



## MODS – od mediátorů k jednoduchému výpočtu



Vladimír Šrámek

1=1

FN u Svaté Anny v Brně, LF MU

XXIX. kongres ČSARIM  
Praha, 5.-7.10.2023

# MOF → MODS

## Kategorická vs Kontinuální proměnná

1970s

- 1 Tilney NL, Bailey GL, Morgan AP. Sequential system failure after rupture of abdominal aortic aneurysms: an unsolved problem in postoperative care. *Ann Surg* 1973;178:117–22.
- 2 Baue AE. Multiple, progressive or sequential systems failure: a syndrome of the 1970s. *Arch Surg* 1975;110:779–81.
- 3 Eiseman B, Beart R, Norton L. Multiple organ failure. *Surg Gynecol Obstet* 1977;144:323–6.

1985/6

## Multiple-Organ Failure

Generalized Autodestructive Inflammation?

R. Jan A. Goris, MD; Theo P. A. te Boekhorst, MD; Johannes K. S. Nuytinck, MD; Jules S. F. Gimbrère, MD  
*Arch Surg* 1985;120:1109-1115

## Multiple-Organ-Failure Syndrome

C. James Carrico, MD; Jonathan L. Meakins, MD, DSc, FRCSC, FACS;  
J. C. Marshall, MD, FRCSC; Donald Fry, MD; Ronald V. Maier, MD  
*Arch Surg*—Vol 121, Feb 1986

John C. Marshall, MD, FRCSC

Panel Discussion—Surgical Infection Society 1985

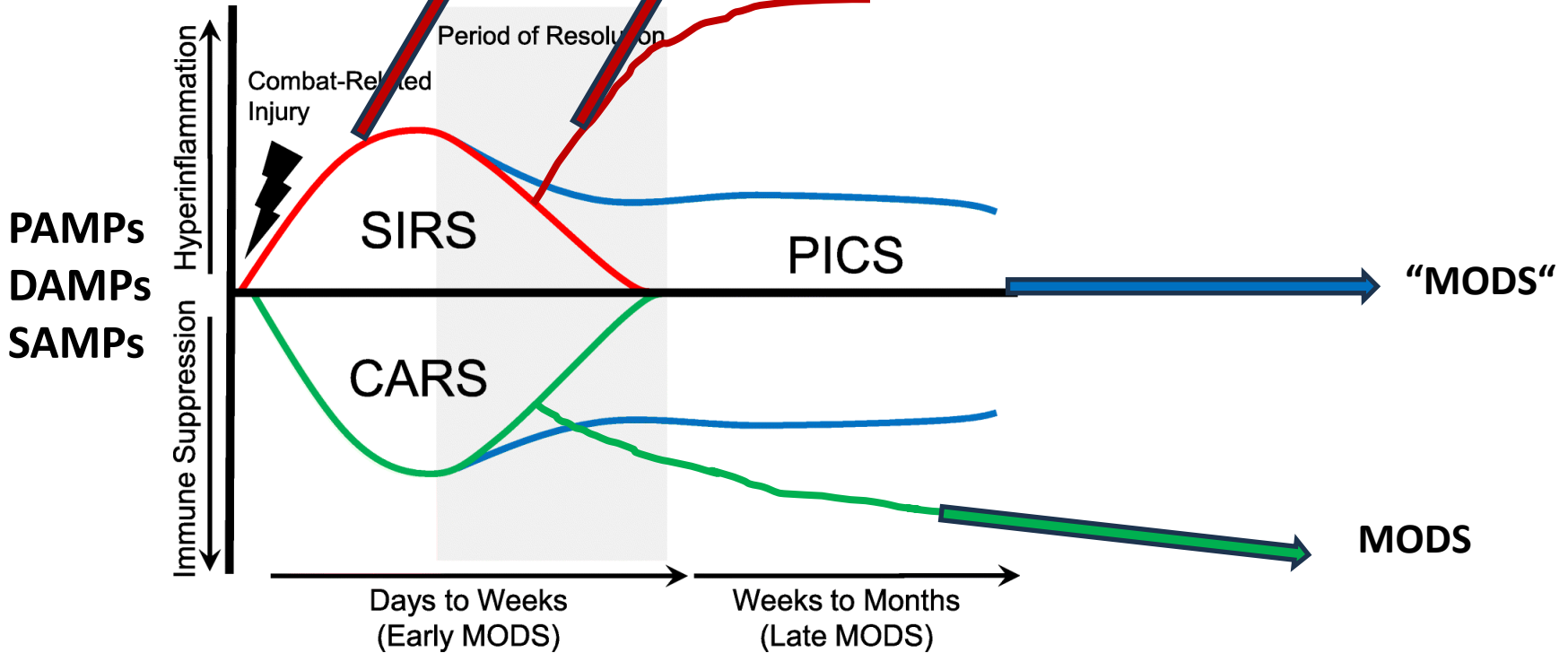
T  
R  
A  
U  
M  
A  
&  
S  
U  
R  
G  
E  
R  
Y

1hit model (TRAUMA)

2hit model (SURGERY)

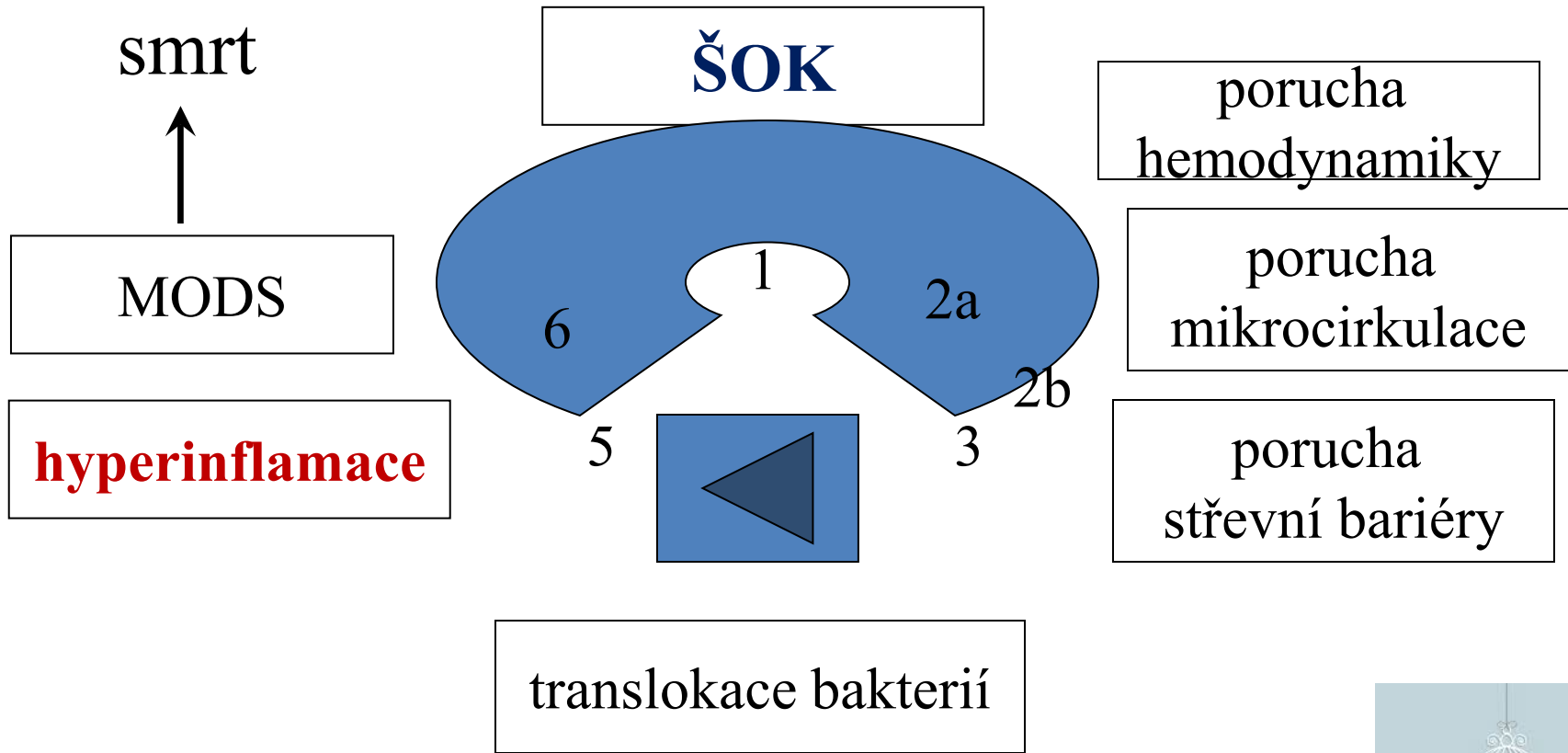
priming vs preconditioning

Cuthbertson 1942



Bone 1997

# 2nd HIT



Meakins JL, Marshall JC 1986

## GUT HYPOTHESIS of MODS



*Goris 1985*

“motorem“ MODS i jiné orgány, MICROBIOME

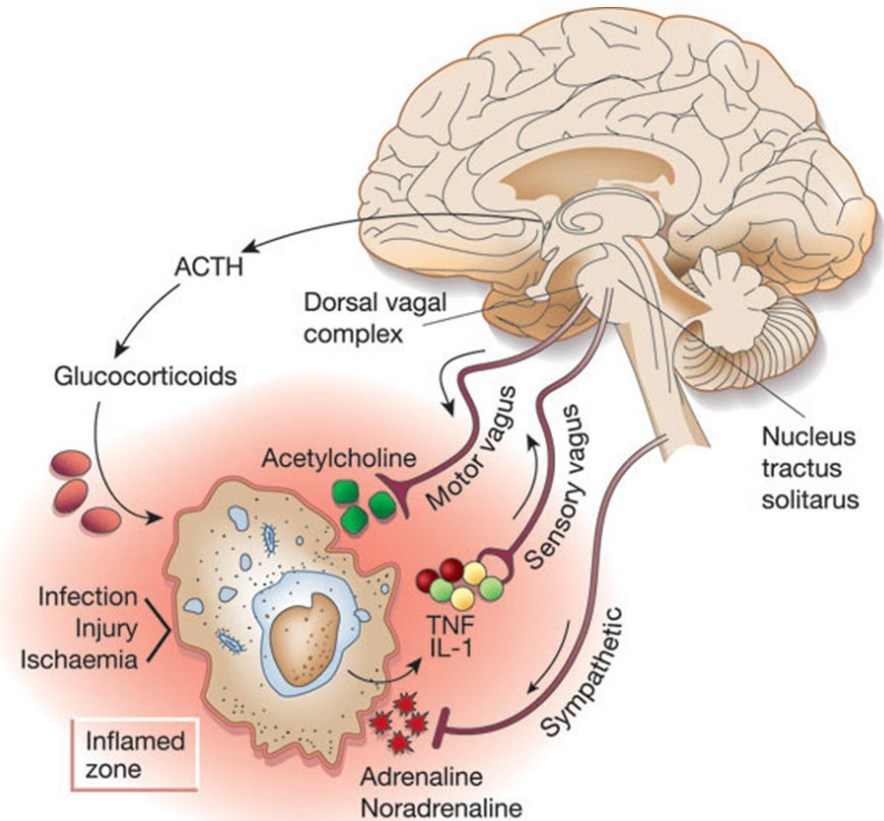
# MODS – důsledek dysregulace mnoha souvisejících systémů

Tracey 2001

- cytokiny (imunitní sy)/koagulace
- hormony (A/NA, RAAS, kortizol, ADH, glukagon versus insulin/GH/oxytocin )
- VNS (S/P)



metabolismus

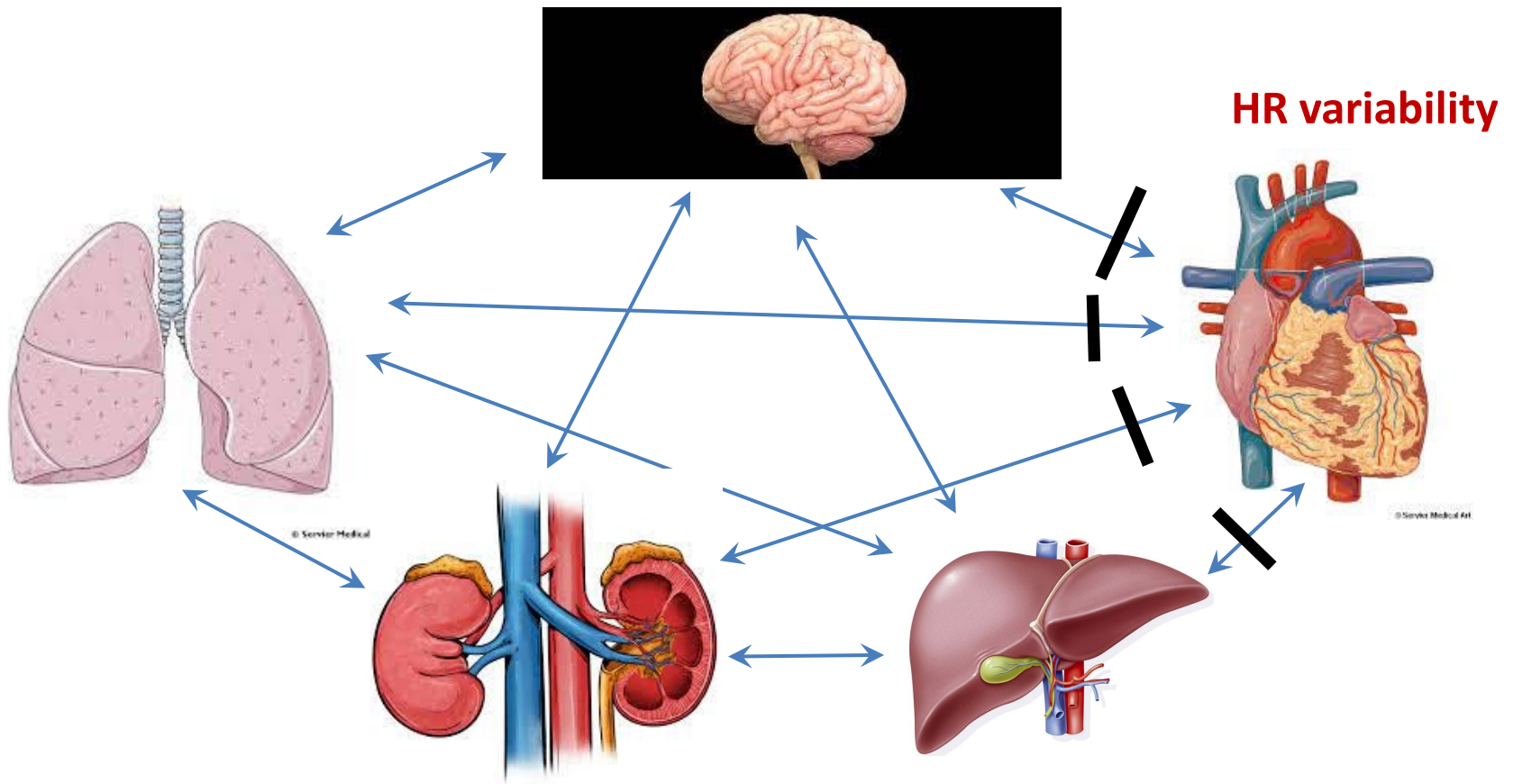


Vagus Nerve Stimulation Attenuates Multiple Organ Dysfunction in Resuscitated Porcine Progressive Sepsis

CCM,2019

# MODS ztráta komunikace mezi orgány ztráta variability signálu

Godin PJ, Buchman TG: Uncoupling of biological oscillators: A complementary hypothesis concerning the pathogenesis of multiple organ dysfunction syndrome. Crit Care Med 1996; 24:1107-1116



# Necrosis? Apoptosis? Failure? Shutdown?



Hotchkiss

**apoptóza >> nekróza**



Singer

**mitochondrial shutdown**

# individuální odpověď – fenotyping



## Fenotypy sepsy

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

### Derivation, Validation, and Potential Treatment Implications of Novel Clinical Phenotypes for Sepsis

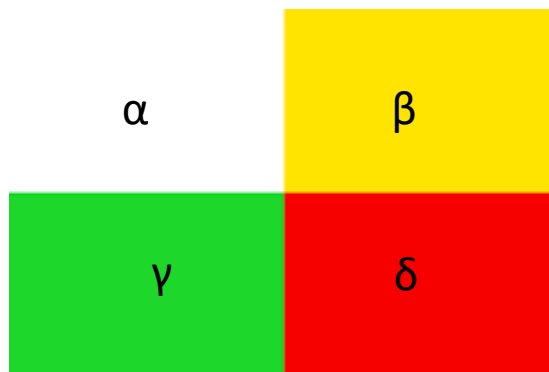
Christopher W. Seymour, MD, MSc; Jason N. Kennedy, MS; Shu Wang, MS; Chung-Chou H. Chang, PhD; Corrine F. Elliott, MS; Zhongying Xu, MS; Scott Berry, PhD; Gilles Clermont, MD, MSc; Gregory Cooper, MD, PhD; Hernando Gomez, MD, MPH; David T. Husang, MD, MPH; John A. Kellum, MD, FACP, MCCM; Qi Mi, PhD; Steven M. Opal, MD; Victor Talisa, MS; Tom van der Poll, MD, PhD; Shyam Visweswaran, MD, PhD; Yoram Vodovotz, PhD; Jeremy C. Weiss, MD, PhD; Donald M. Yealy, MD, FACEP; Sachin Yende, MD, MS; Derek C. Angus, MD, MPH

$\alpha$  33%; † 5%

- málo vasopresorů
- (mladší)

$\gamma$  27%; † 24%

- inflamace
- pulmonální dysfunkce



$\beta$  27%; † 13%

- starší
- chronická onemocnění
- AKI

$\delta$  13%; † 40%

- játra
- septický šok






# Fenotypy ARDS

Comparison of machine learning clustering algorithms for detecting heterogeneity of treatment effect in acute respiratory distress syndrome: A secondary analysis of three randomised controlled trials

Pratik Sinha, Assistant Professor<sup>a,\*</sup>, Alexandra Spicer<sup>b</sup>, Kevin L Delucchi<sup>c</sup>, Daniel F McAuley<sup>d,e</sup>, Carolyn S Calfee<sup>f,g</sup>, Matthew M Churpek<sup>b</sup>

[EBioMedicine 74 \(2021\) 103697](#)

## Trial

-  ALVEOLI
-  FACTT
-  SAILS

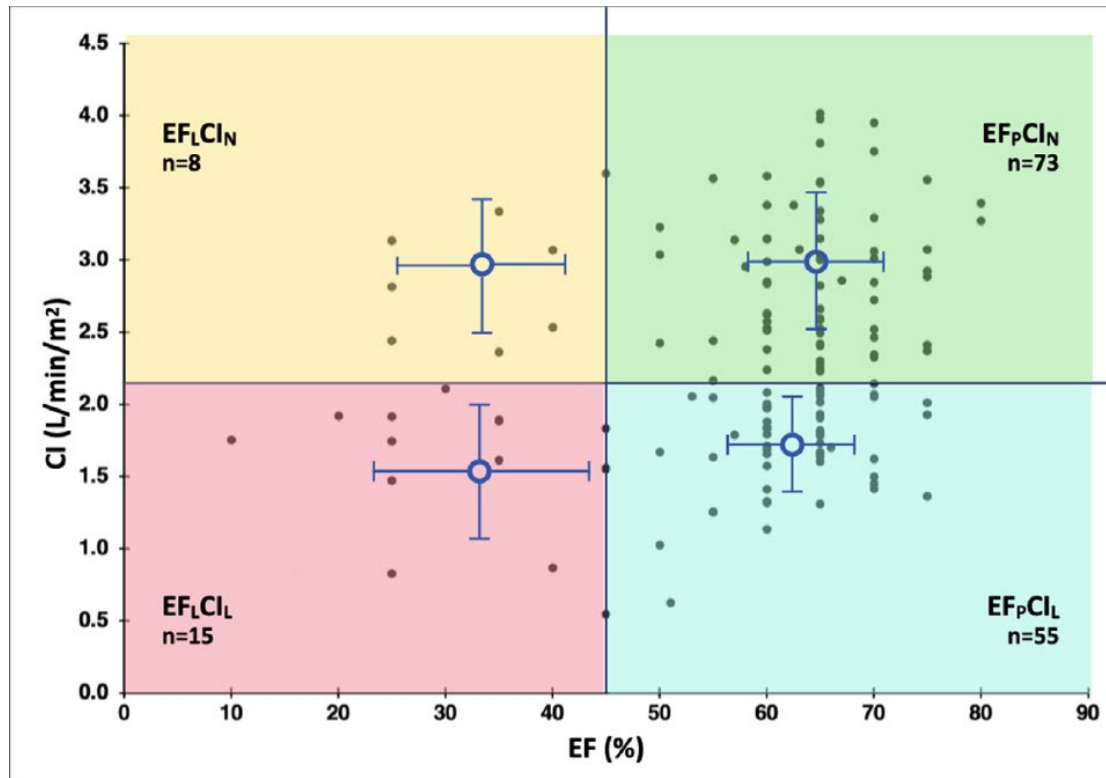
## Resume:

přidání biomarkerů do prognostického algoritmu zlepšilo předpověď D90 mortality (nižší HTE)

# Hemodynamic Profiles of Shock in Patients With COVID-19

Steven M. Hollenberg, MD<sup>a,b,\*</sup>, Lucy Safi, MD<sup>a,b</sup>, Joseph E Parrillo, MD<sup>a,b</sup>, Matthew Fata, MD<sup>c</sup>

Am J Cardiol 2021;153:135–139



# Biological Phenotyping in Sepsis and Acute Respiratory Distress Syndrome

Annu. Rev. Med. 2023. 74:457–71

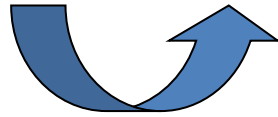
## **Machine data + „omics“**

(geno...RNA...imunotyping...proteiny...metabolity)

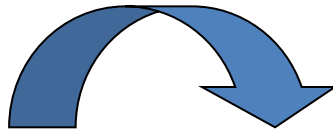
Individualizovaný přístup: retrospektivní subanalýza VANISH trial, aPC trial...

# MODS – poškození orgánů

Lipopolysacharid

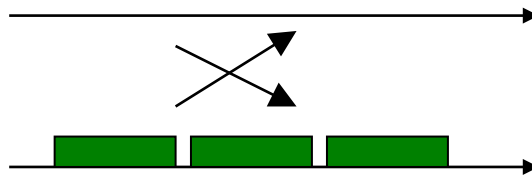


noxa



Tissue Factor

(cytokiny)  
hyperinflamační



hyperkoagulační  
(trombin)

O

R

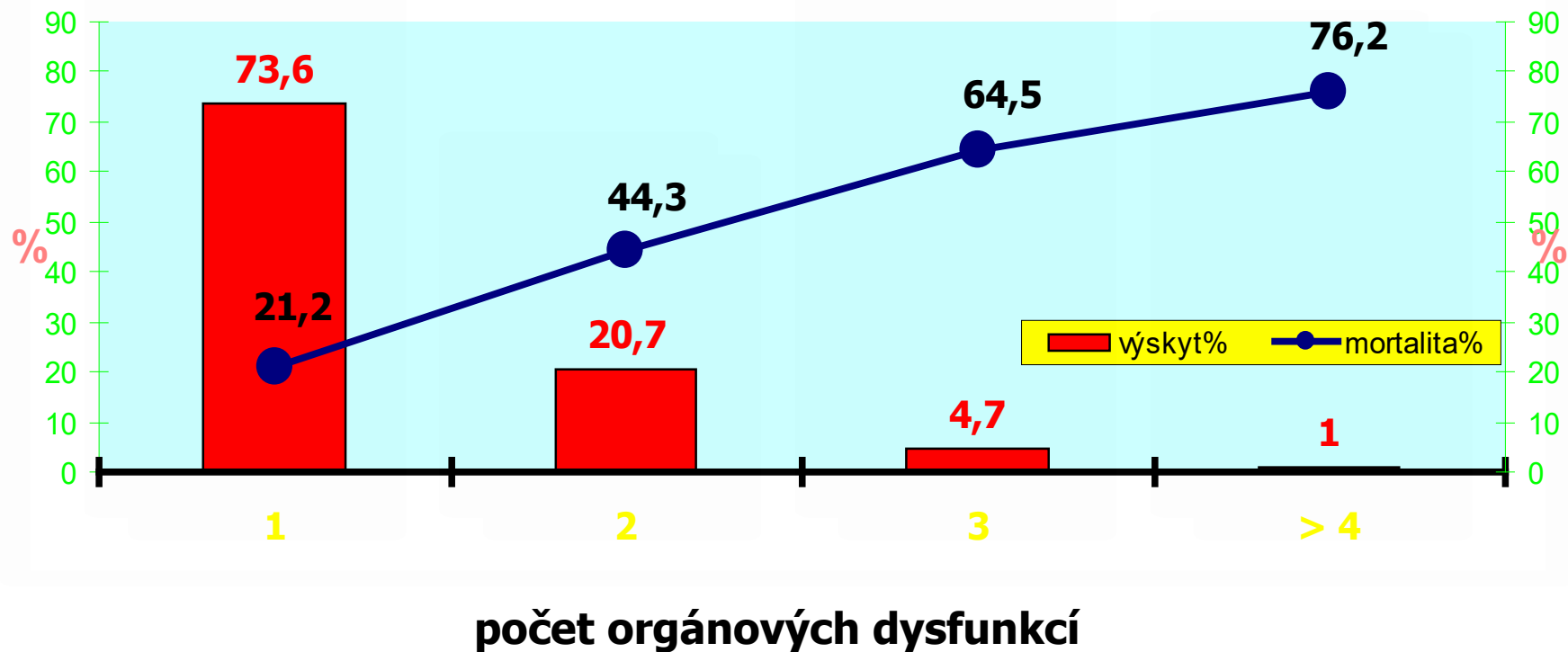
G

Á

N

Y

# Incidence a mortalita nemocných v těžké sepsi dle orgánových dysfunkcí ( N=6 621 559; n=192 980; 51,1% IC; 3/1000 )



*Angus D et al, CCM, 2001*

# SOFA sore



Intensive Care Med (1996) 22:707–710  
© Springer-Verlag 1996

MEETING REPORT

J.-L. Vincent  
R. Moreno  
J. Takala  
S. Willatts  
A. De Mendonça  
H. Bruining  
C. K. Reinhart  
P. M. Suter  
L. G. Thijs

## **The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure**

**On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine (see contributors to the project in the appendix)**

**SOFA: příjem ICU, max. SOFA (timing), dSOFA, SOFA při propuštění z ICU**

**NRIP 2024 – SOFA při příjmu na ICU**

# SOFA – 6 orgánů/systémů

## SOFA:

### SOFA skóre (Sequential Organ Failure Assessment)

Orgán/systém	1 bod	2	3	4
<b>Respirační systém</b>				
paO <sub>2</sub> /FIO <sub>2</sub> (* Murray)	< 400	< 300	< 200 s ventilační podporou	< 100
<b>Koagulace</b>				
Trombocyty x 10 <sup>3</sup> /mm <sup>3</sup>	< 150	< 100	< 50	< 20
<b>Játra</b>				
Bilirubin umol/L	20-32	33-101	102-204	> 204
<b>Kardiovaskulární systém</b>				
Hypotenze	MAP < 70 mm Hg	dopamine ≤ 5 nebo dobutamin	dopamin > 5 nebo A ≤ 0.1 nebo NA ≤ 0.1	dopamin > 15 nebo A > 0.1 nebo NA > 0.1
A = adrenalin, NA = noradrenalin (ugc/kg/min)				
<b>Centrální nervový systém</b>				
Glasgow Coma Score	13-14	10-12	6-9	< 6
<b>Ledviny</b>				
Kreatinin (umol/L) nebo výdej moči	110-170	171-299	300-440 nebo < 500 ml/24h	> 440 nebo < 200 ml/24h

?? ***GIT***, CIPMN, imunitní systém....

**Bone Failure in Critical Illness**

# MODS - závěry pro praxi 2023

- Prevence
- Včasná intervence (několik málo hodin od inzultu do indukce inflamační reakce)
- Zabránit second hit – kvalitní „supportive care“
- Individualizace léčby
- Kvantifikace postižení (SOFA)
- Trpělivost – regenerační schopnost organismu je velká (ale má své limity)



# 10. SVATOMARTINSKÝ WORKSHOP



[www.hemodynamika.cz](http://www.hemodynamika.cz)

Hotel Akademie Velké Bilovice

- ČSImakademie
- ČSARIM

9. -10. listopadu 2023