SLOVENSKÁ SPOLOČNOSŤ ANESTÉZIOLÓGIE A INTENZÍVNEJ MEDICÍNY

Kadlicov Memoriál

XXI. Kongres SSAIM

Piešťany 2015

Doc. MUDr. Tomáš Kadlic

(1913-2000)

zakladatel slovenské anesteziologické školy

zakladatel první kliniky A+R v Československu

Tekutinová resuscitace septického šoku

Druhá strana mince

Roman Kula, Ostrava

NAIROBI 2013

The David Sheldrick Wildlife Trust

The David Sheldrick Orphan´s project

Dr. Dame Daphne Sheldrick,

DBE, MDB, MBS, DVMS, Chair of the David Sheldrick Wildlife Trust, Nairobi, Kenya

Dr. Dame Daphne Sheldrick,

DBE, MDB, MBS, DVMS, Chair of the David Sheldrick Wildlife Trust, Nairobi, Kenya

- trpí infekciou a má horúčku
- je ťažko dehydratované
- rýchla rehydratácia ho môže zabiť – dnes dostane len malé množstvo mlieka

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VOICES SAVING ELEPHANTS

A Forum for Discussion

Elephant Foster Mom: A Conversation with Daphne Sheldrick

Posted by **Laurel Neme** in A Voice for Elephants on December 6, 2013

(29) More »

Orphaned elephants "can be fine one day and dead the next," says Daphne Sheldrick, a Kenyan conservationist and expert in animal husbandry.

Daphne Sheldrick. Photograph courtesy the David Sheldrick Wildlife Trust.

She knows. To date, she has fostered over 250 calves, first in partnership with her husband, David Sheldrick, founding warden of Kenya's Tsavo East National Park and a legendary naturalist, and later (following his death in 1977) as part of the David Sheldrick Wildlife Trust (DSWT), which she founded in his memory.

Many are victims of poaching, like one-year-old Lima Lima, who was found weak and dehydrated. When she arrived at DSWT in February, Lima Lima was very thin and sickened from browsing on the invasive prickly pear plant (which can be poisonous) during her abandonment.

Lima Lima took milk from a hand-held bottle and was warm
the nursery, but she mourned for her lost
behavior for an

Elephants are increasingly endangered by a growing human incursion into their habitats. Poaching has drastically exacerbated the plight of the African elephant in particular. "A Voice for Elephants" is a resource for information, a forum for discussion, and a rally point for those who want to get involved.

Recent Posts

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NATIONAL GEOGRAPHIC

http://voices.nationalgeographic.com/2013/12/06/elephant-foster-mom-a-conversation-with-daphne-sheldrick/#

„ can be fine one day and dead the next "

Bolus Fluids for the Shocky Veterinary Patient: How Much Should I Give?

JUSTINE A. LEE, DVM, DACVECC, DABT
CEO, VETGIRL
VETGIRLONTHERUN.COM

About to see a hit-by-car (aka, an HBC) dog? Wondering how much fluid should you bolus?

For the shocky patient, the classic response to "how much IV fluids should I give?" is often "60–90 mL/kg."

We no longer use this amount!

In older emergency textbooks, this "shock dose" of 60–90 mL/kg was extrapolated from the blood volume of the patient (eg, 60–90 mL/kg for dogs; 60 mL/kg for cats). This older shock dose didn't have a time association with it—it wasn't 60 mL/kg/hour, nor was it 60 mL/kg/minute. This number just represented blood volume.

More recently, emergency and critical care specialists have moved aw
shock dose when trying to stabilize hypovolemic patients
smaller aliquots of IV crystalloids. So, con
shock dose (approxim

NAVC • AAHA VetFolio
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http://www.vetfolio.com/article/bolus-fluids-for-the-shocky-veterinary-patient-how-much-should-i-give

„ … do not give more then 20 ml/kg “

3-Hour Bundle

Hemodynamic Support and Adjunctive Therapy

Fluid Therapy of Severe Sepsis

Initial fluid challenge in patients with sepsis-induced tissue hypoperfusion **should be a minimum of 30 mL/kg of crystalloids** (a portion of this may be albumin equivalent). **More rapid administration and greater amounts of fluid may be needed in some patients.**

Surviving Sepsis Campaign

http://www.survivivgsepsis.org

BE AGGRESSIVE ...

„ … give minimum 30 ml/kg or more “

Máme nejakú oporu pre bolus(y) ?

Máme nejakú oporu pre bolus(y) ?

… sú nejaké štúdie, ktoré by skúmali

- aká je bezprostredná odpoveď na FBT ?
- sú FBT bezpečným postupom ?

Glassford et al. Critical Care 2014, 18:696
http://ccforum.com/content/18/6/696

CRITICAL CARE

REVIEW

Physiological changes after fluid bolus therapy in sepsis: a systematic review of contemporary data

Neil J Glassford[1,2], Glenn M Eastwood[1,3] and Rinaldo Bellomo[1,2*]

Abstract

Fluid bolus therapy (FBT) is a standard of care in the management of the septic, hypotensive, tachycardic and/or oliguric patient. However, contemporary evidence for FBT improving patient-centred outcomes is scant. Moreover, its physiological effects in contemporary ICU environments and populations are poorly understood. Using three electronic databases, we identified all studies describing FBT between January 2010 and December 2013. We found 33 studies describing 41 boluses. No randomised controlled trials compared FBT with alternative interventions, such as vasopressors. The median fluid bolus was 500 ml (range 100 to 1,000 ml) administered over 30 minutes (range 10 to 60 minutes) and the most commonly administered fluid was 0.9% sodium chloride solution. In 19 studies, a predetermined physiological trigger initiated FBT. Although 17 studies describe the temporal course of physiological changes after FBT in 31 patient groups, only three studies describe the physiological changes at 60 minutes, and only one study beyond this point. No studies related the physiological changes after FBT with clinically relevant outcomes. There is a clear need for at least obtaining randomised controlled evidence for the physiological effects of FBT in patients with severe sepsis and septic shock beyond the period immediately after its administration.

Just as water retains no shape, so in warfare there are no constant conditions
Sun Tzu (The Art of War)

Introduction

All critically ill patients receive intravenous (IV) fluids, which are given to maintain physiological homeostasis, or as a vehicle for drug administration, or as direct therapeutic administration to correct perceived haemodynamic instability [1-4]. In these situations, where there is a perceived reduction in venous return and cardiac output secondary to vasodilatation and/or hypovolaemia, using IV fluid to increase intravascular volume is believed to effectively compensate for these changes in vascular tone by increasing stroke volume in accordance with the Frank-Starling principle [5-10].

the timed and rapid infusion methods favoured by Shoemaker [7,8,14-16] and, more recently, techniques involving echocardiographic or ultrasonographic assessment of fluid responsiveness following low-volume IV infusion [17]. However, the current standard of care in the management of septic, hypotensive, tachycardic and/or oliguric patients is fluid bolus therapy (FBT), where IV fluid is rapidly administered in discrete boluses [18-21]. While the ideal fluid bolus would be a discrete volume of a specific fluid administered at a specified rate, accounting for individual patient features and with a defined aim (Figure 1) [11], there is no current agreement regarding

- len jedna štúdia skúmala fyziologické zmeny po FBT
- žiadna zo štúdií neporovnávala FBT s alternatívnymi postupmi

Glassford et al. *Critical Care* 2014, 18:696

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„We use FBT because we believe that FBT is safe and effective . . . "

Glassford et al. *Critical Care* 2014, 18:696

SHOCK, Vol. 40, No. 1, pp. 28–34, 2013

POST RESUSICITATION FLUID BOLUSES IN SEVERE SEPSIS OR SEPTIC SHOCK: PREVALENCE AND EFFICACY (PRICE STUDY)

Shailesh Bihari,*† Shivesh Prakash,* and Andrew D. Bersten*†

**Department of Intensive and Critical Care Unit, Flinders Medical Centre; and †Critical Care Medicine, Flinders University, Bedford Park, Adelaide, South Australia.*

Received 24 Jan 2013; first review completed 6 Feb 2013; accepted in final form 15 Apr 2013

ABSTRACT—**Introduction:** Administration of fluid boluses (FBs) beyond initial resuscitation in patients with severe sepsis is common and may contribute to positive fluid balance. Little is known regarding the efficacy and risk profile of this strategy. **Objective:** To estimate the prevalence and efficacy of FBs after initial resuscitation in septic patients. **Methods:** In a prospective study, patients with severe sepsis/septic shock were recruited after initial resuscitation and followed up for 3 days. Number, types, and volumes of FBs; resuscitation goals; and their perceived success rates were recorded. Data are presented as median (interquartile range). **Results:** Over a 1-year period, 50 patients were recruited, 47 (94%) of them received FBs, with a total of 184 FBs (3 [2–5] per patient) administered over 72 h. On day 1, 2 (1–3) FBs, totaling 750 mL (500–1,720 mL), were administered, which comprised 52.4% (22.1%–124.2%) of the fluid balance. Low blood pressure (mean arterial pressure [MAP]) (76.0%) and increased vasopressor requirement (60.3%) were the two most common indications for FBs. Low filling pressure (70.9%) and clinical signs (79.4%) were perceived as the most successful indications. One hour after these FBs, there was a small increase in MAP ($P < 0.01$) and central venous pressure ($P < 0.01$); however, there was also concomitant increase in noradrenaline administered. There was a significant decrease in Pao_2/Fio_2 ratio, hemoglobin, and temperature, whereas urine output remained unchanged. Factors (Exp[*b*] [SE], *P*) ($R^2 = 0.296$) that affected the increase in MAP were baseline MAP (−0.49 [0.057], $P < 0.001$) and amount of these FBs (−0.05 [0.01], $P = 0.001$). Cumulative fluid balance had a weak correlation with delta sequential organ failure assessment score ($r = 0.32$, $P = 0.001$) and lung injury score ($r = 0.13$, $P = 0.02$) and negative correlation with Pao_2/Fio_2 ratio ($r = -0.28$, $P = 0.001$). **Conclusion:** Postresuscitation FBs are common in septic patients, meet limited success, and may be harmful.

KEYWORDS—Sepsis, septic shock, fluid bolus, fluid balance, resuscitation

INTRODUCTION

Septic shock is an important cause of death in critically ill patients worldwide (1). It is characterized by a vasodilated state, sometimes complicated by early myocardial depression. Fluid boluses (FBs) are often administered with the aim of improving tissue perfusion (2, 3) and are a key component in the effective management of such patients. However, it is also becoming increasingly evident that excessive volume administration can worsen outcome (4–6).

During sepsis, the activity of the inflammatory response is highest in the initial hours after the insult, which has given rise to the concept of early and late resuscitation as distinct therapeutic entities (7). The role of early resuscitation (the first 6 h) (8, 9) has been well established. Early titrated fluid administration modulates inflammation, improves microvascular per-

studies, 18.2% and 28.7% of patients with severe sepsis, respectively, received FBs at least for the first 4 days during their stay in ICU. In the recently conducted 6S (13) trial, patients with severe sepsis had a median 1.5 L of resuscitation fluid administered on days 1 and 2 and 1 L on day 3 in addition to other fluids and blood products. Despite their frequent use in critically ill septic patients, little has been reported regarding the reasons why these FBs are administered and whether they are efficacious.

Except for cases with obvious fluid loss, these FBs can account for some of the positive fluid balance in ICU patients; this in turn has been associated with poor outcomes. Positive fluid balance has been associated with poorer lung function (6), poorer kidney function (14), and delayed return of gastrointestinal function after surgery (15) and an increased mortality risk (16). Given the growing evidence of disadvan-

Epidemiologia a efektivita FBT (PRICE study)

- stratégia opakovaných bolusov sa v praxi používa veľmi často
- FBT významne prispievajú k pozitivite tekutinovej bilance
- FBT významne navyšuje potrebu noradrenalinu
- fyziologické zmeny po FBT sú len „kozmetické“

Bihari et al., *Shock* 2013, 40:28 -34

Nunes *et al. Annals of Intensive Care* 2014, **4**:25
http://www.annalsofintensivecare.com/content/4/1/25

Annals of Intensive Care
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RESEARCH Open Access

Duration of hemodynamic effects of crystalloids in patients with circulatory shock after initial resuscitation

Thieme Souza Oliveira Nunes, Renata Teixeira Ladeira, Antônio Tonete Bafi, Luciano Cesar Pontes de Azevedo, Flavia Ribeiro Machado and Flávio Geraldo Rezende Freitas*

Abstract

Background: In the later stages of circulatory shock, monitoring should help to avoid fluid overload. In this setting, volume expansion is ideally indicated only for patients in whom the cardiac index (CI) is expected to increase. Crystalloids are usually the choice for fluid replacement. As previous studies evaluating the hemodynamic effect of crystalloids have not distinguished responders from non-responders, the present study was designed to evaluate the duration of the hemodynamic effects of crystalloids according to the fluid responsiveness status.

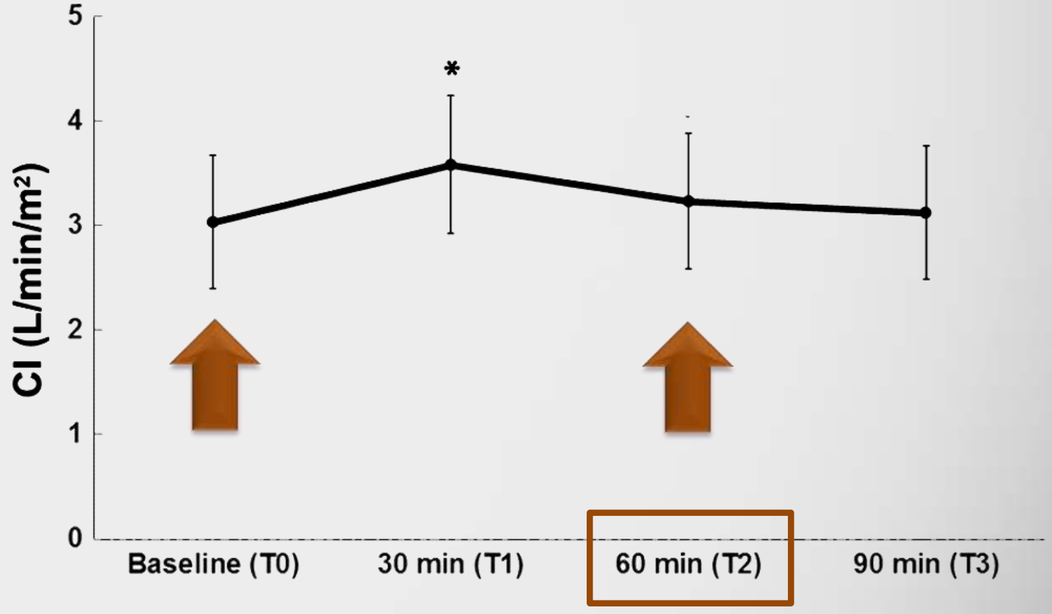
Methods: This is a prospective observational study conducted after the initial resuscitation phase of circulatory shock (>6 h vasopressor use). Critically ill, sedated adult patients monitored with a pulmonary artery catheter who received a fluid challenge with crystalloids (500 mL infused over 30 min) were included. Hemodynamic variables were measured at baseline (T0) and at 30 min (T1), 60 min (T2), and 90 min (T3) after a fluid bolus, totaling 90 min of observation. The patients were analyzed according to their fluid responsiveness status (responders with CI increase >15% and non-responders ≤15% at T1). The data were analyzed by repeated measures of analysis of variance.

Results: Twenty patients were included, 14 of whom had septic shock. Overall, volume expansion significantly increased the CI: 3.03 ± 0.64 L/min/m^2 to 3.58 ± 0.66 L/min/m^2 ($p < 0.05$). From this period, there was a progressive decrease: 3.23 ± 0.65 L/min/m^2 ($p < 0.05$, T2 versus T1) and 3.12 ± 0.64 L/min/m^2 ($p < 0.05$, period T3 versus T1). Similar behavior was observed in responders (13 patients), 2.84 ± 0.61 L/min/m^2 to 3.57 ± 0.65 L/min/m^2 ($p < 0.05$) with volume expansion, followed by a decrease, 3.19 ± 0.69 L/min/m^2 ($p < 0.05$, T2 versus T1) and 3.06 ± 0.70 L/min/m^2 ($p < 0.05$, T3 versus T1). Blood pressure and cardiac filling pressures also decreased significantly after T1 with similar findings in both responders and non-responders.

Conclusions: The results suggest that volume expansion with crystalloids in patients with circulatory shock after the initial resuscitation has limited success, even in responders.

Keywords: Fluid; Fluid responsiveness; Fluid resuscitation; Crystalloids; Circulatory shock; Hemodynamics

… a pokiaľ nejaké sú (*responderi*)
tak netrvajú dlhšie ako 60 min



Nunes et al. *Annals of Intensive Care* 2014, 4:25 S

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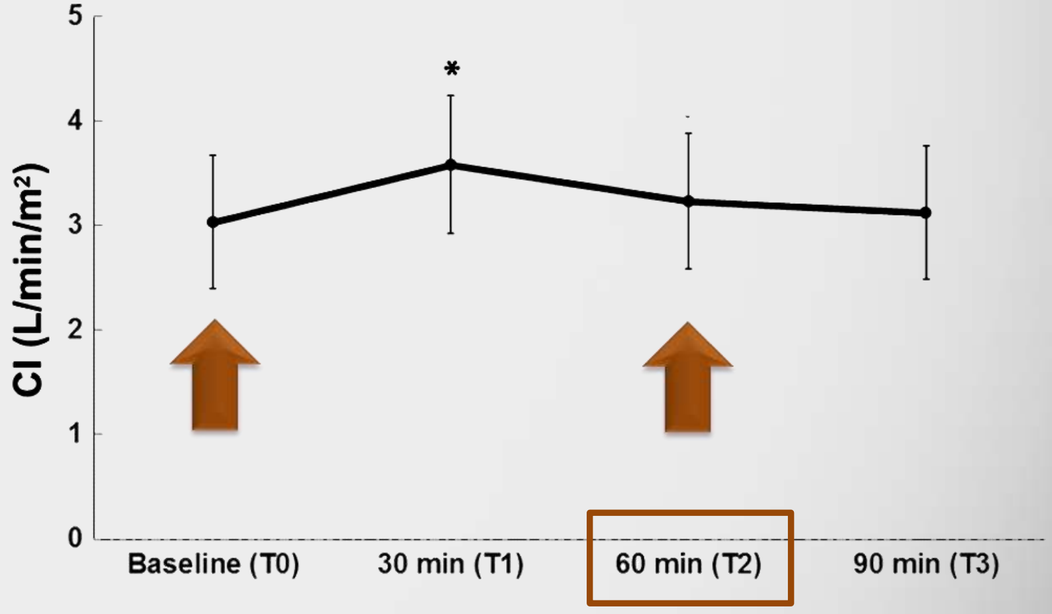
… a pokiaľ nejaké sú (*responderi*)
tak netrvajú dlhšie ako 60 min

A čo ďalších 23 hodín ?



Nunes et al. *Annals of Intensive Care* 2014, 4:25 S

Fluid resuscitation in septic shock: A positive fluid balance and elevated central venous pressure are associated with increased mortality*

John H. Boyd, MD, FRCP(C); Jason Forbes, MD; Taka-aki Nakada, MD, PhD; Keith R. Walley, MD, FRCP(C); James A. Russell, MD, FRCP(C)

Objective: **To determine whether central venous pressure and fluid balance after resuscitation for septic shock are associated with mortality.**

Design: **We conducted a retrospective review of the use of intravenous fluids during the first 4 days of care.**

Setting: **Multicenter randomized controlled trial.**

Patients: **The Vasopressin in Septic Shock Trial (VASST) study enrolled 778 patients who had septic shock and who were receiving a minimum of 5 μg of norepinephrine per minute.**

Interventions: **None.**

Measurements and Main Results: **Based on net fluid balance, we determined whether one's fluid balance quartile was correlated with 28-day mortality. We also analyzed whether fluid balance was predictive of central venous pressure and furthermore whether a guideline-recommended central venous pressure of 8–12 mm Hg yielded a mortality advantage. At enrollment, which occurred on average 12 hrs after presentation, the average fluid balance was +4.2 L. By day 4, the cumulative average fluid balance was +11 L. After correcting for age and Acute Physiology and Chronic Health Evaluation II score, a more positive fluid balance at both at 12 hrs and day 4 correlated significantly with increased mortality. Central venous pressure was correlated with fluid balance at 12 hrs, whereas on days 1–4, there was no significant correlation. At 12 hrs, patients with central venous pressure <8 mm Hg had the lowest mortality rate followed by those with central venous pressure 8–12 mm Hg. The highest mortality rate was observed in those with central venous pressure >12 mm Hg. Contrary to the overall effect, patients whose central venous pressure was <8 mm Hg had improved survival with a more positive fluid balance.**

Conclusions: **A more positive fluid balance both early in resuscitation and cumulatively over 4 days is associated with an increased risk of mortality in septic shock. Central venous pressure may be used to gauge fluid balance ≤12 hrs into septic shock but becomes an unreliable marker of fluid balance thereafter. Optimal survival in the VASST study occurred with a positive fluid balance of approximately 3 L at 12 hrs. (Crit Care Med 2011; 39:259–265)**

Key Words: sepsis; septic shock; fluid resuscitation

Septic shock is an extremely complex disorder whose deranged physiology results from the interplay among the initial infection, the host response, and subsequent medical interventions. Despite exciting new discoveries characterizing molecular events during septic shock (1–3), some basic treatments remain understudied. Intravenous fluids, along with antibiotics, source control, vasopressors, inotropic agents, and mechanical ventilation, are a key component in the early management of septic shock (4). Surprisingly, despite current mortality rates of approximately 40% (5–8), dosing intravenous fluid during resuscitation of septic shock remains largely empirical. Too little fluid may result in tissue hypoperfusion and worsen organ dysfunction (4); however, overprescription of fluid appears to carry its own risks. In a recent European survey of critically ill patients with sepsis, a positive fluid balance was achieving a central venous pressure of 8–12 mm Hg and raise this target to 12–15 mm Hg in the presence of impaired ventricular filling/mechanical ventilation (4) However, there are no recommendations as to when it is appropriate discontinue or reduce the rate of administration of intravenous fluids.

Given the uncertainty surrounding fluid therapy for patients with septic shock, we conducted a retrospective review of 778 patients from the VAsopressin in Septic Shock Trial (VASST). All patients had septic shock and were receiving a minimum of 5 μg norepinephrine per minute. Correcting for age and sever-

*See also p. 396.

From the University of British Columbia Critical Care Research Laboratories, Heart + Lung Institute, St Paul's Hospital, Vancouver, British Columbia, Canada.

Supported by the Canadian Institutes of Health Research.

Dr. Boyd is a Providence Health Care Research Insti-

… pozitívna FB už po 12 hodinách „zabíja“

Boyd et al *Crit Care Med* 2011; 39:259 –265

Potrebuje pacient v sep. šoku FBT ?

Meeting abstract

CI/SVRI relationship during different phases of inflammatory response

R Kula, P Sklienka, I Petrašovicová, L Kolár and **J Jahoda**

Department of Anaesthesia and Intensive Care, Faculty Hospital, Ostrava, Czech Republic

For all author emails, please log on.

Critical Care 2000, **4**(Suppl 1):P13 doi:10.1186/cc733

The electronic version of this article is the complete one and can be found online at:

Published: 21 March 2000

Full text

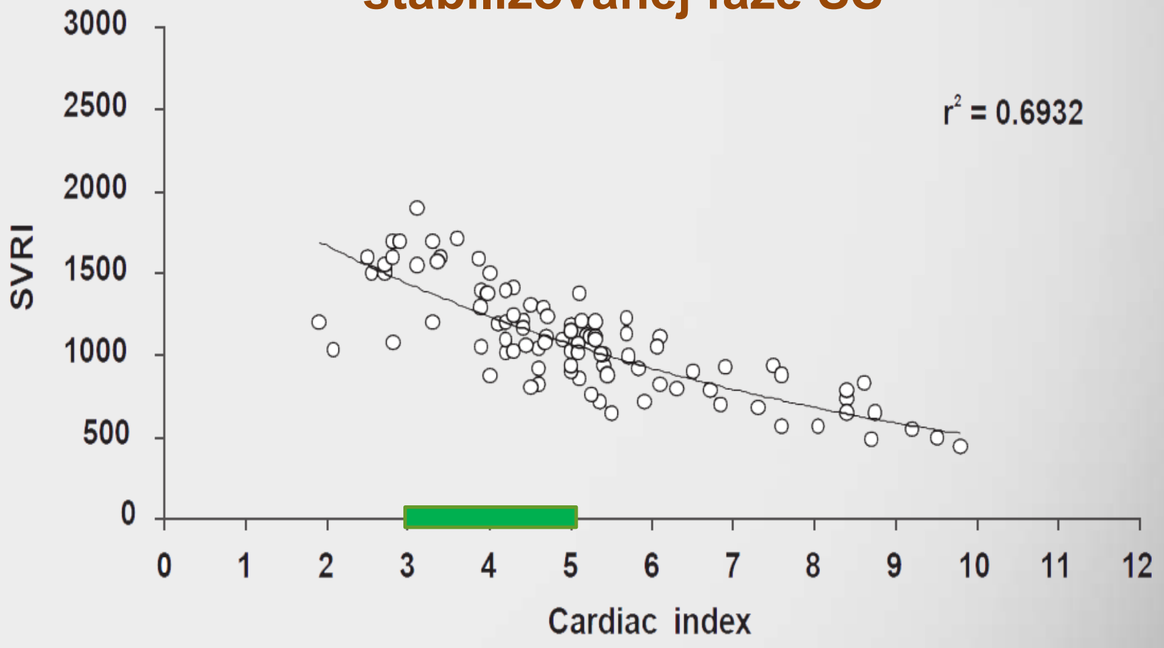
Introduction

High cardiac index (CI) and low systemic vascular resistance (SVRI) are frequently observed in septic patients and are essential in consideration of further therapeutic interventions. As these findings could be observed even in healthy individuals (i.e. during hard exercise) we decided to analyse the relationship between CI and SVRI in patients without apparent clinical signs of the inflammatory response and in patients with the different phase of the inflammatory response.

Methods

Thirty-one critically ill patients with pulmonary artery catheter inserted were included in this prospective study (average age 48±16 years, average sum of SOFA score 2.4±1.36, etiology: 60% traumatic patients), all of them with apparent clinical signs of the inflammatory response (heart rate >90 bpm, WBC >12000 or <4000, BT >38ºC or <36ºC, CRP >50 mg/l) with microbiologically confirmed infectious etiology. In accordance with our findings (published in *Int Care Med* 1997, **23(Suppl.1.)**:S72) we identified 16 periods of generalization of the inflammatory response (fall in platelet count, antithrombine-III activity and serum albumin, positive fluid balance, hemodynamic instability). Within these periods, 101 hemodynamic measurements were

CI/SVRI vzťah v hemodynamicky **stabilizovanej fáze SS**



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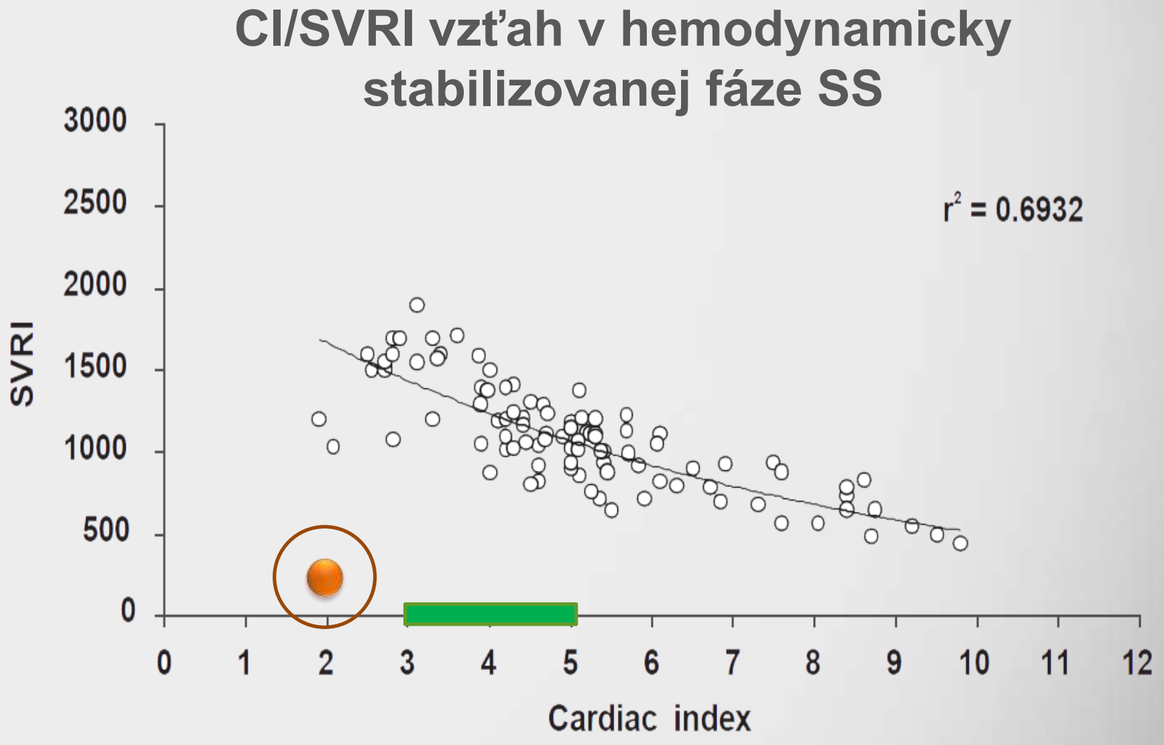
Case1. ↓MAP, ↑HR, **↓CI, ↓SVRI**



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Case1. ↓MAP, ↑HR, ↓CI, ↓SVRI

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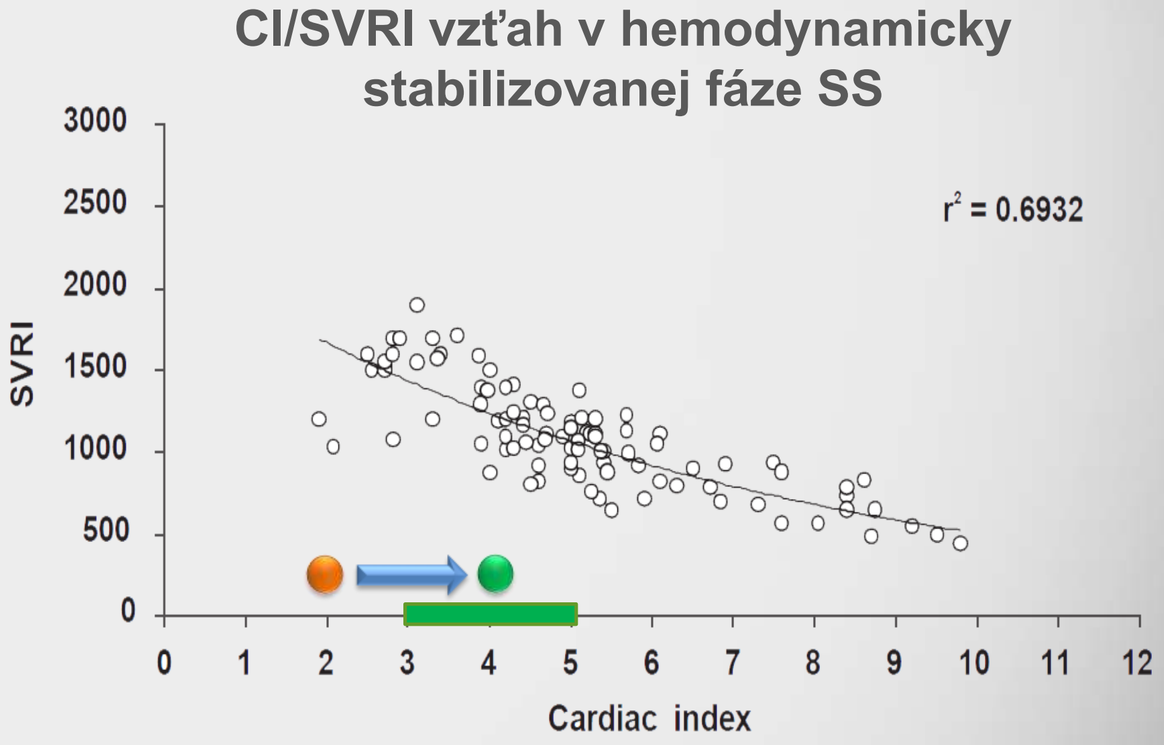

Kula et al. *Critical Care* 2000, **4**(Suppl 1):P13

Meeting abstract

CI/SVRI relationship during different phases of inflammatory response

R Kula, P Sklienka, I Petrašovicová, L Kolár and **J Jahoda**

Department of Anaesthesia and Intensive Care, Faculty Hospital, Ostrava, Czech Republic

For all author emails, please log on.

Critical Care 2000, **4**(Suppl 1):P13 doi:10.1186/cc733

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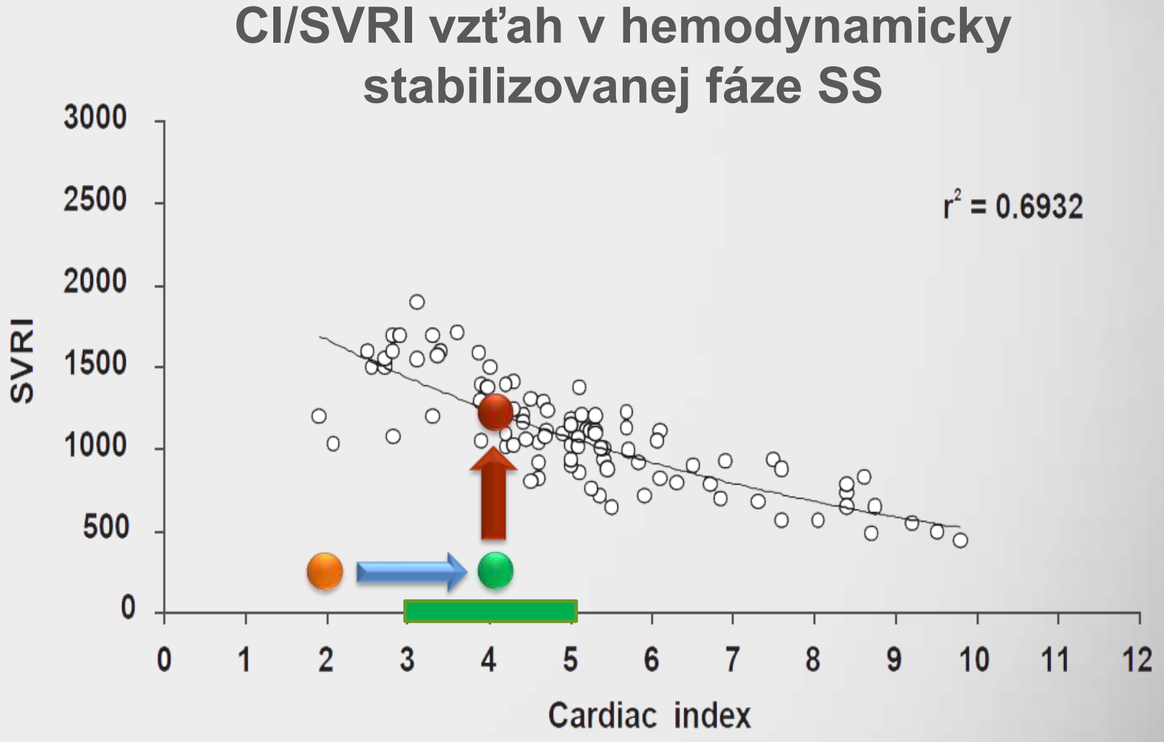

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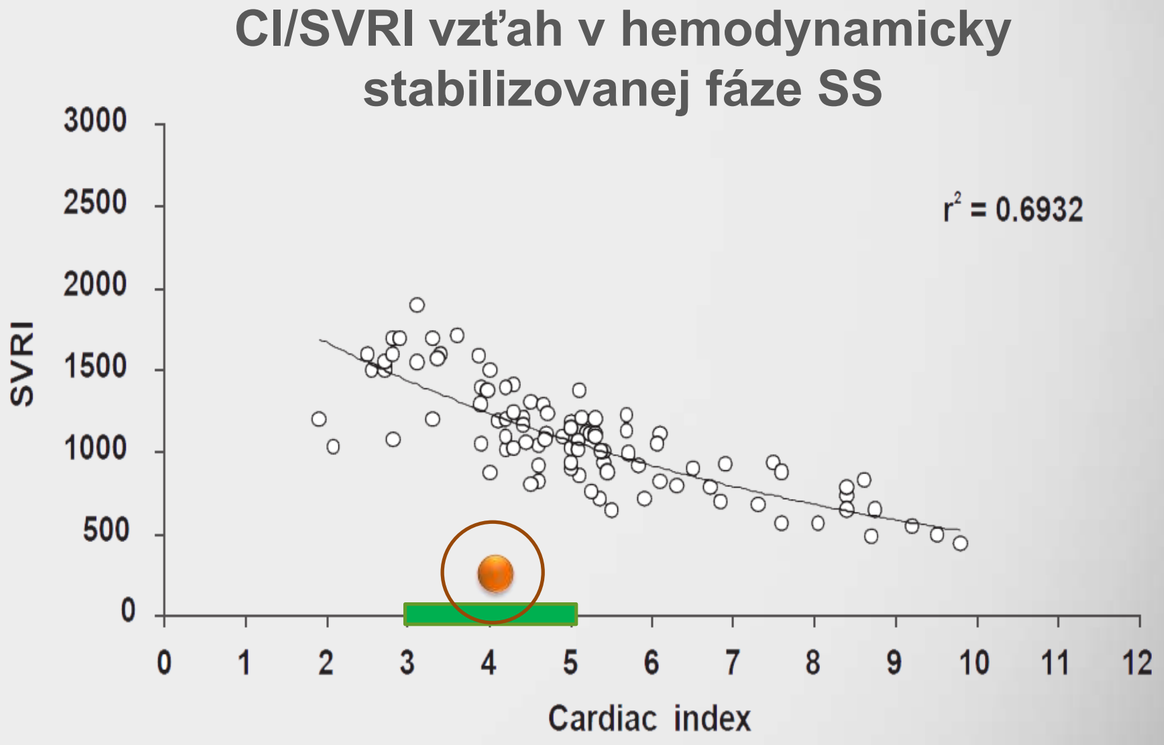
Case2. ↓MAP, ↑HR, len ↓SVRI



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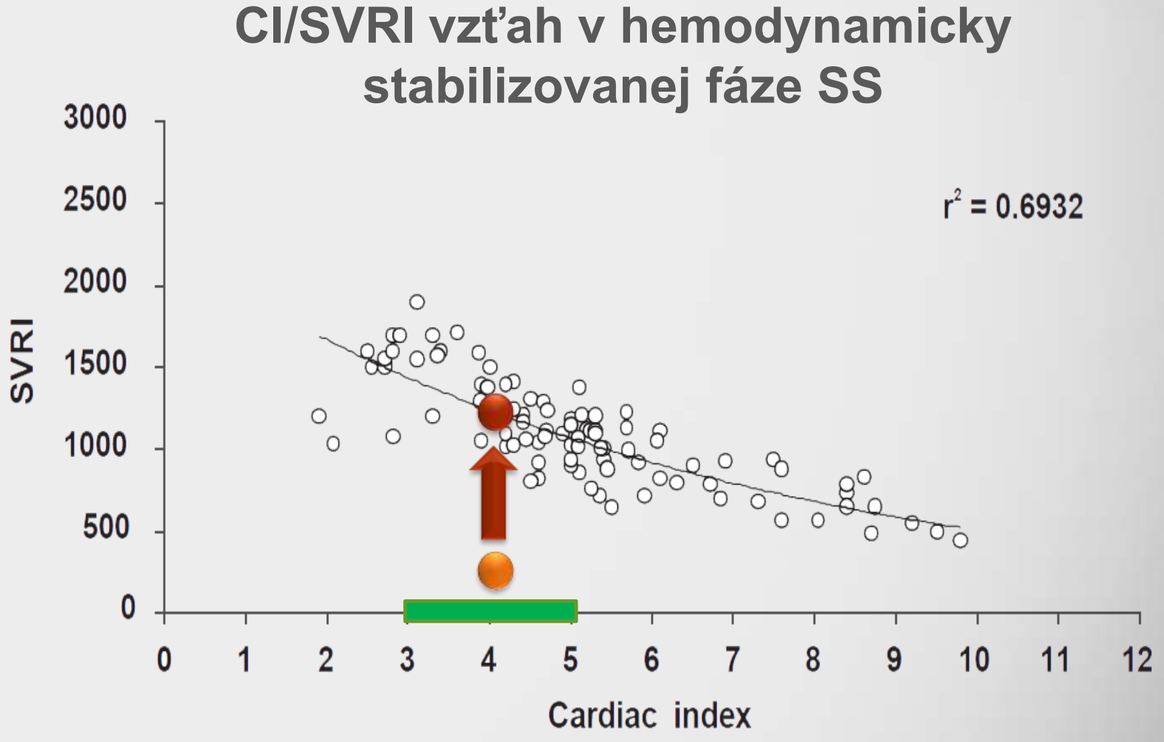

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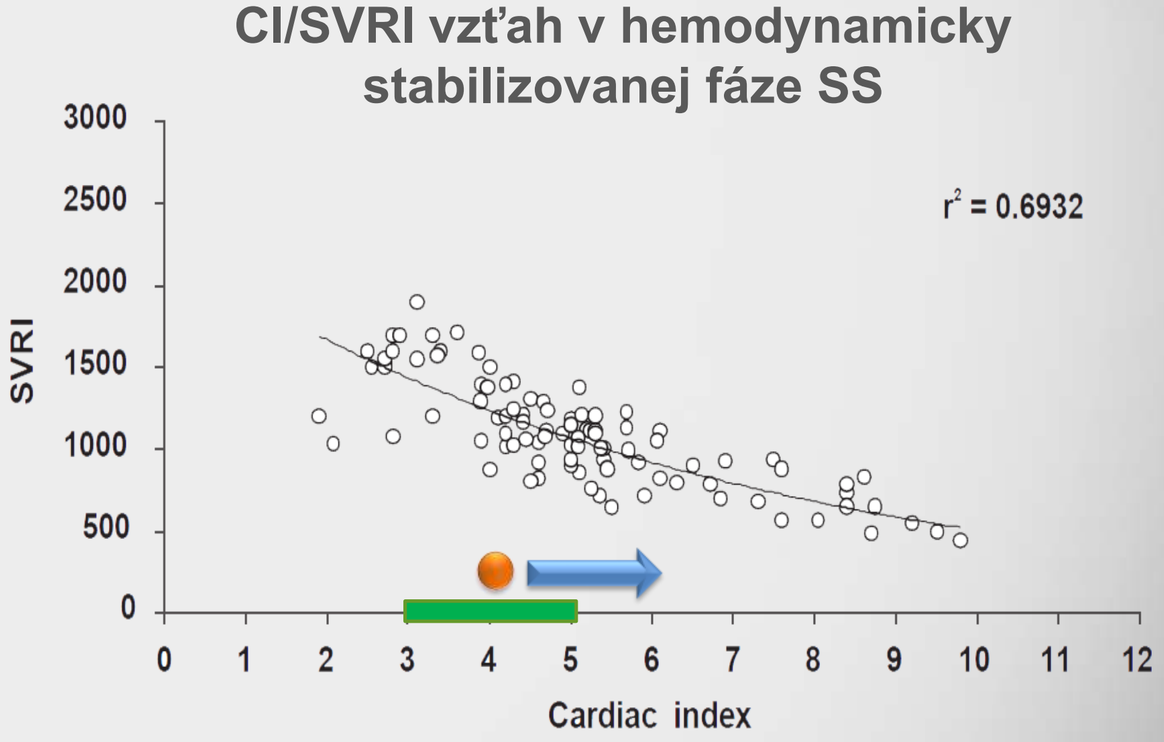
- **len NA !** (SVRI=normal)
- FBT= supranormal DO_2



Kula et al. *Critical Care* 2000, 4(Suppl 1):P13

The New England
Journal of Medicine

ELEVATION OF SYSTEMIC OXYGEN DELIVERY IN THE TREATMENT OF CRITICALLY ILL PATIENTS

MICHELLE A. HAYES, F.R.C.A., ANDREW C. TIMMINS, F.R.C.A., ERNEST H.S. YAU, F.R.C.A., MARK PALAZZO, F.R.C.A., CHARLES J. HINDS, F.R.C.A., AND DAVID WATSON, F.R.C.A.

Abstract *Background.* Elevation of systemic oxygen delivery and consumption has been associated with an improved outcome in critically ill patients. We conducted a randomized trial to determine whether boosting oxygen delivery by infusing the inotropic agent dobutamine would improve the outcome in a diverse group of such patients.

Methods. On the basis of previously published recommendations, we established the following goals: a cardiac index above 4.5 liters per minute per square meter of body-surface area, oxygen delivery above 600 ml per minute per square meter, and oxygen consumption above 170 ml per minute per square meter. If these goals were not achieved with volume expansion alone, patients were randomly assigned to a treatment or control group. The treatment group received intravenous dobutamine (5 to 200 μg per kilogram of body weight per minute) until all three goals had been achieved. Dobutamine was administered to the control group only if the cardiac index was below 2.8 liters per minute per square meter.

Results. A total of 109 patients were studied. In nine patients the therapeutic goals were achieved with volume expansion alone; all nine patients survived to leave the hospital. Fifty patients were randomly assigned to the treatment group, and 50 to the control group. During treatment, there were no differences between the two groups in mean arterial pressure or oxygen consumption, despite a significantly higher cardiac index and level of oxygen delivery in the treatment group ($P<0.05$). Although the predicted risk of death during hospitalization was 34 percent for both groups, the in-hospital mortality was lower in the control group (34 percent) than in the treatment group (54 percent) ($P = 0.04$; 95 percent confidence interval, 0.9 to 39.1 percent).

Conclusions. The use of dobutamine to boost the cardiac index and systemic oxygen delivery failed to improve the outcome in this heterogeneous group of critically ill patients. Contrary to what might have been expected, our results suggest that in some cases aggressive efforts to increase oxygen consumption may have been detrimental. (N Engl J Med 1994;330:1717-22.)

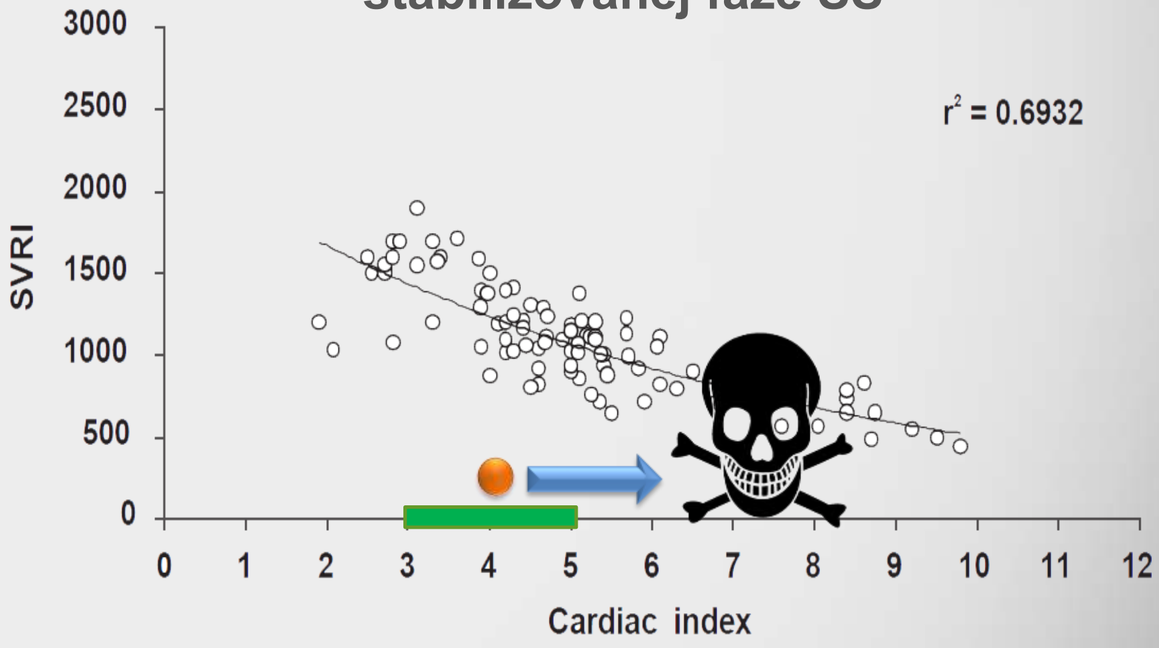
DESPITE improvements in resuscitation and supportive care, one or more vital organs fail in a large proportion of patients with acute, life-threatening illnesses.[1] It has been proposed that organ damage in critical illness is due to inadequate oxygen delivery, often exacerbated by a level of tissue oxygen extraction that fails to satisfy metabolic demands.[2] Consequently, some investigators have recommended that in patients at high risk who are undergoing surgery, the cardiac index and the delivery and consumption of oxygen be increased to levels that have previously been identified as the median maximal values in survivors (cardiac index, over 4.5 liters per minute per square meter of body-surface area; oxygen delivery, over 600 ml per minute per square meter; and oxygen consumption, over 170 ml per minute per square meter) to replenish tissue oxygen and prevent organ dysfunction.[3-5] One septic shock,[7-9] as well as in heterogeneous groups of critically ill patients.[10]

Some researchers, however, remain skeptical.[11] Provided volume replacement is optimal, it remains unclear whether achievement of these target values simply indicates an adequate physiologic reserve and therefore a better outcome. Although the prognosis is very good for patients in whom oxygen delivery and consumption reach the target levels in response to intravenous fluids alone or only moderate inotropic support, in a substantial number of patients it proves impossible to increase oxygen consumption despite aggressive inotropic support.[12] In such patients the outcome is poor,[12] and the use of high doses of inotropic agents may be associated with an increased incidence of complications, such as tachyarrhythmias, myocardial ischemia, and maldistribution of tissue blood flow. Furthermore, inotropic support is fre-

Case2. ↓MAP, ↑HR, len ↓SVRI

- **len NA !** (SVRI=normal)
- FBT= supranormal DO_2
  = vyššia mortalita

CI/SVRI vzťah v hemodynamicky stabilizovanej fáze SS



Hayes et al. *N Engl J Med* 1994, 330:1717-22

Nie všetci pacienti v SS potrebujú FBT.

Všetci však potrebujú noradrenalin.

Noradrenalín, tekutiny a história ...

Noradrenalín, tekutiny a história ...

90. roky LC (doporučenia pre liečbu SS)

„Aggressive volume resuscitation is considered the best initial therapy for the cardiovascular instability of sepsis. Hypotension can often be reversed with fluid administration alone. Fluid requirements for the initial resuscitation of patients with septic shock are frequently large, with up to 10 L of crystalloid or 4 L of colloid being required in the first 24 h.“

Marik et al. *CHEST* 1998; 114:854-860

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90. roky LC

- agresívne tekutiny (10 L)
- **nedajbože vazopresor** !!
- **mortalita > 50%**

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Rivers´s EGTD 2001

- tekutiny: 3500 ml (↓)
- **vazopresor: 27%** (↑)
- **mortalita = 30%**

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ProCESS 2014

- tekutiny: 2200ml (↓↓)
- **vazopresor: 44% (↑↑)**
- **mortalita = 19%**

Marik et al. *CHEST* 1998; 114:854-860
Rivers et al. *N Engl J Med* 2001; 345: 1368-77
Angus et al. *N Engl J Med* 2014; 370: 1383-93

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Vazopresory/6 hod ...

	Použitie u % pacientů	Mortalita
Rivers	27%	30%
ProMISE	44%	24%
ProCESS	47%	19%
ARISE	58%	16%

Marik et al. *CHEST* 1998; 114:854-860
Rivers et al. *N Engl J Med* 2001; 345: 1368-77
Angus et al. *N Engl J Med* 2014; 370: 1383-93

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Angus et al. *N Engl J Med* 2014; 370: 1383-93

Noradrenalín je **kamarát** ...

- **objem šetriaci efekt**
  … a nielen u septického šoku (VITRIS trial)
- **rekruitment sekvestrovaného objemu**
  … ↑ venózneho návratu, ↑ CO
- **pozitivne inotropný efekt**
  … ↑ CO
- **neinterferuje s PLE testom**
  … spoľahlivé titrovanie dávky
- **anti-inflamatórny efekt**

Greenway et al. *Am J Physiol* 1985; 248:H468-76
Hamzaoui et al *Crit Care* 2010; 14:R142
Monnet et al. *Crit Care Med* 2011; 39:689-94
Persichini et al. *Crit Care Med* 2012;40:3146-53
Beloncle et al. *Annals of Intensive Care* 2013, 3:13

Noradrenalín je kamarát ...

- ak je podaný ZAVČAS !!

Noradrenalín je **kamarát** ...

- **ak je podaný ZAVČAS !!**

Morimatsu et al *Resuscitation* 2004;62:249-54
Bai et al. *Critical Care* 2014, 18:532

Brusel 2014

34th ISICEM

Copper Hall

Optimal blood pressure

13:45 **Vasopressors or fluid: Which should come first ?**

Daniel De Backer
(Brussels, Belgium)

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Bai et al. *Critical Care* 2014, 18:532

RATIONALE

Vazodilatácia sa nedá vyriešiť podaním tekutín

Brusel 2014

34th ISICEM

Copper Hall

Optimal blood pressure

13:45 **Vasopressors or fluid: Which should come first ?**

Daniel De Backer
(Brussels, Belgium)

vazodilatácia…

daj **adrenalin** …

ANAFYLAKTICKÝ ŠOK

vazodilatácia…

daj **adrenalin** …

SEPTICKÝ ŠOK

… **vazodilatácia**

… daj **tekutiny**

ANAFYLAKTICKÝ ŠOK

Prebiehajúce štúdie ...

ClinicalTrials.gov

A service of the U.S. National Institutes of Health

Find Studies | About Clinical Studies | Submit Studies | Resources | About This Site

Home > Find Studies > Study Record Detail

Conservative vs. Liberal Approach to Fluid Therapy of Septic Shock in Intensive Care (CLASSIC)

ClinicalTrials.gov

A service of the U.S. National Institutes of Health

Find Studies | About Clinical Studies | Submit Studies | Resources | About This Site

Home > Find Studies > Study Record Detail

Early Use of Norepinephrine in Septic Shock Resuscitation (CENSER)

Môžu tekutinové bolusy škodiť ?

Experimentálne štúdie tvrdia, že ÁNO ...

Experimentálne štúdie tvrdia, že **ÁNO** ...

Research

Open Access

Effect of fluid resuscitation on mortality and organ function in experimental sepsis models

Sebastian Brandt[1], Tomas Regueira[2*], Hendrik Bracht[2*], Francesca Porta[2], Siamak Djafarzadeh[2], Jukka Takala[2], José Gorrasi[2], Erika Borotto[2], Vladimir Krejci[1], Luzius B Hiltebrand[1], Lukas E Bruegger[3], Guido Beldi[3], Ludwig Wilkens[5], Philipp M Lepper[2], Ulf Kessler[4] and Stephan M Jakob[2]

Critical Care **2009**, 13:R186

DETRIMENTAL EFFECTS OF RAPID FLUID RESUSCITATION ON HEPATOCELLULAR FUNCTION AND SURVIVAL AFTER HEMORRHAGIC SHOCK

Kaushal J. Shah, William C. Chiu, Thomas M. Scalea, and Drew E. Carlson

Department of Surgery and Program in Trauma, R Adams Cowley Shock Trauma Center, University of Maryland School of Medicine, Baltimore, Maryland 21201

SHOCK **2002**, 18: 242-247

Tekutinová liečba (stratégia) **je dôležitá**

- … význam má **rýchlosť korekcie** objemového deficitu

  - experiment (potkany)

Shah KJ et al., *Shock* 2002., 18:242-247

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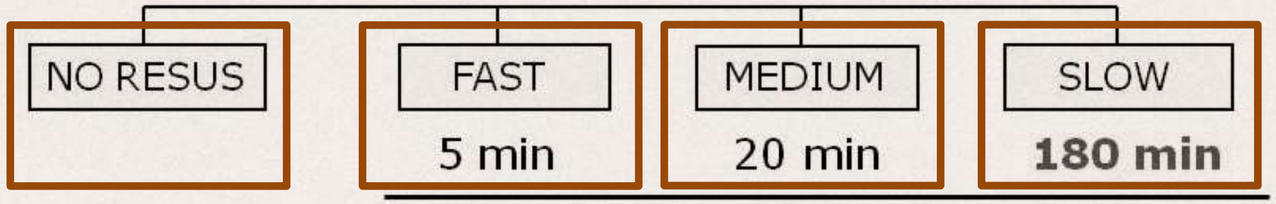
  - fáza hypovolémie: **150 min**
  - fáza objemovej resuscitácie:



Ringer laktát o objeme = 3x krvná strata

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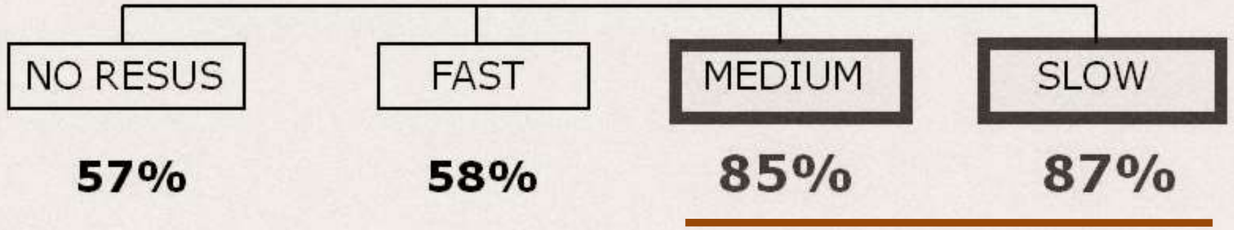
  - **PREŽÍVANIE** (po 72 hodinách., $p<0.05$)



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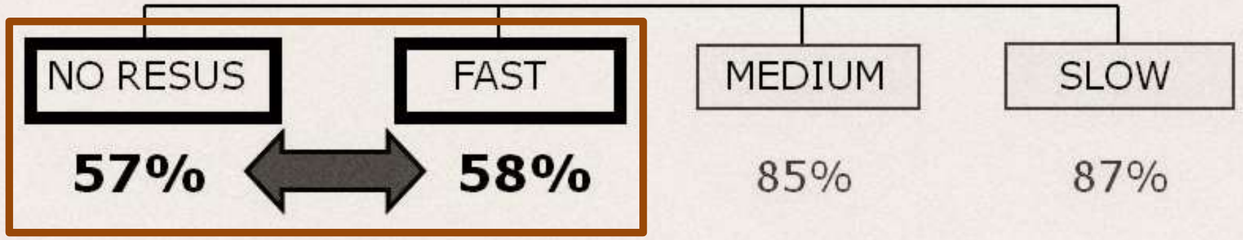

Shah KJ et al., *Shock* 2002., 18:242-247

Ja si tiež myslím, že, **bolusy škodia** ...

… hlavne v situácii, keď **od začiatku sepsy po začiatok liečby uplynul dlhší časový interval**

… pacient prežíva vďaka svojim kompenzačným mechanizmom, ktoré bolusom tekutín zrušíme

… po ischémii príde „fatálna hyperémia“

Najrobustnější dôkaz o škodlivosti FBT

FEAST trial

Fluid Expansion As Supportive Therapy

Maitland K et al.
N Engl J Med 2011;364:2483-95

Prof. K. Maitland

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 JUNE 30, 2011 VOL. 364 NO. 26

Mortality after Fluid Bolus in African Children with Severe Infectio

Kathryn Maitland, M.B., B.S., Ph.D., Sarah Kiguli, M.B., Ch.B., M.Med., Robert O. Opoka, M.B., Ch.B., M.Med
Charles Engoru, M.B., Ch.B., M.Med., Peter Olupot-Olupot, M.B., Ch.B., Samuel O. Akech, M.B., Ch.B.,
Richard Nyeko, M.B., Ch.B., M.Med., George Mtove, M.D., Hugh Reyburn, M.B., B.S., Trudie Lang, Ph.D.,
Bernadette Brent, M.B., B.S., Jennifer A. Evans, M.B., B.S., James K. Tibenderana, M.B., Ch.B., Ph.D.,
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ABSTRACT

BACKGROUND
The role of fluid resuscitation in the treatment of children with shock and life-threatening infections who live in resource-limited settings is not established.

METHODS
We randomly assigned children with severe febrile illness and impaired perfusion to receive boluses of 20 to 40 ml of 5% albumin solution (albumin-bolus group) or 0.9% saline solution (saline-bolus group) per kilogram of body weight or no bolus (control group) at the time of admission to a hospital in Uganda, Kenya, or Tanzania (stratum A); children with severe hypotension were randomly assigned to one of the bolus groups only (stratum B). All children received appropriate antimicrobial treatment, intravenous maintenance fluids, and supportive care, according to guidelines. Children with malnutrition or gastroenteritis were excluded. The primary end point was 48-hour mortality; secondary end points included pulmonary edema, increased intracranial pressure, and mortality or neurologic sequelae at 4 weeks.

RESULTS
The data and safety monitoring committee recommended halting recruitment after 3141 of the projected 3600 children in stratum A were enrolled. Malaria status (57% overall) and clinical severity were similar across groups. The 48-hour mortality was 10.6% (111 of 1050 children), 10.5% (110 of 1047 children), and 7.3% (76 of 1044 children) in the albumin-bolus, saline-bolus, and control groups, respectively (relative risk for saline bolus vs. control, 1.44; 95% confidence interval [CI], 1.09 to 1.90; P=0.01; relative risk for albumin bolus vs. saline bolus, 1.01; 95% CI, 0.78 to 1.29; P=0.96; and relative risk for any bolus vs. control, 1.45; 95% CI, 1.13 to 1.86; P=0.003). The 4-week mortality was 12.2%, 12.0%, and 8.7% in the three groups, respectively (P=0.004 for the comparison of bolus with control). Neurologic sequelae occurred in 2.2%, 1.9%, and 2.0% of the children in the respective groups (P=0.92), and pulmonary edema or increased intracranial pressure occurred in 2.6%, 2.2%, and 1.7% respectively. In stratum B, 69% of the children (9 of 13) in the albumin-bolus group died (P=0.45). The results

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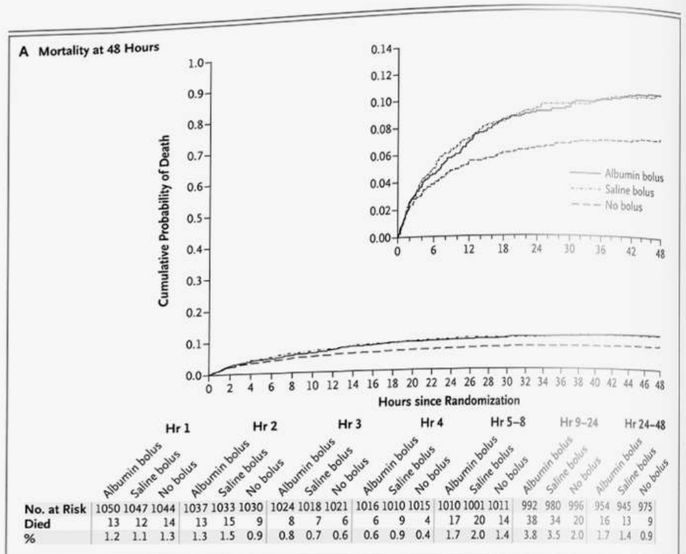
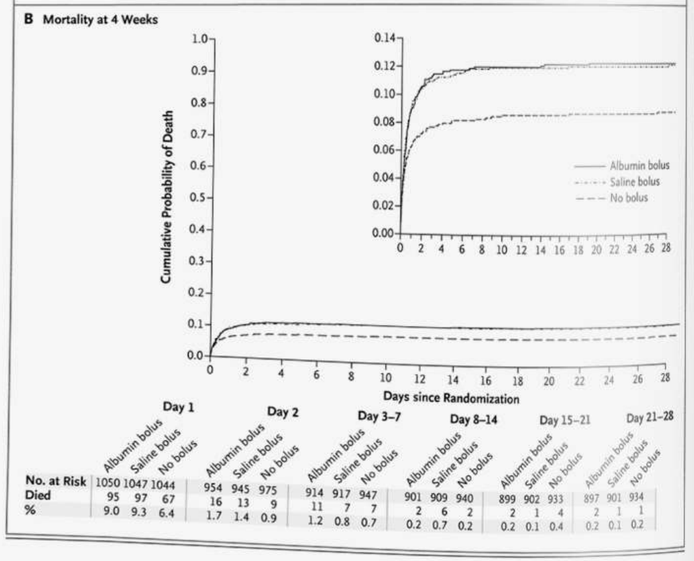


	Hr 1			Hr 2			Hr 3			Hr 4			Hr 5–8			Hr 9–24			Hr 24–48		
	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus
No. at Risk	1050	1047	1044	1037	1033	1030	1024	1018	1021	1016	1010	1015	1010	1001	1011	992	980	996	954	945	975
Died	13	12	14	13	15	9	8	7	6	6	9	4	17	20	14	38	34	20	16	13	9
%	1.2	1.1	1.3	1.3	1.5	0.9	0.8	0.7	0.6	0.6	0.9	0.4	1.7	2.0	1.4	3.8	3.5	2.0	1.7	1.4	0.9



	Day 1			Day 2			Day 3–7			Day 8–14			Day 15–21			Day 21–28		
	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus
No. at Risk	1050	1047	1044	954	945	975	914	917	947	901	909	940	899	902	933	897	901	934
Died	95	97	67	16	13	9	11	7	7	2	6	2	2	1	4	2	1	1
%	9.0	9.3	6.4	1.7	1.4	0.9	1.2	0.8	0.7	0.2	0.7	0.2	0.2	0.1	0.4	0.2	0.1	0.2

0 to 2.5) and 2.9 ml per kilogram (in-
2.2 to 4.2), respectively, in the
of 8 hours, the
was
30.0
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gram
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blood
n-bolus

	tal 3141)
	24
	13–38
	1452 (46)
	2959 (2)
	743 (24)
	189 (6)
	585/3130 (83)
	58±15
	759/3038 (25)
	30 (1)
	2195 (70)
	654 (21)
	2105 (67)
	819 (26)
	1859 (59)
	93
	85–101
	192/3100 (6)
	231 (7)
	1589 (51)
59)	1941/3138 (62)
3)	457 (15)
(36)	1172/3131 (37)
14)	389 (12)
(32)	1002 (32)

45% vzostup úmrtnosti v skupine detí liečených bolusmi FR alebo albuminu ...

Štúdia vyvolala obrovský rozruch …

Štúdia vyvolala obrovský **rozruch** …

Maitland *et al. BMC Medicine* 2013, **11**:68
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Medicine for Global Health

BMC Medicine

RESEARCH Open Access

Exploring mechanisms of excess mortality with early fluid resuscitation: insights from the FEAST trial

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Fatal cardiovascular collapse

Štúdia vyvolala obrovskú kritiku …

- vyčíta sa jej, že bola robená „v Afrike“ …

Stále mám problém uveriť, že liečebný postup ktorý škodí africkým deťom, bude pomáhať inde na zemeguli ...

Štúdia vyvolala obrovskú kritiku …

- **vyčíta sa jej vysoké percento detí s maláriou**
  (v povedomí „štúdia u malárie“)

Štúdia vyvolala obrovskú **kritiku** …

- **vyčíta sa jej vysoké percento detí s malériou**
  (v povedomí „štúdia u malárie“)
  - … 57% zastúpenie detí s malériou
  - … škodlivosť bolusov bola rovnaná aj v skupine detí bez malárie
  - … zápalová odpoveď u malárie je rovnaká, ako u každého iného inf. ochorenia

Štúdia vyvolala obrovskú kritiku …

- **vyčíta sa jej vysoké percento detí s maláriou**
  (v povedomí „štúdia u malárie“)
- **vyčíta sa jej použitie „mäkkých dg. kritérií šoku**

Štúdia vyvolala obrovskú **kritiku** …

including respiratory infections or 'panting' due to their acidosis; and 4% had HIV.

Children with shock caused by diarrhoea, burns or traumatic injuries, where substantial losses of fluids from the body had taken place were not included. Children with acute malnutrition were also excluded and only a few (2%) had a mid upper arm circumference <11.5cm.

What was the effect of Fluid resuscitation on mortality?

The trial results showed that 89.4% of those given boluses survived the first 48 hours in hospital. But those given only maintenance fluids did better: 92.7% of them survived. This is a statistically significant difference. This means that compared to maintenance fluids, boluses cause more than 3 children (3.3%) to die out of every hundred treated. The death rates were no different between children receiving boluses of albumin compared with boluses of saline. For all of the illnesses described above children treated with boluses were more likely to die within

Table 1: Risk of death among participants in the FEAST trial with different definitions of shock

	Mortality (%)			Absolute risk difference
Shock definition	Overall (all arms)	Bolus (saline or albumin)	No bolus (control arm)	(95% confidence interval)
FEAST inclusion criteria	297/3141 (9.5%)	221/2097 (10.6%)	76/1044 (7.3%)	3.3% (1.2-5.3)
ACCM-PALS	194/2030 (10%)	150/1389 (11%)	44/641 (7%)	3.9% (1.4-6.5)
Surviving Sepsis Campaign	230/1419 (16%)	167/950 (18%)	63/469 (13%)	4.1% (0.2-8.1)
WHO	27/65 (42%)	24/50 (48%)	3/15 (20%)	28% (3.4-52.5)

> “The use of boluses increased mortality among children with shock regardless of which definition of shock was used”

increased intra-cranial pressure were not statistically different between the arms

Why did the use of boluses lead to more deaths?

worldwide of how shock works in children and how it should be treated.

Emergency triage and treatment

MRC CTU Briefing Paper, March 2012, Issue 3

Štúdia vyvolala obrovskú kritiku …

- **vyčíta sa jej vysoké percento detí s maláriou**
  (v povedomí „študia u malárie“ …)
- **vyčíta sa jej použitie „mäkkých dg. kritérií šoku**
- **vyčíta sa jej absencia použitia podporných liečebných metód**
  (proste neboli dostupné …)

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- **vyčíta sa jej absencia použitia podporných liečebných metód**
  (proste neboli dostupné …)

  - absencia možnosti podať krvné trasnfúzie
  - absencia možnosti podať noradrenalín
  - absencia možnosti použiť UPV
  - absencia možnosti eliminačných technik
  - absencia možnosti …

Tekutinová resuscitácia septického šoku …

… má i druhú stranu mince

„ Administration of resuscitation fluid requires as much thought and care as the administration of any other potentially lethal drug."

John Myburgh

http://www.medscape.com/viewarticle/780800#

Welcome to Ostrava!!!

COLOURS of Sepsis

18th

Ostrava 2016

before as PG Course on Sepsis and MODS

Ostrava, January 26-29, 2016