Sepsis and septic shock

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An Infection, Unnoticed, Turns Unstoppable

About New York

By JIM DWYER JULY 11, 2012

Dwyer, J – NY Times, 11.07.2012

What happened?

Two days earlier, diving for a basketball at his school gym, Rory had cut his arm. He arrived at his pediatrician's office the next day, Thursday, March 29, vomiting, feverish and with pain in his leg. He was sent to the emergency room at NYU Langone Medical Center. The doctors agreed: He was suffering from an upset stomach and dehydration. He was given fluids, told to take Tylenol, and sent home.

Dwyer, J – NY a , 11.07.2012

Before we begin: Recognize sepsis!

Quick SOFA

Source: www.qsofa.org


STOP
Danger of death

Study objectives

1. Sepsis: knowing and understanding current definitions and guidelines
2. Diagnosis and treatment of sepsis: important points to consider

Clinical case

Surgical intensive care unit

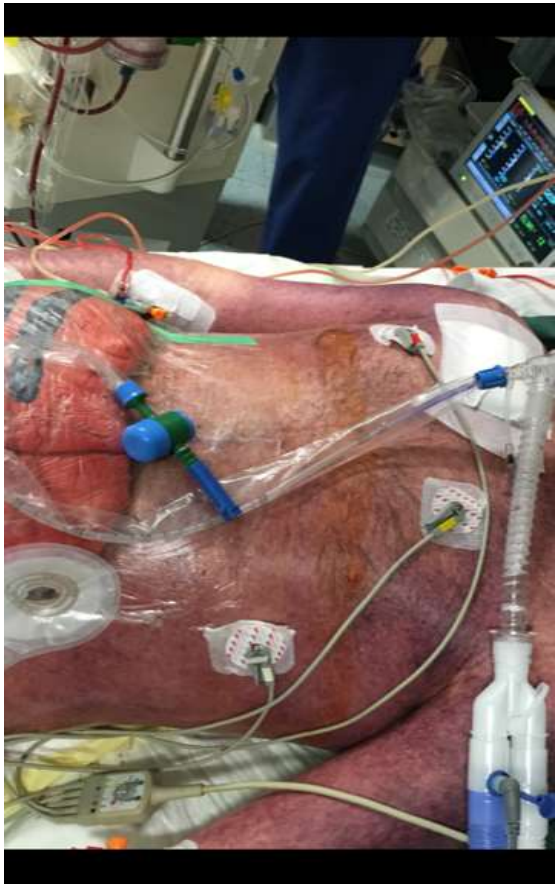
Clinical case

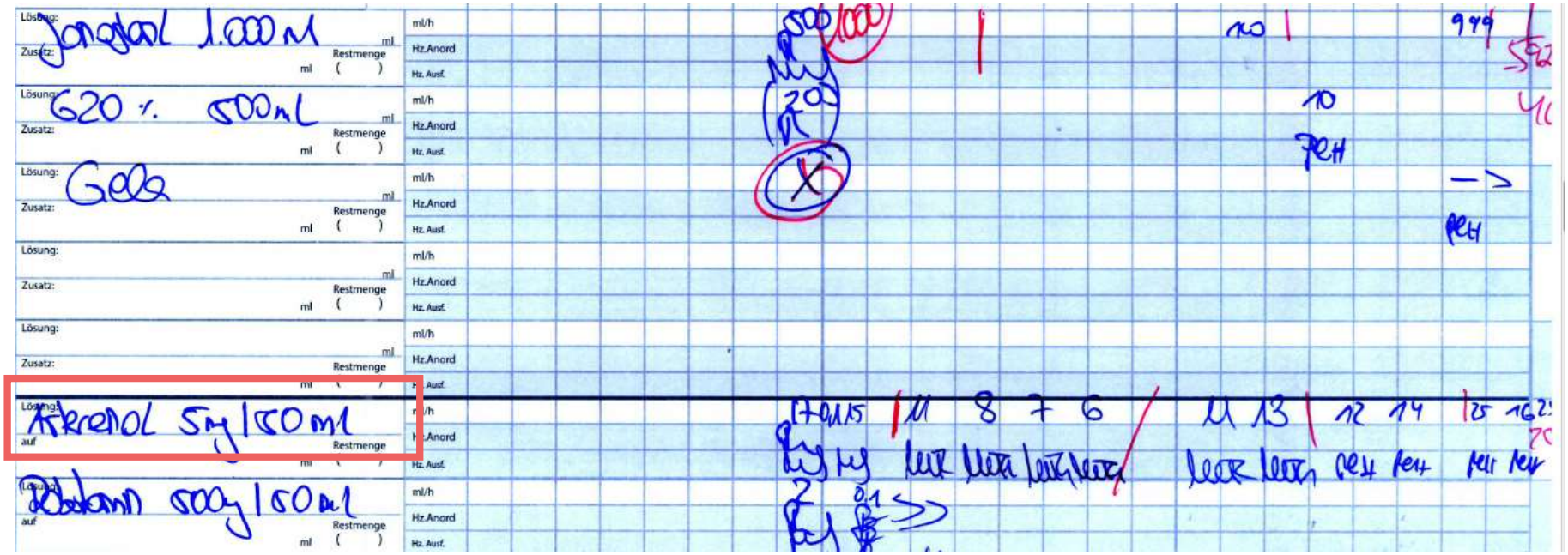
- 71-year-old patient Klaus E.
- Diagnosis: perforated gangrenous cholecystitis with peritonitis in all 4 quadrants and septic shock

- **Preexisting conditions**
  - CVRF: aHT, NIDDM

- **Medication**
  - Ramipril

Postoperative ICU admission





Lactate 5.9 mmol/L

Definition

1

New definitions of:

- Sepsis
- Septic shock

New

Special Communication | CARING FOR THE CRITICALLY ILL PATIENT

The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)

Mervyn Singer, MD, FRCP; Clifford S. Deutschman, MD, MS; Christopher Warren Seymour, MD, MSc; Manu Shankar-Hari, MSc, MD, FFICM; Djillali Annane, MD, PhD; Michael Bauer, MD; Rinaldo Bellomo, MD; Gordon R. Bernard, MD; Jean-Daniel Chiche, MD, PhD; Craig M. Coopersmith, MD; Richard S. Hotchkiss, MD; Mitchell M. Levy, MD; John C. Marshall, MD; Greg S. Martin, MD, MSc; Steven M. Opal, MD; Gordon D. Rubenfeld, MD, MS; Tom van der Poll, MD, PhD; Jean-Louis Vincent, MD, PhD; Derek C. Angus, MD, MPH

IMPORTANCE Definitions of sepsis and septic shock were last revised in 2001. Considerable advances have since been made into the pathobiology (changes in organ function, morphology, cell biology, biochemistry, immunology, and circulation), management, and epidemiology of sepsis, suggesting the need for reexamination.

OBJECTIVE To evaluate and, as needed, update definitions for sepsis and septic shock.

Editorial page 757

Author Video Interview, Author Audio Interview, and JAMA Report Video at jama.com

Related articles pages 762 and 775

JAMA. 2016;315(8):801-810

New

Current Guidelines and Terminology	Sepsis	Septic Shock
1991 and 2001 consensus terminology[9,10]	Severe sepsis Sepsis-induced hypoperfusion	Septic shock[13]
2015 Definition	Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection	Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality
2015 Clinical criteria	Suspected or documented infection and an acute increase of ≥2 SOFA points (a proxy for organ dysfunction)	Sepsis[a] and vasopressor therapy needed to elevate MAP ≥65 mm Hg and lactate >2 mmol/L (18 mg/dL) despite adequate fluid resuscitation[13]

JAMA. 2016;315(8):801-810.

Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score[a]

	Score				
System	0	1	2	3	4
Respiration					
Pao_2/Fio_2, mm Hg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation					
Platelets, $\times 10^3/\mu L$	≥150	<150	<100	<50	<20
Liver					
Bilirubin, mg/dL (μmol/L)	<1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular	MAP ≥70 mm Hg	MAP <70 mm Hg	Dopamine <5 or dobutamine (any dose)[b]	Dopamine 5.1-15 or epinephrine ≤0.1 or norepinephrine ≤0.1[b]	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1[b]
Central nervous system					
Glasgow Coma Scale score[c]	15	13-14	10-12	6-9	<6
Renal					
Creatinine, mg/dL (μmol/L)	<1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440)	>5.0 (440)
Urine output, mL/d				<500	<200

JAMA. 2016;315(8):801-810.

The new definition of sepsis shifts the focus towards the body's reaction to infection; the crucial point for the case definition is not the infection itself but the bodily reaction it triggers and the resulting organ damage!

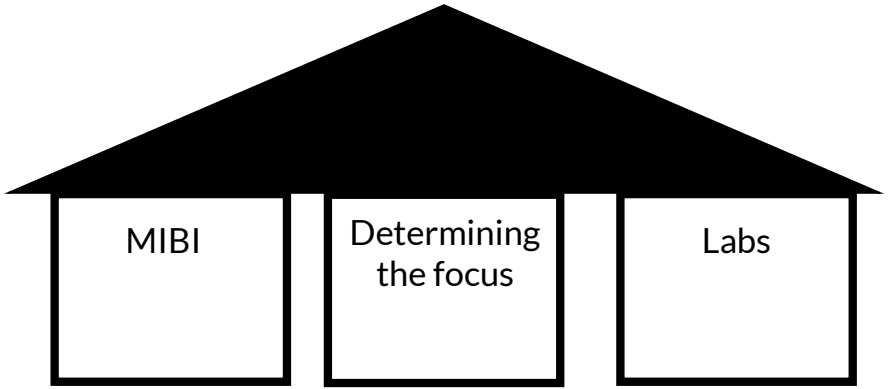
Diagnosis

Diagnosis

The diagnosis of sepsis is based on three principles:

1. Microbiological diagnostics to determine the pathogen and possibly identify a focus
2. Finding the focus, possibly involving specific imaging modalities
3. Laboratory diagnostics to assess the status of organ function and signs of inflammation

In sepsis, the administration of early antibiotic treatment within one hour of diagnosis is vital. Accordingly, focused and timely diagnosis is essential before initiating antibiotic treatment.



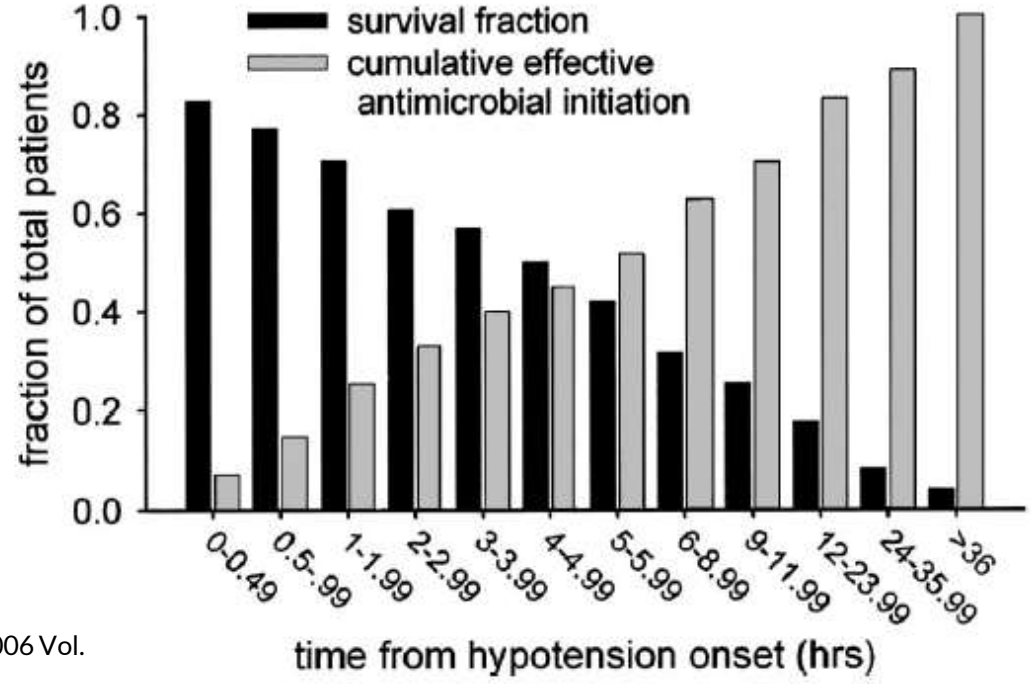
Blood cultures

- Most important diagnostic
- Identifying the pathogen enables targeted antibiotic treatment.
- Two pairs before administration of antibiotics
- Minimum of 3 pairs within 24 hours

Additional microbiological testing

- Tracheal secretion/BAL
- Urine sample/swab culture/puncture specimen ...

Regardless of diagnostics: Administer antibiotics within the hour!



Kumar A et al. - Crit Care Med 2006 Vol. 34, No. 6 1589

Therefore …

- Focused and timely diagnosis
- Administer antibiotics within one hour!

→ SURVIVING SEPSIS CAMPAIGN BUNDLES

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021

KEY WORDS: adults; evidence-based medicine; guidelines; sepsis; septic shock

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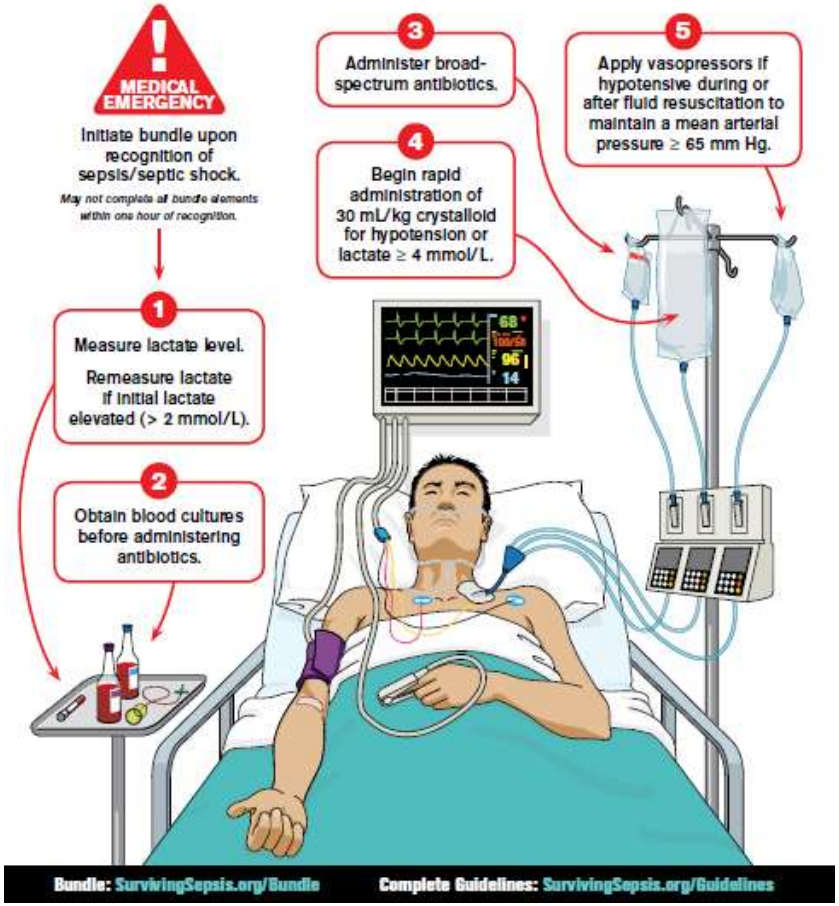
New in 2017 / 2021

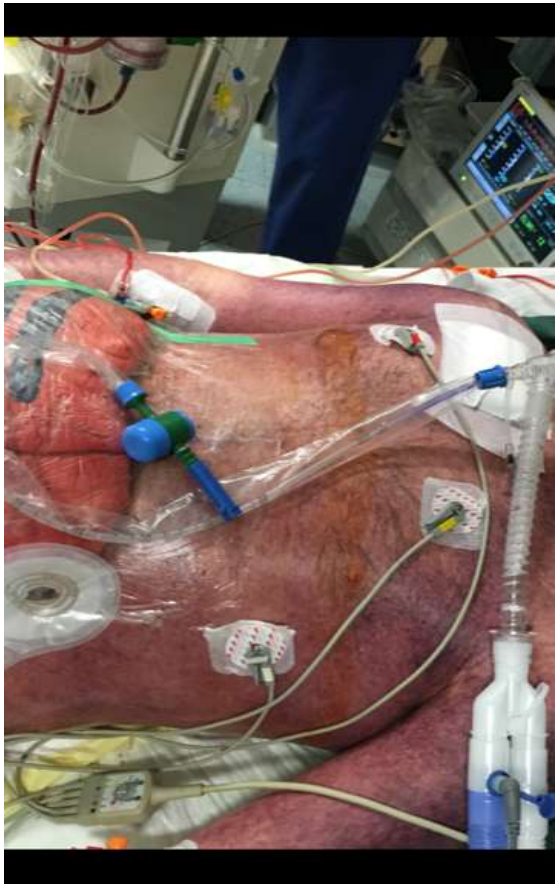
1 hour bundle

New in 2017

One-hour bundle



Postoperative ICU admission



Antibiotic treatment

Order for this patient:

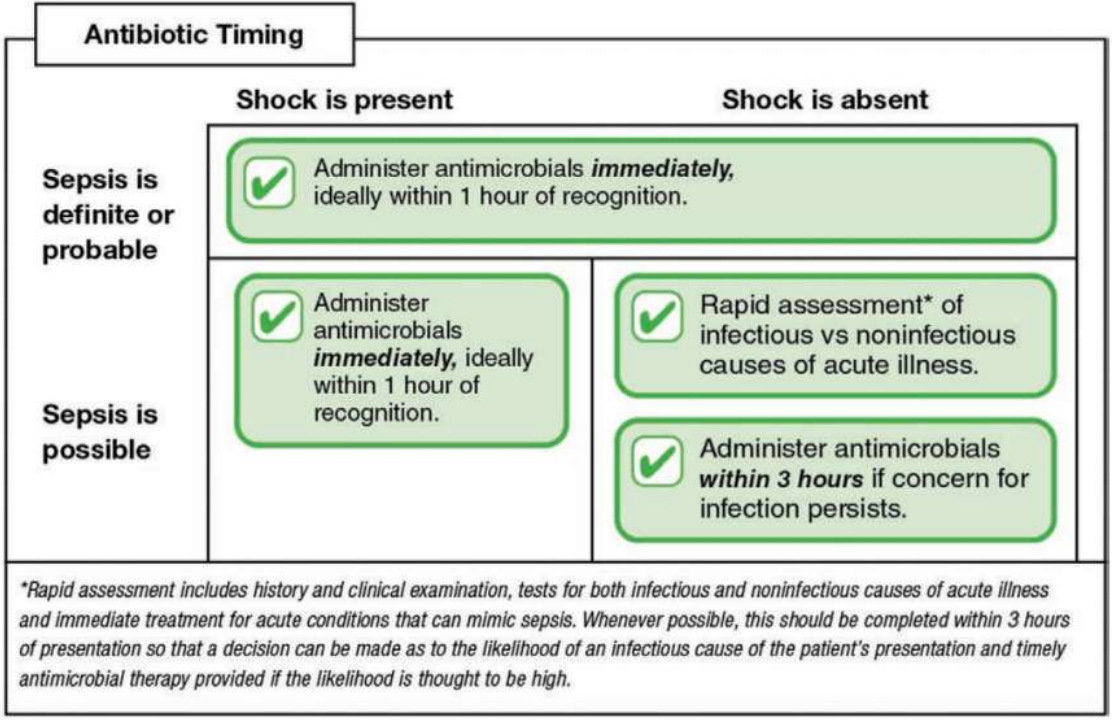
a) Ceftriaxone 2 g once daily

b) Meropenem 1 g three times daily

c) Imipenem/cilastatin 1 g 3–4 times daily PLUS ciprofloxacin 400 mg 3 times daily

What does the guideline recommend?

Administration of antibiotics



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Antibiotic treatment in septic shock

Combination treatment is possible.

- Carbapenem (e.g. meropenem)
- Piperacillin/tazobactam
- Ceftazidime OR cefepime

PLUS

- Ciprofloxacin
- Aminoglykoside

PLUS

- In suspected MRSA: vancomycin/teicoplanin (linezolid)
- In suspected Legionnaires' disease: clarithromycin/azithromycin

Initial stabilization of circulation

Old: goal criteria according to Rivers protocol

- Central venous pressure: 8–12 mmHg
- Mean arterial pressure: ≥ 65–70 mmHg
- Central venous oxygen saturation: ≥ 70%
- Diuresis: ≥ 0.5 mL/kg/h

New: dynamic management parameters

- Passive leg raises
- Stroke volume variability
- Pulse pressure variability during ventilation
- Echocardiography/PiCCO

Intensive Care Med (2017) 43:304–377

Initial stabilization of circulation

First circulatory goal:
mean arterial pressure > 65 mm Hg

- Norepinephrine
- Vasopressin up to 2 IU/h (0.03 IU/min)

Second circulatory goal:
sufficient cardiac output

- Dobutamine
- Epinephrine
- (alternative inotropics)

Intensive Care Med (2017) 43:304–377

Diagnosis

- Blood work
- CRP
- PCT
- Interleukin 6

- Fever
- Imaging
- ...

Intensive Care Med (2017) 43:304–377

Additional treatment measures in sepsis/septic shock

First circulatory goal: mean arterial pressure > 65 mm Hg

- Volume therapy 30 mL/kg within the first 3 hours
- Balanced crystalloid fluid
- No HES

Circulatory goal not reached

- Norepinephrine
- Vasopressin up to 2 IU/h (0.03 IU/min)

Second circulatory goal: sufficient cardiac output

- Dobutamine/(epinephrine)

Tarragona concept

Tarragona strategy (modified according to Sandiumenge et al. [125])		
Key statement		**Explanation**
1.	"Look at your patient"	Site of infection? → determine focus/causative pathogen
		Preexisting conditions?
		Immune status?
		Risk of MRB (prior antibiotic treatment; frequent hospitalization; known MRB colonization; travels to regions endemic for MRB)?
2.	"Listen to your hospital"	Surveillance: knowledge of local pathogens/phenotypes of resistance, ABS measures
3.	"Hit hard and early"	Administration of high-dosage broad band antibiotic (within 1 h), possibly combination therapy
4.	"Get to the point"	Suspected site of infection → PK/PD profile and antibiotic tissue penetration
5.	"Focus"	Reevaluate therapy in regular intervals
		Deescalate, if possible
		Escalate if clinically and/or microbiologically necessary

The final question:

When should I taper/cease antibiotic treatment?

Guideline recommendations

10. We suggest that an antimicrobial treatment duration of 7 to 10 days is adequate for most serious infections associated with sepsis and septic shock (weak recommendation, low quality of evidence).

Exceptions: endocarditis, osteomyelitis …

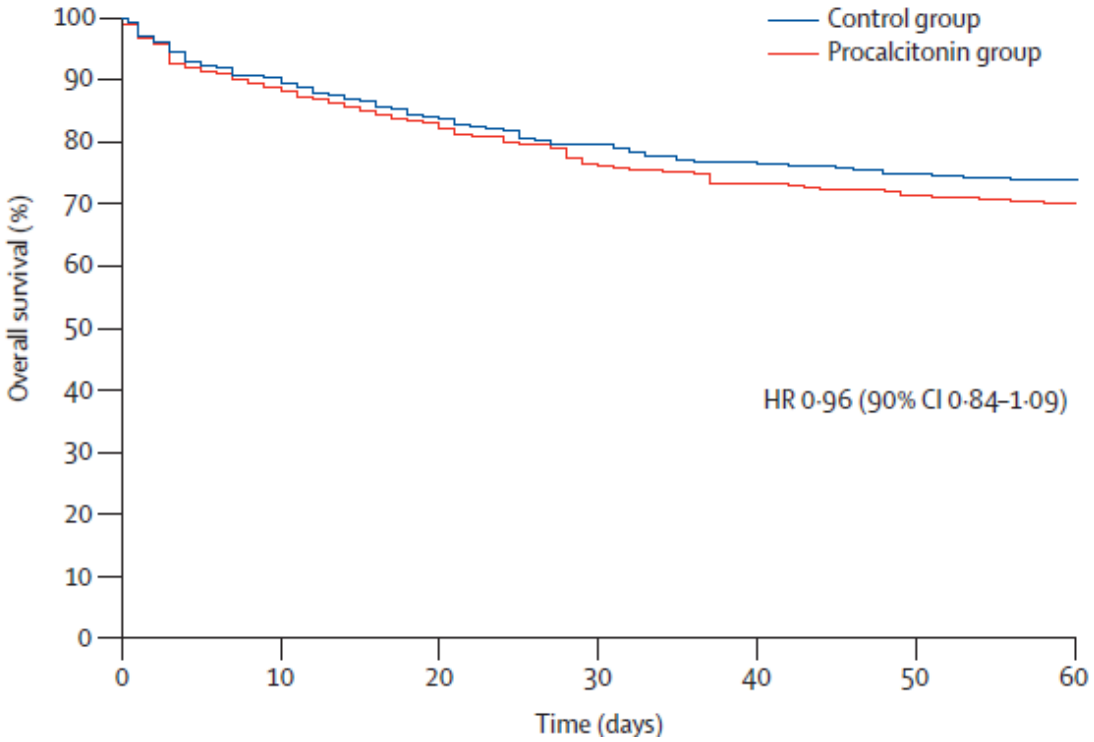
Intensive Care Med (2017) 43:304–377
DOI 10.1007/s00134-017-4683-6

PCT-guided antibiotic stewardship:

Cease antibiotics when PCT drops to < 20% of initial values.

Control group: 14.3 days

PCT group: 11.6 days



Bouadma L et al. - Lancet 2010; 375: 463–74

14. We suggest that measurement of procalcitonin levels can be used to support shortening the duration of antimicrobial therapy in sepsis patients (weak recommendation, low quality of evidence).

Intensive Care Med (2017) 43:304–377
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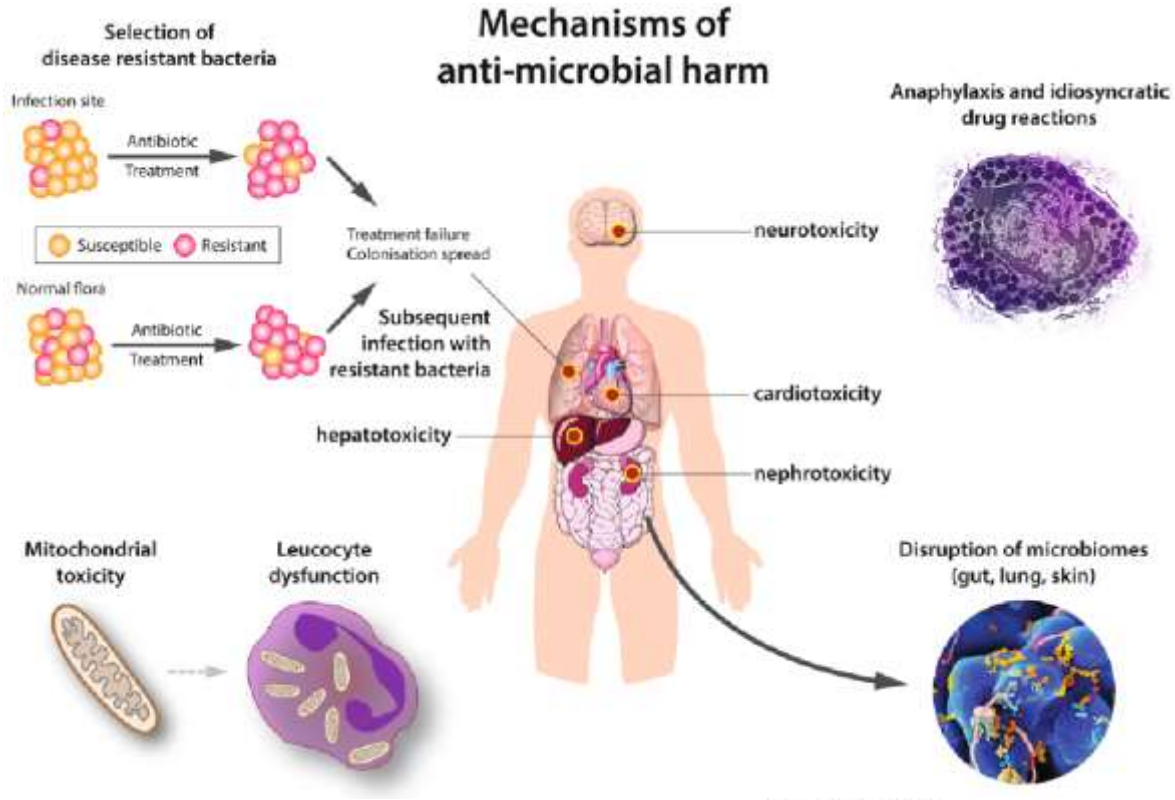
Reduce adverse effects associated with antibiotics



Intensive Care Med
https://doi.org/10.1007/s00134-020-05929-3

The New York Times

April 13, 2017

"A Boy's Life Is Lost to Sepsis. Thousands Are Saved in His Wake."

Click here to read Jim Dwyer's article