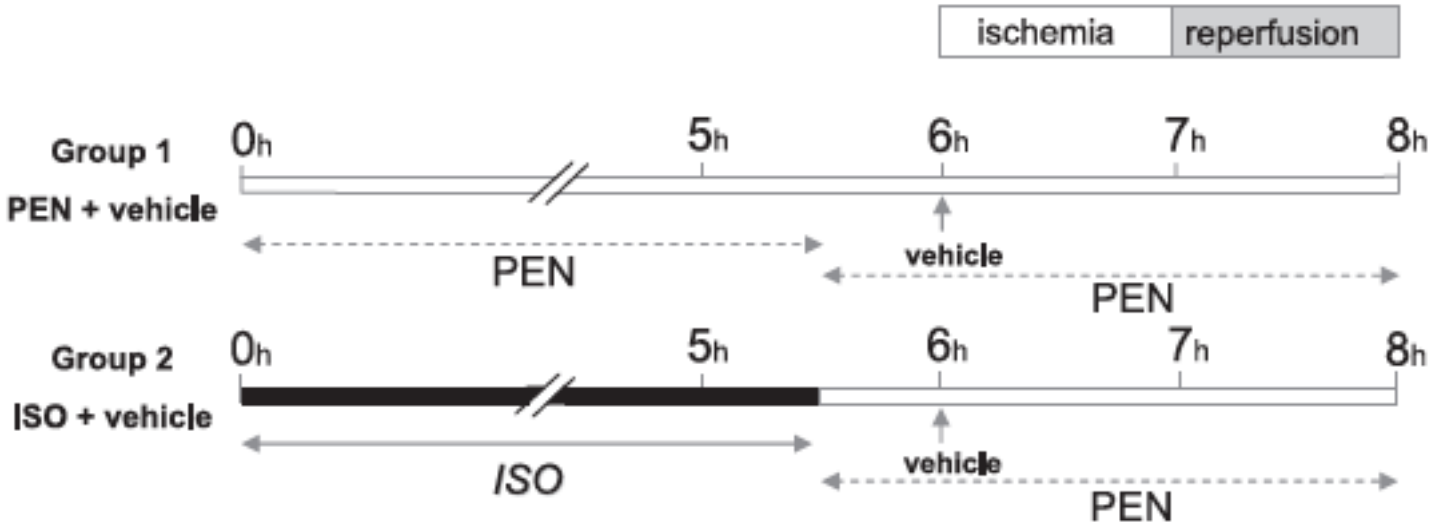
Heme Oxygenase-1 Induction by the Clinically Used Anesthetic Isoflurane Protects Rat Livers From Ischemia/Reperfusion Injury

Rene Schmidt, MD, Eva Tritschler, Alexander Hoetzel, MD, Torsten Loop, MD, Matjaz Humar, PhD, Leonie Halverscheid, MD, Klaus K. Geiger, MD, and Benedikt H. J. Pannen, MD

***Ann Surg*, 2007**

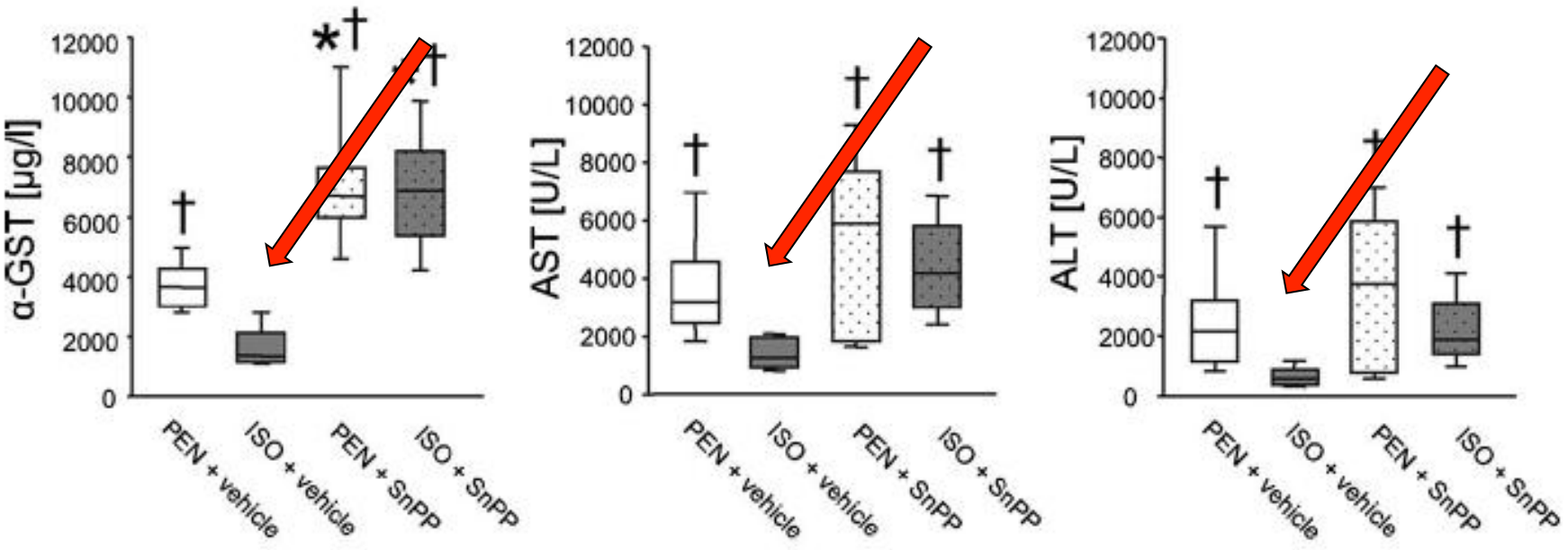
Liver and volatile anaesthetics

Partial hepatic ischemia in rats



Schmidt et al., *Ann Surg*, 2007

Liver and volatile anaesthetics



Schmidt et al., *Ann Surg*, 2007

Liver and volatile anaesthetics

The Influence of Pharmacological Preconditioning with Sevoflurane on Incidence of Early Allograft Dysfunction in Liver Transplant Recipients

Andrei F. Minou,[1] Alexander M. Dzyadzko,[1] Aliaksei E. Shcherba,[2] and Oleg O. Rummo[2]

[1] *Department of Anesthesiology and Critical Care, Republican Center of Organ and Tissue Transplantation, Semashko Street 8, 220116 Minsk, Belarus*
[2] *Department of Transplantology, Republican Center of Organ and Tissue Transplantation, Semashko Street 8, 220116 Minsk, Belarus*

***Anesth Res Pract*, 2012**

Liver and volatile anaesthetics

- **Randomisation: air only or air/sevoflurane 2 Vol% (each group n=30)**
- **Primary endpoint: postoperative liver injury (AST, ALT)**
- **Secondary endpoint: early allograft dysfunction**

Minou et al., *Anesth Res Pract*, 2012

Liver and volatile anaesthetics

	Sevoflurane group	Control group	*P* value
Peak AST, IU/L	792 (481–1436)	1861 (519–3590)	0,038*
Peak ALT, IU/L	606 (344–892)	1191 (392–2137)	0,117*
Incidence of EAD, %	16,7 (5 of 30)	50,0 (15 of 30)	0,013**
Length of ICU stay, d	6 (5–8)	6 (4–9)	0,655*
Length of hospital stay, d	18 (14–22)	18 (15–26)	0,833*

Minou et al., *Anesth Res Pract*, 2012

Liver and volatile anaesthetics

Macrovesicular steatosis	Incidence of EAD, %		Fisher's exact test, two-tailed *P* value
	Sevoflurane group	Control group	
None (0%)	11,1 (1 of 9)	11,1 (1 of 9)	1,000
Mild (1–30%)	18,8 (3 of 16)	60,0 (9 of 15)	0,029
Moderate (31–60%)	20,0 (1 of 5)	83,3 (5 of 6)	0,080

Minou et al., *Anesth Res Pract*, 2012

Liver and volatile anaesthetics

Protection of Pharmacological Postconditioning in Liver Surgery

Results of a Prospective Randomized Controlled Trial

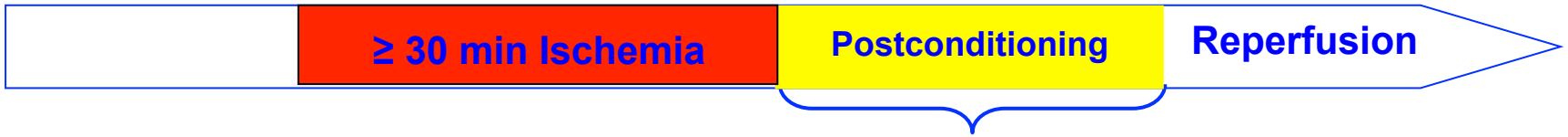
Beatrice Beck-Schimmer, MD,†‡ Stefan Breitenstein, MD,*§ John M. Bonvini, MD,*†*
Mickael Lesurtel, MD, PhD,§ Michael Ganter, MD,*† Achim Weber, MD,*|| Milo A. Puhan, MD, PhD,¶***
and Pierre-Alain Clavien, MD, PhD, FACS§*

***Ann Surg*, 2012**

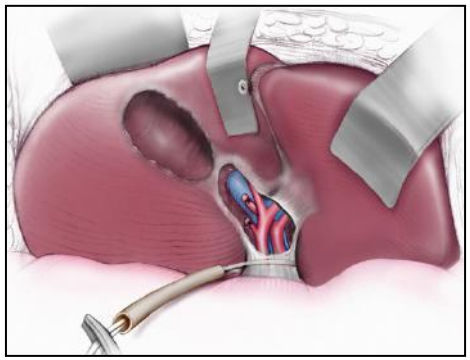
UniversityHospital Zurich

University of Zurich[UZH]

Liver and volatile anaesthetics

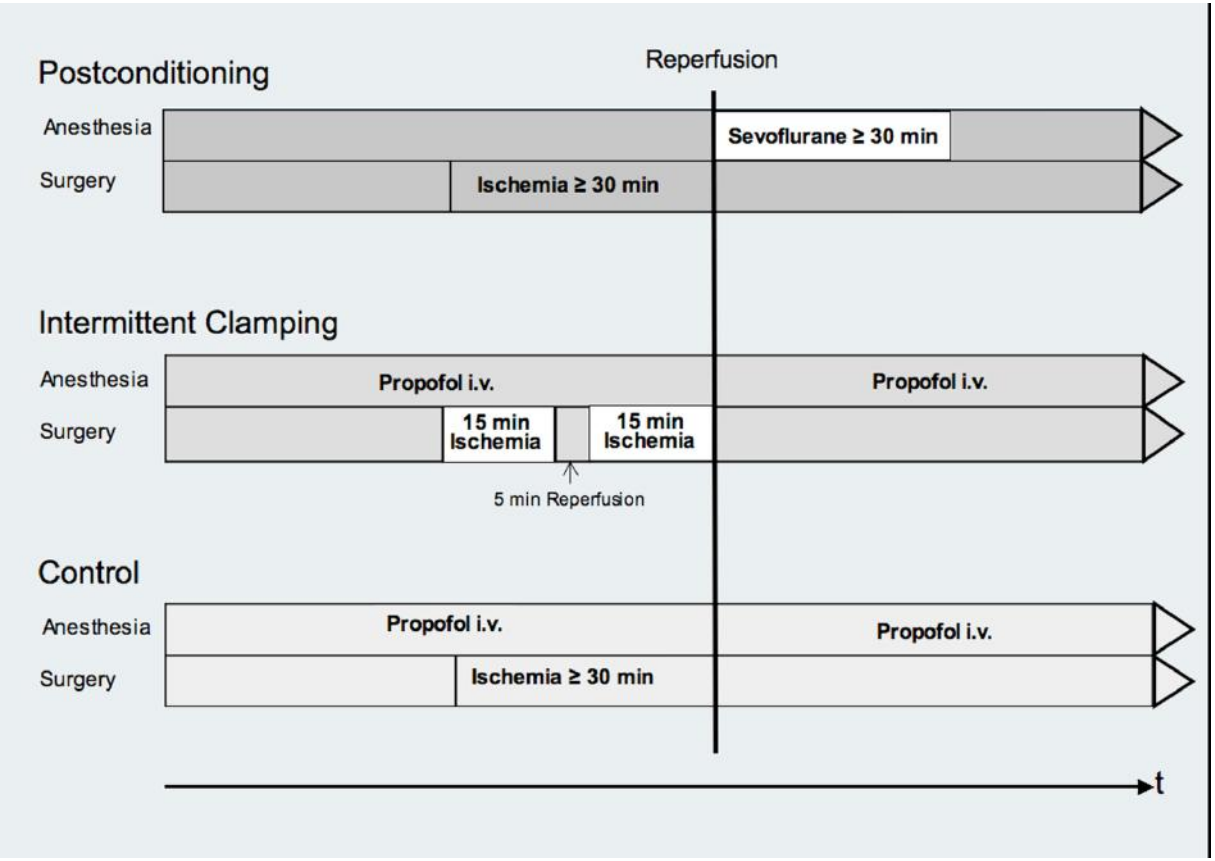


Sevoflurane
1.5 MAC



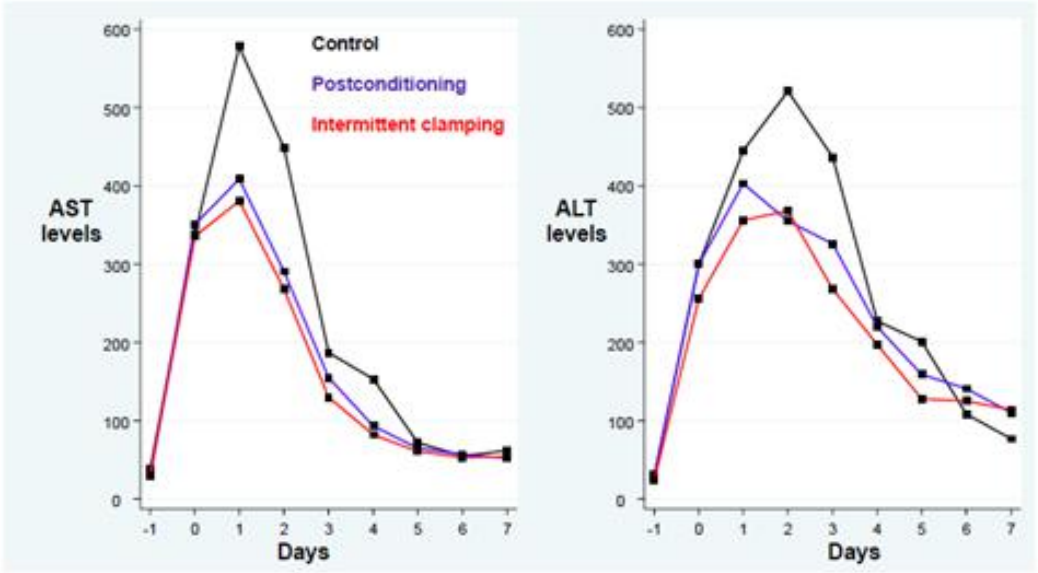
Beck-Schimmer et al., *Ann Surg*, 2012

Liver and volatile anaesthetics



Beck-Schimmer et al., *Ann Surg*, 2012

Liver and volatile anaesthetics



AST	
Postconditioning vs. control	p=0.041
Intermittent clamping vs. control	p=0.008
Postconditioning vs. intermittent clamping	p=0.52

ALT	
Postconditioning vs. control	p=0.21
Intermittent clamping vs. control	p=0.11
Postconditioning vs. intermittent clamping	p=0.78

Beck-Schimmer et al., *Ann Surg*, 2012

Liver and volatile anaesthetics

	Control	Post-conditioning	Intermittent clamping	Postconditioning versus control Median difference (95% CI, p value)	Intermittent clamping versus control Median difference (95% CI, p value)
Peak AST: median (IQR) (U/L)	631 (386-741)	443 (306-644)	438 (303-549)	-214 (-352 to -8, p=0.044)	-123 (-204 to -27, p=0.015)
Peak ALT: median (IQR) (U/L)	557 (292-775)	421 (308-637)	373 (256-605)	-150 (-289 to 60, p=0.14)	-92 (-173 to 6, p=0.07)
Peak bili: median (IQR) (µmol/L)	21 (17-39)	25 (17-41)	19 (14-29	1 (-6 to 11, p=0.88)	-1 (-5 to 3, p=0.53)
Peak APh: median (IQR) (U/L)	187 (93-268)	145 (106-235)	123 (89-202)	-11 (-64 to 64, p=0.73)	-17 (-46 to 18, p=0.31)
Peak crea: median (IQR) (µmol/L)	90 (76-101)	80 (64-97)	83 (67-94)	-14 (-29- to 5, p=0.15)	-8 (-16 to 0, p=0.06)
Hospital stay: median (IQR) (days)	13 (8-21)	9 (8-10)	9 (7-12)	-4 (-6 to -1, p=0.009)	-2 (-4 to 0, p=0.019)
				Odds ratio	**Odds ratio**
Any complication, n (%)	13 (76.5)	12 (25.0)	23 (46.0)	0.08 (0.02 to 0.36, p=0.001)	0.50 (0.26 to 0.96, p=0.038)
Major complication (IIIa-V), n (%)	7 (42.2)	5 (10.4)	8 (16.0)	0.22 (0.05 to 0.97, p=0.045)	0.52 (0.27 to 1.00, p=0.05)
ICU stay, number (%)	3 (17.7)	3 (6.3)	9 (18.0)	0.31 (0.06-1.72, p=0.18)	1.01 (0.49 to 2.08, p=0.97)

Beck-Schimmer et al., *Ann Surg*, 2012

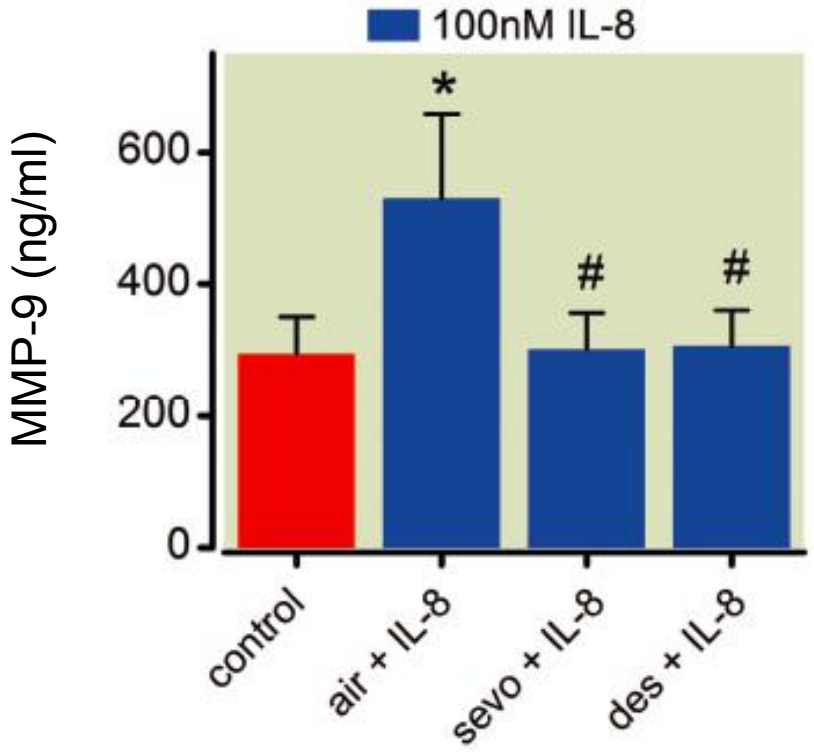
Liver and volatile anaesthetics

Volatile Anesthetics Reduce Invasion of Colorectal Cancer Cells through Down-regulation of Matrix Metalloproteinase-9

Björn Müller-Edenborn, M.D.,* Birgit Roth-Z'graggen, Ph.D.,† Kamila Bartnicka, M.Sc.,‡
Alain Borgeat, M.D.,§ Alexandra Hoos, M.Sc.,‡ Lubor Borsig, Ph.D.,‖
Beatrice Beck-Schimmer, M.D.#

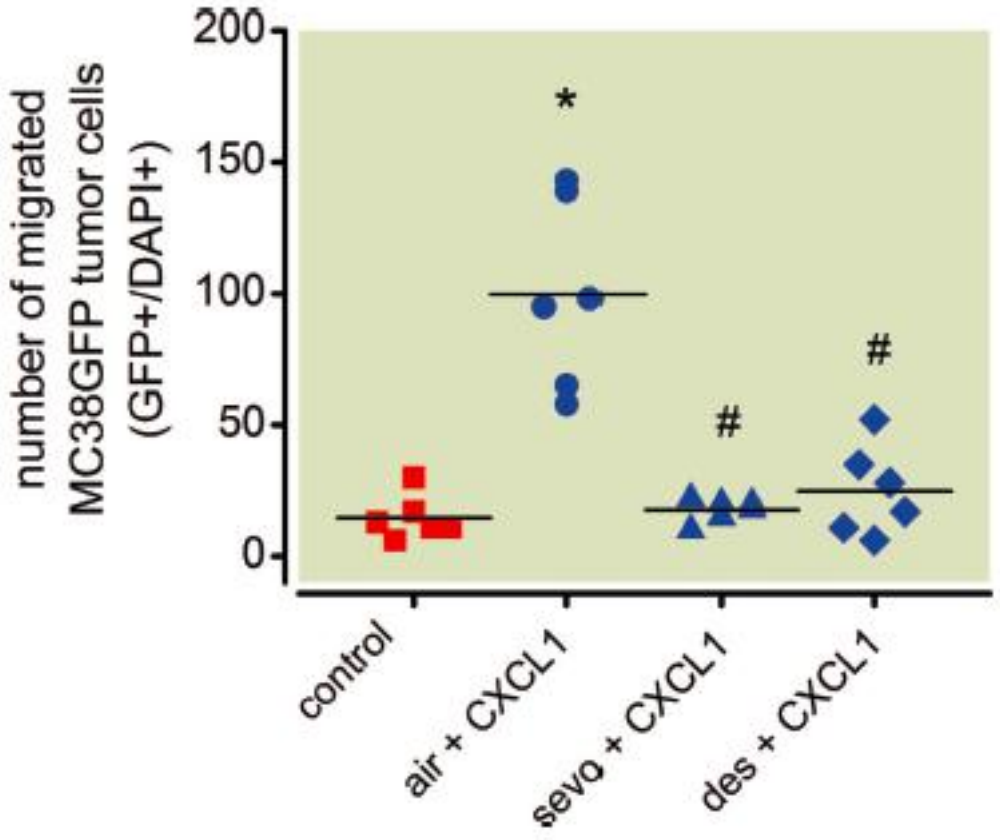
***Anesthesiology*, 2012**

Liver and volatile anaesthetics



Müller-Edenborn et al., *Anesthesiology*, 2012

Liver and volatile anaesthetics



Müller-Edenborn et al., *Anesthesiology*, 2012

Kidneys and volatile anaesthetics

Differential Protective Effects of Volatile Anesthetics against Renal Ischemia–Reperfusion Injury In Vivo

H. Thomas Lee, M.D., Ph.D., Ayuko Ota-Setlik, M.S.,† Yulei Fu, M.S.,‡ Samih H. Nasr, M.D.,§ Charles W. Emala, M.D.‖*

***Anesthesiology*, 2004**

Kidneys and volatile anaesthetics

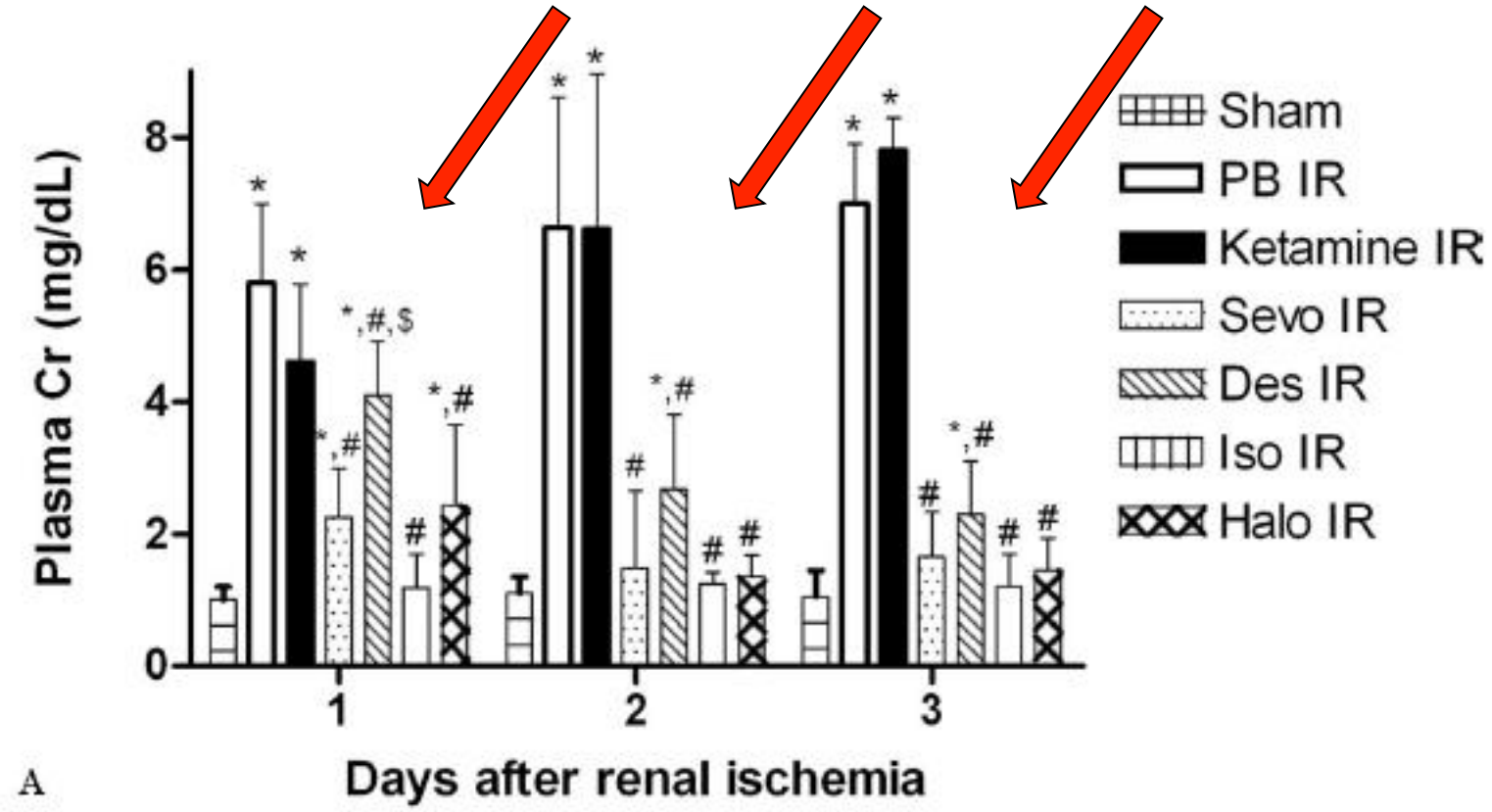
- **Right nephrectomy, 45 min left kidney ischemia, followed by reperfusion (rat model)**

- **Application of 1 MAC volatile anesthetics (isoflurane, sevoflurane, halothane, desflurane) during ischemia and for 3 hours of reperfusion**

- **Determination of plasma creatinine and renal inflammatory mediators**

Lee et al., *Anesthesiology*, 2004

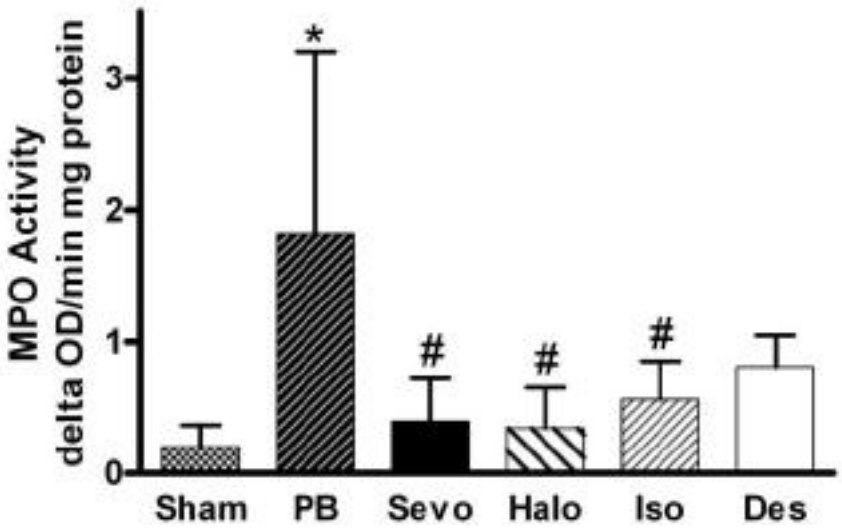
Kidneys and volatile anaesthetics



Lee et al., *Anesthesiology*, 2004

Kidneys and volatile anaesthetics

Renal cortices, 24 hours:



Lee et al., *Anesthesiology*, 2004

Kidneys and volatile anaesthetics

Isoflurane mediates protection from renal ischemia-reperfusion injury via sphingosine kinase and sphingosine-1-phosphate-dependent pathways

Minjae Kim,[1] Mihwa Kim,[1] Nala Kim,[1] Vivette D. D'Agati,[2] Charles W. Emala, Sr,[1] and H. Thomas Lee[1]

Departments of [1]Anesthesiology and [2]Pathology, College of Physicians and Surgeons of Columbia University, New York, New York

***Am J Physiol Renal*, 2007**

Kidneys and volatile anaesthetics

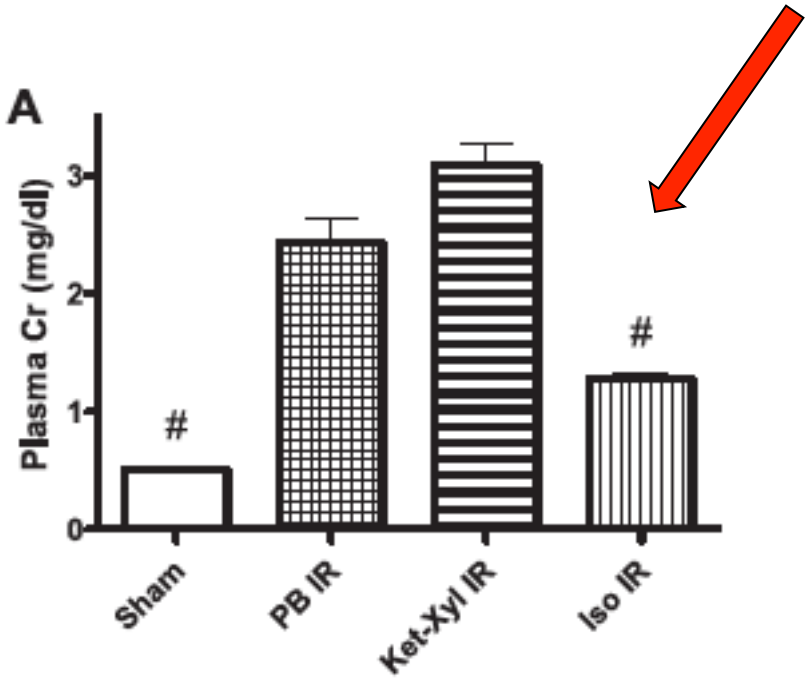
- **Right nephrectomy, 30 min left kidney ischemia, followed by reperfusion (mouse model)**

- **Application of 1 MAC of isoflurane during ischemia and for 3 hours of reperfusion**

- **Determination of plasma creatinine and renal inflammatory mediators**

Kim et al., *Am J Physiol Renal*, 2007

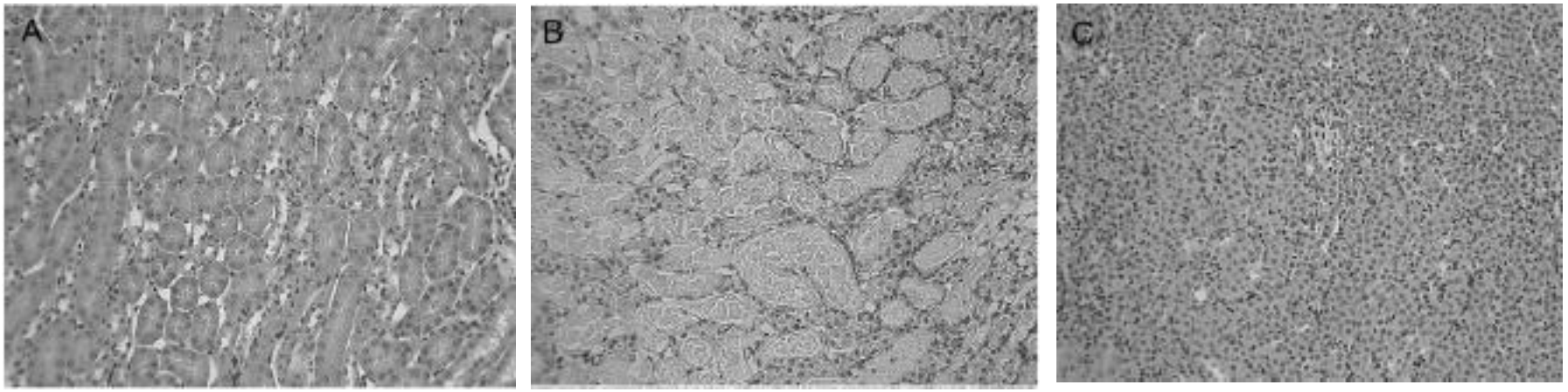
Kidneys and volatile anaesthetics



Kim et al., *Am J Physiol Renal*, 2007

Kidneys and volatile anaesthetics

Outer medulla after 24 hours:



Control **Pentobarbital** **Isoflurane**

Kim et al., *Am J Physiol Renal*, 2007

Kidneys and volatile anaesthetics

Clinical trials??

Kidneys and volatile anaesthetics

ClinicalTrials.gov:

- Volatile anesthetic protection of renal transplants VAPOR-1-trail

- Comparison of the protective effect of desflurane and propofol in patients with renal transplantation

No benefit with volatile anaesthetics

Possible reasons for 'failure':

-Retrospective approach

No benefit with volatile anaesthetics

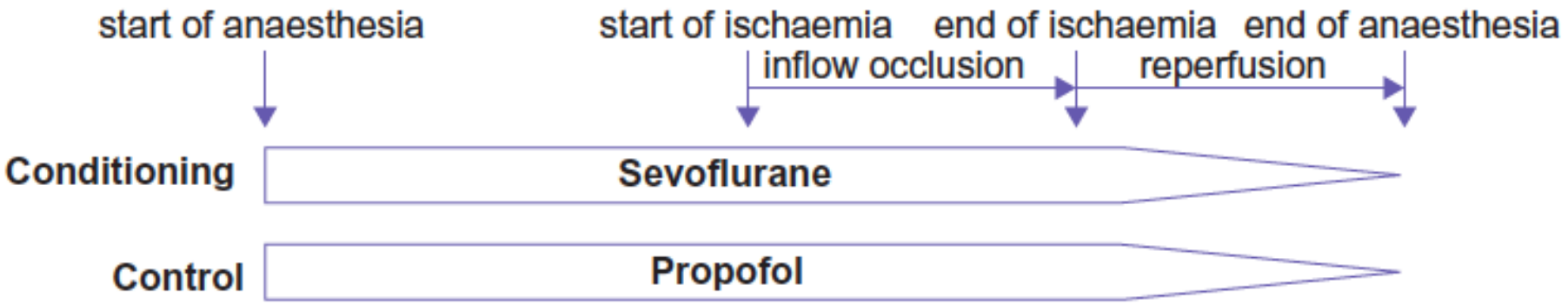
Does pharmacological conditioning with the volatile anaesthetic sevoflurane offer protection in liver surgery?

Ksenija Slankamenac[1]*, Stefan Breitenstein[1]*, Beatrice Beck-Schimmer[2], Rolf Graf[1], Milo A. Puhan[3,4] & Pierre-Alain Clavien[1]

[1]Swiss HPB (Hepato-Pancreato-Biliary) Center, [2]Institute of Anesthesiology, [3]Horten Centre for Patient-Oriented Research, University Hospital of Zurich, Zurich, Switzerland, and [4]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD USA

***HPB*, 2012**

No benefit with volatile anaesthetics



Slankamenac et al., *HPB*, 2012

No benefit with volatile anaesthetics

Outcome	Conditioning (n = 141)	Control (n = 86)	Unadjusted difference (95% CI, P-value)	Adjusted difference (95% CI, P-value)
Peak AST, mean (SD) U/l	629.0 (782.6)	592.5 (695.9)	36.52 (–158.26–231.30, P = 0.712)	61.85 (–151.66–275.38, P = 0.568)
Peak ALT, mean (SD) U/l	615.2 (845.5)	554.1 (582.9)	61.11 (–124.87–247.09, P = 0.518)	136.06 (–113.77–385.90, P = 0.284)
Peak bilirubin, mean (SD) µmol/l	56.2 (84.3)	46.15 (64.1)	10.00 (–7.59–27.60, P = 0.263)	9.40 (–15.79–34.58, P = 0.462)
Peak creatinine, mean (SD) µmol/l	108.8 (56.8)	95.7 (47.7)	13.14 (–0.53–26.81, P = 0.060)	–0.28 (–16.93–16.36, P = 0.973)
Blood loss, mean (SD) ml	491.5 (572.6)	396.4 (364.3)	455.46 (389.17–521.76, P = 0.001)	43.21 (–101.46–187.88, P = 0.557)
Length of hospital stay in days, median (IQR)	12 (9–19)	11 (9–14)	2.97 (0.23–15.80, P = 0.034)	0.85 (–2.56–4.26, P = 0.622)
Length of ICU stay in days, median (IQR)	1 (0–3)	0	2.16 (0.66–3.66, P = 0.005)	1.55 (–0.18–3.28, P = 0.079)

Slankamenac et al., *HPB*, 2012

No benefit with volatile anaesthetics

			Unadjusted odds ratio (95% CI, p value)	Adjusted odds ratio (95% CI, p-value)
Any complication (grade I–V) (%)	78 (55.3)	42 (48.8)	1.30 (0.77–2.18, $P = 0.325$)	1.12 (0.55–2.28, $P = 0.761$)
More severe complication (grade IIIb–V) (%)	29 (20.6)	11 (12.8)	1.77 (0.85–3.7, $P = 0.130$)	0.84 (0.36–1.97, $P = 0.688$)
Mortality (%)	6 (4.3)	2 (2.3)	0.40 (0.08–1.91, $P = 0.249$)	0.63 (0.08–5.11, $P = 0.668$)

Slankamenac et al., *HPB*, 2012

No benefit with volatile anaesthetics

Possible reasons for 'failure':

-Retrospective studies

-No ischemia/reperfusion (hypoxia/reoxygenation)

No benefit with volatile anaesthetics

The Effects of Desflurane and Propofol-Remifentanil on Postoperative Hepatic and Renal Functions After Right Hepatectomy in Liver Donors

Justin Sang Ko,[1] Mi Sook Gwak,[1] Soo Joo Choi,[1] Gaab Soo Kim,[1] Jie Ae Kim,[1] Mikyung Yang,[1] Sangmin Maria Lee,[1] Hyun Sung Cho,[1] In Sun Chung,[1] and Myung Hee Kim[1]

[1]*Department of Anesthesiology and Pain Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea*

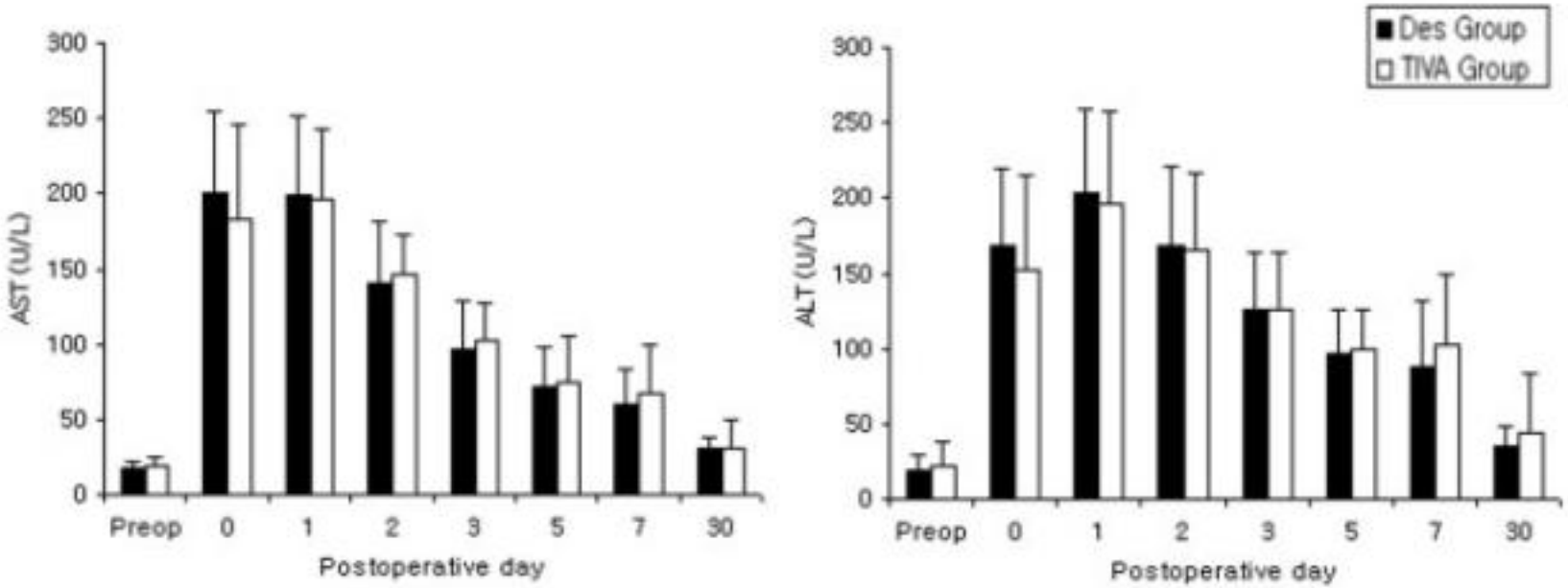
***Liver Transpl*, 2008**

No benefit with volatile anaesthetics

- **TIVA vs desflurane anesthesia (each group n=35)**
- **Determination of postoperative liver, coagulation and kidney parameters**

Ko et al., *Liver Transpl*, 2008

No benefit with volatile anaesthetics



Ko et al., *Liver Transpl*, 2008

No benefit with volatile anaesthetics

TABLE 4. Postoperative Complications

Complications	Des Group (n = 35)	TIVA Group (n = 35)
Number of donors who experienced complications	12 (34.2)	16 (45.7)
Overall complications	14 (40.0)	20 (57.1)
Major complications	2 (5.7)	0
Bile duct stenosis (PCD insertion)	1 (2.8)	0
Intra-abdominal bleeding (reoperation)	1 (2.8)	0
Minor complications	12 (34.2)	20 (57.1)*
Atelectasis	0	4 (11.4)
Pleural effusion	4 (11.4)	5 (14.3)
Wound infection or dehiscence	3 (8.5)	3 (8.5)
Wound hematoma or seroma	5 (14.3)	7 (20.2)
Hoarseness	0	1 (2.8)

No benefit with volatile anaesthetics

Possible reasons for 'failure':

-Retrospective studies

-No ischemia/reperfusion (hypoxia/reoxygenation)

-Design of clinical trial:
Definition of possible confounders

No benefit with volatile anaesthetics

A Comparison of Liver Function After Hepatectomy with Inflow Occlusion Between Sevoflurane and Propofol Anesthesia

J. C. Song, MD,* Y. M. Sun, MD,* L. Q. Yang, MD,* M. Z. Zhang, MD,† Z. J. Lu, MD,* and W. F. Yu, MD*

Anesth Analg, 2010

No benefit with volatile anaesthetics

- **Propofol TCI vs sevoflurane anesthesia (each group n=50)**

- **Determination of postoperative transaminases and kidney parameters**

Song et al., *Anesth Analg*, 2010

No benefit with volatile anaesthetics

Table 2. Intraoperative Data from Patients Undergoing Hepatectomy with Inflow Occlusion

	Sevoflurane group (n = 50)	Propofol group (n = 50)
Pringle time (min)	21.4 (8.5)	18.4 (6.3)
Operation time (min)	136.0 (38.4)	124.3 (29.1)
Blood loss (mL)	302 (269)	291 (187)
Bispectral index	40.6 (5.2)	39.1 (6.1)
Size of excised liver (cm^3)	474.1 (450.4)	527.7 (398.9)
Major/minor resection		
Major resection ≥3 segments	22	23
Minor resection <3 segments	28	27

Song et al., *Anesth Analg*, 2010

No benefit with volatile anaesthetics

Table 4. Postoperative Laboratory Data and Length of Hospital Stay

	Sevoflurane group (n = 50)	Propofol group (n = 50)
Peak ALT (U/L)	504 (295)	571 (460)
Peak AST (U/L)	435 (275)	581 (494)
Peak bilirubin (μmol/L)	25.2 (9.3)	33.3 (28.7)
Peak ALP (U/L)	121 (35)	144 (83)
Peak WBC ($\times 10^3$/mL)	13.1 (2.7)	14.6 (4.6)
Peak creatinine (μmol/L)	70.3 (11.0)	66.8 (11.7)
Hospital stay (d)	16.1 (4.8)	14.0 (2.9)

Steatosis?
Preoperative chemotherapy?

Song et al., *Anesth Analg*, 2010

Volatile anaesthetics without protection

Possible reasons for 'failure':

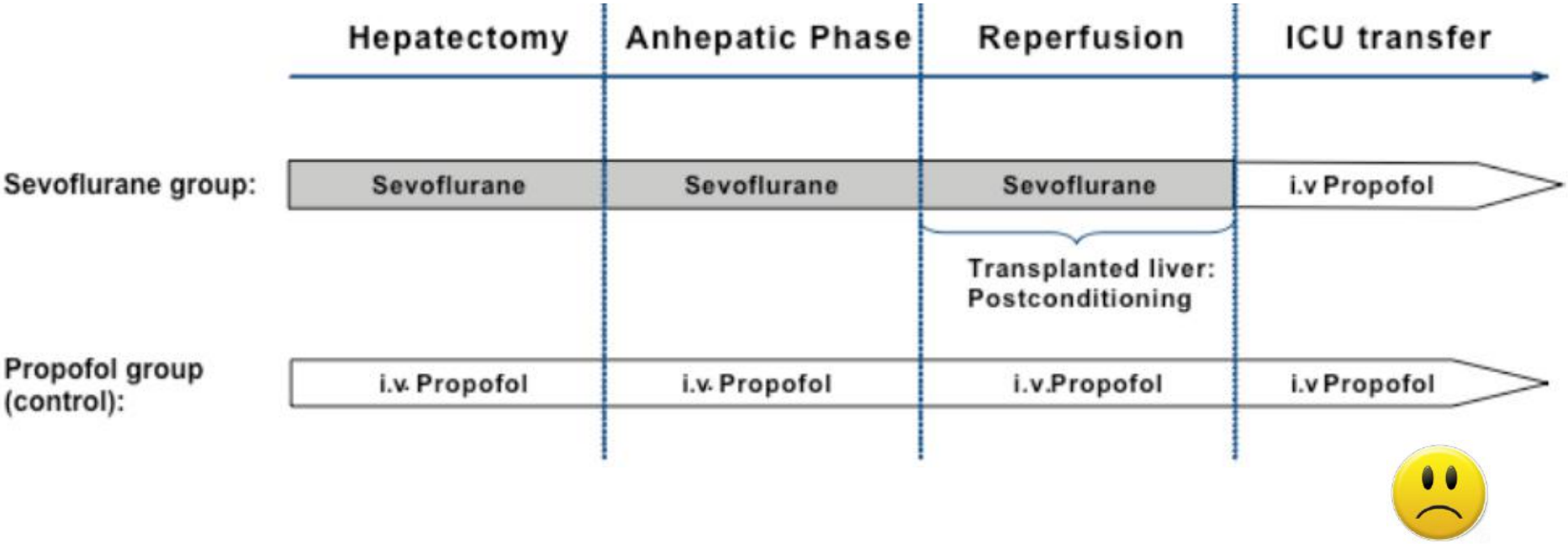
-Retrospective studies, no RCT

-No ischemia/reperfusion (hypoxia/reoxygenation)

-Design of clinical trial:
Definition of possible confounders

-Surrogate markers, no functional endpoints

Volatile anaesthetics without protection



Beck-Schimmer et al., unpublished

Volatile anaesthetics without protection

	Propofol	Sevoflurane	Mean difference (95% CI), p-value [1]
Peak AST: median (IQR) (U/l)	925 (512-3274)	1097 (540-2633)	215 (-1017 to 1448), p=0.73
Peak ALT: median (IQR) (U/l)	781 (405-2063)	711 (424-1645)	-162 (-722 to 399), p=0.57

Beck-Schimmer et al., unpublished

Volatile anaesthetics without protection

Possible reasons for 'failure':

-Retrospective studies, no RCT

-No ischemia/reperfusion (hypoxia/reoxygenation)

-Design of clinical trial:
Definition of possible confounders

-Surrogate markers, no functional endpoints

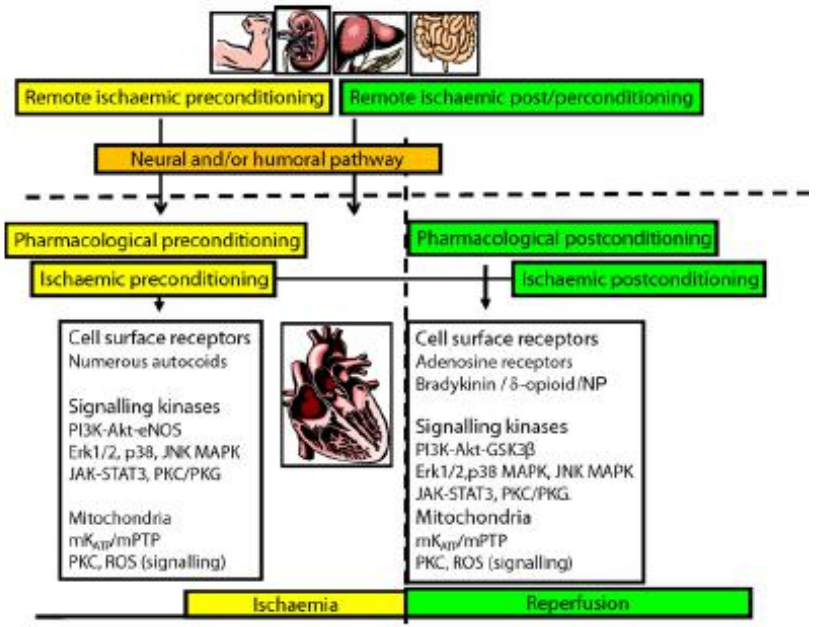
-Patients included: number too small, single center

Volatile anaesthetics: Conclusions

- **Volatile anesthetics are protective for heart, lung, liver and kidneys:**
    - **In the presence of ischemia/reperfusion injury**
    - **Upon on/off application (pre- and/or postconditioning) with washout phase**

Volatile anaesthetics: To do list (1)

Elucidation of cell signaling:



Hausenloy et al., *Atherosclerosis*, 2008

Volatile anaesthetics: To do list (2)

RCT, multicenter approach

Exploring further situations in which the patient could benefit from volatile anaesthetics

Volatile anaesthetics and anti-aging?

UniversityHospital Zurich

University of Zurich[UZH]

Volatile anaesthetics: from the OR to the ICU

Inhalative Anästhetika auf der Intensivstation

Team

Gruppe Beck-Schimmer, Universität Zürich









Agenda

- Funktionsweise des AnaConDa© Systems
- Sicherheit bei der Anwendung
- Vorteile der Sedation mit volatilen Anästhetika
- Immunomodulation mit volatilen Anästhetika ?

Analgosedierung

- Steuerbarkeit, schneller Wirkungseintritt, schneller Abbau
- Organunabhängige Elimination
- Keine Kumulation, keine Enzyminduktion
- Keine Beeinträchtigung einer Organfunktion
- Keine Toleranzentwicklung

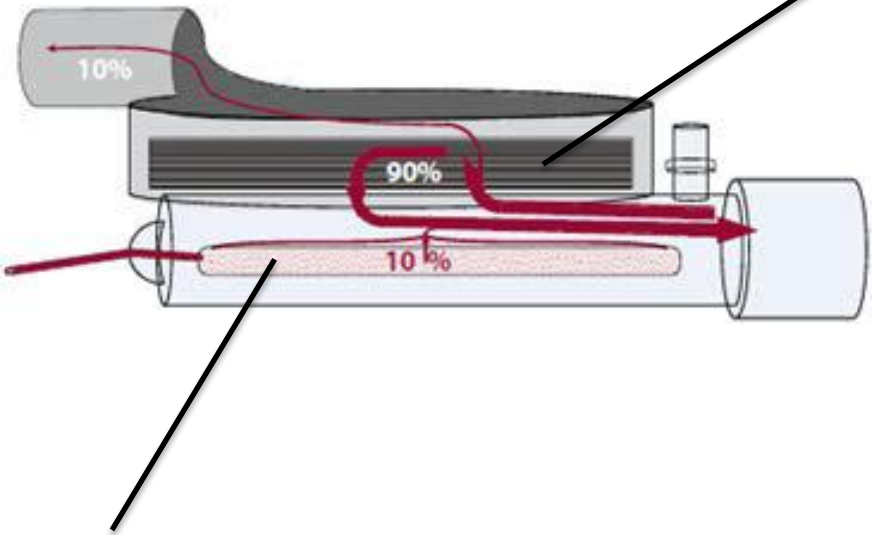
Bracco et al., Intensive Care Med (2011) 37:895–897
Roberts et al., Drugs (2012) 72 (14): 1881-1916

Konzepte der Sedation

- ***Intravenöse Sedativa***
  → Propofol
  → Benzodiazepine (z.B. Midazolam)
  → Opiate (Fentanyl, Sufentanil, Remifentanil, Morphine)
  → α_2-Agonisten (Clonidine, Dexmedetomidine)
  → Ketamin

- ***Gasnarkotika?***
  → Isoflurane, Sevoflurane, (Desflurane)

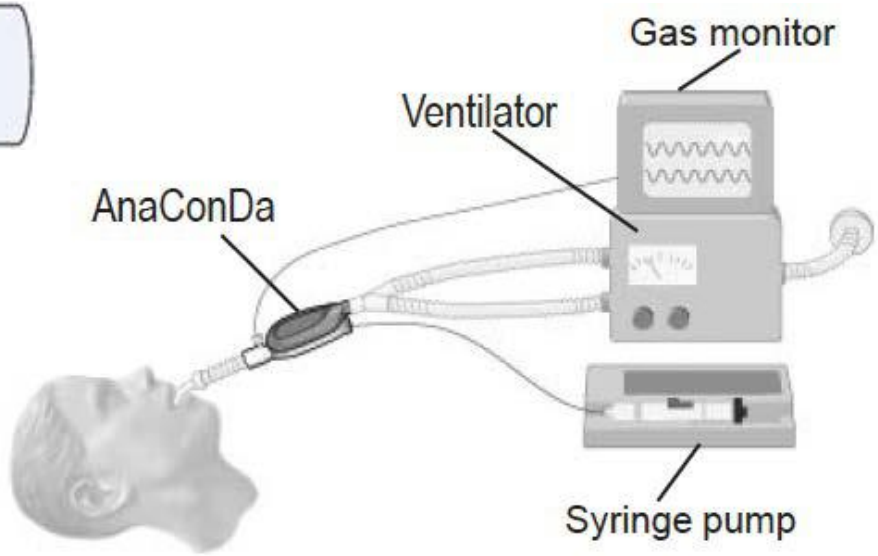
Aufbau des AnaConDa © Systems



Reflektor

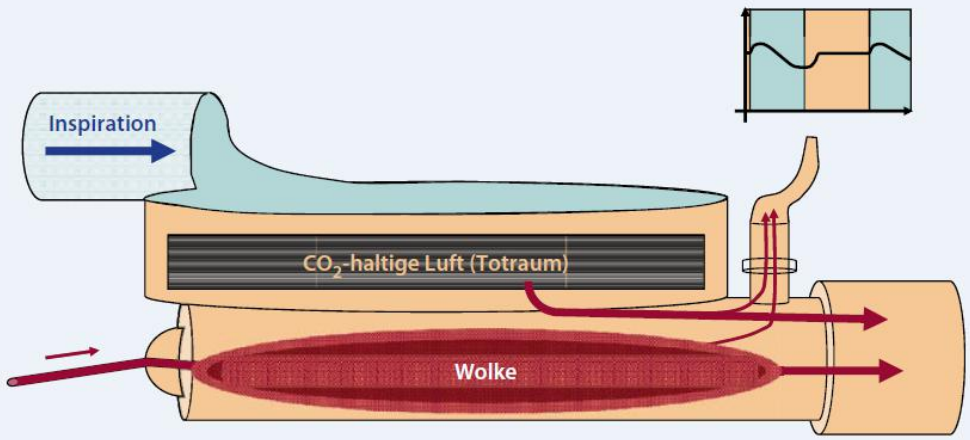
Aktivierte Karbonfasern in den HME eingewoben

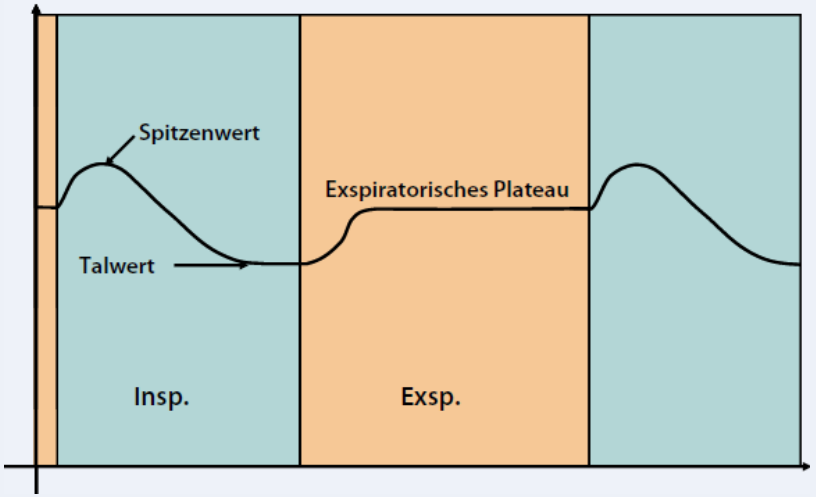
Evaporator



Meiser et al., Anaesthesist (2010) 59:1029–1040

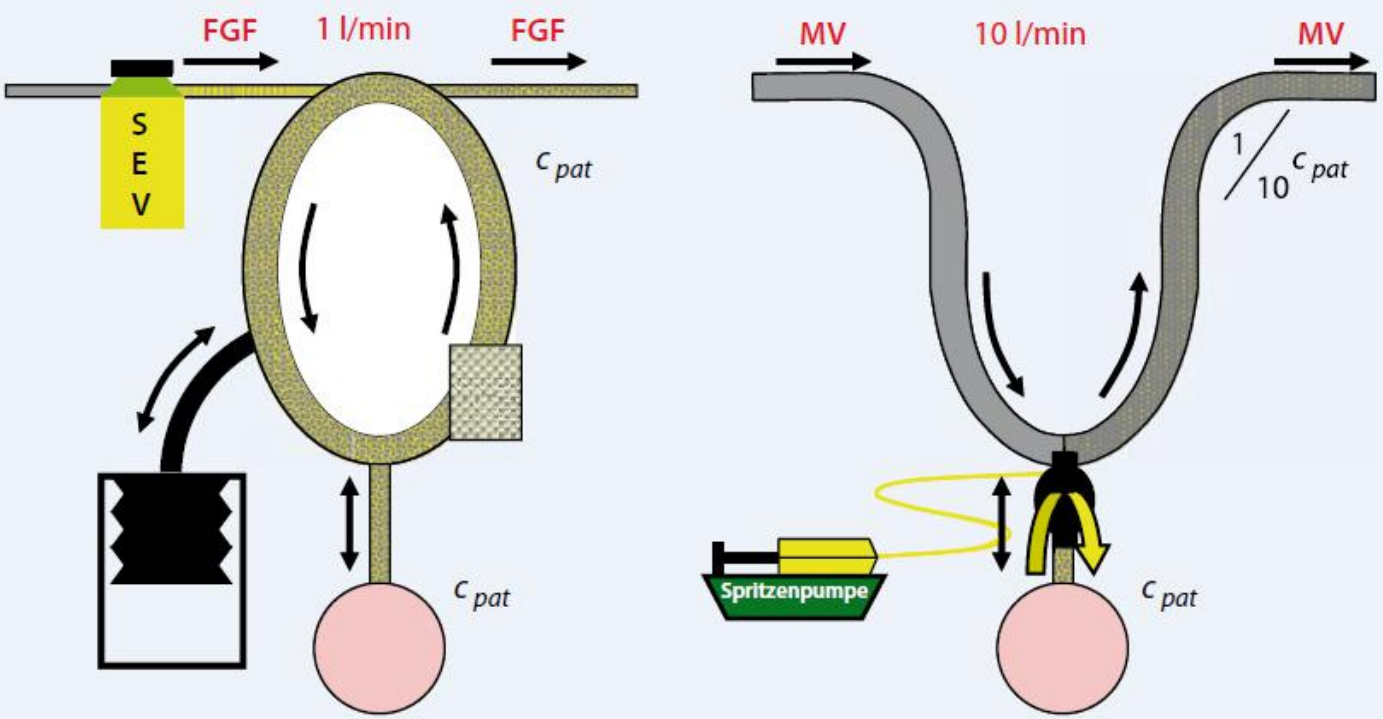
Gasmonitoring und der «Spill over» Effekt





Meiser et al., Anaesthesist (2010) 59:1029–1040

Steuerbarkeit und Effizienz



Meiser et al., Anaesthesist (2010) 59:1029–1040

Target-controlled infusion

The Predictive Performance of a Pharmacokinetic Model for Manually Adjusted Infusion of Liquid Sevofluorane for Use with the Anesthetic-Conserving Device (AnaConDa): A Clinical Study

Javier F. Belda, MD, PhD*
Marina Soro, MD, PhD†
Rafael Badenes, MD†

BACKGROUND: The Anesthetic-Conserving Device (AnaConDa) can be used to administer inhaled anesthetics using an intensive care unit (ICU) ventilator. We evaluated the predictive performance of a simple manually adjusted pump infusion scheme, for infusion of liquid sevoflurane to the AnaConDa.
METHODS: We studied 50 ICU patients who received sevoflurane via the AnaConDa. They were randomly divided into three groups. A 6-h infusion of liquid anesthetic

Anesth Analg (2008) 106:1207–14

Excellent 6h-predictive performance (50 ICU patients)

Population pharmacokinetics of sevoflurane in conjunction with the AnaConDa®: toward target-controlled infusion of volatiles into the breathing system

M. Enlund[1], D. Kietzmann[2], T. Bouillon[3], K. Züchner[4] and I. Meineke[5]
[1]*Department of Anesthesia & Intensive Care, Central Hospital, Västerås, Sweden,* [2]*University Department of Anesthesia & Intensive Care, Uppsala, Sweden,* [3]*Modeling and Simulation, Novartis AG, Basel, Switzerland,* [4]*Department of Anesthesia Engineering,* [5]*Department of Clinical Pharmacology, University of Göttingen, Göttingen, Germany*

Acta Anaesthesiol Scand (2008) 52: 553–560

38 Patients
Age 31-87
BMI 20-38

Sicherheitsaspekte

- Korrektes Handling
- Nephrotoxizität?
- Schädliche Fluoridspiegel?
- Einfluss auf die Leber?

Safety issues: Spritzenpumpe

- Adapter und dezidierte Spritze
- Nicht im Kühlschrank lagern
- Schwerkraft-Effekte:
  - ➢ Niveau der Spritzenpumpe

Safety issues: Minimieren der Exposition

- Geschlossene Absaugsysteme
- Gas Scavening Systeme benutzen

Meiser et al., Anaesthesist (2010) 59:1029–1040

Safety issues: Belastung des Arbeitsplatzes?

Malcie Mesnil
Xavier Capdevila
Sophie Bringuier
Pierre-Olivier Trine
Yoan Falquet
Jonathan Charbit
Jean-Paul Roustan
Gerald Chanques
Samir Jaber

Long-term sedation in intensive care unit: a randomized comparison between inhaled sevoflurane and intravenous propofol or midazolam

Intensive Care Med (2011) 37:933–941

Mean ambient sevoflurane concentration:
0.3 ± 0.1 ppm

Ambient isoflurane pollution and isoflurane consumption during intensive care unit sedation with the Anesthetic Conserving Device*

Peter V. Sackey, MD; Claes-Roland Martling, MD, PhD; Gun Nise, PhD; Peter J. Radell, MD, PhD

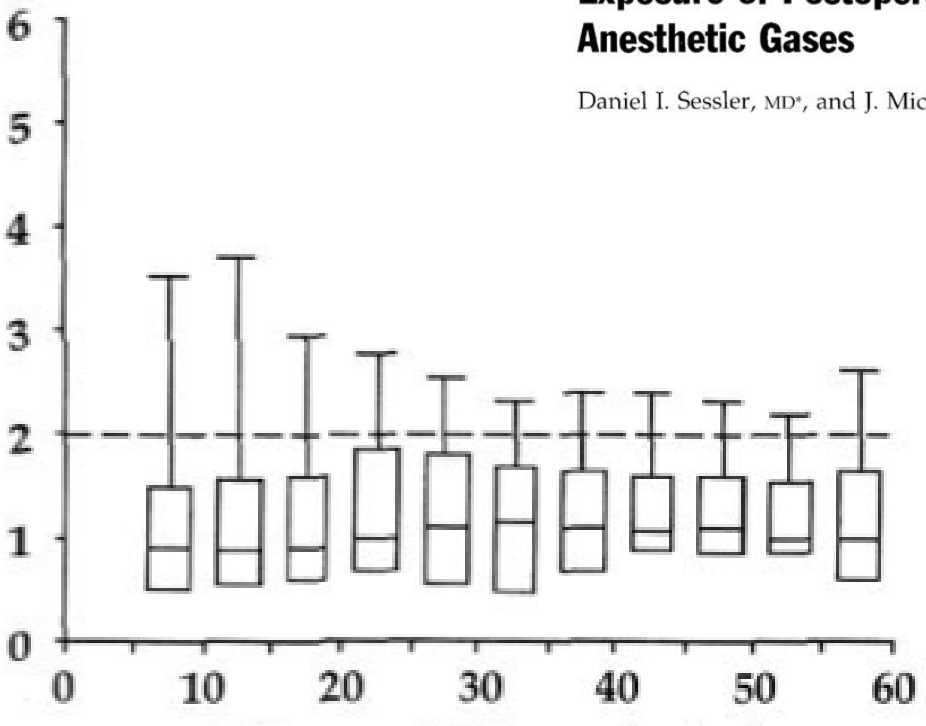
Critical Care Med (2005) 33:585-590

Konzentrationen < 1ppm (sogar ohne Absorber)

Zum Vergleich: Konzentrationen im Aufwachraum

Exposure of Postoperative Nurses to Exhaled Anesthetic Gases

Daniel I. Sessler, MD*, and J. Michael Badgwell, MD† (Anesth Analg 1998;87:1083–8)



Isoflurane (ppm über Zeit in Minuten)

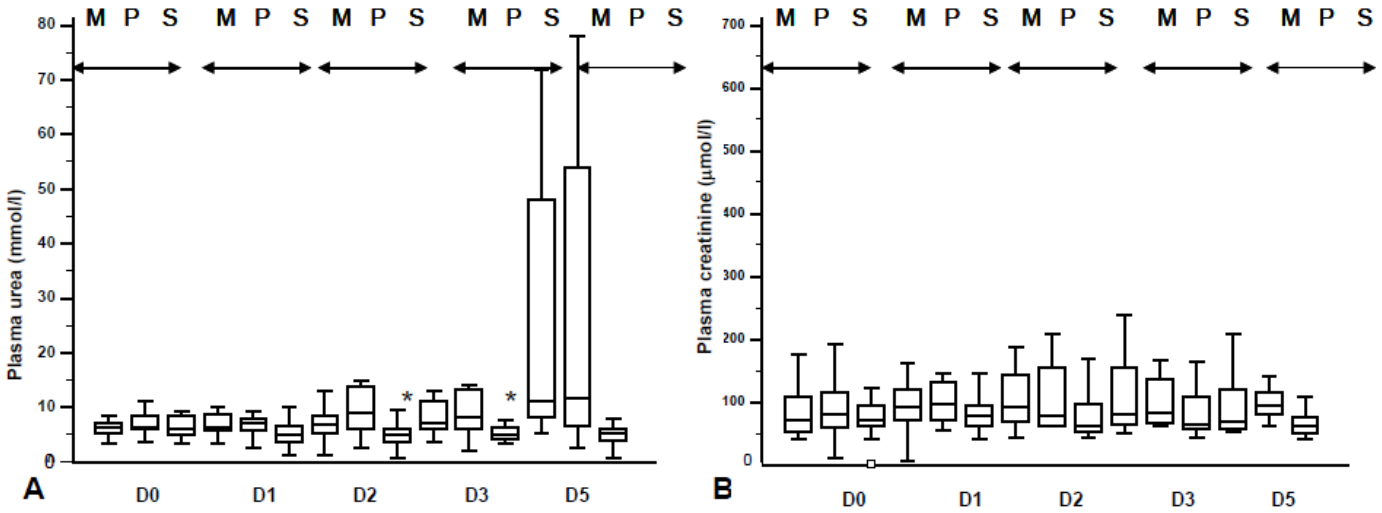
Safety issues: Nephrotoxizität durch Fluoride?

Mesnil et al., Intensive Care Med (2011) 37:933–941

→ Langzeit-Sedation (Mittel: 50 Stunden) mit Sevoflurane

→ Transienter Anstieg des Plasma Fluorid-Spiegel: **82 µmol/l** (Range: 12-220 µmol/l)

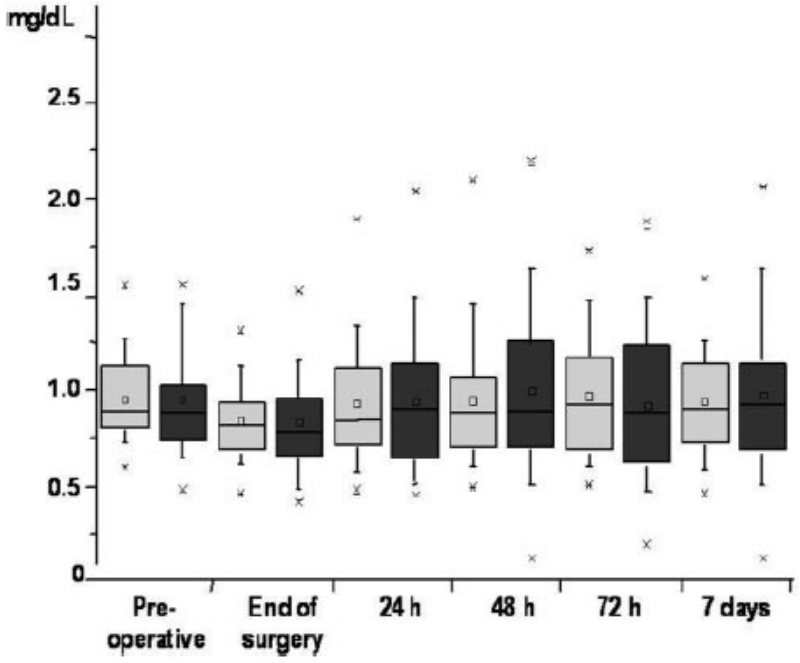
→ <u>Kein Einfluss auf die Nierenfunktion</u>



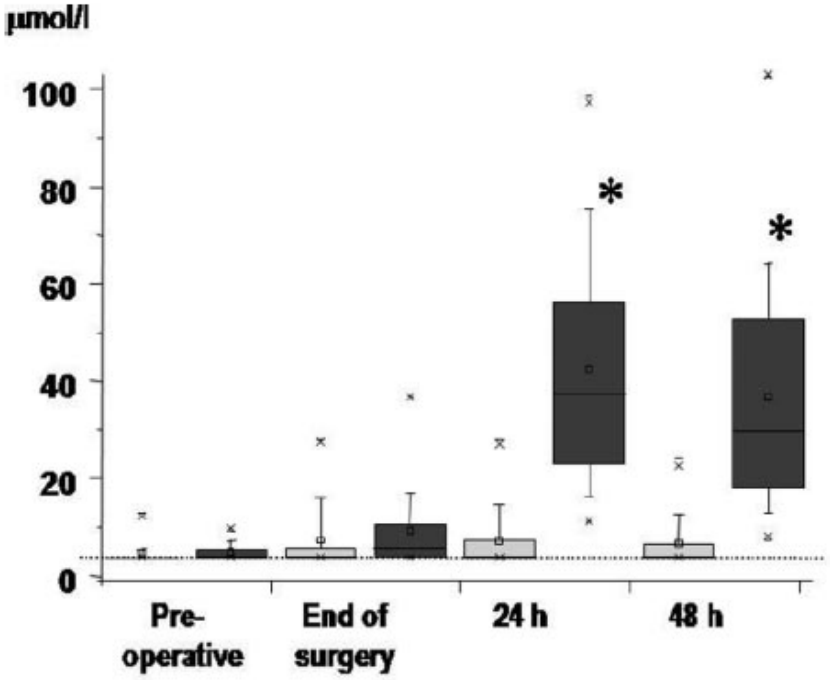
Safety issues: Nephrotoxizität durch Fluoride?

Renal Integrity in Sevoflurane Sedation in the Intensive Care Unit with the Anesthetic-Conserving Device: A Comparison with Intravenous Propofol Sedation

Röhm KA et al., Anesth Analg (2009) 6:1848-54



Creatinine



Plasma Fluoride

Safety issues: Toxisch für die Leber?

Sevofluran

Intensive Care Med (2011) 37:933–941
DOI 10.1007/s00134-011-2187-3

ORIGINAL

Malcie Mesnil
Xavier Capdevila
Sophie Bringuier
Pierre-Olivier Trine
Yoan Falquet
Jonathan Charbit
Jean-Paul Roustan
Gerald Chanques
Samir Jaber

Long-term sedation in intensive care unit: a randomized comparison between inhaled sevoflurane and intravenous propofol or midazolam

Isofluran

Prolonged isoflurane sedation of intensive care unit patients with the Anesthetic Conserving Device

Peter V. Sackey, MD; Claes-Roland Martling, MD, PhD; Fredrik Granath, PhD; Peter J. Radell, MD, PhD

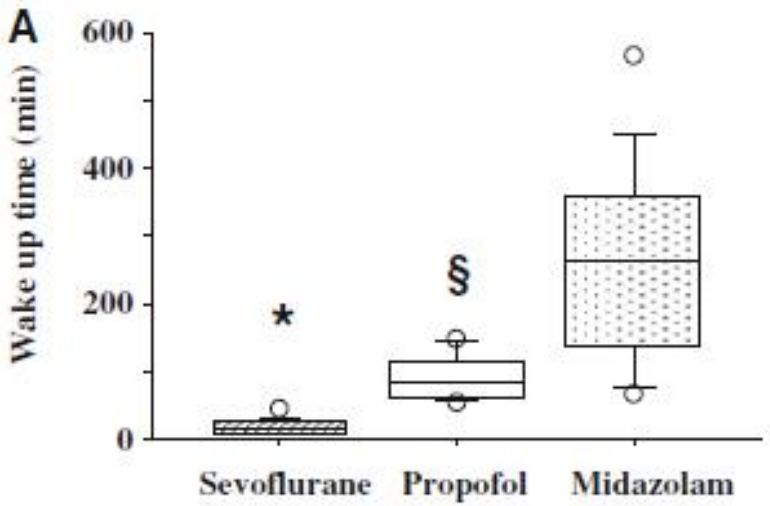
Crit Care Med 2004 Vol. 32, No. 11

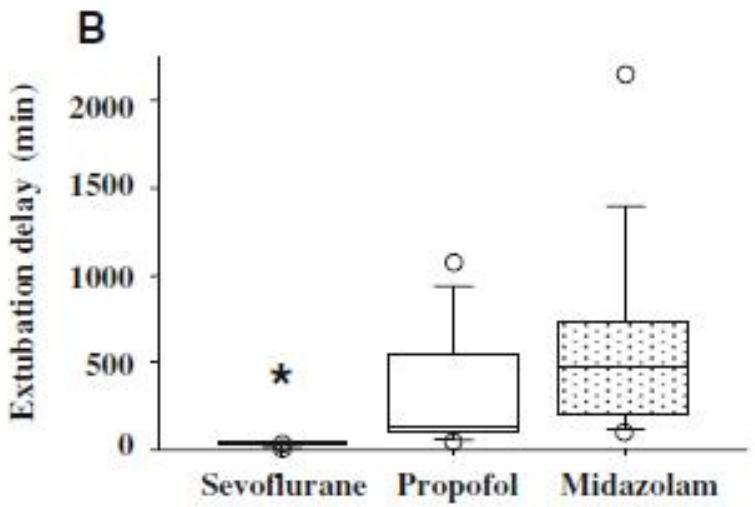
Kein Einfluss auf ASAT und ALAT

Summary: Sicherheit der volatilen Sedation

- **Arbeitsplatz-Belastung:** bei korrekter Handhabung nicht relevant
- **Niere:** Steigende Fluoridspiegel, aber kein Hinweis für Toxizität
- **Leber:** Keine Hinweise für eine schädigende Wirkung

Aufwachzeit besser planbar und kürzer





Aufwachzeit [min]:

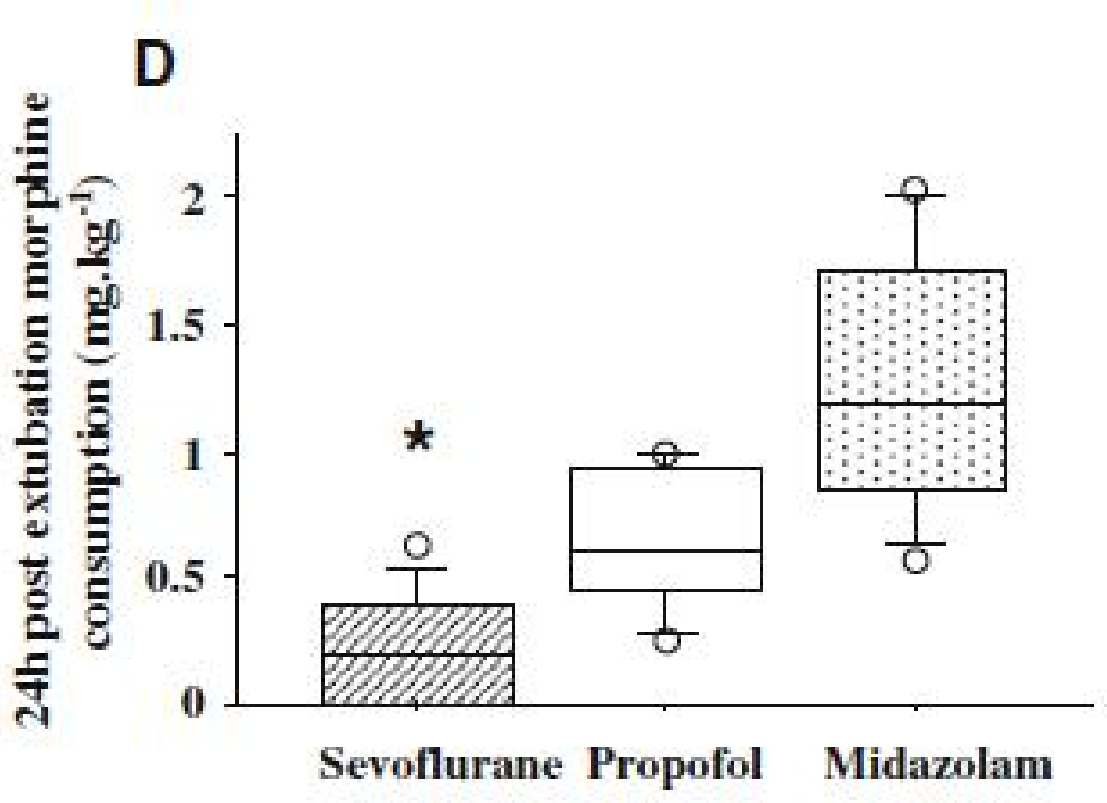
Sevofluran: 18.6 ± 11.8
Propofol: 91.3 ± 35.2
Midazolam: 260.2 ± 150.5

Zeit bis Extubation [min]:

Sevofluran: 33.6 ± 13.1
Propofol: 326.11 ± 360.2
Midazolam: 599.62 ± 586.95

Mesnil M et al., Intensive Care Med (2011) 37:933–941

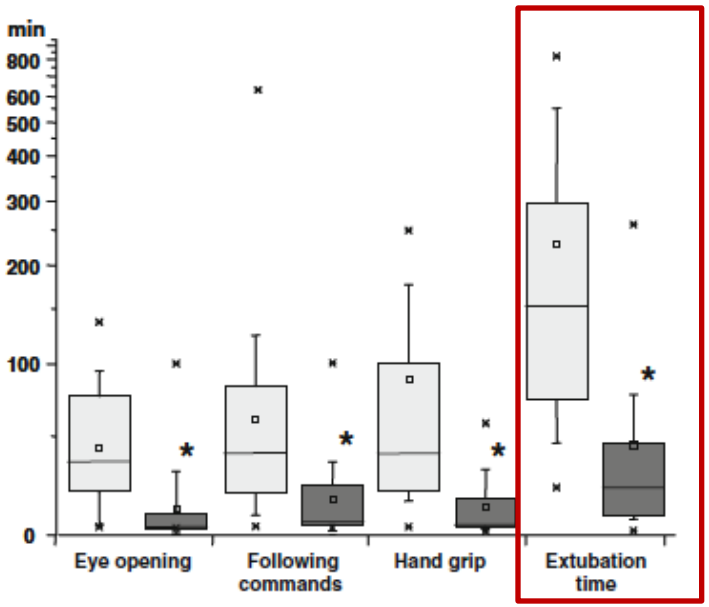
Geringerer Morphinbedarf nach Extubation



Mesnil M et al., Intensive Care Med (2011) 37:933–941

Zeit bis zur Extubation deutlich kürzer

	Sevoflurane ($n = 35$)	Propofol ($n = 35$)	P value
Sedation time on ICU (h)	8.1 ± 3.1	8.4 ± 4.2	0.87
Ventilator time on ICU (h)	9.0 ± 4.0	12.5 ± 5.8*	0.0001
LOS on ICU (h)	27.8 ± 14.0	39.6 ± 35.5	0.062
LOS in hospital (days)	10.6 ± 3.3	14.0 ± 7.7*	0.026

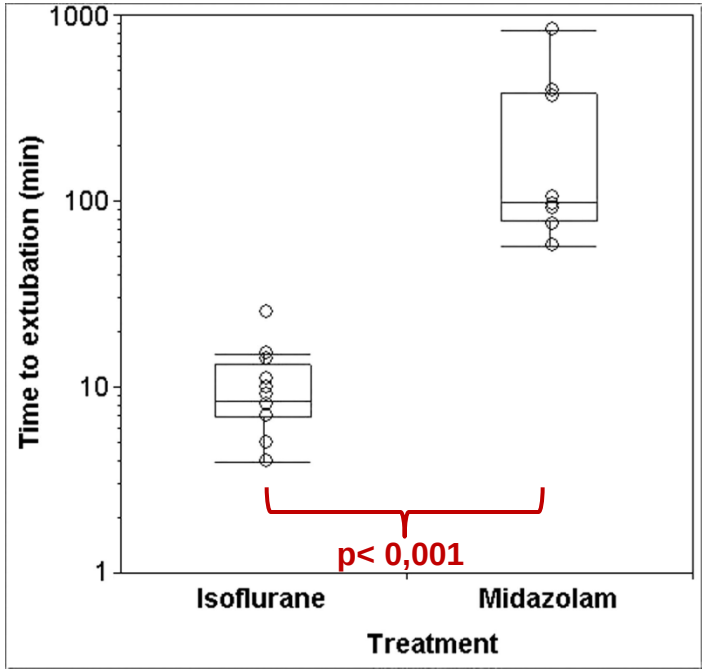


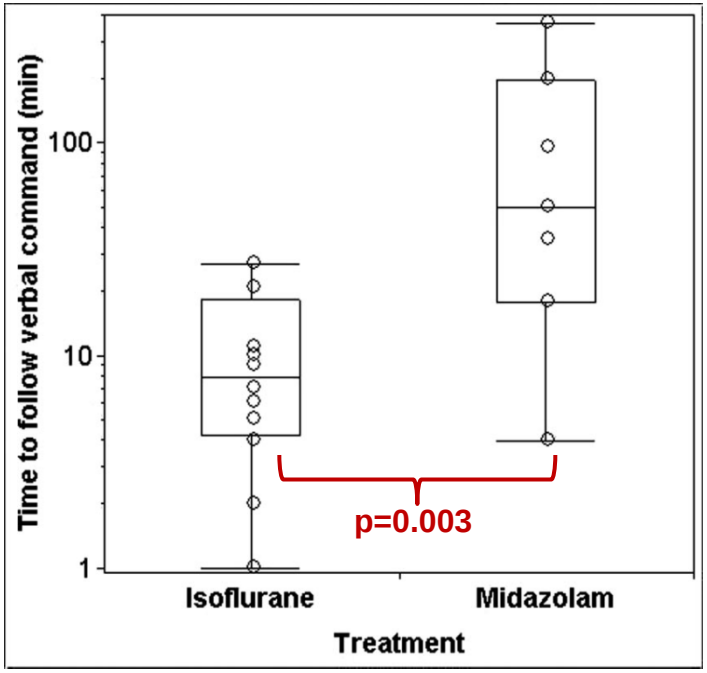
Signifikant kürzere Zeit:

- **Bis beurteilbar**
- **Bis zur Extubation**
- **Gesamter Krankenhausaufenthalt**

Röhm KD, Intensive Care Med (2008) 34:1683-1689

Kognitive Funktion schneller vorhanden

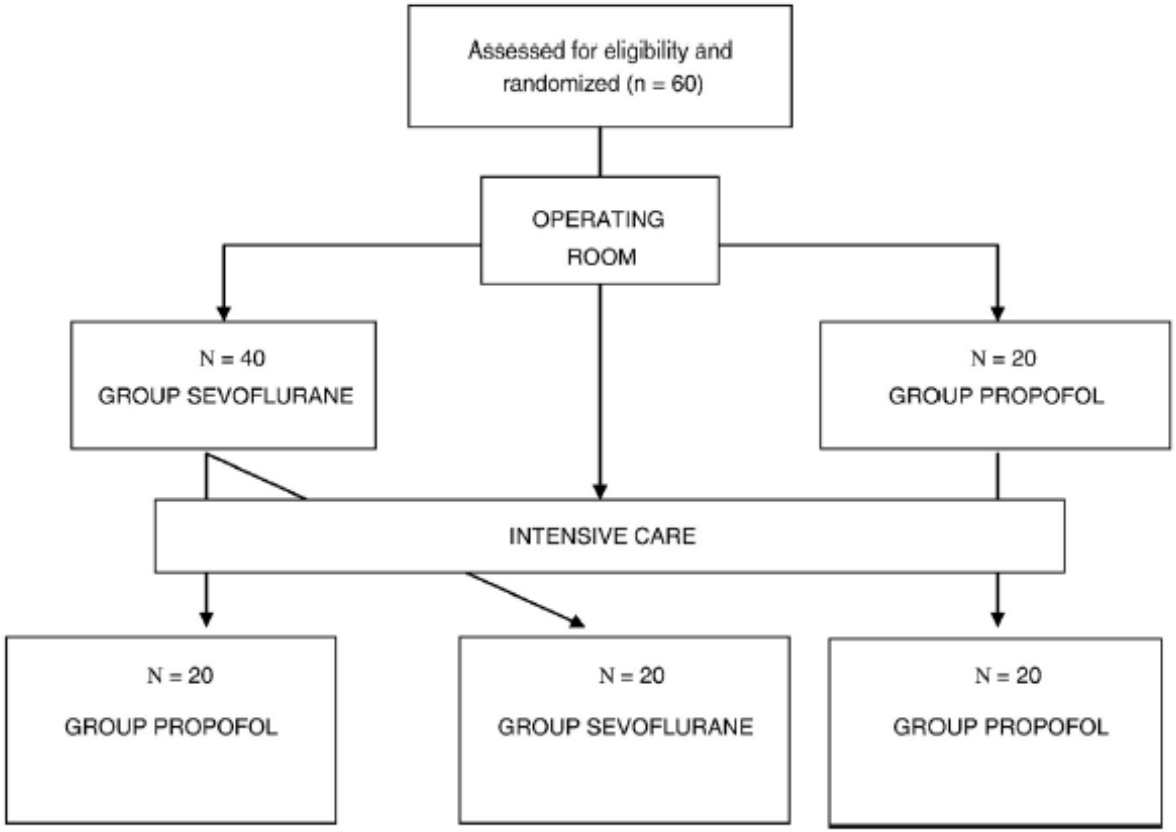




	Isoflurane	Midazolam
Time to extubation, mins	10 ± 5[a]	250 ± 270
Time to follow verbal command, mins	10 ± 8[b]	110 ± 130

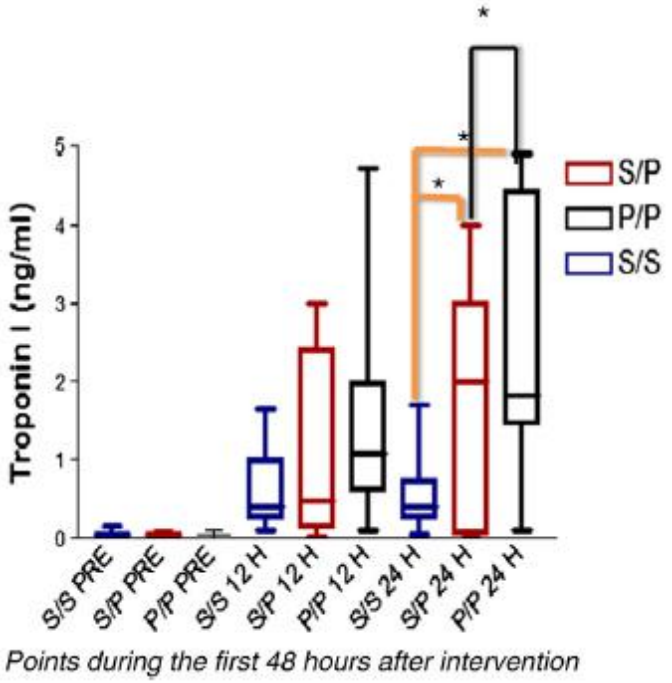
Sackey PV et al., Crit Care Med (2004) 32:2241-2246

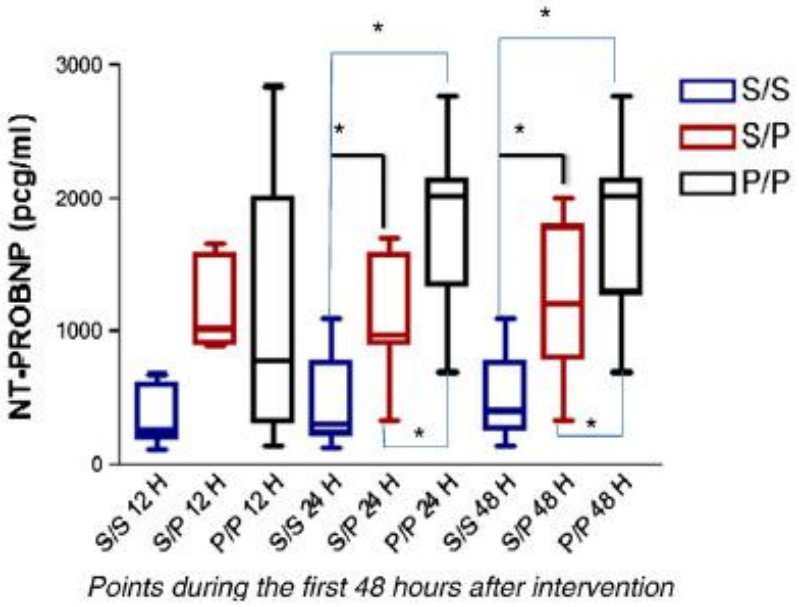
Protektive Effekte nach Herzchirurgie



Guerrero et al., J Critical Care (2013) 28:879.e13-879.e18

Protektive Effekte nach Herzchirurgie

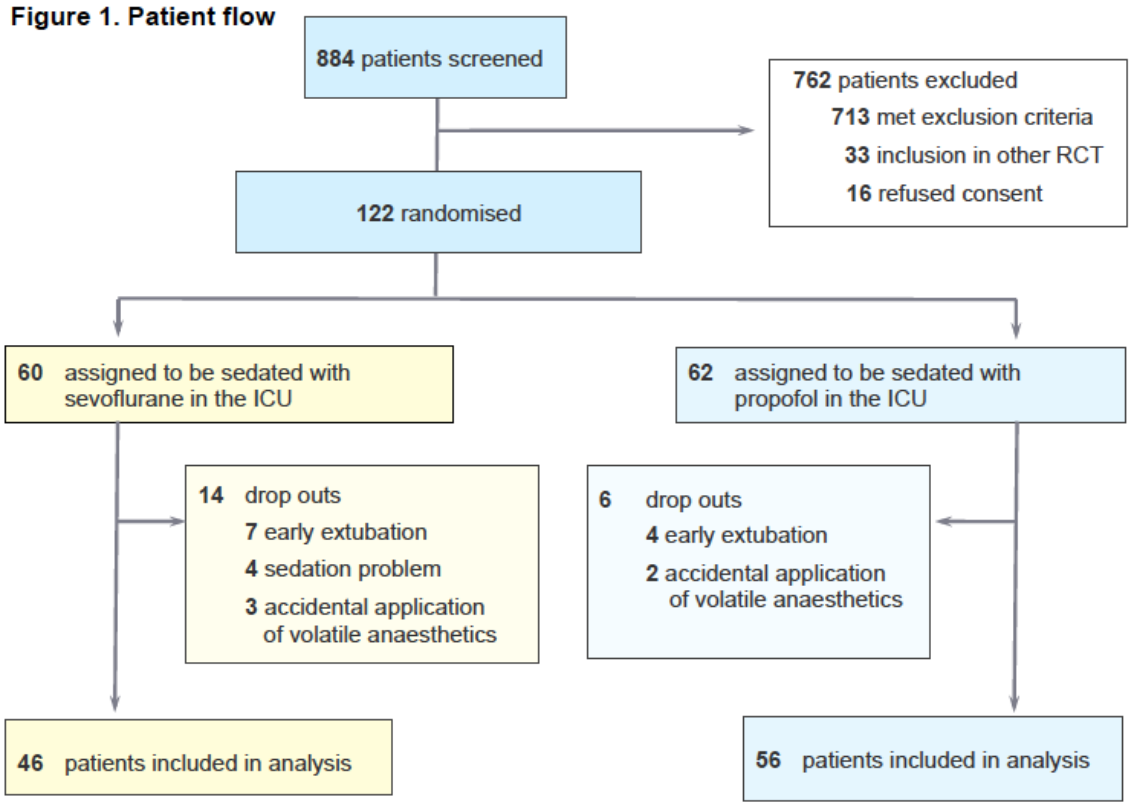




Signifikanter Unterschied im Inotropikabedarf - SS < SP und PP (24 und 48 h)

Guerrero et al., J Critical Care (2013) 28:879.e13-879.e18

Protektive Effekte nach Herzchirurgie



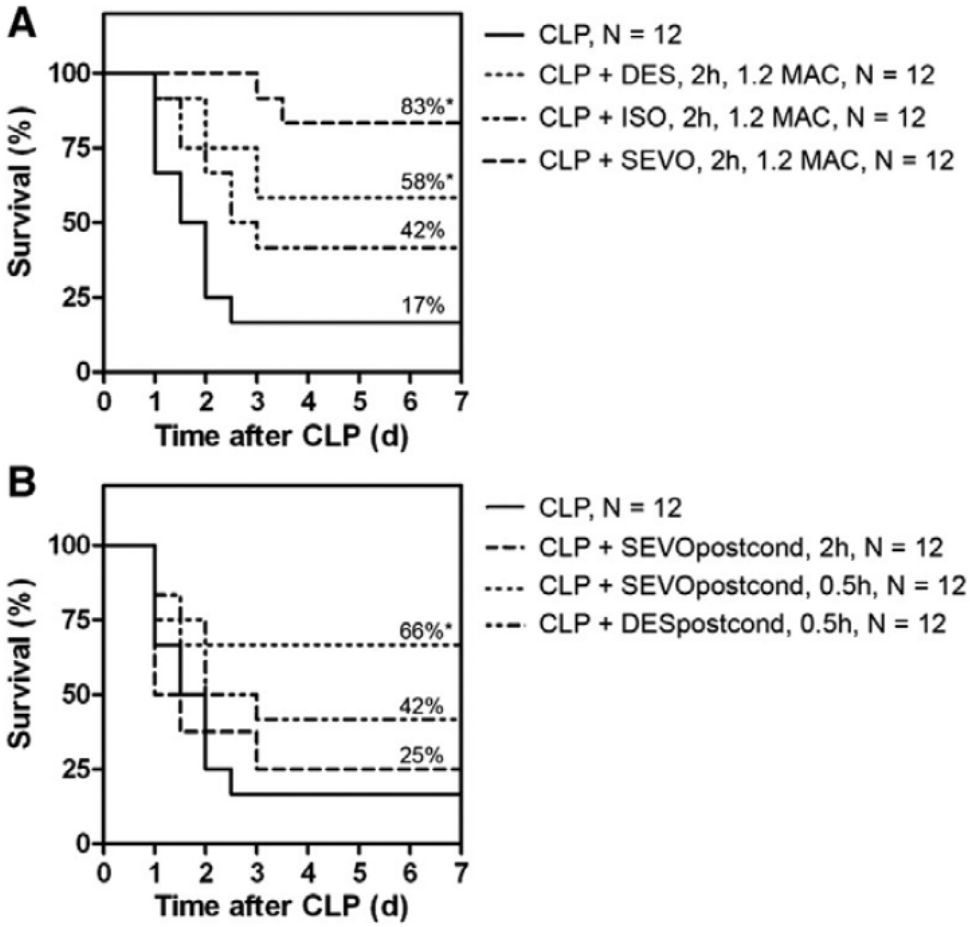
Steurer et al., Critical Care (2012) 16:R191

Protektive Effekte nach Herzchirurgie

Cardiac marker (U/L)	Unadjusted difference in means (point estimate)	95% CI	Adjusted difference in means (point estimate)	95% CI
Troponin T, 4 hours (µg/L)	-0.3	-0.7, 0.1	-0.1	-0.2, 0.1
CK, 4 hours (U/L)	**-140**[a]	**-250, -30**	-38	-96, 20
CK-MB, 4 hours (U/L)	-2.4	-23.9, 19.2	1.2	-6.4, 8.7
Myoglobin, 4 hours (µg/L)	**-113**[a]	**-187, -39**	-42	-100, 16
Troponin T, POD1 (µg/L)	**-0.4**[a]	**-0.7, -0.1**	**-0.2**[a]	**-0.4, -0.02**
CK, POD1 (U/L)	**-258**[a]	**-434, -83**	**-169**[a]	**-331, -8**
CK-MB, POD1 (U/L)	-4.6	-27.5, 18.3	-1.1	-13.2, 11.0
Myoglobin, POD1 (µg/L)	-107	-217, 3	-48	-157, 60

Steurer et al., Critical Care (2012) 16:R191

Anwendung in der Sepsis?



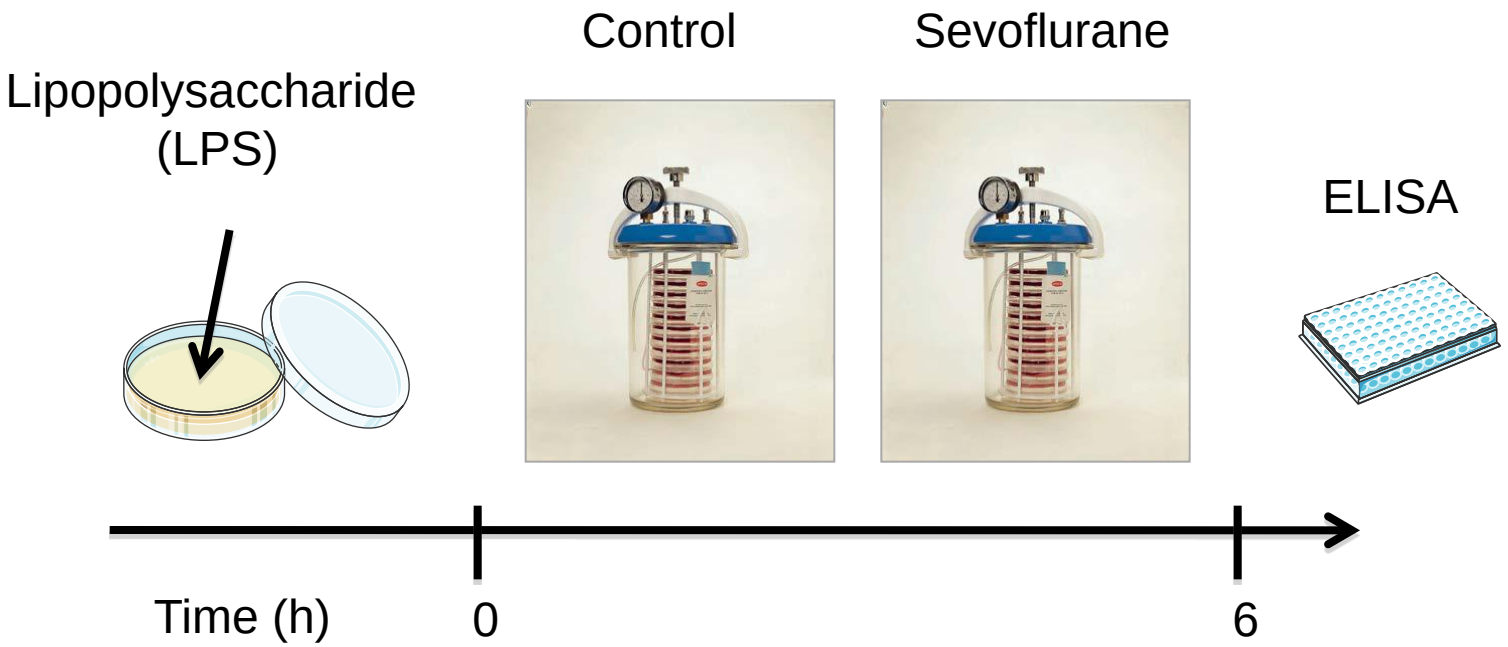
- Sevoflurane und Desflurane : besseres 7-Tage-Überleben
- Sevoflurane nach 24h Peritonitis: besseres Überleben

Herrmann et al., Anesthesiology (2013) 119(4):755-6

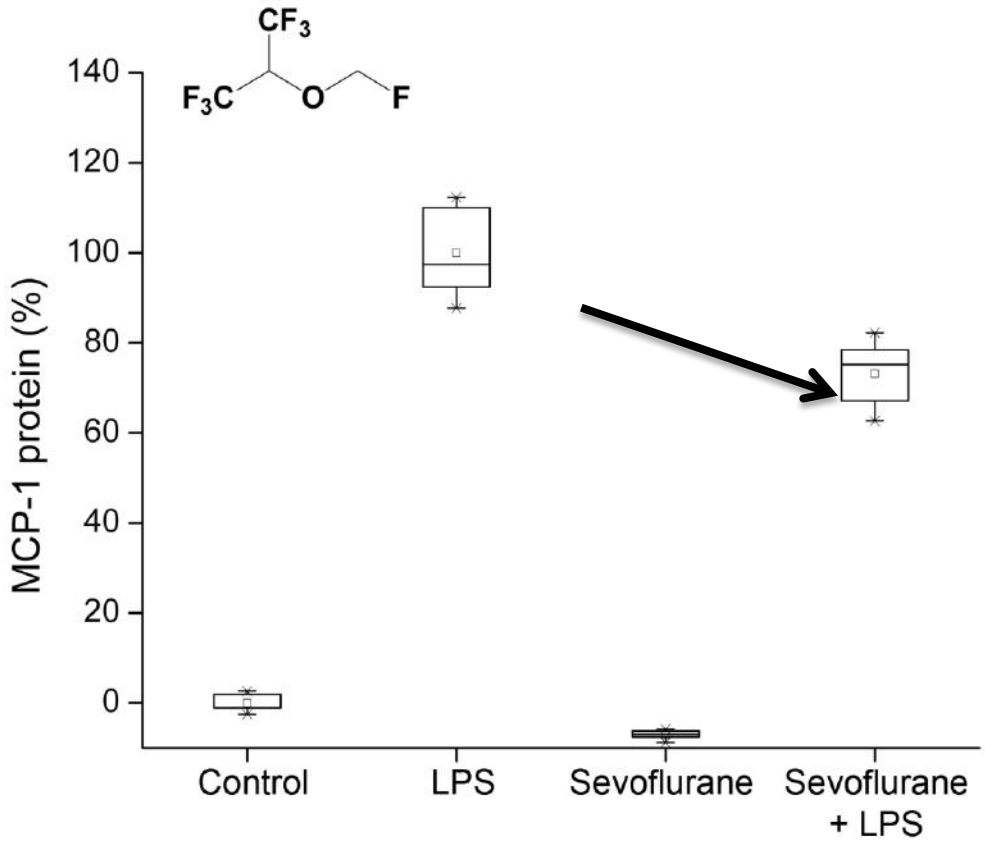
Summary: Potential der volatilen Sedation

- Aufwachzeiten
- Neurologische Beurteilbarkeit
- Toleranz
- Post traumatic stress disorder
- Weniger Opiate
- Organ-Protektion

Was ist die Natur der protektiven Effekte?



Sekretion proinflammatorischer Moleküle

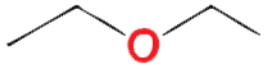


Urner et al., Am J Respir Cell Mol Biol. (2011) 45(3):617-24

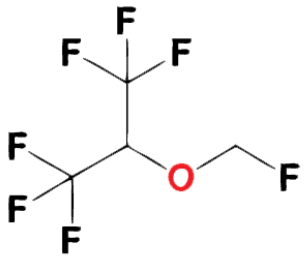
Warum ist Sevoflurane protektiv?

1. Hypothesis:

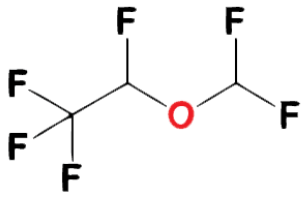
Hydrophobizität?



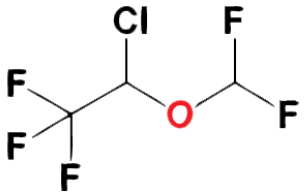
Diethyl-ether



Sevoflurane



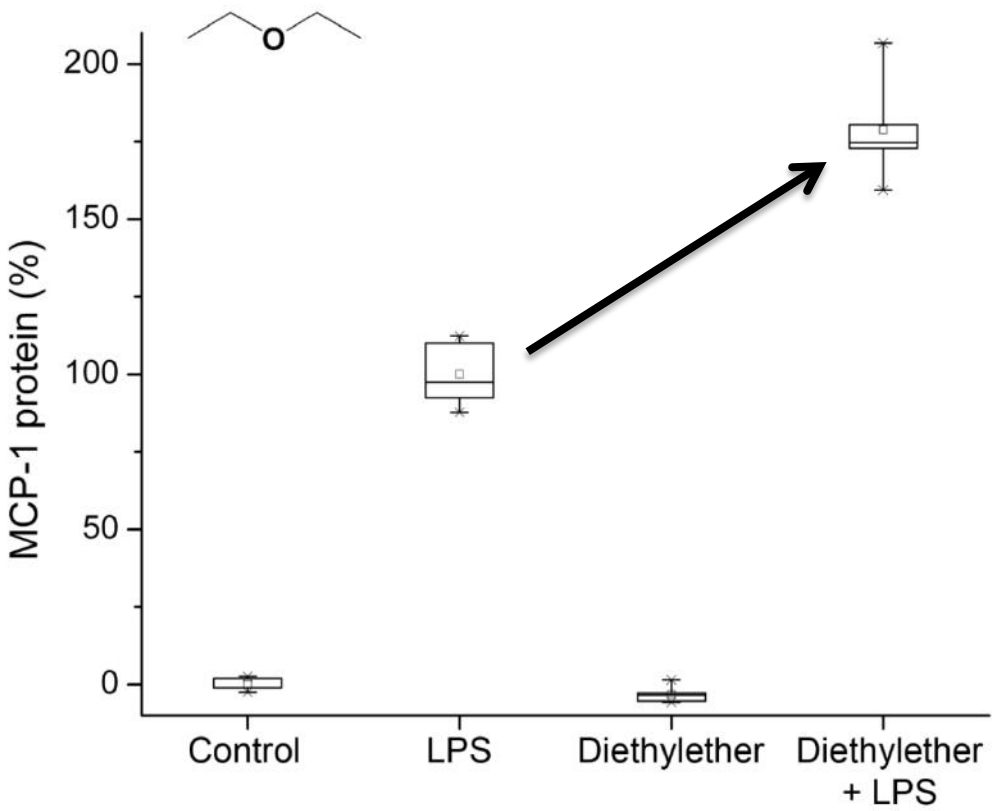
Desflurane



Isoflurane

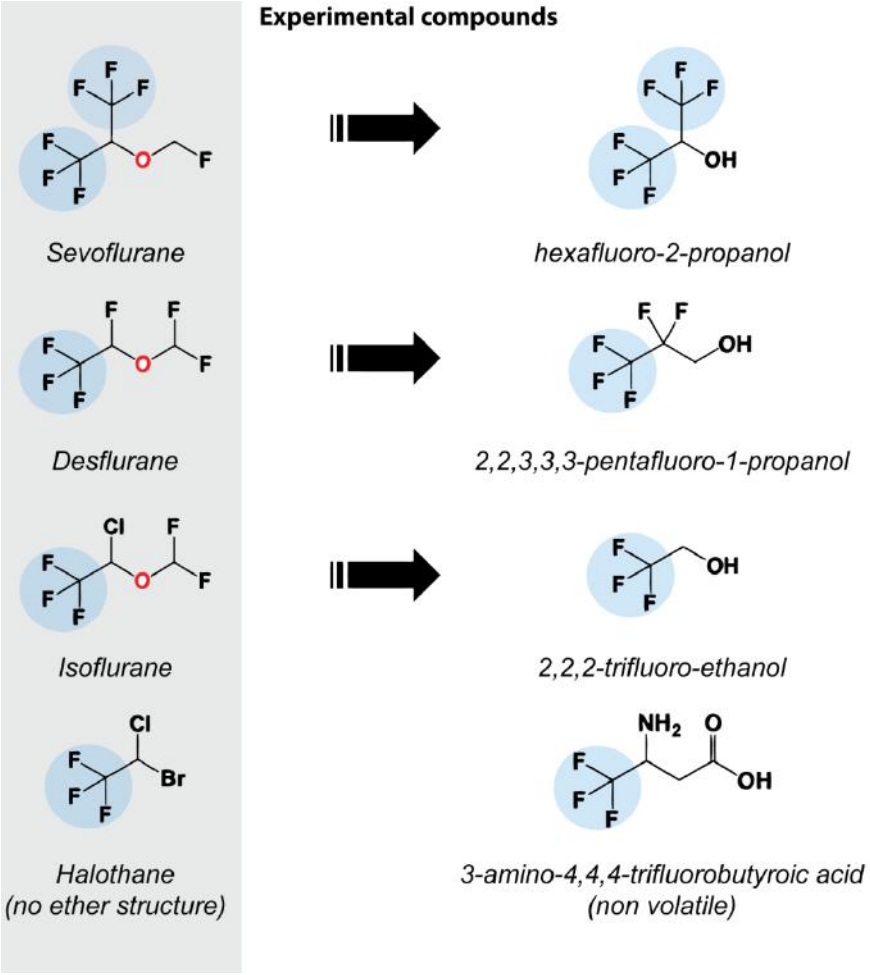
Urner et al., Am J Respir Cell Mol Biol. (2011) 45(3):617-24

Hydrophobizität ist nicht Ursache



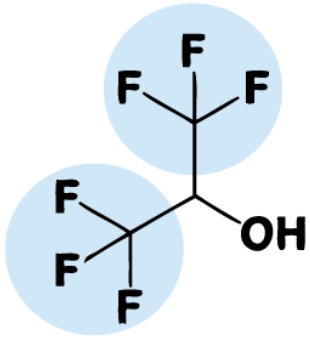
Urner et al., Am J Respir Cell Mol Biol. (2011) 45(3):617-24

Liegt es an der Halogenierung?



Urner et al., Am J Respir Cell Mol Biol. (2011) 45(3):617-24

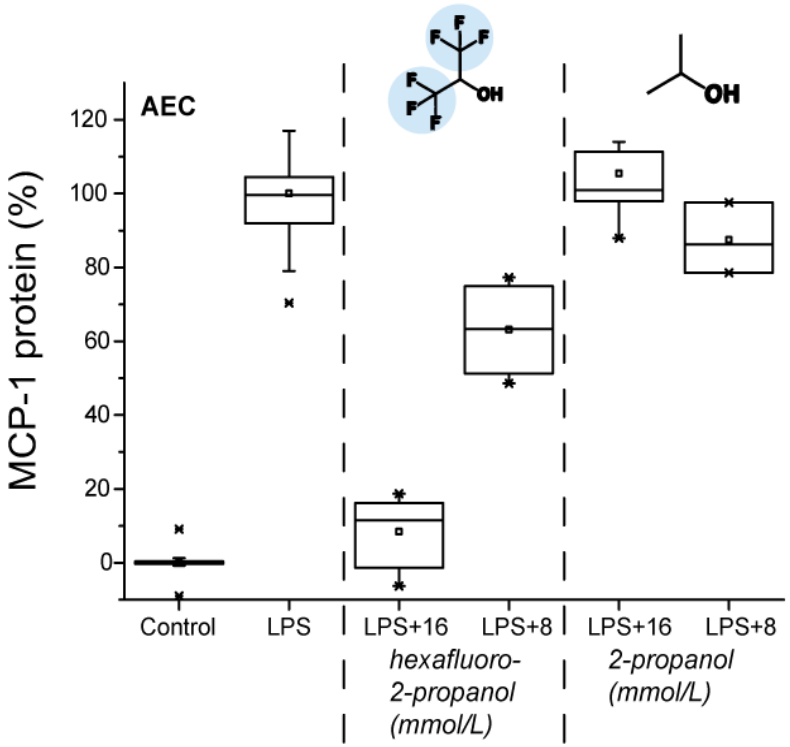
Hexafluoro-2-propanol (HFIP)

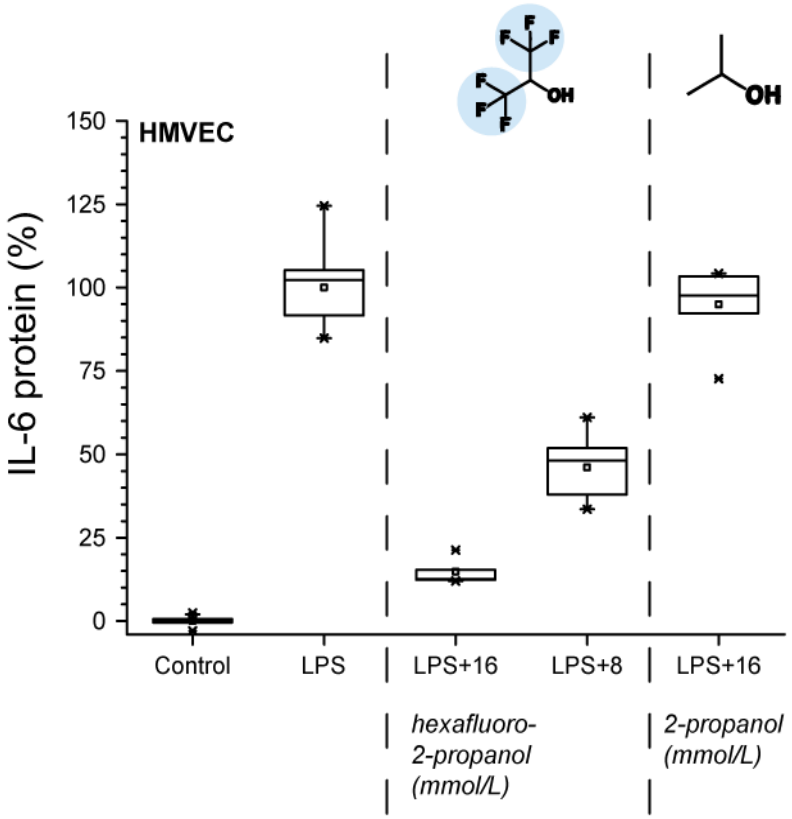


hexafluoro-2-propanol

- Billig (1g ~ CHF 3.-)
- Zwei CF3-Gruppen
- Metabolit von Sevoflurane

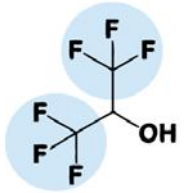
Dosisabhängige Attenuation der Sekretion



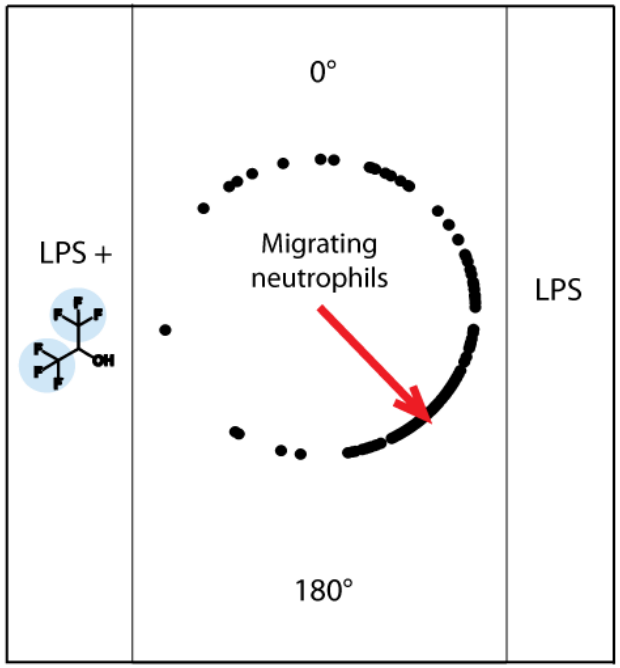


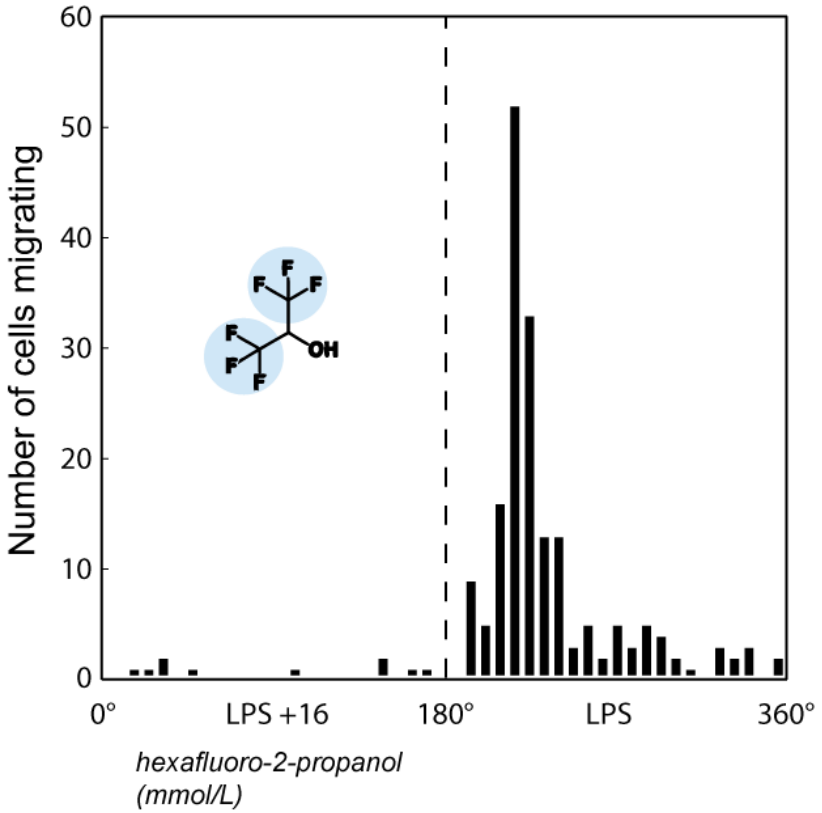
Urner et al., Am J Respir Cell Mol Biol. (2011) 45(3):617-24

Migration von neutrophilen Zellen



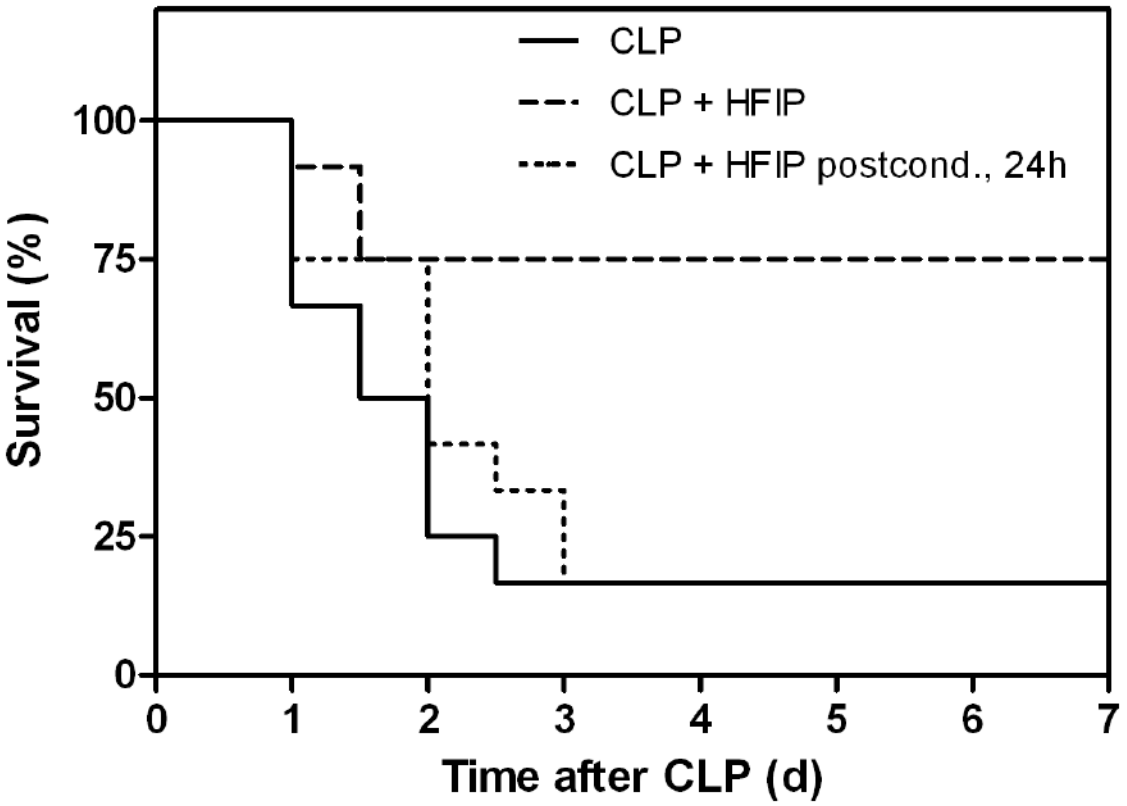
hexafluoro-2-propanol





Urner et al., Am J Respir Cell Mol Biol. (2011) 45(3):617-24

Einfluss auf das Überleben in der Sepsis?



Herrmann et al., PLOS One (2013) 19;8(8):e72057

Summary: Organ-Protektion mit HFIP

- Vermittelt durch Halogenierung (CF3-Gruppe)
- Wasserlösliche, protektive Moleküle
- Protektion ohne Sedation?
- Zukünftige Anwendung ohne Monitoring?

Vielen Dank

KANTONSSPITAL WINTERTHUR

Universität Zürich[UZH]