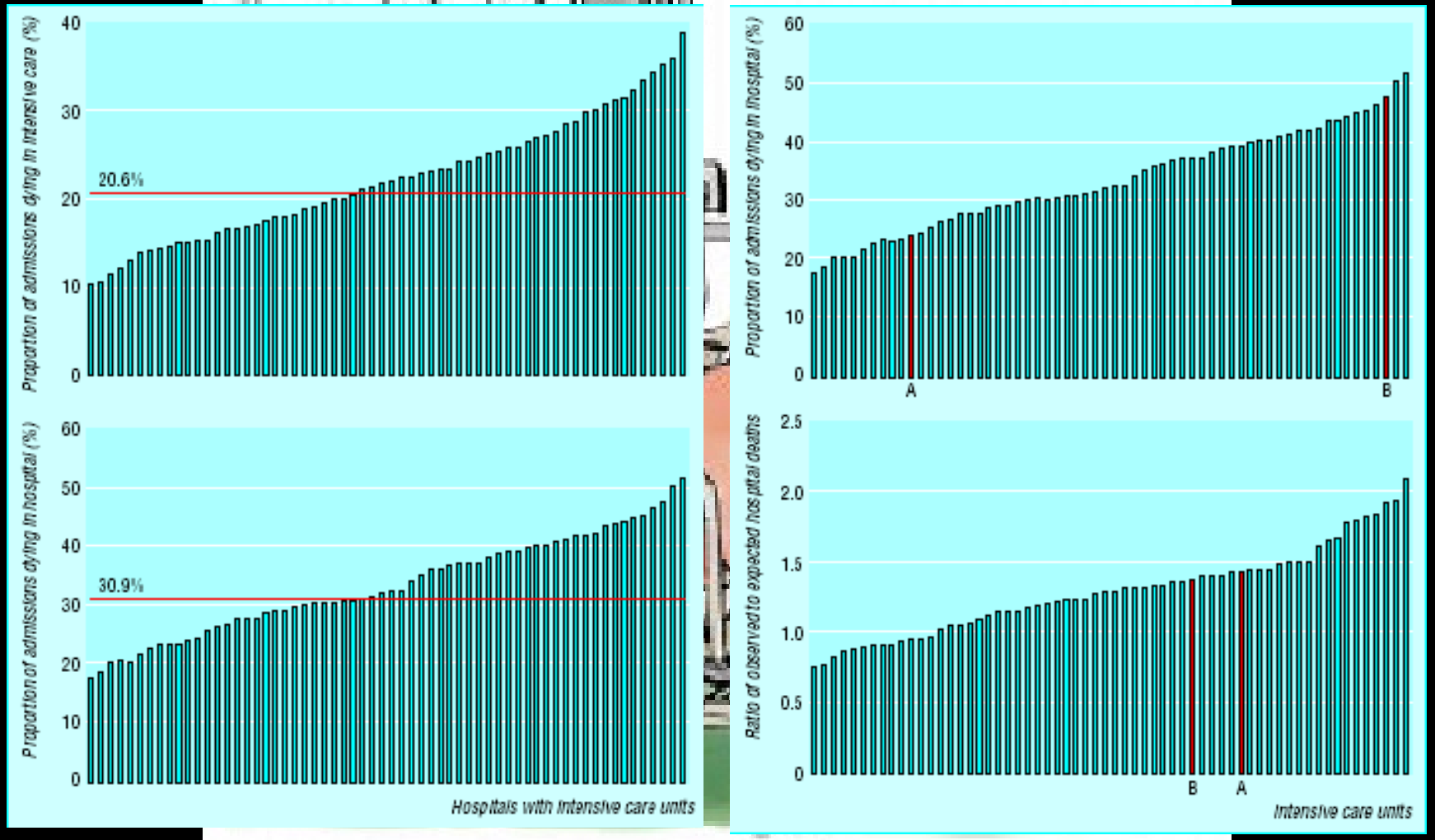
Pediatrická problematika v intenzivní péči

Doc. MUDr. Michal Fedora, PhD.

Klinika dětské anesteziologie a resuscitace LF MU a FN Brno

62 JIP, 22 057 pts, 1995 - 1998



Gunning K, *BMJ* 1999; 319: 241 - 244

PRISM skore

Systolický krevní tlak
Diastolický krevní tlak
Srdeční frekvence
Počet dechů
PaO_2/FiO_2
$PaCO_2$
Glasgow Coma Scale

Reakce zornic
PT / PTT
Celkový bilirubin
Kalium
Kalcium
Glykemie
$NaHCO_3$

Predikce mortality během prvních 24 hod i celého pobytu na JIP

Skutečná mortalita, predikovaná mortalita, SMR

Pollack MM, *Crit Care Med* 1988; 16: 1110 - 1116

PRISM skore

Srovnání jednotlivých JIP

Srovnání regionů

SMR

∅ délka hospitalisace

∅ délka hospitalisace pro jednotlivou dg.

cena za hospitalisaci

cena za 1 den hospitalisace pro jednotlivou dg.

Srovnání jednotlivých JIP

Srovnání mortality a péče u dětí s AHRF a KCT za 6 měsíců

	JIP III. typu	JIP nižšího typu	p
mortalita (%)	23 %	6 %	<.00001
predikovaná mortalita	29.3	14	
skutečná mortalita	30	20	
p	>.4	<.05	

Pollack MM, *Crit Care Med* 1991; 19: 150 - 159

Paediatric Intensive Care Society
British Paediatric Association

rok 1991

12 882 dětí, které byly „...identified as having received intensive care“

- 29 % standardní oddělení
- 20 % JIP pro dospělé = 2627 dětí: 23 % < 1 rok
- 51 % PICU 5 % < 1 měsíc

British Paediatric Association. *The care of critically ill children. Report of a multidisciplinary working party on intensive care.* London: BPA, 1993

Paediatric Intensive Care Society

British Paediatric Association

Paediatric Intensive Care Society. *Standards for paediatric intensive care including standards of practice for the transportation of the critically ill child.* Bishop 's Stortford, Herts: Saldatore, 1996

1995 zemřel Nicolas Geldard (spontánní intracerebrální krvácení)

Ashworth W. *Inquiry into the care and treatment of Nicholas Geldard.* Manchester: North West Regional Health Authority, 1996.

National Coordinating Group on Paediatric Intensive Care. *Paediatric intensive care: a framework for the future.* London: Department of Health, 1997.

29 PICU

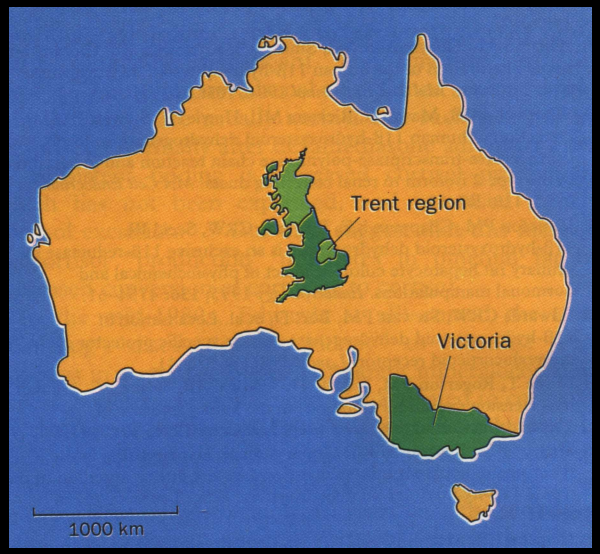
10 PICU < 3 lůžka, 6 PICU > 8 lůžek

1.2 příjmu na PICU / 1000 dětí / rok

Pearson G, Shann F, Barry P et al:

Should paediatric intensive care be centralised? Trent versus Victoria.

Lancet 1997; 349: 1213 - 1217



všechny děti přijaté na

oddělení intensivní péče

věk: 1 měsíc - 16 let

1.4.1994 - 31.3.1995

	Trent (n=1014)	Victoria (n=1194)
Median (IQR)*		
Age (months)	31 (6–86)	30 (10–103)
Base excess (mmol/L)	−2·2 (−4·9 to 0·9)	−2·1 (−5·5 to 0)
Systolic blood pressure (mm Hg)	104 (85–120)	105 (82–120)
$100 \times FiO_2/PaO_2$	0·35 (0·24–0·63)	0·36 (0·23–0·83)
Number of children (% of total)		
Elective admission	409 (40·3%)	316 (26·5%)
Specified diagnosis	40 (3·9%)	48 (4·0%)
Ventilated in first hour	540 (53·3%)	510 (42·7%)
Pupils fixed in response to light	8 (0·8%)	25 (2·1%)

FiO_2=fractional inspired oxygen concentration; PaO_2=arterial oxygen tension in mm Hg.
*Data were available from the following numbers of children: age (Trent, Victoria) n=996, n=1194; base excess n=568, n=624; systolic blood pressure n=731, n=891; $100 \times FiO_2/PaO_2$ n=540, n=594.

Table 1: **Characteristics of children from Trent and Victoria**

	Regression coefficient (SE)	
	PRISM model	PIM model
Constant	−1·845 (0·563)	−4·690 (0·284)
Location (Trent=1, Victoria=0)	0·734 (0·233)	0·738 (0·216)
Probability of death*	1·257 (0·819)	..
Natural log of probability of death*	0·678 (0·150)	..
$100 \times FiO_2/PaO_2$	0·401 (0·146)	0·632 (0·139)
Pupils not reacting†	1·852 (0·555)	2·920 (0·437)
Specified diagnosis†	2·060 (0·323)	2·224 (0·307)
Elective admission†	..	−1·333 (0·280)
Ventilated within 1 h of admission†	..	1·530 (0·276)
Absolute base excess (mmol/L)	..	0·057 (0·020)

*Predicted by PRSM. †yes=1, no=0. PaO_2=arterial oxygen tension in mm Hg.

Table 2: **Logistic regression models**

Pearson G, *Lancet* 1997; 349: 1213 - 1217

	Trent	Victoria
Population		
Total	4 200 000	4 500 000
<16 years	833 000	1 011 000
Deaths aged 1 month to <16 years		
Number	266	257
Per 100 000 <16 years	31·9	25·4
Child ICU admissions*		
Number per year*	1014	1194
Per 1000 <16 years*	1·22	1·18
Ventilated in first hour per 1000 <16 years*	10·65	0·05
Mean length of stay (days)*	3·93	2·14
Child ICU days/1000 <16 years*	4·80	2·53

	Trent			Victoria		
	n	Deaths	Expected deaths*	n	Deaths	Expected deaths*
Total	1014	74	42·3	1194	60	60·0
Diagnostic category						
Respiratory	162	10	7·4	330	8	9·8
Cardiac	318	20	14·4	296	19	15·1
Postoperative	189	4	1·7	91	1	1·9
Accidents	137	13	7·5	197	10	14·2
Neurological	93	9	4·9	96	12	9·1
Other	115	18	6·5	184	10	10·0
Expected mortality						
<1%	381	5	2·4	528	1	4·2
1–4%	374	17	8·4	416	7	9·5
5–14%	226	36	16·9	185	15	14·5
15–29%	11	4	2·4	19	8	4·2
≥30%	22	12	12·2	46	29	27·6

*Calculated with Trent/Victoria location variable set to Victoria.

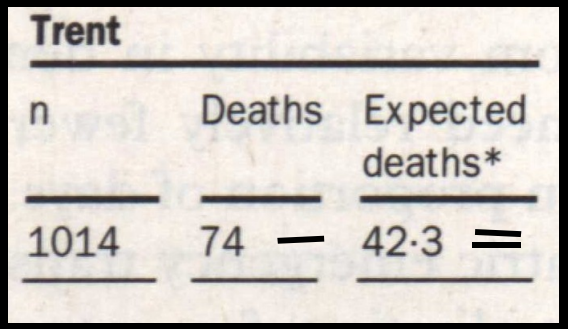
Table 3: **Deaths in Trent and Victoria by diagnostic category and by expected mortality**

Pearson G, *Lancet* 1997; 349: 1213 - 1217

mortalita: Trent 7.3 % Victoria 5.0 %

riziko úmrtí vztažené k závažnosti celkového stavu:

Trent vs Victoria 2.09 (95 % CI, 1.37 - 3.19, p < 0.005)



Trent		
n	Deaths	Expected deaths*
1014	74	42·3

úmrtí „navíc“ v Trentu 31.7 (42.8 %)

Trent: děti < 16 let - 833 000 31.7 úmrtí „navíc“ / rok

UK: děti < 16 let - 11 900 000 453 úmrtí „navíc“ / rok

12 PICU pro UK

↓ mortality: ET intubace > 12 - 24 hod → PICU

Pearson G, *Lancet* 1997; 349: 1213 - 1217

Ratcliffe J:
Provision of intensive care for children
BMJ 1998; 316: 1547 - 1548

pediatrická intensivní péče bude centralisována

kriteria pro PICU

červenec 1998: dítě, které vyžaduje intensivní péči, nesmí být hospitalisováno na standardním oddělení

2000: kriticky nemocné děti musí být hospitalisovány pouze na PICU

Pearson G, Barry P, Timmins C et al: Changes in the profile of paediatric intensive care associated with centralisation *Intensive Care Med* 2001; 27: 1670 - 1673

porovnání 2 období 12 měsíců - 1991 a 1999
v Birminghamu a okolí (Trent)

počet pts na PICU	277 vs 510 1.3 vs 2.3 příjmu na PICU / 1000 dětí / rok	$p < 0.0001$
% pts přijatých na PICU	60 % vs 90 %	$p < 0.0001$
délka hospitalisace	103 vs 74 hod	$p < 0.0001$
mortalita	↓ o 34 úmrtí / 100 000 dětí	$p < 0.0001$

JIRP NsP Most

JIRP DK IPVZ Ústí nad Labem

JIRP DK FN Plzeň

JIRP DK FN Hradec Králové

JIRP DK IPVZ Nemocnice České Budějovice

JIP Kliniky popáleninové medicíny FN KV

JIRP dětské chirurgie FTN Praha

JIRP pediatrické kliniky FTN Praha

JIRP KDDL VFN Praha

ARK FN Motol

JIRP Kliniky dětské chirurgie FN Motol

Dětská JIRP ARK FN Ostrava

JIRP DK FN Olomouc

KDAR FN Brno


Havlíčkův Brod
Pelhřimov
Jihlava
Žďár nad Sázavou
Třebíč


Ústecký
Liberecký
Karlovarský
Královéhradecký
Praha
Středočeský
Plzeňský
Pardubický
Moravsko-Slezský
Vysočina
Olomoucký
Jihočeský
Zlínský
Jihomoravský


Blansko
Brno - město
Vyškov
Brno - Venkov
Znojmo
Břeclav
Hodonín


Vsetín
Kroměříž
Zlín
Uherské Hradiště


Liberec
Ústí nad Labem
Karlovy Vary
Hradec Králové
Praha
Pardubice
Ostrava
Plzeň
Olomouc
Jihlava
Zlín
Brno
České Budějovice

1.1.2001 - 1.9.2003 KDAR FN Brno

888 pts

∅ LOS: 5.8 dne

∅ PRISM: 7.3

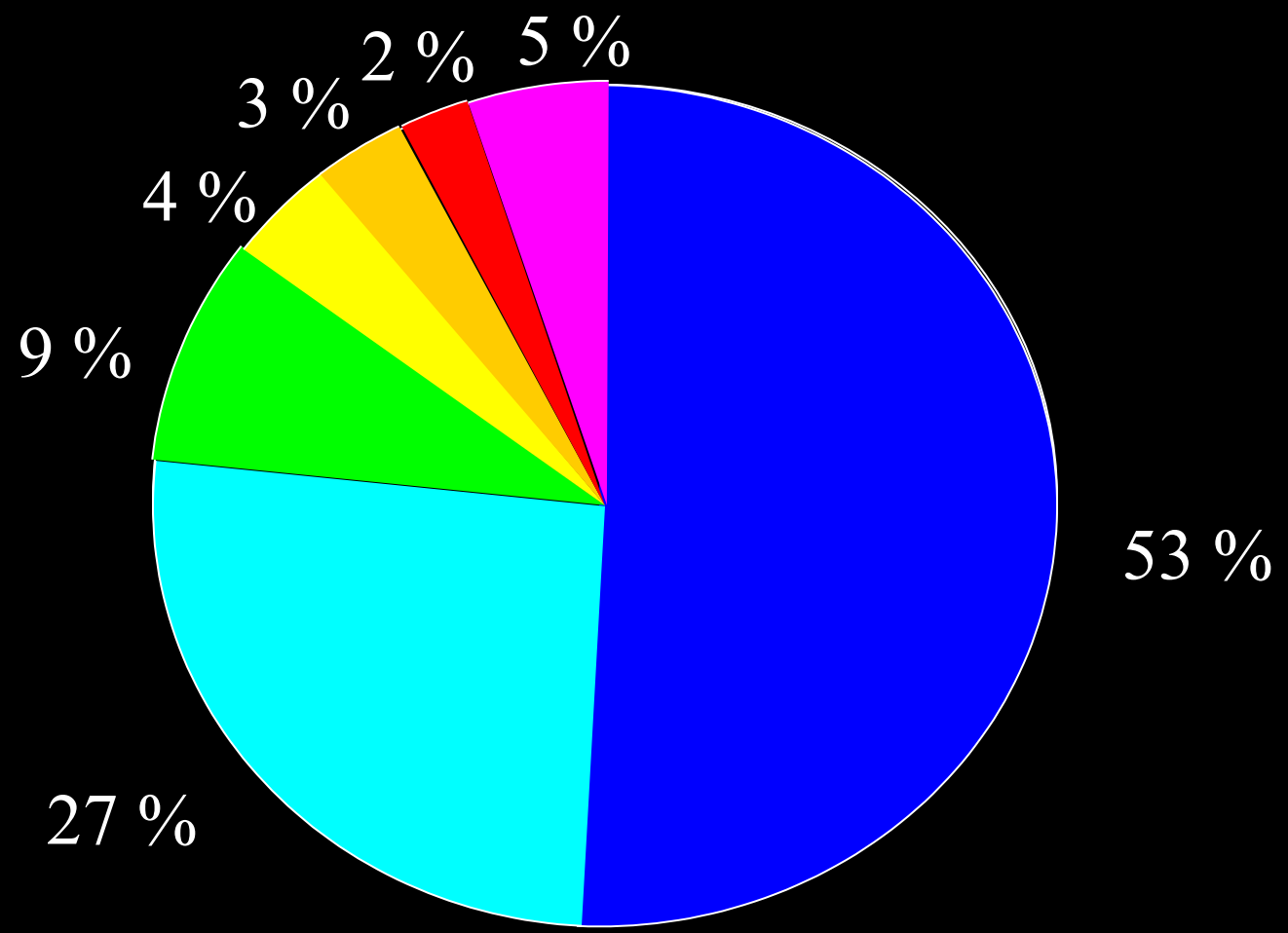
Predikovaná mortalita: 8.6 %

Zemřelo: 66 pts

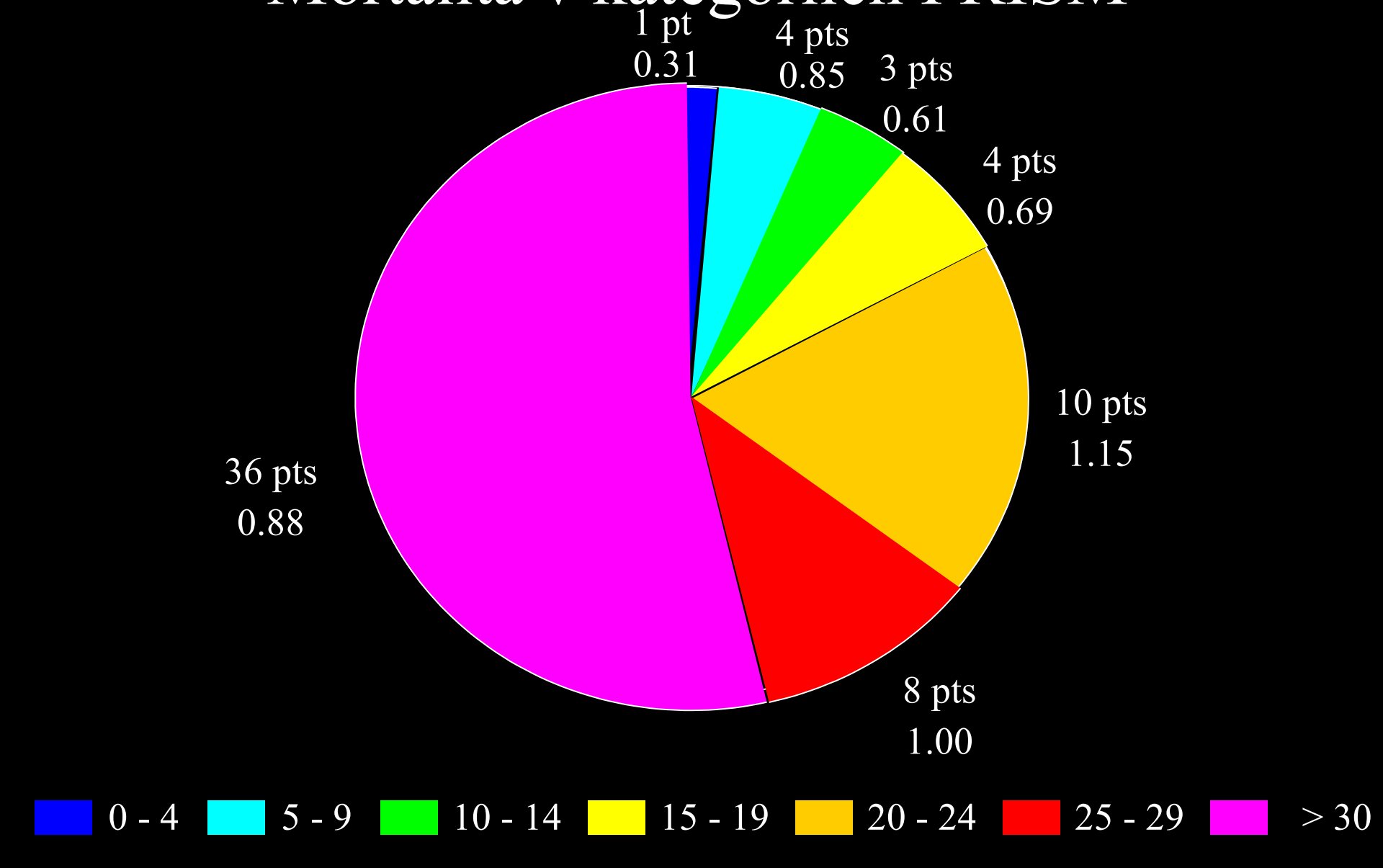
Skutečná mortalita: 7.4 %

SMR: 0.87

% kategorií PRISM



Mortalita v kategoriích PRISM



1.1.2001 - 1.9.2003 všechna pracoviště

8014 pts

∅ LOS: 5.2 dne

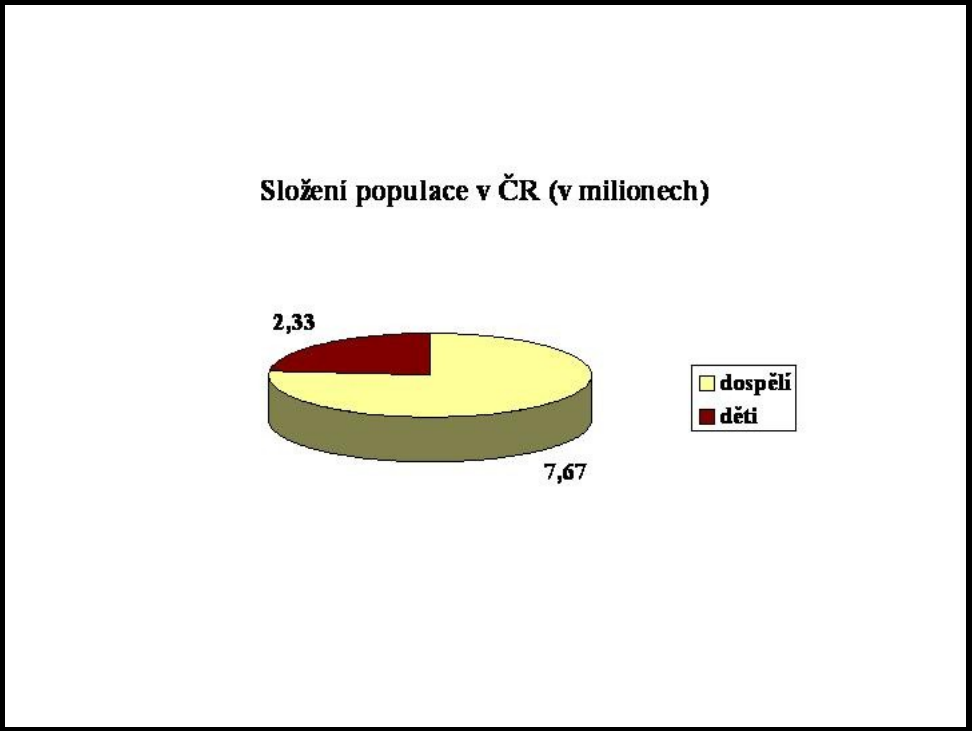
∅ PRISM: 5.2 Predikovaná mortalita: 4.2 %

Zemřelo: 209 pts Skutečná mortalita: 2.6 %

SMR: 0.62

rok 2001

www.simcps.cz
www.csarim.cz



2 330 000 dětí v ČR
1.6 pt / 1000 dětí / rok

11 900 000 dětí v UK
... 12 PICU v UK
... 2.3 PICU v ČR

Special Article

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

R. Phillip Dellinger, MD; Mitchell M. Levy, MD; Jean M. Carlet, MD; Julian Bion, MD; Margaret M. Parker, MD; Roman Jaeschke, MD; Konrad Reinhart, MD; Derek C. Angus, MD, MPH; Christian Brun-Buisson, MD; Richard Beale, MD; Thierry Calandra, MD, PhD; Jean-Francois Dhainaut, MD; Herwig Gerlach, MD; Maurene Harvey, RN; John J. Marini, MD; John Marshall, MD; Marco Ranieri, MD; Graham Ramsay, MD; Jonathan Sevransky, MD; B. Taylor Thompson, MD; Sean Townsend, MD; Jeffrey S. Vender, MD; Janice L. Zimmerman, MD; Jean-Louis Vincent, MD, PhD; for the International Surviving Sepsis Campaign Guidelines Committee

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greater use of physical examination therapeutic end points (2C);
dopamine as the first drug of choice for hypotension (2C);
steroids only in children with suspected or proven adrenal insufficiency (2C);
and a recommendation against the use of recombinant activated protein C in children (1B).

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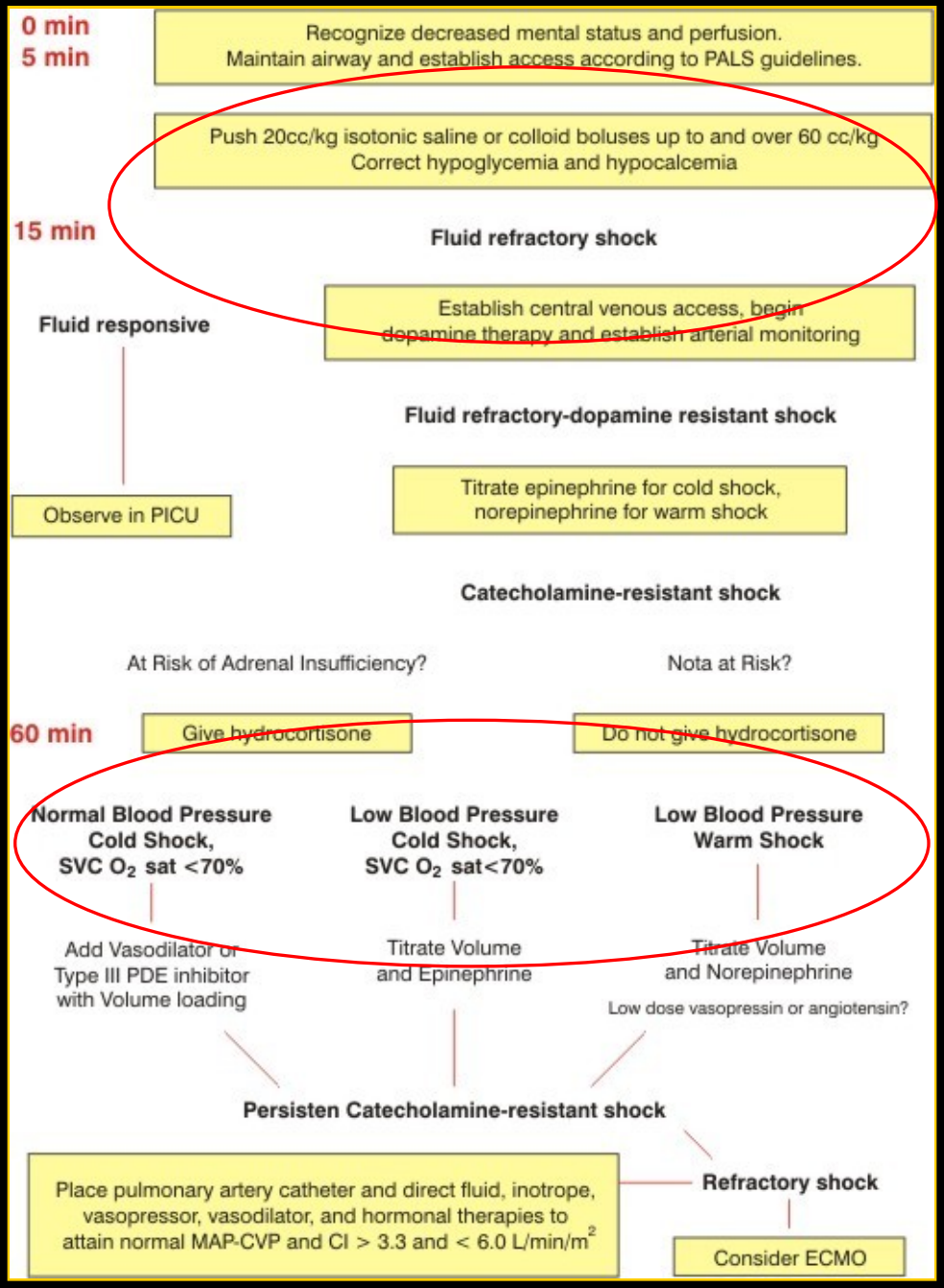


Carcillo JA et al, *Crit Care Med* 2002; 30: 1365 – 137

Úvodní tekutinová resuscitace

Podání i.v. krystaloidů (20 ml/kg) během 5 – 10 minut

- HR
- diuresa
- kapilární návrat
- stav vědomí

Zajištění i.v. přístupu u dětí složitější

Úvodní dávka tekutin 40 – 60 ml/kg

Normotenze není spolehlivým terapeutickým cílem

Dellinger RP et al, *Crit Care Med* 2008; 36: 296 – 32

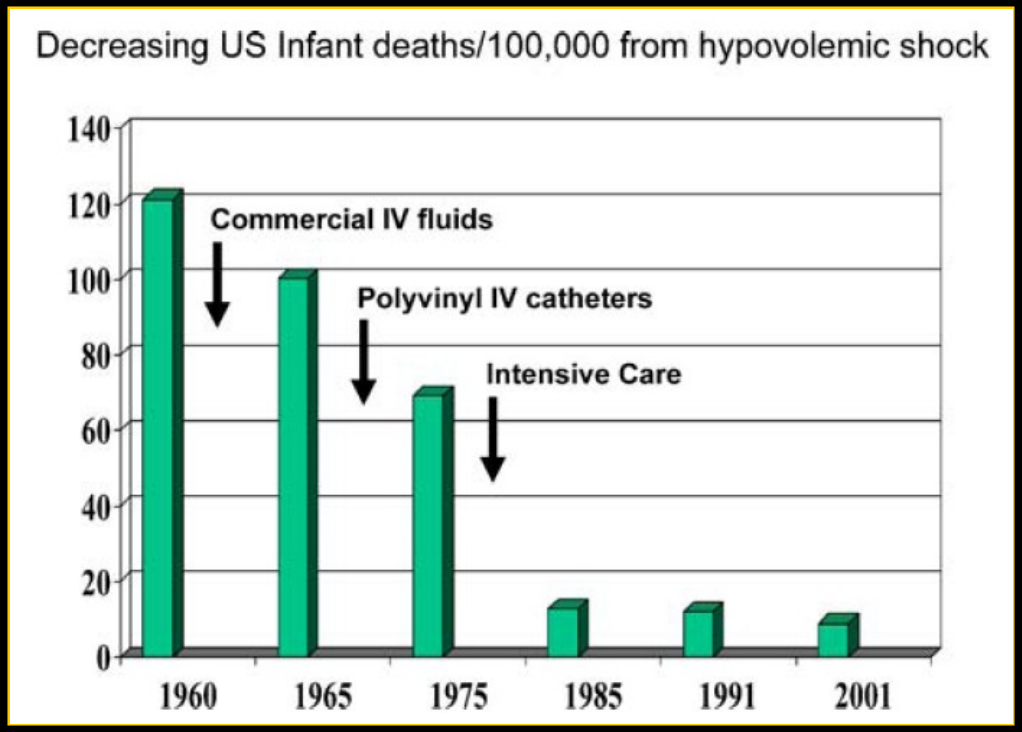
Úvodní tekutinová resuscitace

Terapeutické cíle:

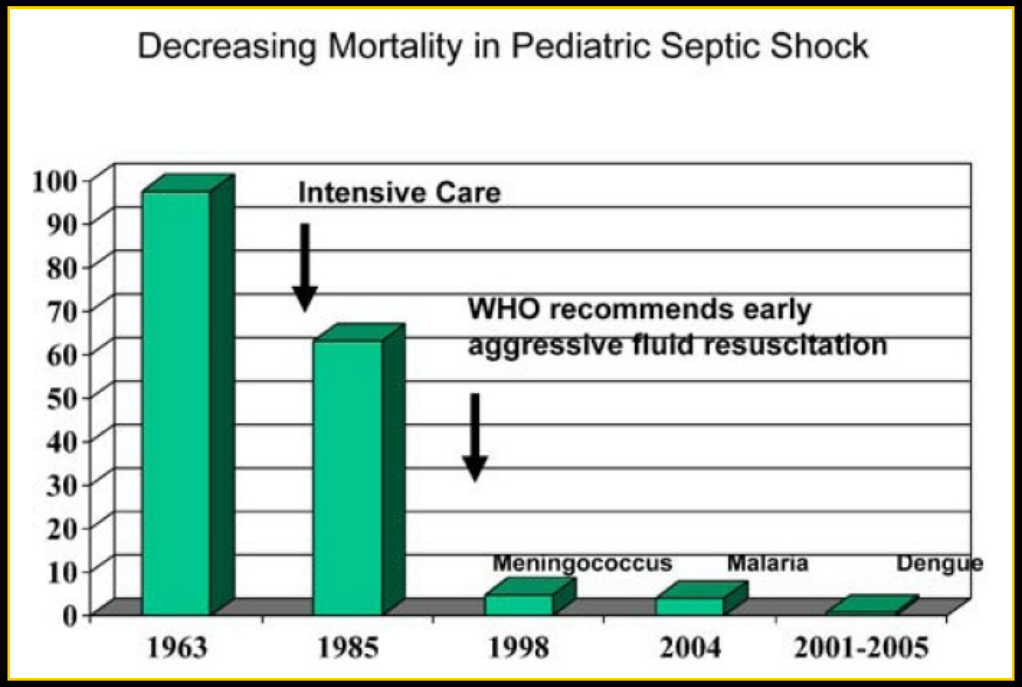
- normální HR pro věk
- kapilární návrat < 2 s
- teplé končetiny
- diuresa > 1 ml/kg/h
- normální stav vědomí

- normální hodnota laktátu
- CVP 8 – 12 mmHg
- SvO_2 ($ScvO_2$) > 70 %

Dellinger RP et al, *Crit Care Med* 2008; 36: 296 – 32



Carcillo JA, Tasker RC, *Intensive Care Med* 2006; 32: 958 – 9



Carcillo JA, Tasker RC, *Intensive Care Med* 2006; 32: 958 – 9

Role of early fluid resuscitation in pediatric septic shock

J. A. Carcillo, A. L. Davis and A. Zaritsky
Department of Anesthesiology, Children's Hospital National Medical Center, George Washington University, Washington, DC.

Septický šok, retrospektivní studie (6 let), PAC do 6 h od přijetí

34 pts, ø věk 13 měs

3 skupiny podle množství tekutin během první hodiny

	pts	1. hod	6. hod	mortalita
< 20 ml/kg	14	11 ± 6	71 ± 29	57 %
20 – 40 ml/kg	11	32 ± 5	108 ± 54	63 %
> 40 ml/kg	9	69 ± 19	117 ± 29	11 %

Carcillo JA et al, *JAMA* 1991; 266: 1242 – 124

Acute Management of Dengue Shock Syndrome: A Randomized Double-Blind Comparison of 4 Intravenous Fluid Regimens in the First Hour

Ngo Thi Nhan,[1] Cao Xuan Thanh Phuong,[1,a] Rachel Kneen,[2,3] Bridget Wills,[2,3] Nguyen Van My,[1] Nguyen Thi Que Phuong,[1] Chu Van Thien,[1] Nguyen Thi Thuy Nga,[1] Julie A. Simpson,[2,3] Tom Solomon,[2,3] Nicholas J. White,[2,3] and Jeremy Farrar[2,3]

[1]Dong Nai Paediatric Hospital, Bien Hoa, Dong Nai Province, [2]Wellcome Trust Clinical Research Unit, Centre for Tropical Diseases, Ho Chi Minh City, Vietnam; and [3]Centre for Tropical Medicine, Nuffield Department of Medicine, University of Oxford, Oxford, United Kingdom

Table 1. WHO guidelines for the diagnosis of dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS).

DHF grade	Duration of fever, d	Hemorrhage	Thrombocytopenia: platelets/mm^3	Increased vascular permeability
I	>2, ≤7	Positive tourniquet test only	≤100,000	Plasma leakage[a]
II	>2, ≤7	Spontaneous bleeding[b]	≤100,000	Plasma leakage[a]
III (DSS)	>2, ≤7	Positive tourniquet test and/or spontaneous bleeding[b]	≤100,000	Plasma leakage[a] and circulatory failure with pulse pressure ≤20 mm Hg or hypotension for age
IV (DSS)	>2, ≤7	Positive tourniquet test and/or spontaneous bleeding[b]	≤100,000	Plasma leakage[a] and profound shock with undetectable pulse and blood pressure

Nhan NT et al, *CID* 2001; 32: 204 – 21

Table 3. Effect of treatment group on selected clinical and laboratory parameters.

Outcome variable	Solution administered: All patients (n = 222)	Dextran 70 (n = 55)	Gelatin (n = 56)	Lactate Ringer's (n = 55)	"Normal" saline (n = 56)	P
Primary						
PPRT, h median (range)	0.75 (0.25–7)	0.50 (0.25–3)	0.50 (0.25–2)	0.75 (0.25–7)	0.75 (0.25–3)	.030[a]
PPRT >1 h, no. (%) of patients	21 (9.5)	3 (5.5)	3 (5.4)	11 (20)	4 (7.1)	.022[a]
Mean h ± SD	11.7 ± 5.5	15 ± 6.8	11.4 ± 4	10 ± 4.1	10.3 ± 5.6	.068
Range	1.5–23	2.5–23	3–17	3–16	1.5–23	
Secondary						
Decrease in hematocrit at 1 h, %						
Mean ± SD	8.4 ± 3.8	11.5 ± 3.3	9.7 ± 3.0	5.7 ± 2.8	6.5 ± 2.9	<.001[a]
Range	−2 to 19	2 to 19	0 to 16	−2 to 13	0 to 17	
Decrease in pulse at 1 h, beats/min						
Total volume of iv fluid infused, mL/kg						
Mean ± SD	134.1 ± 20.6	134.3 ± 22.1	135 ± 23.5	134.2 ± 19.9	132.9 ± 16.6	.954
Range	89–212	89–189	93–212	103–182	106–172	
Requirement for dextran after first hour, no. (%) of patients	69 (31.1)	17 (30.9)	15 (26.8)	20 (36.4)	17 (30.4)	.749
Volume of dextran after first hour, mL/kg (n = 69)[b]						
Mean ± SD	28.3 ± 12.7	22.1 ± 6.1	30.7 ± 11.6	33.5 ± 14.3	26.3 ± 14.3	.035[a]
Range	10–69	10–37.5	14.5–57	15–64	15–69	
Required frusemide, no. (%) of patients	30 (13.7)	5 (9.1)	10 (17.9)	8 (14.5)	12 (21.4)	.328

Mortalita 0 %

NOTE. PPRT, pulse pressure recovery time.

[a] Significant P value.

[b] In 6 patients the pulse at presentation with shock was too rapid and weak to count accurately; thus n = 216 for the whole study group (A, 55; B, 56; C, 50; D, 55).

Nhan NT et al, *CID* 2001; 32: 204 – 21

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 1, 2005 VOL. 353 NO. 9

Comparison of Three Fluid Solutions for Resuscitation in Dengue Shock Syndrome

Bridget A. Wills, M.R.C.P., Nguyen M. Dung, M.D., Ha T. Loan, M.D., Dong T.H. Tam, M.D., Tran T.N. Thuy, M.D., Le T.T. Minh, M.D., Tran V. Diet, M.D., Nguyen T. Hao, M.D., Nguyen V. Chau, M.D., Kasia Stepniewska, Ph.D., Nicholas J. White, F.R.C.P., and Jeremy J. Farrar, F.R.C.P.

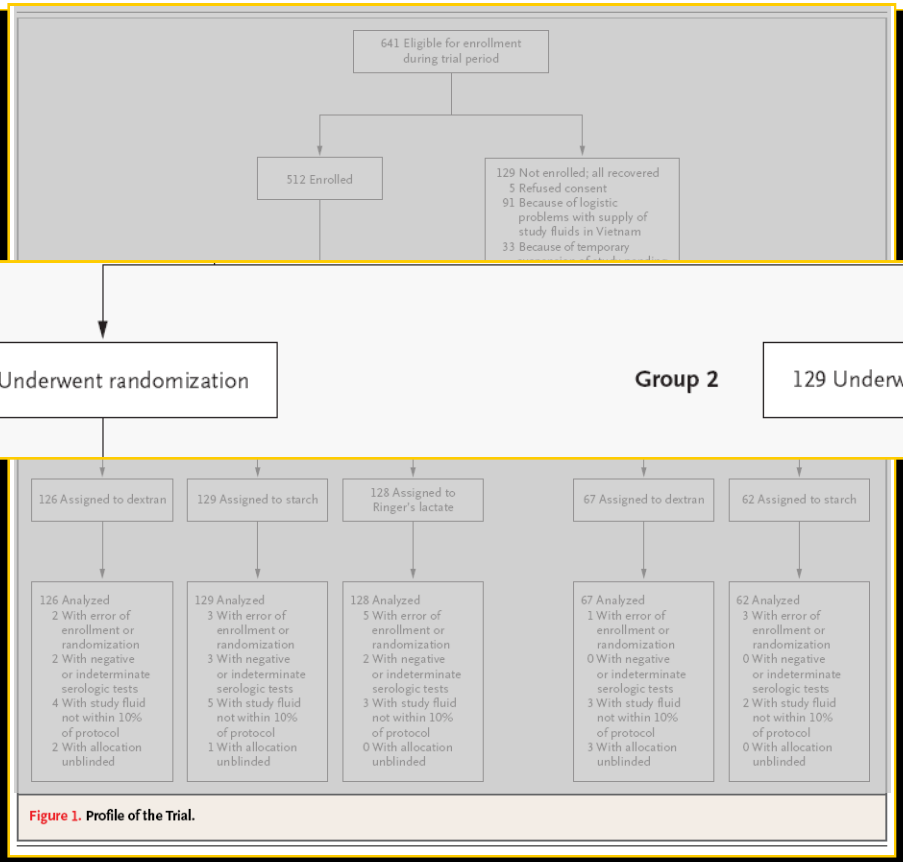


Figure 1. Profile of the Trial.

Wills BA et al, *N Engl J Med* 2005; 353: 877 – 88

Table 2. Primary and Secondary Outcome Measures.*

Outcome	Dextran	Starch	Ringer's Lactate	P Value†
Any rescue colloid — no. (%)				
Group 1	31 (25)	43 (33)	40 (31)	0.28
Group 2	28 (42)	23 (37)	—	0.59
Groups combined	59 (31)	66 (35)	—	0.38
Rescue colloid required subsequently — no. (%)				
Group 1	29 (23)	43 (33)	38 (30)	0.18
Group 2	26 (39)	22 (35)	—	0.70
Groups combined	55 (28)	65 (34)	—	0.22
Total volume of rescue colloid — ml/kg				
Group 1				0.11
Median	0	0	0	
Total fluid volume — ml/kg				
Group 1				0.76
Median	100	100	100	
90% range	66–142	70–163	65–157	
Group 2				0.70
Median	104	106	—	
90% range	63–178	66–202	—	
Groups combined				0.17
Median	100	100	—	
90% range	64–152	70–166	—	
Percentage reduction in hematocrit at 2 hr‡				
Group 1				<0.001
Median	25	22	9	
90% range	10–35	7–31	1–19	
Group 2				<0.001
Median	28	25	—	
90% range	21–37	16–34	—	
Groups combined				<0.001
Median	26	22	—	
90% range	10–36	10–32	—	
Days in hospital				
All groups				0.81
Median	4	4	4	
90% range	4–7	4–7	4–7	

Mortalita < 0.2 %

1 / 512

Wills BA et al, *N Engl J Med* 2005; 353: 877 – 88

Úvodní tekutinová resuscitace

Terapeutické cíle:

- normální HR pro věk
- kapilární návrat < 2 s
- teplé končetiny
- diuresa > 1 ml/kg/h
- normální stav vědomí

- normální hodnota laktátu
- CVP 8 – 12 mmHg
- SvO_2 ($ScvO_2$) > 70 %

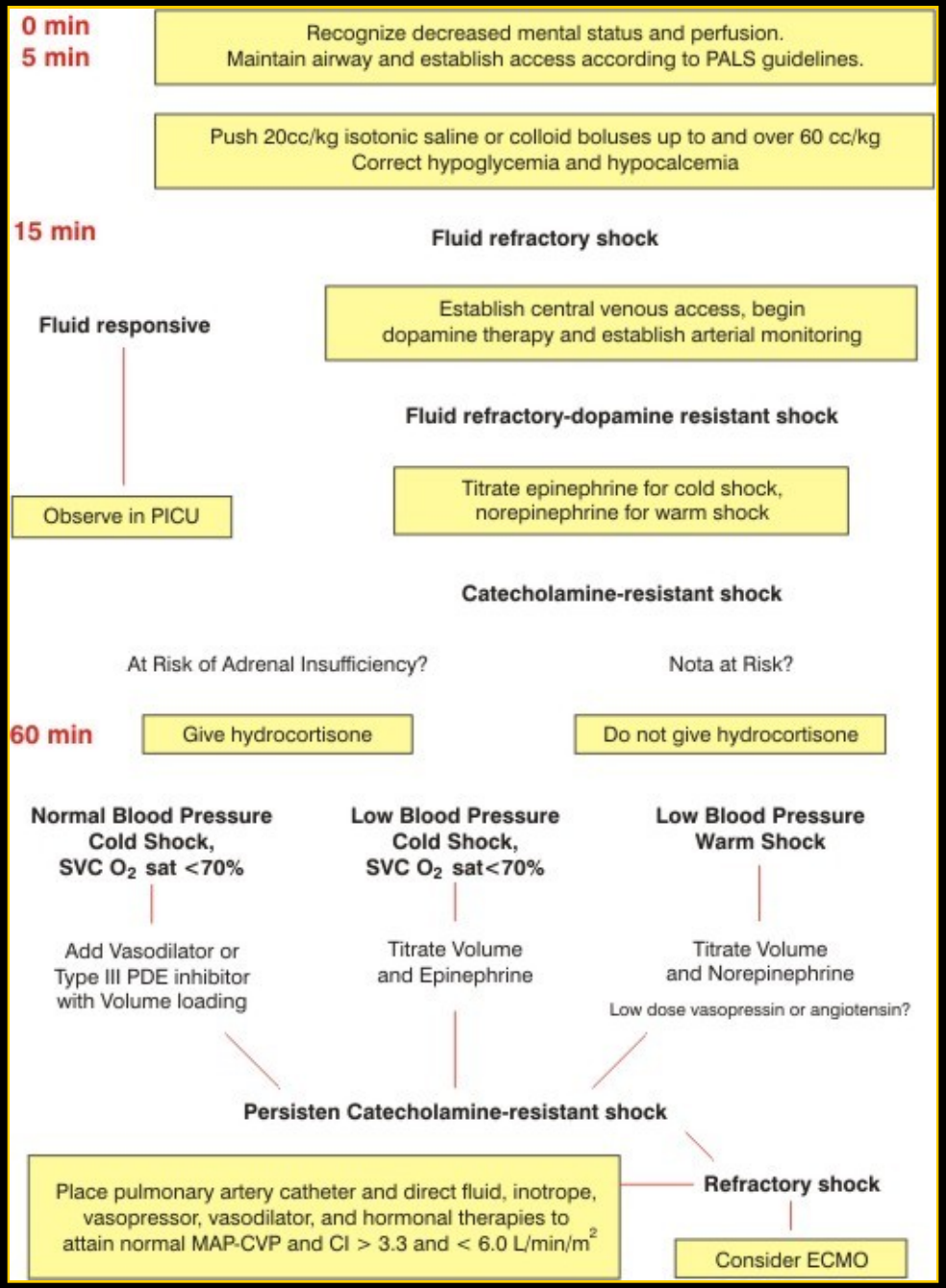
Dellinger RP et al, *Crit Care Med* 2008; 36: 296 – 32

Úvodní tekutinová resuscitace

Table 3. Threshold heart rates and perfusion pressure (MAP-CVP or MAP-IAP) for age[a]

Term Newborn (yrs)	Heart Rate (beats/min)	MAP-CVP (cm H_2O)
	120–180	55
≤1	120–180	60
≤2	120–160	65
≤7	100–140	65
≤15	90–140	65

Carcillo JA et al, *Crit Care Med* 2002; 30: 1365 – 137



Carcillo JA et al, *Crit Care Med* 2002; 30: 1365 – 137

Hemodynamic Support in Fluid-refractory Pediatric Septic Shock
Gary Ceneviva, J. Alan Paschall, Frank Maffei and Joseph A. Carcillo
Pediatrics 1998;102;e19

Septický šok refrakterní k podání tekutin (> 60 ml/kg),
PAC do 6 h od dg, 50 dětí

Pts rozděleni podle hemodynamiky a použití
inotropů, vasopresorů a/nebo vasodilatátorů s cílem
CI > 3.3 l/min/m^2 a SVRI > 800 dyn/s/cm^5/m^2

			mortalita
1. ↓CO ↑SVRI	58 %	inotropika (+ vasodilatace)	28 %
2. ↑CO ↓SVRI	20 %	vasopresor	
3. ↓CO ↓SVRI	22 %	vasopresor + inotropika	10 %
			9 %

Ceneviva G et al, *Pediatrics* 1998; 102: e1

Nízký CO je spojen s vyšší mortalitou u dětí

(u dospělých nízká SVR)

$CI > 3.3\ l/min/m^2$

Hlavní determinantou VO_2 je DO_2,

nikoliv O_2ext jako u dospělých.

$VO_2 > 200\ ml/min/m^2$

Carcillo JA et al, *Crit Care Med* 2002; 30: 1365 – 137

Intensive Care Med (2008) 34:1065–1075
DOI 10.1007/s00134-008-1085-9

PEDIATRIC ORIGINAL

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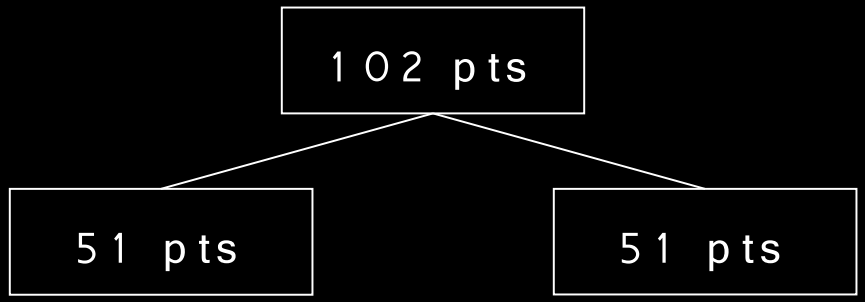
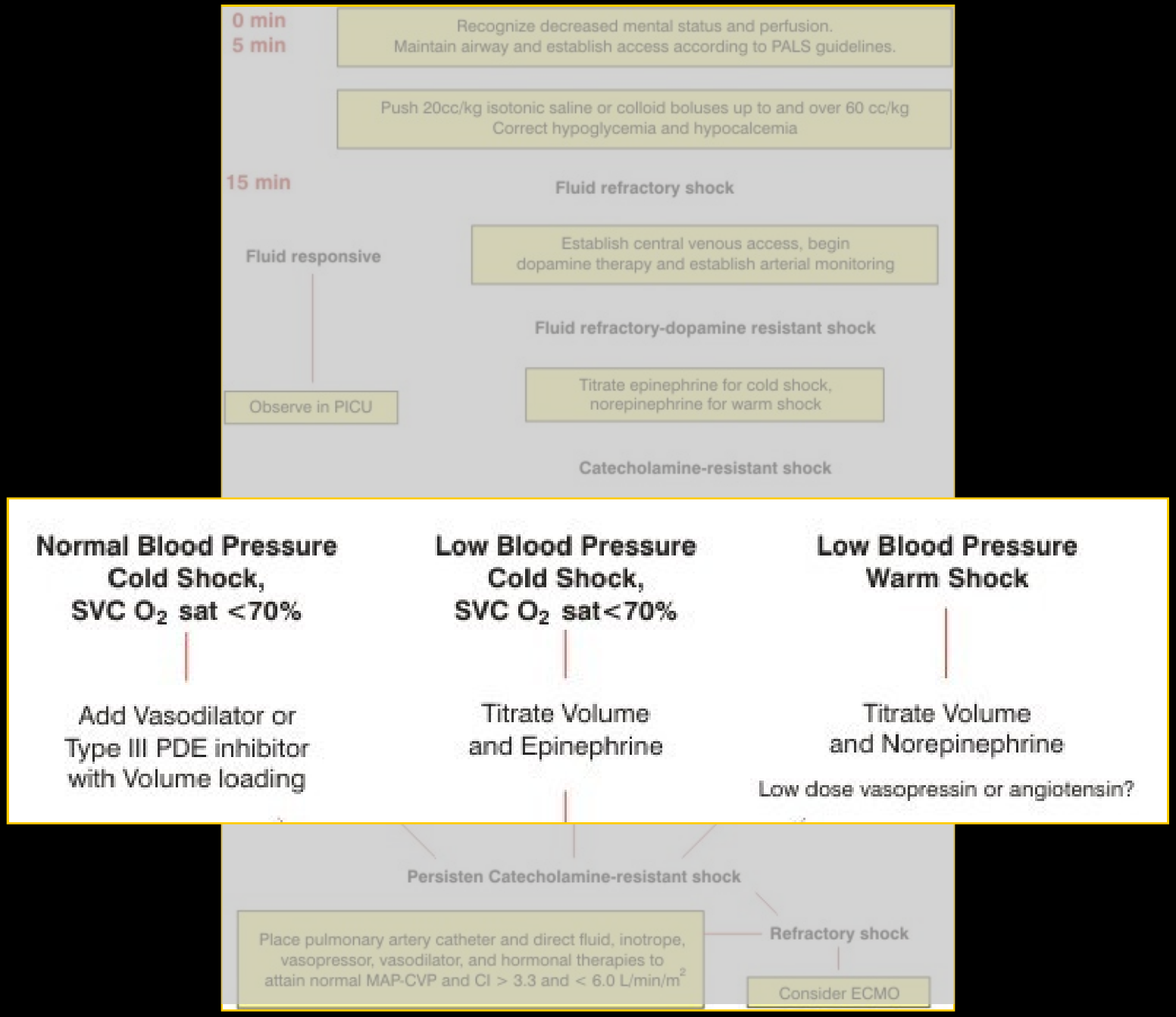
ACCM/PALS haemodynamic support guidelines for paediatric septic shock: an outcomes comparison with and without monitoring central venous oxygen saturation

Septický šok refrakterní k podání tekutin



Mortalita (28.den)	39.2 %	11.8 %	0.002
Krystaloidy (během 6 h)	5 ml/kg	28 ml/kg	< 0.0001
Inotropika (během 6 h)	7.8 %	29.4 %	0.01

de Oliveira et al, *Intensive Care Med* 2008; 34: 1065 – 10

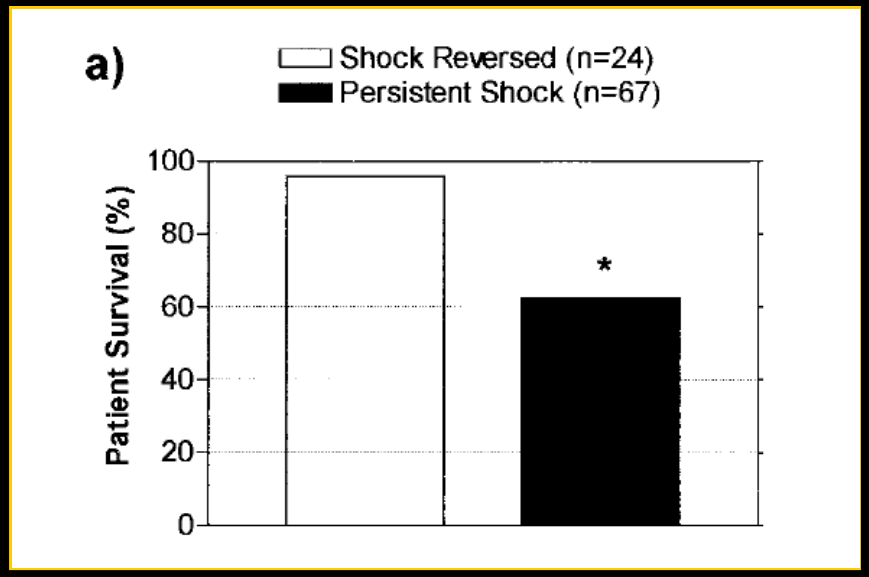


Carcillo JA et al, *Crit Care Med* 2002; 30: 1365 – 137

Early Reversal of Pediatric-Neonatal Septic Shock by Community Physicians Is Associated With Improved Outcome

Yong Y. Han, Joseph A. Carcillo, Michelle A. Dragotta, Debra M. Bills, R. Scott Watson, Mark E. Westerman and Richard A. Orr

Pediatrics 2003;112;793-799



Han YY et al, *Pediatrics* 2003; 112: 793 – 79

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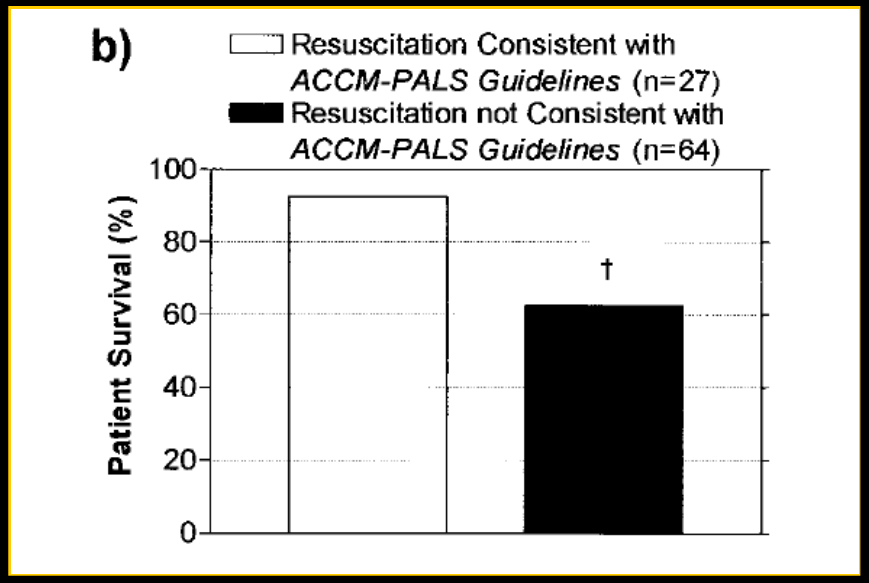

Han YY et al, *Pediatrics* 2003; 112: 793 – 79