GDT and EGDT:
similar expectations, similar pitfalls

Azriel Perel

Professor of Anesthesiology and Intensive Care

Sheba Medical Center, Tel Aviv University, Israel

Poland 2016

Disclosure

Pulsion / MAQUET

Masimo

The concept

Goal-Directed Therapy: Time to Move on?

Maurizio Cecconi, MD, FRCA, MD(UK), FICM, and Andrew Rhodes, FRCP, FRCA, FFICM, MD

ANESTHESIA & ANALGESIA September 2014 • Volume 119 • Number 3

"In the fields of anesthesia and intensive care medicine, goal-directed therapy (GDT) refers to the use of fluids and/or inotropes to target hemodynamic goals to improve oxygen delivery (DO_2) to the tissues."

The protocols

Clinical review: Goal-directed therapy in high risk surgical patients

Nicholas Lees, Mark Hamilton and Andrew Rhodes

Critical Care 2009, 13:231

- **Fluids should be given to increase CO, and inodilators, such as dopexamine and dobutamine, added once the patient is no longer fluid (preload) responsive or not achieving the goals.**

- **CO (CI $\geq$ 4.5 L/min/m^2) and oxygen transport (DO_2I ≥600 ml/min/m^2) goals are important so direct flow monitoring should be implemented.**

Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

February 2013 • Volume 41 • Number 2

The 6H bundle

During the first 6 hrs of resuscitation, the goals of initial resuscitation of sepsis-induced hypoperfusion should include all of the following as a part of a treatment protocol (grade 1C):

a) CVP 8–12 mm Hg

12-15 under MV

b) MAP ≥ 65 mm Hg

c) Urine output ≥ 0.5 mL·kg·hr

d) Superior vena cava oxygenation saturation ($Scvo_2$) or mixed venous oxygen saturation (Svo_2) 70% or 65%, respectively.

GDT is not EGDT

GDT is a preemptive strategy

The evidence-base

A Systematic Review and Meta-Analysis on the Use of Preemptive Hemodynamic Intervention to Improve Postoperative Outcomes in Moderate and High-Risk Surgical Patients

Anesth Analg 2010

Mark A. Hamilton, MRCP, FRCA, Maurizio Cecconi, MD, and Andrew Rhodes, FRCP, FRCA

Perioeprative GDT, a preemptive strategy of hemodynamic monitoring and coupled therapy, reduces surgical mortality and morbidity.

Perioperative Fluid Management Strategies in Major Surgery: A Stratified Meta-Analysis

Tomas Corcoran, MB, BCh, BAO, MRCPI, FCARCSCI, MD, FCICM,* Julia Emma Joy Rhodes, MBBS (Hons),* Sarah Clarke, MBBS (Hons),† Paul S. Myles, MB, BS, MPH, MD, FCARCSCI, FANZCA, FRCA,‡ and Kwok M. Ho, MPH, PhD, FRCP, FCICM§

(Anesth Analg 2012;114:640–51)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

◄ Previous Volume 345:1368-1377 November 8, 2001 Number 19 Next ►

Early Goal-Directed Therapy in the Treatment of Severe Sepsis and Septic Shock

Emanuel Rivers, M.D., M.P.H., Bryant Nguyen, M.D., Suzanne Havstad, M.A., Julie Ressler, B.S., Alexandria Muzzin, B.S., Bernhard Knoblich, M.D., Edward Peterson, Ph.D., Michael Tomlanovich, M.D., for the Early Goal-Directed Therapy Collaborative Group

Early goal-directed therapy improves outcome in patients with severe sepsis and septic shock.

Critical Care Congress

JANUARY 21, 2013

Society of Critical Care Medicine
The Intensive Care Professionals

Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

February 2013 • Volume 41 • Number 2

A large number of observational studies have shown significant mortality reduction compared to the institutions' historical controls.

The consensus

LIPPINCOTT WILLIAMS & WILKINS

Critical Care Medicine

OFFICIAL JOURNAL OF THE SOCIETY OF CRITICAL CARE MEDICINE

ARTICLE LINKS:

References (12) | View full size inline images

Critical Care Medicine: Volume 27(10) October 1999 pp 2298-2299

Achieving the goal

Boyd, Owen MRCP, FRCA; Bennett, E. David FRCP

"It may be considered unethical not to use goal-directed perioperative therapy"

Surviving Sepsis Campaign

Surviving Sepsis Campaign

Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock

Crit Care Med 2004

Surviving Sepsis Campaign: International guidelines for management of severe sepsis and septic shock: 2008

Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012

Surviving Sepsis Campaign

Sponsoring Organizations

- American Association of Critical Care Nurses
- American College of Chest Physicians
- American College of Emergency Physicians
- American Thoracic Society
- Australian and New Zealand Intensive Care Society
- European Society of Clinical Microbiology and Infectious Diseases
- European Society of Intensive Care Medicine
- European Respiratory Society
- International Sepsis Forum
- Society of Critical Care Medicine
- Surgical Infection Society

The compliance

Hemodynamic monitoring and management in patients undergoing high risk surgery: a survey among North American and European anesthesiologists

Maxime Cannesson[1*], Gunther Pestel[2], Cameron Ricks[1], Andreas Hoeft[3] and Azriel Perel[4]

Critical Care 2011, **15**:R197

A web-based Italian survey of current trends, habits and beliefs in hemodynamic monitoring and management

Gianni Biancofiore · Maurizio Cecconi · Giorgio Della Rocca

J Clin Monit Comput (2015) 29:635–642

There is a considerable gap between available evidence and clinical practice regarding perioperative GDT.

www.medscape.com

Two Key Findings From the Surviving Sepsis Campaign

Greg Martin, MD

Apr 22, 2013

- **Even in highly selected and committed institutions compliance with both the resuscitation and the management bundles was only about 20%.**
- **This suggests that compliance is either quite difficult, or that clinicians disagree with some aspects of the guidelines and specifically do not reach compliance.**

The Mystery of Guideline Non-compliance: Why don't Doctors do the Right Thing?

Avery Tung, M.D.

ANESTHESIOLOGY 2011
AMERICAN SOCIETY OF ANESTHESIOLOGISTS ANNUAL MEETING

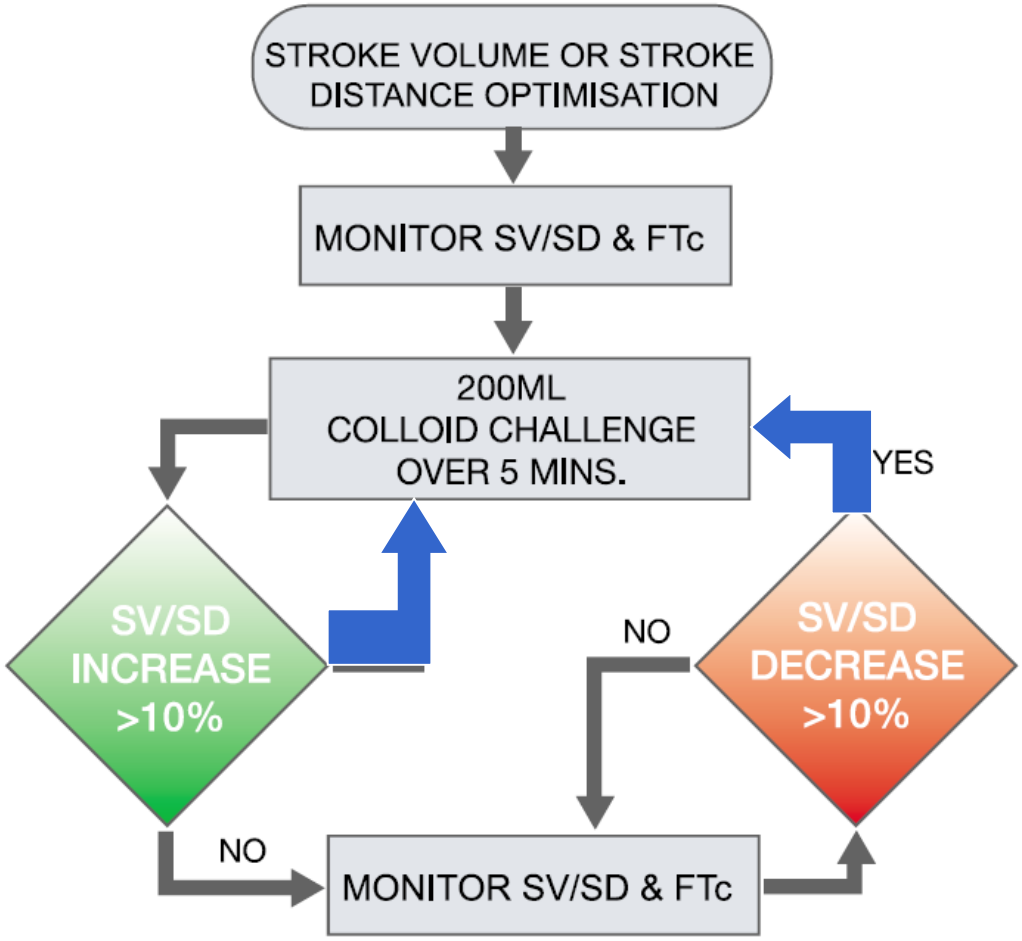
In part, physician non-compliance with evidence-based guidelines can be explained by the weaknesses in the evidence base itself.

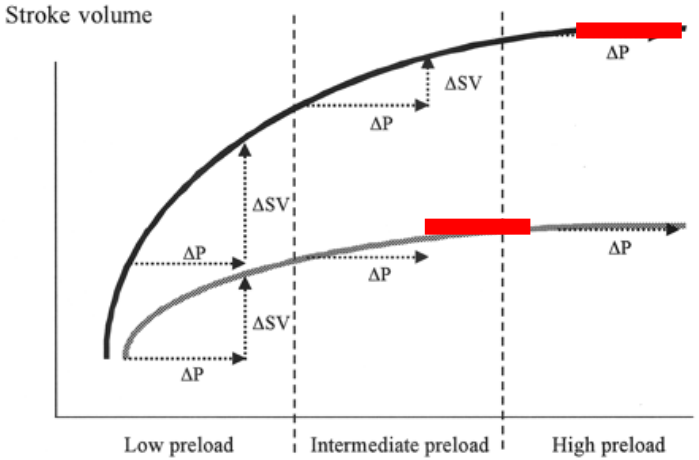
Questionable pathophysiological rationale of GDT and EGDT

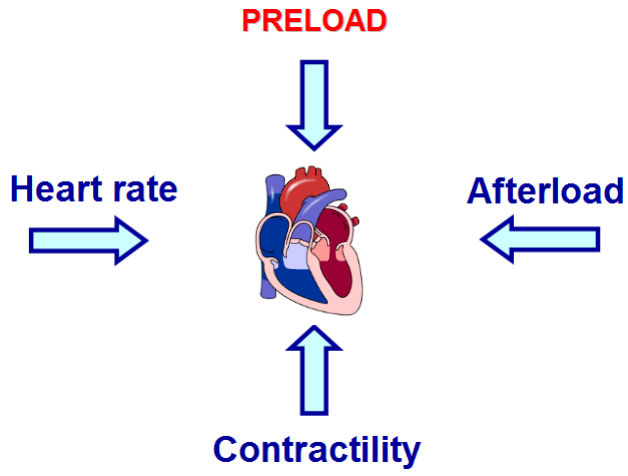
DELTEX MEDICAL

CardioQ Quick Reference Guide

Surgical Application - Interpreting results



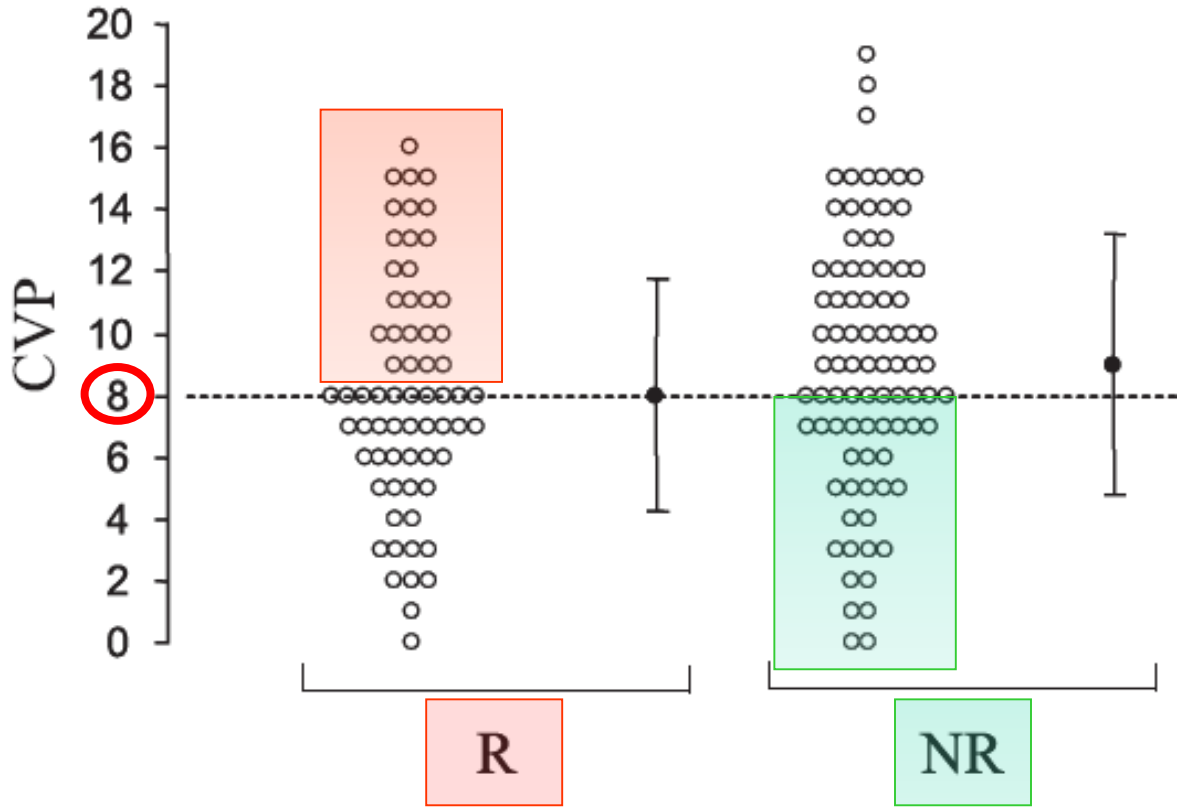




Cardiac filling pressures are not appropriate to predict hemodynamic response to volume challenge*

CCM 2007 35:64-8

David Osman, MD; Christophe Ridel, MD; Patrick Ray, MD; Xavier Monnet, MD, PhD; Nadia Anguel, MD; Christian Richard, MD; Jean-Louis Teboul, MD, PhD



Variable and Treatment Group	Base Line (0 hr)	Hours a 6
Heart rate (beats/min)		
Standard therapy	114±27	105±25
EGDT	117±31	103±19
P value	0.45	0.12
Central venous pressure (mm Hg)		
Standard therapy	6.1±7.7	11.8±6.8
EGDT	5.3±9.3	13.8±4.4
P value	0.57	0.007
Mean arterial pressure (mm Hg)		
Standard therapy	76±24	81±18
EGDT	74±27	95±19
P value	0.60	<0.001
Central venous oxygen saturation (%)		
Standard therapy	49.2±13.3	66.0±15.5
EGDT	48.6±11.2	77.3±10.0
P value	[illegible]	<0.001

The normal $ScvO_2$ is ~70%

Rivers et al NEJM 2001

Bench-to-bedside review: The initial hemodynamic resuscitation of the septic patient according to Surviving Sepsis Campaign guidelines – does one size fit all?

Azriel Perel

Critical Care 2008, 12:223

The physiological "goals" that were suggested by the SSC Guidelines are not suitable for all septic patients and may be misleading in many instances.

Contradictory new evidence

Oesophageal Doppler monitoring, doubt and equipoise: evidence based medicine means change

C. Morris
Consultant Anaesthetist and Intensivist

Anaesthesia 2013
Editorial

It is probably premature to say that ODM-directed fluid therapy is ineffective, but the available evidence is hardly definitive. My interpretation of the evidence base is a shift towards lack of benefit and possibly harm, and this is why I don't use the ODM anymore.

Which goal for fluid therapy during colorectal surgery is followed by the best outcome: near-maximal stroke volume or zero fluid balance?

B. Brandstrup[1,2*], P. E. Svendsen[4], M. Rasmussen[5], B. Belhage[4], S. Å. Rodt[6], B. Hansen[6], D. R. Møller[7], L. B. Lundbech[6], N. Andersen[8], V. Berg[9], N. Thomassen[10], S. T. Andersen[11] and L. Simonsen[3]

British Journal of Anaesthesia **109** (2): 191–9 (2012)

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

BJA Advance Access published August 26, 2011

C. Challand[1,3], R. Struthers[2,3], J. R. Sneyd[2,3], P. D. Erasmus[2], N. Mellor[1], K. B. Hosie[1] and G. Minto[2,3*]

Optimising stroke volume and oxygen delivery in abdominal aortic surgery: a randomised controlled trial

J. Bisgaard[1], T. Gilsaa[1], E. Rønholm[1] and P. Toft[2]
[1]*Department of Anaesthesia and Intensive Care, Lillebaelt Hospital Kolding, Kolding, Denmark and* [2]*Department of Anaesthesia and Intensive Care, Odense University Hospital, Kolding, Denmark*

Acta Anaesthesiol Scand 2013; **57**: *178–188*

Randomized clinical trial of goal-directed fluid therapy within an enhanced recovery protocol for elective colectomy

S. Srinivasa[1], M. H. G. Taylor[2], P. P. Singh[1], T.-C. Yu[1], M. Soop[3] and A. G. Hill[1]

British Journal of Surgery 2013; **100**: 66–74

MacDonald and Pearse *Critical Care* 2011, **15**:122
http://ccforum.com/content/15/3/122

CRITICAL CARE

COMMENTARY

Peri-operative hemodynamic therapy: only large clinical trials can resolve our uncertainty

Neil MacDonald and Rupert M Pearse*

Perioperative Goal-Directed Hemodynamic Optimization Using Noninvasive Cardiac Output Monitoring in Major Abdominal Surgery: A Prospective, Randomized, Multicenter, Pragmatic Trial: POEMAS Study (PeriOperative goal-directed thErapy in Major Abdominal Surgery)

David Pestaña, PhD,* Elena Espinosa, PhD,† Arieh Eden, MD,‡ Diana Nájera, MD,* Luis Collar, MD,§ César Aldecoa, MD,‖ Eva Higuera, MD,¶ Soledad Escribano, MD,† Dmitri Bystritski, MD,‡ Javier Pascual, PhD,§ Pilar Fernández-Garijo, MD,‖ Blanca de Prada, MD,¶ Alfonso Muriel,# and Reuven Pizov, MD‡

Anesth Analg. 2014 Sep;119(3):579-87

In this RCT, including 142 patients from 6 hospitals, GDT was not associated with a decrease in the incidence of overall complications or LOS.

Effect of a Perioperative, Cardiac Output–Guided Hemodynamic Therapy Algorithm on Outcomes Following Major Gastrointestinal Surgery

A Randomized Clinical Trial and Systematic Review

Rupert M. Pearse, MD; David A. Harrison, PhD; Neil MacDonald, FRCA; Michael A. Gillies, FRCA; Mark Blunt, FRCA; Gareth Ackland, PhD; Michael P. W. Grocott, MD; Aoife Ahern, BSc; Kathryn Griggs, MSc; Rachael Scott, PhD; Charles Hinds, FRCA; Kathryn Rowan, PhD; for the OPTIMISE Study Group

JAMA. 2014;311(21):2181-2190.

- **Patients were randomly assigned to a CO–guided hemodynamic therapy algorithm for fluid and inotrope (dopexamine) infusion during and 6 hours following surgery (n=368) or to usual care (n=366).**
- **This algorithm did not reduce a composite outcome of complications and 30-day mortality.**

POM-O

Individualised oxygen delivery targeted haemodynamic therapy in high-risk surgical patients: a multicentre, randomised, double-blind, controlled, mechanistic trial

*Gareth L Ackland, Sadaf Iqbal, Laura Gallego Paredes, Andrew Toner, Craig Lyness, Nicholas Jenkins, Phoebe Bodger, Shamir Karmali, John Whittle, Anna Reyes, Mervyn Singer, Mark Hamilton, Maurizio Cecconi, Rupert M Pearse, Susan V Mallett, Rumana Z Omar, for the POM-O (PostOperative Morbidity-Oxygen delivery) study group**

Lancet Respir Med 2015; 3: 33–41

Early morbidity was similar between goal-directed therapy and control groups.

Effect of a Perioperative, Cardiac Output–Guided Hemodynamic Therapy Algorithm on Outcomes Following Major Gastrointestinal Surgery

A Randomized Clinical Trial and Systematic Review

Rupert M. Pearse, MD; David A. Harrison, PhD; Neil MacDonald, FRCA; Michael A. Gillies, FRCA; Mark Blunt, FRCA; Gareth Ackland, PhD; Michael P. W. Grocott, MD; Aoife Ahern, BSc; Kathryn Griggs, MSc; Rachael Scott, PhD; Charles Hinds, FRCA; Kathryn Rowan, PhD; for the OPTIMISE Study Group

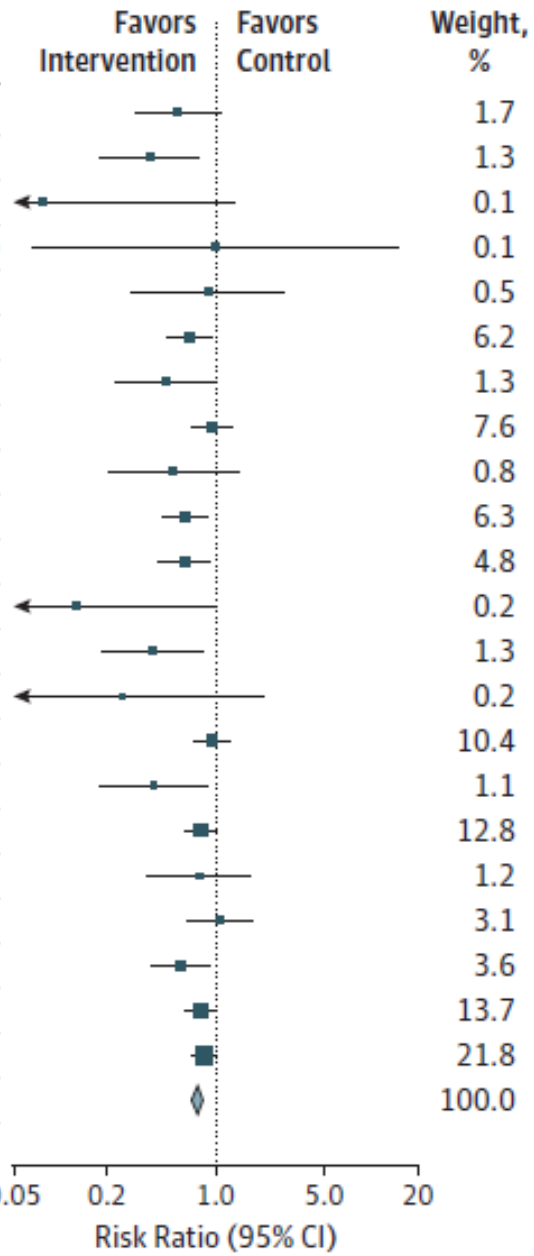
JAMA. 2014;311(21):2181-2190.

- **However, inclusion of these data in an updated meta-analysis indicates that the intervention was associated with a reduction in complication rates.**

Figure 3. Meta-analysis of Number of Patients Developing Complications After Surgery

Source	Intervention		Control		Risk Ratio (95% CI)	Weight, %
	No. of Events	Total No.	No. of Events	Total No.		
Shoemaker et al,[20] 1988	8	28	30	60	0.57 (0.30-1.08)	1.7
Berlauk et al,[21] 1991	11	68	9	21	0.38 (0.18-0.79)	1.3
Mythen et al,[22] 1995	0	30	6	30	0.08 (0.00-1.31)	0.1
Sinclair et al,[23] 1997	1	20	1	20	1.00 (0.07-14.90)	0.1
Ueno et al,[24] 1998	4	16	5	18	0.90 (0.29-2.78)	0.5
Wilson et al,[25] 1999	38	92	28	46	0.68 (0.48-0.95)	6.2
Lobo et al,[26] 2000	6	19	12	18	0.47 (0.23-0.99)	1.3
Jerez et al,[27] 2001	53	181	65	209	0.94 (0.70-1.28)	7.6
Conway et al,[28] 2002	5	29	9	28	0.54 (0.20-1.40)	0.8
Pearse et al,[14] 2005	27	62	41	60	0.64 (0.46-0.89)	6.3
Wakeling et al,[29] 2005	24	67	38	67	0.63 (0.43-0.93)	4.8
Noblett et al,[30] 2006	1	51	8	52	0.13 (0.02-0.98)	0.2
Donati et al,[31] 2007	8	68	20	67	0.39 (0.19-0.83)	1.3
Smetkin et al,[32] 2009[a]	1	20	4	20	0.25 (0.03-2.05)	0.2
Jhanji et al,[6] 2010	57	90	30	45	0.95 (0.73-1.23)	10.4
Mayer et al,[33] 2010	6	30	15	30	0.40 (0.18-0.89)	1.1
Cecconi et al,[34] 2011	16	20	20	20	0.80 (0.64-1.02)	12.8
Challand et al,[35] 2012	10	89	13	90	0.78 (0.36-1.68)	1.2
Brandstrup et al,[36] 2012[a]	23	71	24	79	1.07 (0.66-1.71)	3.1
Salzwedel et al,[37] 2013[a]	21	79	36	81	0.60 (0.39-0.93)	3.6
Goepfert et al,[38] 2013[a]	34	50	42	50	0.81 (0.65-1.01)	13.7
OPTIMISE, 2014	134	368	158	365	0.84 (0.70-1.01)	21.8
Total	488	1548	614	1476	0.77 (0.71-0.83)	100.0

Heterogeneity: $\chi^2_{21} = 30.44$; $P = .08$; $I^2 = 31\%$
Test for overall effect: $z = 6.22$; $P < .001$



32. Smetkin AA, Kirov MY, Kuzkov VV, et al. Single transpulmonary thermodilution and continuous monitoring of central venous oxygen saturation during off-pump coronary surgery. *Acta Anaesthesiol Scand*. 2009;53(4):505-514.

PiCCO and $ScvO_2$

37. Salzwedel C, Puig J, Carstens A, et al. Perioperative goal-directed hemodynamic therapy based on radial arterial pulse pressure variation and continuous cardiac index trending reduces postoperative complications after major abdominal surgery: a multi-center, prospective, randomized study. *Crit Care*. 2013;17(5):R191.

Individually PPV-optimized CI

38. Goepfert MS, Richter HP, Zu Eulenburg C, et al. Individually optimized hemodynamic therapy reduces complications and length of stay in the intensive care unit: a prospective, randomized controlled trial. *Anesthesiology*. 2013;119(4):824-836.

PiCCO-based protocol

Goal-directed or goal-misdirected – how should we interpret the literature?

Anthony M Roche* and Timothy E Miller

Critical Care 2010, **14**:129

Goal-directed therapy (GDT) can be a vague term, meaning different things to different people and, depending on the clinical environment, sometimes even different things to the same person.

ProCESS

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

A Randomized Trial of Protocol-Based Care for Early Septic Shock

The ProCESS Investigators*

This article was published on March 18, 2014, at NEJM.org.

Surviving Sepsis Campaign Responds to ProCESS Trial
28 March 2014

"…the SSC has no plans to revise the bundles…

…Given the existing evidence supporting early targeted resuscitation in these patients, SSC continues to recommend all elements of the current bundles".

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Goal-Directed Resuscitation for Patients with Early Septic Shock

The ARISE Investigators and the ANZICS Clinical Trials Group*

This article was published on October 1, 2014, at NEJM.org.

ARISE

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Trial of Early, Goal-Directed Resuscitation for Septic Shock

Paul R. Mouncey, M.Sc., Tiffany M. Osborn, M.D., G. Sarah Power, M.Sc., David A. Harrison, Ph.D., M. Zia Sadique, Ph.D., Richard D. Grieve, Ph.D., Rahi Jahan, B.A., Sheila E. Harvey, Ph.D., Derek Bell, M.D., Julian F. Bion, M.D., Timothy J. Coats, M.D., Mervyn Singer, M.D., J. Duncan Young, D.M., and Kathryn M. Rowan, Ph.D., for the ProMISe Trial Investigators*

This article was published on March 17, 2015, at NEJM.org.

ProMISe

CMS.gov
Centers for Medicare & Medicaid Services

NATIONAL QUALITY FORUM

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TO BE COMPLETED WITHIN 3 HOURS OF TIME OF PRESENTATION*:

1. Measure lactate level
2. Obtain blood cultures prior to administration of antibiotics
3. Administer broad spectrum antibiotics
4. Administer 30ml/kg crystalloid for hypotension or lactate ≥4mmol/L

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TO BE COMPLETED WITHIN 6 HOURS OF TIME OF PRESENTATION:

5. Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥65mmHg
6. In the event of persistent hypotension after initial fluid administration (MAP < 65 mm Hg) or if initial lactate was ≥4 mmol/L, re-assess volume status and tissue perfusion and document findings according to Table 1.
7. Re-measure lactate if initial lactate elevated.

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TABLE 1

DOCUMENT REASSESSMENT OF VOLUME STATUS AND TISSUE PERFUSION WITH:

EITHER

- Repeat focused exam (after initial fluid resuscitation) by licensed independent practitioner including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings.

Surviving Sepsis Campaign

Updated Bundles in Response to New Evidence

TABLE 1

DOCUMENT REASSESSMENT OF VOLUME STATUS AND TISSUE PERFUSION WITH:

EITHER

- Repeat focused exam (after initial fluid resuscitation) by licensed independent practitioner including vital signs, cardiopulmonary, capillary refill, pulse, and skin findings.

OR TWO OF THE FOLLOWING:

- Measure CVP
- Measure $ScvO_2$
- Bedside cardiovascular ultrasound
- Dynamic assessment of fluid responsiveness with passive leg raise or fluid challenge

What is a fluid challenge?

Maurizio Cecconi, Anthony K. Parsons and Andrew Rhodes

Current Opinion in Critical Care 2011, 17:290–295

Continuous CO monitoring is the gold standard to monitor the response to a fluid challenge.

Passive leg raising: five rules, not a drop of fluid!

Xavier Monnet[1,2*] and Jean-Louis Teboul[1,2]

Critical Care (2015) 19:18

The PLR effects must be assessed by a direct and continuous measurement of CO and not by the simple measurement of blood pressure.

Possible harm

Medical Reversal: Why We Must Raise the Bar Before Adopting New Technologies

Vinay Prasad, MD,[a] and Adam Cifu, MD[b*]

YALE JOURNAL OF BIOLOGY AND MEDICINE 84 (2011), pp.471-478.

Medical reversal harms patients who undergo the contradicted therapy during the years it was in favor.

OPTIMISE JAMA. Published on line May 19, 2014.

Characteristics	Cardiac Output–Guided Hemodynamic Therapy Algorithm (n = 367)	Usual Care (n = 362)
Intravenous crystalloid, median (IQR), mL[c]		
During surgery	1000 (459-2000)	2000 (1283-3000)
During 6 h following surgery	506 (410-660)	600 (450-800)
Intravenous colloid, median (IQR), mL[c]		
During surgery	1250 (1000-2000)	500 (0-1000)
During 6 h following surgery	500 (250-1000)	0 (0-500)
Blood products, mean (SD), mL[c]		
During surgery	141 (723)	95 (542)
During 6 h following surgery	80 (555)	10 (66)

Dynamic preload markers to predict fluid responsiveness during and after major gastrointestinal surgery: an observational substudy of the OPTIMISE trial

N. MacDonald[1], T. Ahmad[1], O. Mohr[2], J. Kirk-Bayley[3], I. Moppett[4], C. J. Hinds[1] and R. M. Pearse[1*]

British Journal of Anaesthesia **114** (4): 598–604 (2015)

- **Sub-study of the OPTIMISE trial including 100 of the original 368 patients enrolled in the intervention group.**
- **Only 28.6% of the fluid challenges were associated with increased stroke volume.**

28.6%!

Intensive Care Med (2016) 42:1461–1463
DOI 10.1007/s00134-015-4172-8

EDITORIAL

Jukka Takala

Volume responsive, but does the patient need volume?

Giving volume to fluid responders as long as they respond should not become the iatrogenic syndrome of the decade;

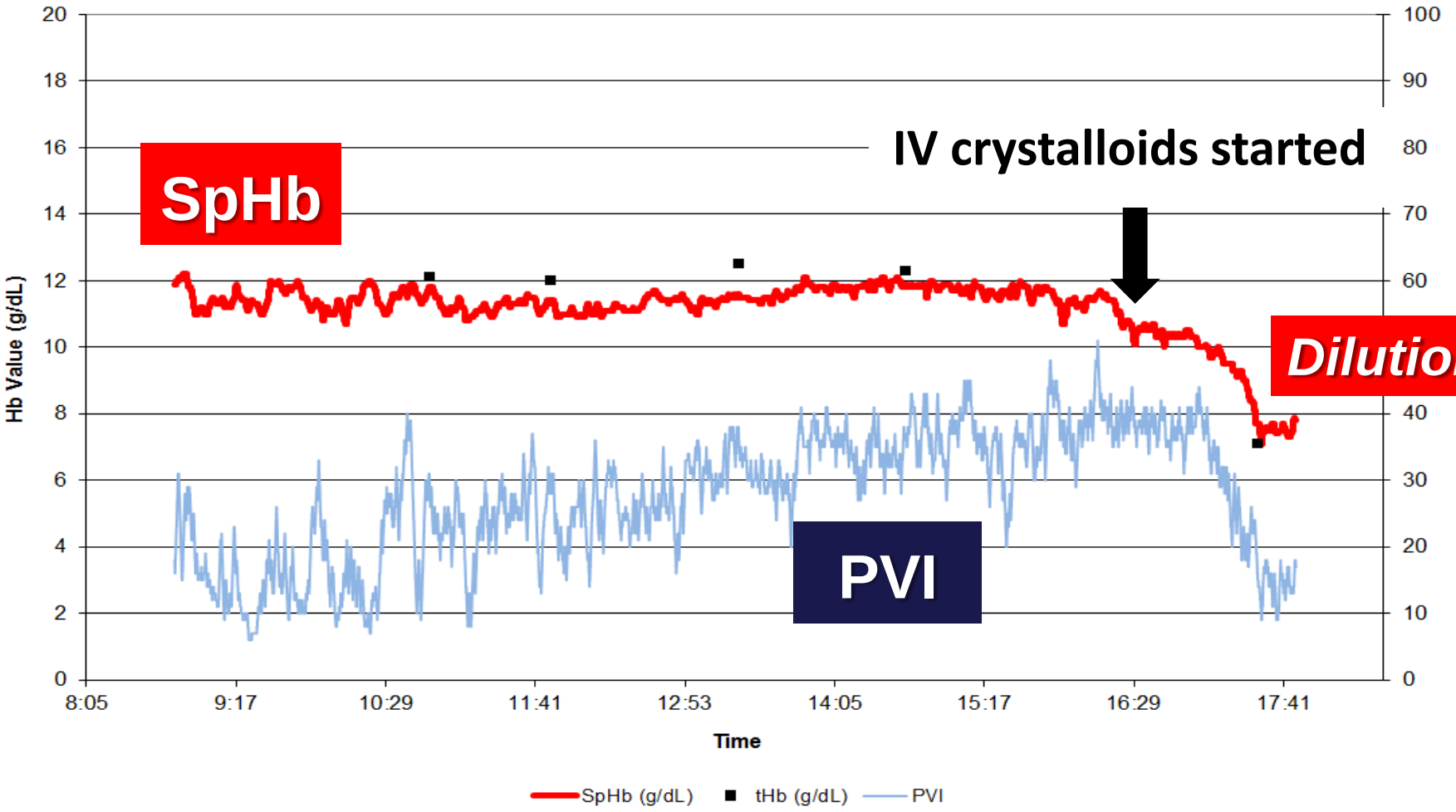
Individualised oxygen delivery targeted haemodynamic therapy in high-risk surgical patients: a multicentre, randomised, double-blind, controlled, mechanistic trial

*Gareth L Ackland, Sadaf Iqbal, Laura Gallego Paredes, Andrew Toner, Craig Lyness, Nicholas Jenkins, Phoebe Bodger, Shamir Karmali, John Whittle, Anna Reyes, Mervyn Singer, Mark Hamilton, Maurizio Cecconi, Rupert M Pearse, Susan V Mallett, Rumana Z Omar, for the POM-O (PostOperative Morbidity-Oxygen delivery) study group**

Lancet Respir Med 2015; 3: 33–41

	Control (n=92)	Goal-directed therapy (n=95)
APACHE II score on intensive care unit admission	16 (5)	15 (6)
Crystalloid (mL/kg per h)	1·0 (1·0–1·1)	1·0 (1·0–1·2)
Colloid (mL/kg per h)	1·4 (0–2·8)	2·9 (1·7–3·6)
Blood transfusion	11 (12%)	22 (23%)
Dobutamine infusion	0	38 (40%)

SpHb + PVI monitoring during partial hepatectomy

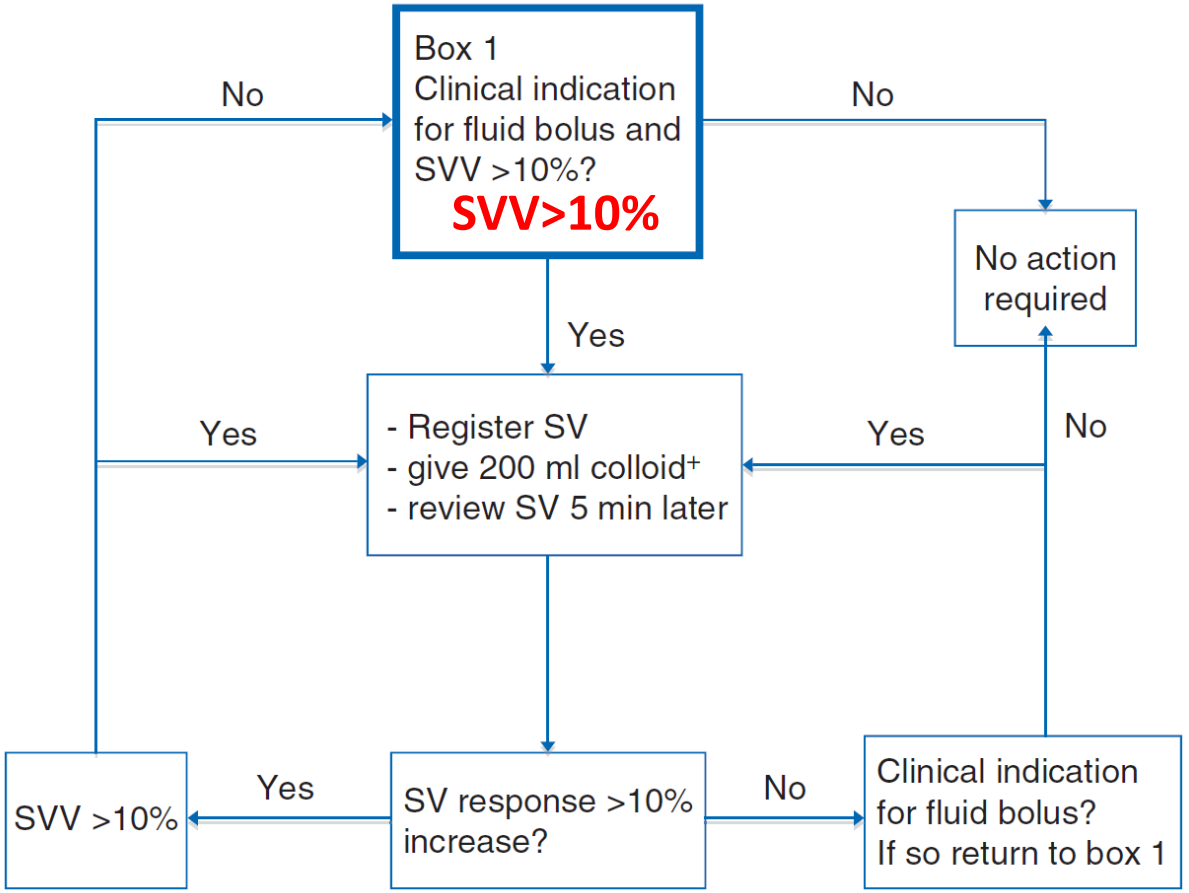


Randomized controlled trial of stroke volume optimization during elective major abdominal surgery in patients stratified by aerobic fitness

C. W. Lai[1,3], T. Starkie[2], S. Creanor[3], R. A. Struthers[2,3], D. Portch[4], P. D. Erasmus[2], N. Mellor[1], K. B. Hosie[1], J. R. Sneyd[2,3] and G. Minto[2,3,*]

British Journal of Anaesthesia, 115 (4): 578–89 (2015)

RCT; 220 patients having major surgery using enhanced recovery pathway with or without supplementary blinded intra-operative SV optimization.



The GDT group received additional 956 ml colloids during surgery

Parameter	Control (n=111)	GDT (n=109)
Stroke volume variation (%)		
Before incision	10.1 (10.5)	7.4 (6.6)
End	9.0 (6.6)	7.9 (6.8)
Cardiac index (litres min^{-1})		
Awake	3.7 (1.0)	3.7 (1.3)
Before incision	2.4 (0.8)	2.5 (0.8)
End	2.8 (1.0)	2.8 (1.0)
D_{O_2} (ml O_2 min^{-1} m^{-2})		
Start	343.0 (174.0)	332.0 (179.0)
End	411.1 (149.6)	387.5 (154.2)
Lactate (mmol $litre^{-1}$)		
Start	1.6 (0.6)	1.5 (0.5)
End	1.8 (0.8)	1.7 (0.9)
Hb (g $litre^{-1}$)		
Start	120 (18)	120 (17)
End	112 (18)	103 (17)

British Journal of Anaesthesia, 115 (4): 578–89 (2015)

Changing trends in transfusion practice in liver transplantation

Yves Ozier[a] and Mei-Yung Tsou[b]

Current Opinion in Organ Transplantation 2008, 13:304–309

- **Blood volume expansion with crystalloids and colloid solutions will result in dilution, a decrease in plasma levels of coagulation factors, and worsening coagulopathy.**
- **As a consequence, differences in volume loading can markedly influence blood product requirements.**

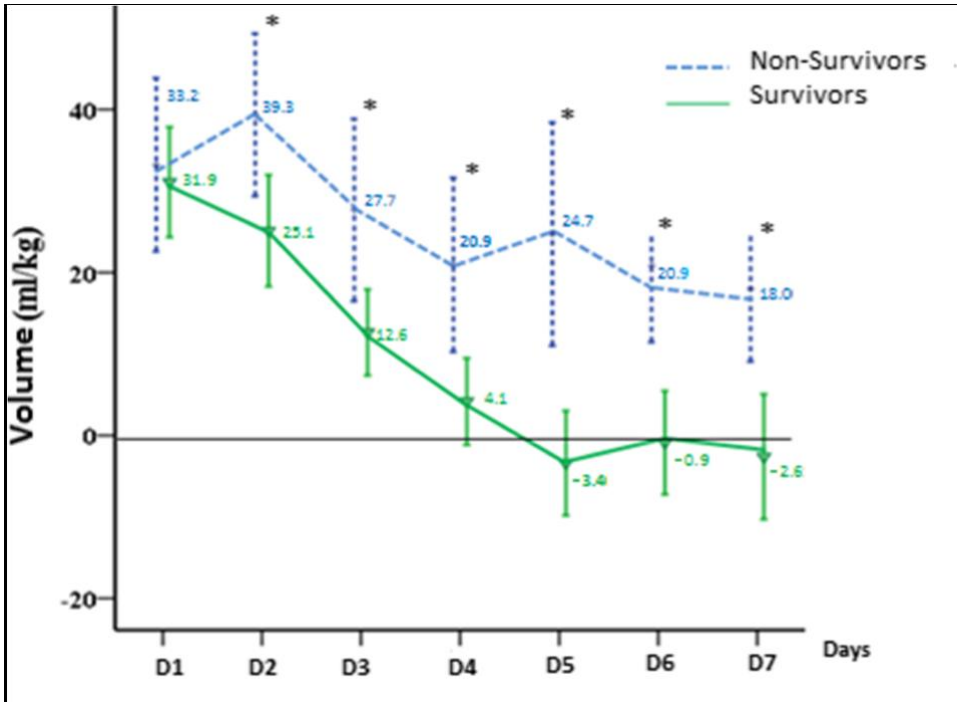
Some of the perioperative goal-directed strategies have failed because they were based on CO/SV maximization without taking into account fluid responsiveness.

A positive fluid balance is an independent prognostic factor in patients with sepsis

Angela Acheampong and Jean-Louis Vincent*

Critical Care (2015) 19:251

- **Daily fluid balance was more than twice as large in the non-survivors as in the survivors (29 ± 22 vs. 13 ± 19 ml/kg, p <0.001).**
- **A positive fluid balance was independently associated with an increase in the risk of death.**



A rational approach to fluid therapy in sepsis

P. Marik[1,*] and R. Bellomo[2]

British Journal of Anaesthesia, 2015, 1–11

- **The majority of patients with severe sepsis and septic shock are not fluid responders.**
- **The haemodynamic changes in the fluid responders are small, short-lived and likely to be clinically insignificant.**
- **It is likely that aggressive fluid resuscitation increases the morbidly and mortality of patients with sepsis.**

Early Liberal Fluids for Sepsis Patients Are Harmful

Kelly Genga, MD[1]; James A. Russell, MD[1,2]

Crit Care Med. 2016 Apr 7. [Epub ahead of print]

Cumulative Fluid Balance and Mortality in Septic Patients With or Without Acute Kidney Injury and Chronic Kidney Disease*

Javier A. Neyra, MD, MSCS[1,2]; Xilong Li, PhD, MS[3]; Fabrizio Canepa-Escaro, MD[4]; Beverley Adams-Huet, MS[3]; Robert D. Toto, MD[1]; Jerry Yee, MD[5]; S. Susan Hedayati, MD, MHSc[1,6]; for the Acute Kidney Injury in Critical Illness Study Group

Crit Care Med. October 2016; 44:1891–1900

Cumulative Fluid Balance: The Dark Side of the Fluid*

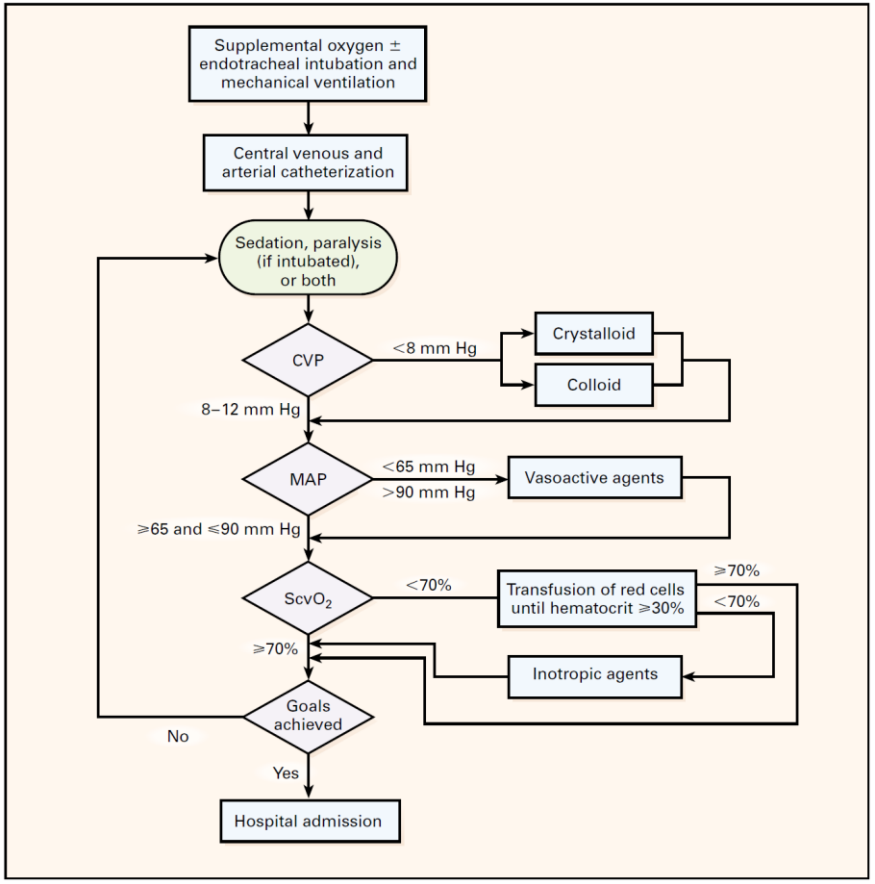
Jan Benes, MD, PhD

Crit Care Med. October 2016; 44:1945–6

EARLY GOAL-DIRECTED THERAPY IN THE TREATMENT OF SEVERE SEPSIS AND SEPTIC SHOCK

EMANUEL RIVERS, M.D., M.P.H., BRYANT NGUYEN, M.D., SUZANNE HAVSTAD, M.A., JULIE RESSLER, B.S., ALEXANDRIA MUZZIN, B.S., BERNHARD KNOBLICH, M.D., EDWARD PETERSON, PH.D., AND MICHAEL TOMLANOVICH, M.D., FOR THE EARLY GOAL-DIRECTED THERAPY COLLABORATIVE GROUP*

N Engl J Med, Vol. 345, No. 19 · November 8, 2001



VARIABLE AND TREATMENT GROUP	BASE LINE (0 hr)	HOURS AFTER START OF THERAPY		
		6	0–6†	7–72‡
Hematocrit (%)				
Standard therapy	34.7±8.5	32.0±6.9	—	30.1±4.1
EGDT	34.6±8.3	33.3±4.8	—	32.1±4.2
P value	0.91	0.03		<0.001

TABLE 4. TREATMENTS ADMINISTERED.*

TREATMENT	HOURS AFTER THE START OF THERAPY		
	0–6	7–72	0–72
Total fluids (ml)			
Standard therapy	3499±2438	10,602±6,216	13,358±7,729
EGDT	4981±2984	8,625±5,162	13,443±6,390
P value	<0.001	0.01	0.73
Red-cell transfusion (%)			
Standard therapy	18.5	32.8	44.5
EGDT	64.1	11.1	68.4
P value	<0.001	<0.001	<0.001

Severe Sepsis and Septic Shock

Should Blood Be Transfused To Raise Mixed Venous Oxygen Saturation?

Vinayak Jha, MD
Guillermo Gutierrez, MD, PhD, FCCP

CHEST / 131 / 4 / APRIL, 2007 **1267**

Response

As Dr. Jha points out, the baseline hematocrit was not the basis for transfusing a patient 3 h into the resuscitation.

It was a uniform observation that the volume provided during the resuscitative course decreased the hematocrit by 30% at 3 h.

Ronny M. Otero, MD
Emanuel P. Rivers, MD, MPH, FCCP

Fluid resuscitation for acute kidney injury: an empty promise

Scott C. Watkins[a] *and Andrew D. Shaw*[b]

Curr Opin Crit Care 2016, 22:000–000

KEY POINTS

- Evidence is mounting that the practice of aggressive fluid therapy with the intent of improving end organ perfusion and function is misguided and in fact may lead to fluid overload and further end organ injury.
- After the initial acute phase of illness, additional fluids are unlikely to augment *CO* and tissue perfusion and may in fact contribute to worsening organ dysfunction.
- GDT or protocol-based fluid therapy offers no benefit over conventional fluid therapy that maintains organ perfusion and avoids fluid overload.
- The composition, quantity, and timing of fluid therapy should be personalized to each patient based on the patient's unique physiological response to fluids.

Lessons to be learned

An Official Multi-Society Statement: The Role of Clinical Research Results in the Practice of Critical Care Medicine

Am J Respir Crit Care Med Vol 185, Iss. 10, pp 1117–1124, May 15, 2012

ACCP, ATS, SCCM

There are serious questions regarding the value of EBM in the bedside practice of critical care medicine, which is, in large part, defined by the careful monitoring and real-time analysis of many physiologic variables.

Evidence-Based Medicine

A New Approach to Teaching the Practice of Medicine

Evidence-Based Medicine Working Group

JAMA, November 4, 1992—Vol 268, No. 17

A NEW paradigm for medical practice is emerging. Evidence-based medicine de-emphasizes intuition, unsystematic clinical experience, and pathophysiologic rationale as sufficient grounds for clinical decision making and stresses the examination of evidence from clinical research. Evidence-based medicine requires new skills of the physician, including efficient literature searching and the application of formal rules of evidence evaluating the clinical literature.

Society of Critical Care Medicine
The Intensive Care Professionals

Harvard Business Essentials. "Creating Teams with an Edge." Boston Massachusetts: Harvard Business School Press; 2004.

Critical Care eNewsletter

March 17, 2005

Avoiding Groupthink in Your Team

Groupthink is an interesting term. You may be asking, _What is groupthink and does my team do it?_ The term _groupthink_ was coined by the late Yale psychologist Irving Janis. Janis defined groupthink as _a way of thinking that people may adopt when they are members of a cohesive or homogeneous group; in particular, a group whose members seek unanimity of thought to the point that they cannot consider alternative ideas_ (*Harvard Business Essentials*, 2004).

_ An illusion of invulnerability prevails
_ Leaders are insulated or protected from contradictory evidence
_ Members accept confirming data and reject data that fails to fit their views
_ Alternatives are not considered
_ Individuals with conflicting views are discounted or demonized

Hemodynamic Instability in Sepsis

Bedside Assessment by Doppler Echocardiography

Antoine Vieillard-Baron, Sebastien Prin, Karim Chergui, Olivier Dubourg, and François Jardin

Am J Respir Crit Care Med Vol 168. pp 1270–1276, 2003

- **The cause of hemodynamic instability in septic shock may be hypovolemic, cardiogenic, or distributive.**
- **This diagnosis is required for an adequate treatment, which may be rapid fluid administration, infusion of an inotropic agent, infusion of a vasoconstrictor agent, or various combinations of the above.**

The effects of advanced monitoring on hemodynamic management in critically ill patients: a pre and post questionnaire study

Azriel Perel[1] · Bernd Saugel[2] · Jean-Louis Teboul[3,4] · Manu L. N. G. Malbrain[5] · Francisco Javier Belda[6] · Enrique Fernández-Mondéjar[7] · Mikhail Kirov[8] · Julia Wendon[9] · Roger Lussmann[10,11] · Marco Maggiorini[12]

J Clin Monit Comput (2016) 30:511–518

- **Physicians have a limited clinical ability of to correctly assess the hemodynamic status.**
- **The significant impact that more physiological information has on major therapeutic decisions, supports the use of advanced hemodynamic monitoring in critically ill patients.**

Conclusions

- Both EGDT and GDT ("SV maximization") strategies are aimed at improving hemodynamic status, yet are based on questionable physiology.
- Both strategies were widely embraced based on evidence that was later refuted.
- Both strategies may cause potential harm, especially in the form of fluid overload.
- A more physiologically-suitable monitoring methodology, combined with better bedside decision-making strategies, are the key to improve the outcome of high-risk surgery and septic shock.

Dziękuję bardzo!