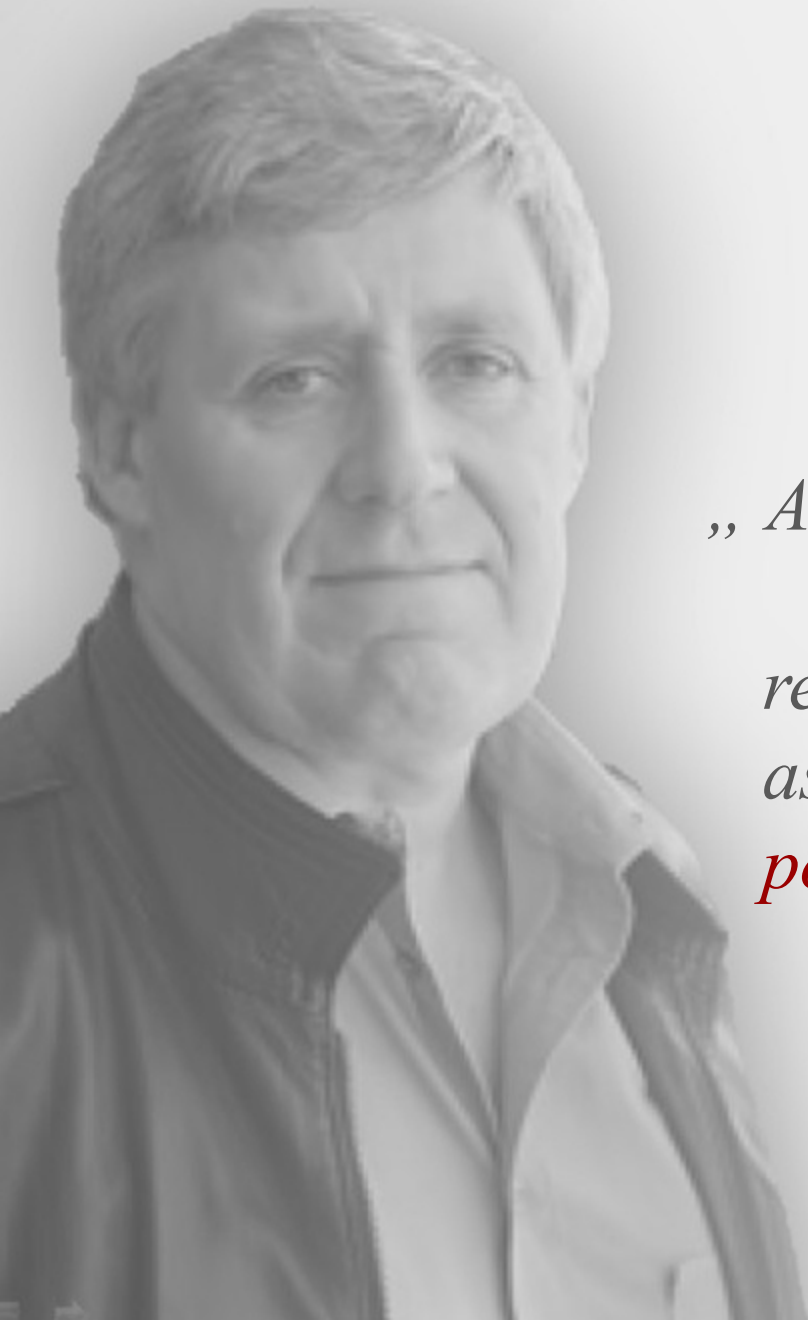
A black and white photograph of a person in a boat, splashing water with their hands raised. The person is wearing a life jacket. The background shows a body of water and distant hills. The text is overlaid on the image.

**BOLUSY TEKUTIN**  
**BUĎME OPATRNÍ**

**R.KULA (KARIM FN OSTRAVA)**



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

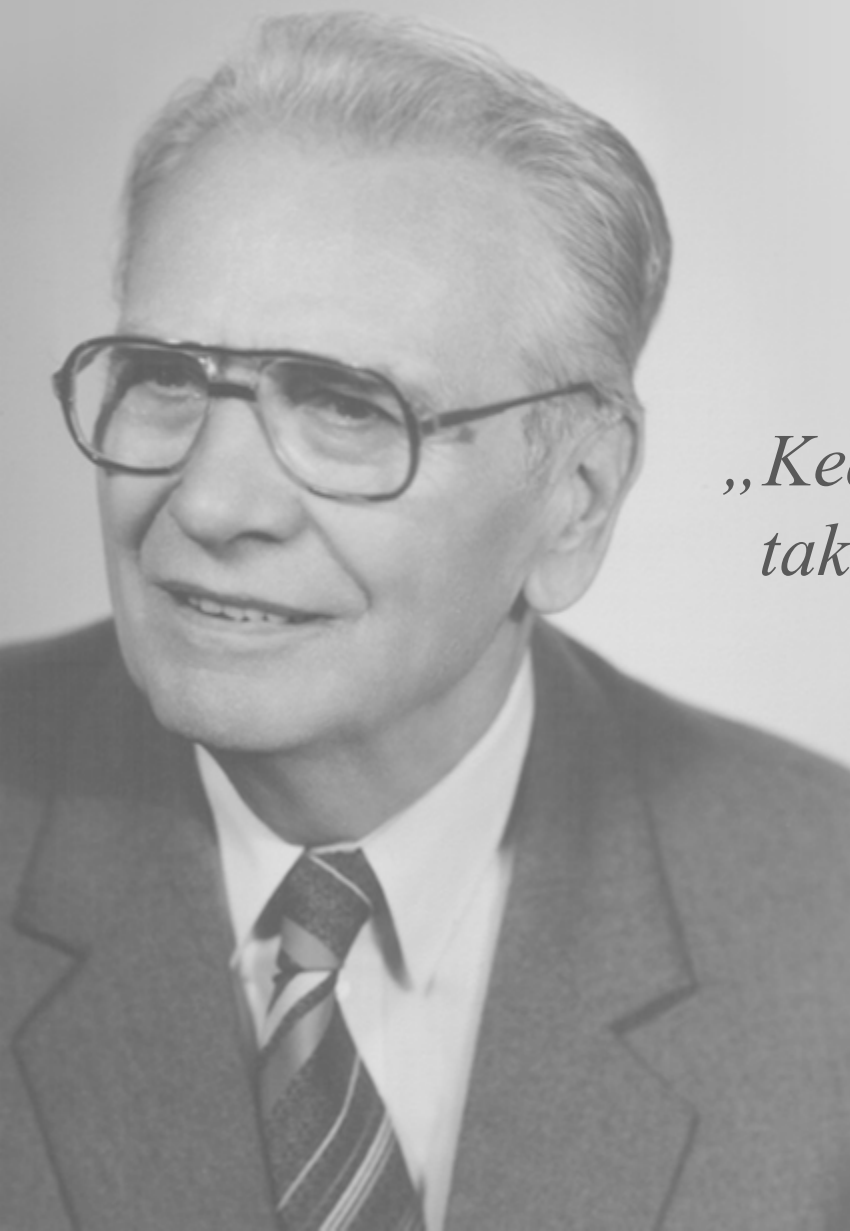
*John Myburgh*

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



*Sepse a tekutinová resuscitace ...*

***... UTÁPÍME SE V DILEMATECH***



*„Ked' bude pacient strácat' dextran,  
tak mu dajte dextran ..."*

*Tomáš Kadlic  
(1913-2000)*

Tekutiny jsou FAJN ...



# Tekutiny jsou FAJN ...



**TREATMENT**                      **HOURS AFTER THE START OF THERAPY**

0–6

Total fluids (ml)

Standard therapy                      3499 ± 2438

EGDT                                      4981 ± 2984

P value                                      <0.001

Rivers E et al. *N Engl J Med* 2001;345:1368-77



... včasná a cílená **tekutinová resuscitace** je spojena s 34% redukcí mortality

# Tekutiny jsou FAJN, ALE ...



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# Jak předejít „fluid overload“ ...



**RIGHT**

**WRONG**



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# Jak předejít „fluid overload“ ...



- **nepodávej bolusy tekutin zbytečně**



**RIGHT**



**WRONG**

# Jak předejít „fluid overload“ ...



- nepodávej bolusy tekutin zbytečně
- pokud se už rozhodneš tekutiny podat, pak vždy nejdříve otestuj jestli je pacient „fluid responder“



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**RIGHT**

**WRONG**



Paul Ellis Marik. **Evidence-Based Critical Care**  
(Third Edition ). Springer International Publishing 2015

*„Furthermore, patients with sepsis are primarily not dehydrated but suffering from vasoplegic shock with an increase in the non-stressed blood volume (venodilatation); **it is therefore totally illogical (and stupid) to give large volumes of fluid to patients with sepsis**“*

*Paul Marik*

# Jak předejít „fluid overload“ ...



- nepodávej bolusy tekutin zbytečně
- pokud se už rozhodneš tekutiny podat, pak vždy nejdříve otestuj jestli je pacient „fluid responder“
- měj na paměti, že septický šok je hlavně šokem vazoplegickým

# Noradrenalin šetří tekutiny ...



**Tekutiny/6 hod**

**Vazopresory/6h**

**Mortalita**

**EGTD**

**ProCESS**

**ProMISe**

**ARISE**



Peake et al. *N Engl J Med* 2014; 371:1496-506

Mouncey et al. *N Engl J Med* 2015; 372:1301-11

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

Rivers et al. *N Engl J Med* 2001; 345: 1368-77

???? ...



	Tekutiny/6 hod	Vazopresory/6h	Mortalita
EGTD		27%	46%
ProCESS		44%	34%
ProMISe	1700 ml	47%	29%
ARISE	1700 ml	58%	19%

Peake et al. *N Engl J Med* 2014; 371:1496-506  
Mouncey et al. *N Engl J Med* 2015; 372:1301-11  
Angus et al. *N Engl J Med* 2014; 370: 1383-93  
Rivers et al. *N Engl J Med* 2001; 345: 1368-77



# Jsou BOLUSY (FBT) tekutin nutné?



■

# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**

SHOCK, Vol. 18, No. 3, pp. 242–247, 2002

## 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*

# Jsou BOLUSY (FBT) tekutin nutné?



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- experiment (potkany)

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

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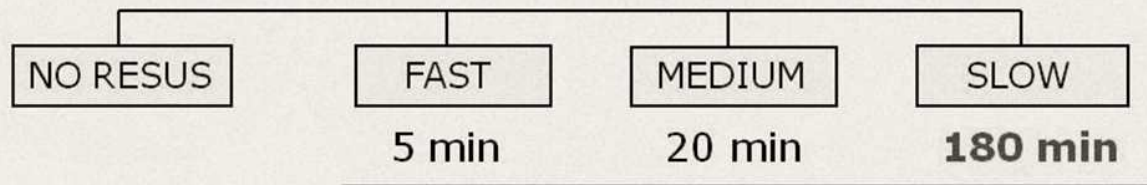
**Shah KJ** et al., *Shock* 2002., 18:242-247

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- fáza krvácania: 33-36 ml/kg/2.5 hod
- fáza hypovolémie: **150 min**
- fáza objemovej resuscitácie:



Ringer laktát o objeme = 3x krvná strata

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



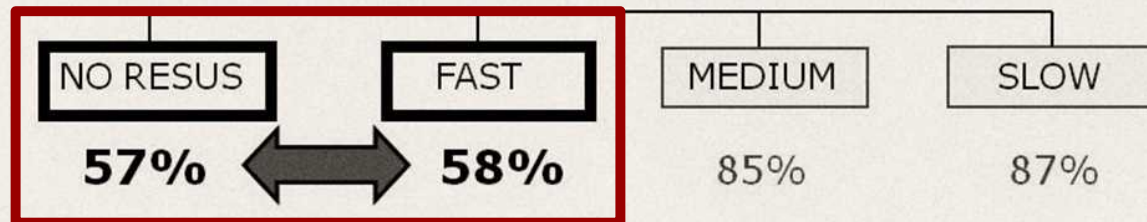
# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**

Příčina úmrtí ve FAST group – **kardiovaskulární kolaps**

- experiment (potkany)
- fáza krvácania: 33-36 ml/kg/2.5 hod
- fáza hypovolémie: 150 min
- **PREŽÍVANIE** (po 72 hodinách.,  $p < 0.05$ )



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

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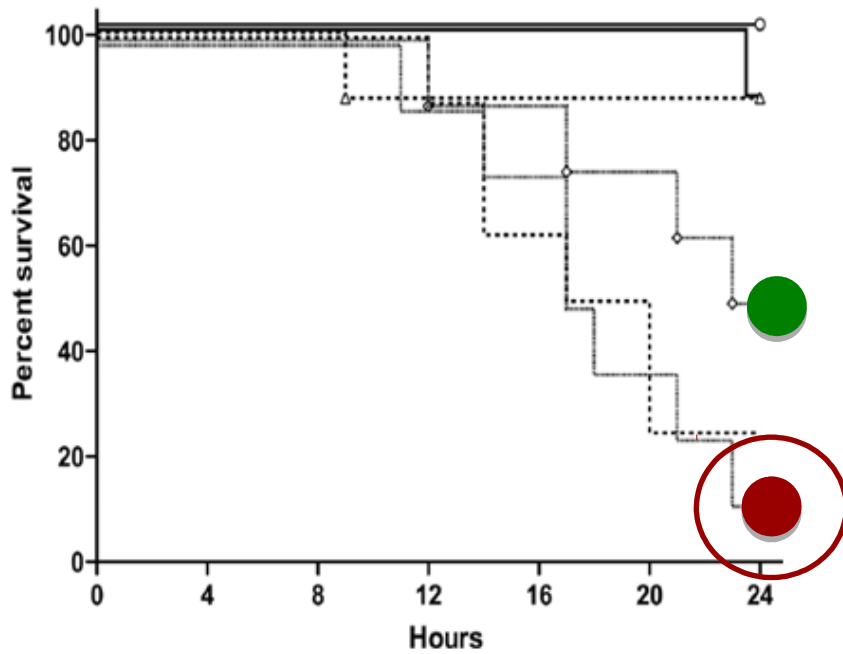
*Department of Surgery and Program in Trauma, R Adams Cowley Shock Trauma Center, University of  
Maryland School of Medicine, Baltimore, Maryland 21201*



# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**



Přežívání zvířat s **exp. peritonitou**

+ **medium-volume RES**

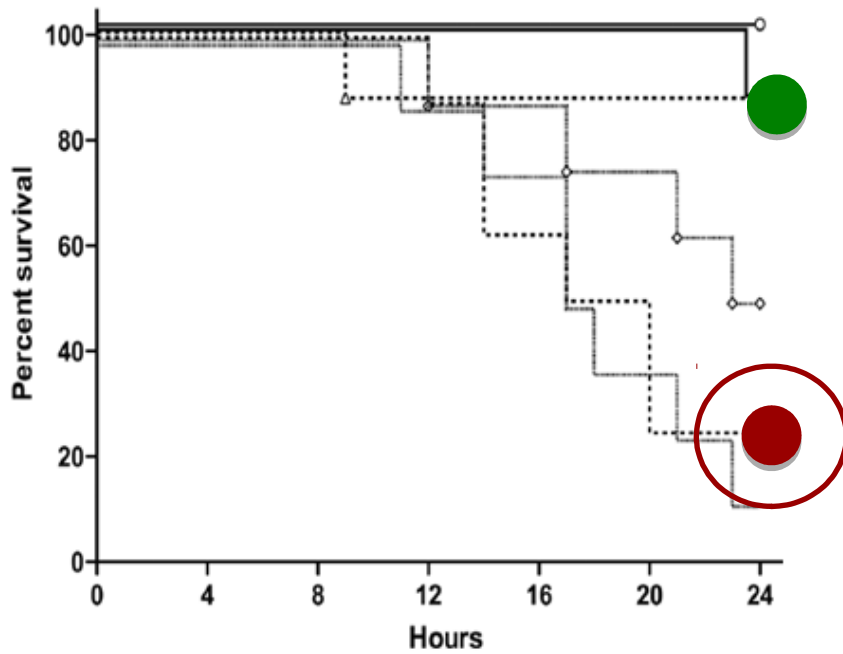
+ **high-volume RES + boluses HES**

Brandt S et al. *Critical Care* 2009,  
13:R186

# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**



Přežívání zvířat **po podání LPS**

**+ medium-volume RES**

**+ high-volume RES + boluses HES**

Brandt S et al. *Critical Care* 2009,  
13:R186

# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**

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

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

Shailesh Bihari,<sup>\*†</sup> Shivesh Prakash,<sup>\*</sup> and Andrew D. Bersten<sup>\*†</sup>

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

FBT se používá často (>90% pts) a je (byla) spojena s ...

# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**

*J Trauma Acute Care Surg* 2013;74: 1207-1214

## Goal-directed resuscitation in the prehospital setting: A propensity-adjusted analysis

Joshua B. Brown, MD, Mitchell J. Cohen, MD, Joseph P. Minei, MD, Ronald V. Maier, MD,  
Michael A. West, MD, Timothy R. Billiar, MD, Andrew B. Peitzman, MD, Ernest E. Moore, MD,  
Joseph Cuschieri, MD, Jason L. Sperry, MD, MPH,  
*and The Inflammation and the Host Response to Injury Investigators, Pittsburgh, Pennsylvania*

Pokud dostali **normotenzní, tachykardičtí a „kyselí“ pacienti** s „blunt trauma“  
v přednemocniční péči bolus tekutin (>500 ml krystaloidu) pak:

# Jsou BOLUSY (FBT) tekutin nutné?



... někdy **můžou být i škodlivé !!!**

*N Engl J Med* 2011;364:2483-95.



## Mortality after Fluid Bolus in African Children with Severe Infection

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., Jane Crawley, M.B., B.S., M.D., Elizabeth C. Russell, M.Sc., Michael Levin, F.Med.Sci., Ph.D., Abdel G. Babiker, Ph.D., and Diana M. Gibb, M.B., Ch.B., M.D., for the FEAST Trial Group\*

Pokud dostali **normotenšní, tachykardičtí a „kyselí“ dětské pacienti** se sepsí bolus tekutin (albumin, FR) pak měli o 30% vyšší mortalitu ve srovnání s dětmi, které dostali pouze udržovací dávku FR (4 ml/kg/hod)

# Mechanizmy KVS selhání po FBT...



... **nejsou** zcela jasné

# Mechanismy KVS selhání po FBT...



**BOLUS TEKUTINY**



**Ztráta sympatikem zprostředkované fyziologické kompenzace  
ve fázi kompenzovaného šoku**

**CAVE**

**Normotenzní, tachykardičtí, „kyselí“ pacienti  
s anamnézou příznaků sepse několik dnů**

**Bolus tekutiny - Vazodilatace - Kolaps**

MŮJ PŘÍBĚH







NAIROBI 2013



The David Sheldrick  
Orphan's project



**Dr. Dame Daphne Sheldrick,**  
*DBE, MDB, MBS, DVMS, Chair of the David  
Sheldrick Wildlife Trust, Nairobi, Kenya*

- trpí infekcí a má horečku
- je těžce dehydratované
- **rychlá rehydratace ho může zabít** - dnes dostane jenom malé množství mléka

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.**

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 at the nursery, but she mourned for her lost mother. Her behavior for an elephant was unusual.



Daphne Sheldrick. Photograph courtesy the David Sheldrick Wildlife Trust.

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

- [To Stem Thriving Online U.S. Ivory Market, Stronger Laws and Enforcement Needed, Says Author of New Report](#) Laurel Neme
- [For Africa’s Elephants, Bearing Witness Bears Fruit](#) Wildlife Conservation Society
- [In South Africa, Where Elephants Are Fenced In, Choosing Contraception Over Culling Gets the Edge](#) er
- [Ivory Is Worthless, Elephants Are Safe](#) er
- [Malawi’s Ivory Is Not For Sale](#) er
- [Congo Ivory Burn](#) er
- [Against War](#) er

„ 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



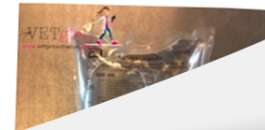
About to see a hit-by-car (aka, an HBC) dog? Wondering how much fluid should you bolus?

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 away from the shock dose when trying to stabilize hypovolemic patients. Instead, they use smaller aliquots of IV crystalloids. So, consider the “shock dose” (approximately 60–90 mL/kg) as a historical reference point.



**„ do not give more then 20ml/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.**

***„ give minimum 30ml/kg or more “***

*First*



*Do No Harm*