



Sepsis

Nosocomial infections

ABX in the ICU

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Sepsis – definition

- **The Third International Consensus Definitions for Sepsis and Septic Shock (2016)**



Sepsis - definition

- Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection
- Organ dysfunction can be identified as an acute change in total SOFA score ≥ 2 points consequent to the infection.



Sepsis - definition

- In lay terms, sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs
- Patients with suspected infection who are likely to have a prolonged ICU stay or to die in the hospital can be promptly identified at the bedside with qSOFA



ALTERED
MENTAL STATUS



FAST RESPIRATORY
RATE



LOW BLOOD
PRESSURE

- alteration in mental status
- systolic blood pressure ≤ 100 mm Hg
- respiratory rate ≥ 22 /min

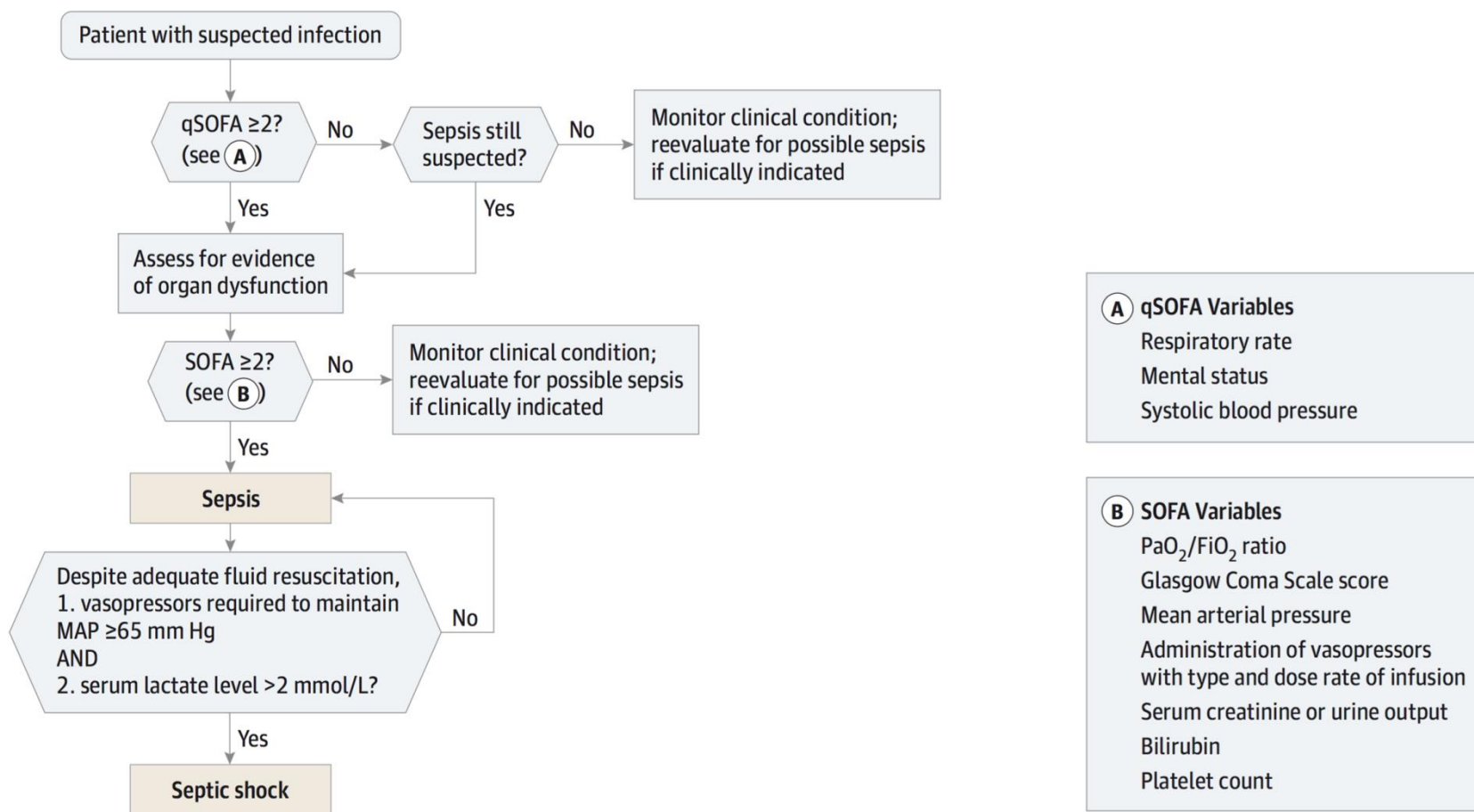


SOFA score

■ Sequential Organ Failure Assessment

SOFA score	0	1	2	3	4
Respiration PaO ₂ /FIO ₂ (mm Hg) SaO ₂ /FIO ₂	>400	<400 221–301	<300 142–220	<200 67–141	<100 <67
Coagulation Platelets 10 ³ /mm ³	>150	<150	<100	<50	<20
Liver Bilirubin (mg/dL)	<1.2	1.2–1.9	2.0–5.9	6.0–11.9	>12.0
Cardiovascular^b Hypotension	No hypotension	MAP <70	Dopamine ≤5 or dobutamine (any)	Dopamine >5 or norepinephrine ≤0.1	Dopamine >15 or norepinephrine >0.1
CNS Glasgow Coma Score	15	13–14	10–12	6–9	<6
Renal Creatinine (mg/dL) or urine output (mL/d)	<1.2	1.2–1.9	2.0–3.4	3.5–4.9 or <500	>5.0 or <200

Figure. Operationalization of Clinical Criteria Identifying Patients With Sepsis and Septic Shock



The baseline Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score should be assumed to be zero unless the patient is known to have preexisting (acute or chronic) organ dysfunction before the onset of infection. qSOFA indicates quick SOFA; MAP, mean arterial pressure.



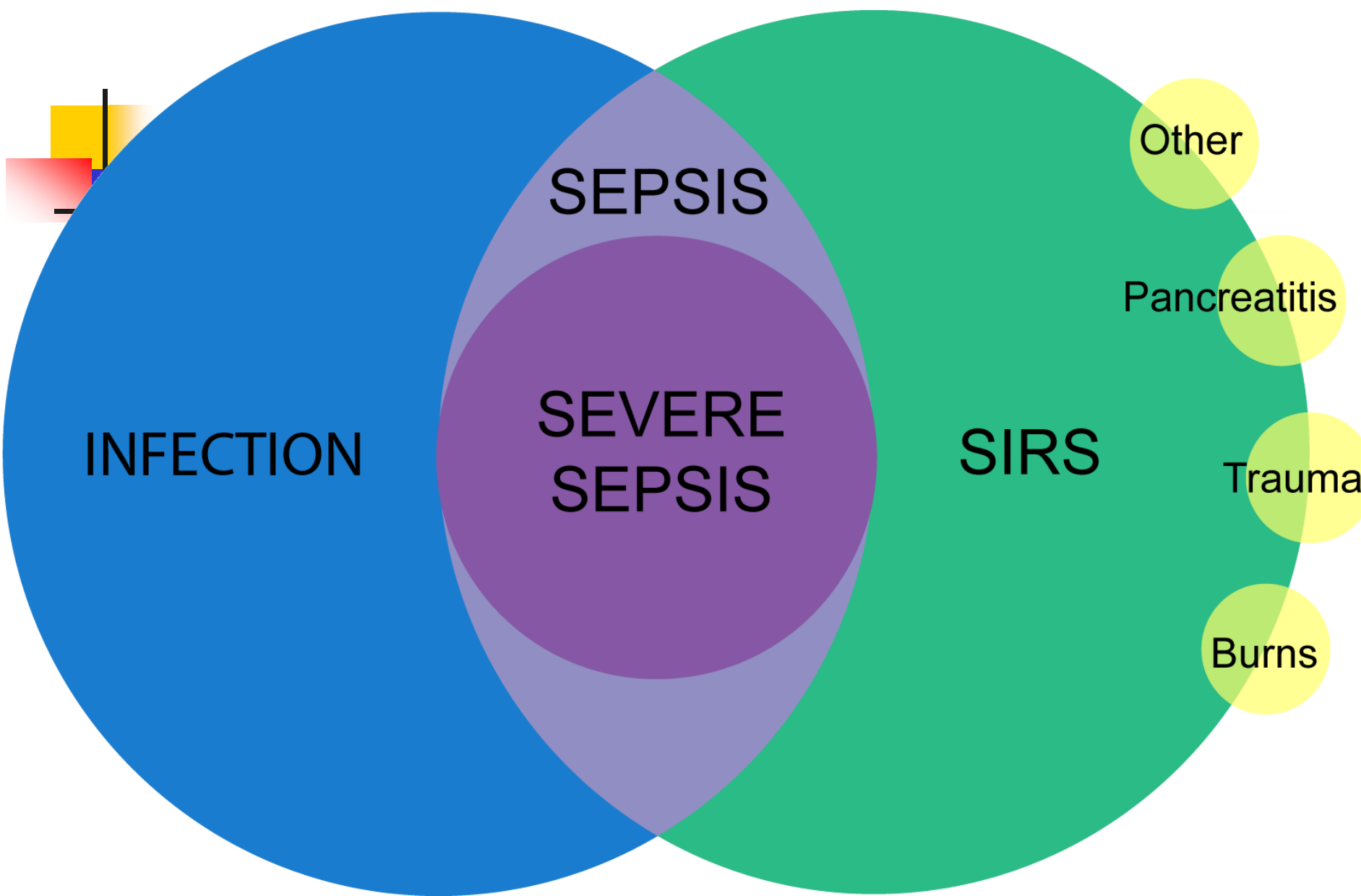
Septic shock - definition

- Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality
- Patients with septic shock can be identified with a clinical construct of sepsis with
 - persisting hypotension requiring **vasopressors** to maintain MAP ≥ 65 mm Hg
 - having a serum **lactate level > 2 mmol/L** (18 mg/dL) despite adequate volume resuscitation
- With these criteria, hospital mortality is in excess of 40%.



Sepsis – „OLD“ definition

- **Systemic inflammatory reaction** (Systemic Inflammatory Response Syndrome – **SIRS**) caused by presumed or confirmed infection
- **2 or more** of the following criteria :
 - Temperature $\geq 38^{\circ}\text{C}$ or $\leq 36^{\circ}\text{C}$
 - Tachycardia ≥ 90 bpm
 - Tachypnea ≥ 20 bpm or $\text{PaCO}_2 \leq 4,3$ kPa
 - WBC $\geq 12 \times 10^9/\text{l}$ or $\leq 4 \times 10^9/\text{l}$ or ≥ 10 % bands
- ALSO define SEVERE SEPSIS – this term should not be used today



INFECTION

SEPSIS

SEVERE
SEPSIS

SIRS

Other

Pancreatitis

Trauma

Burns

Continuity of the process of uncontrolled infection

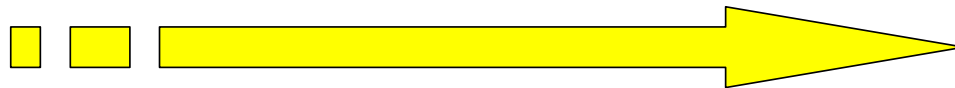


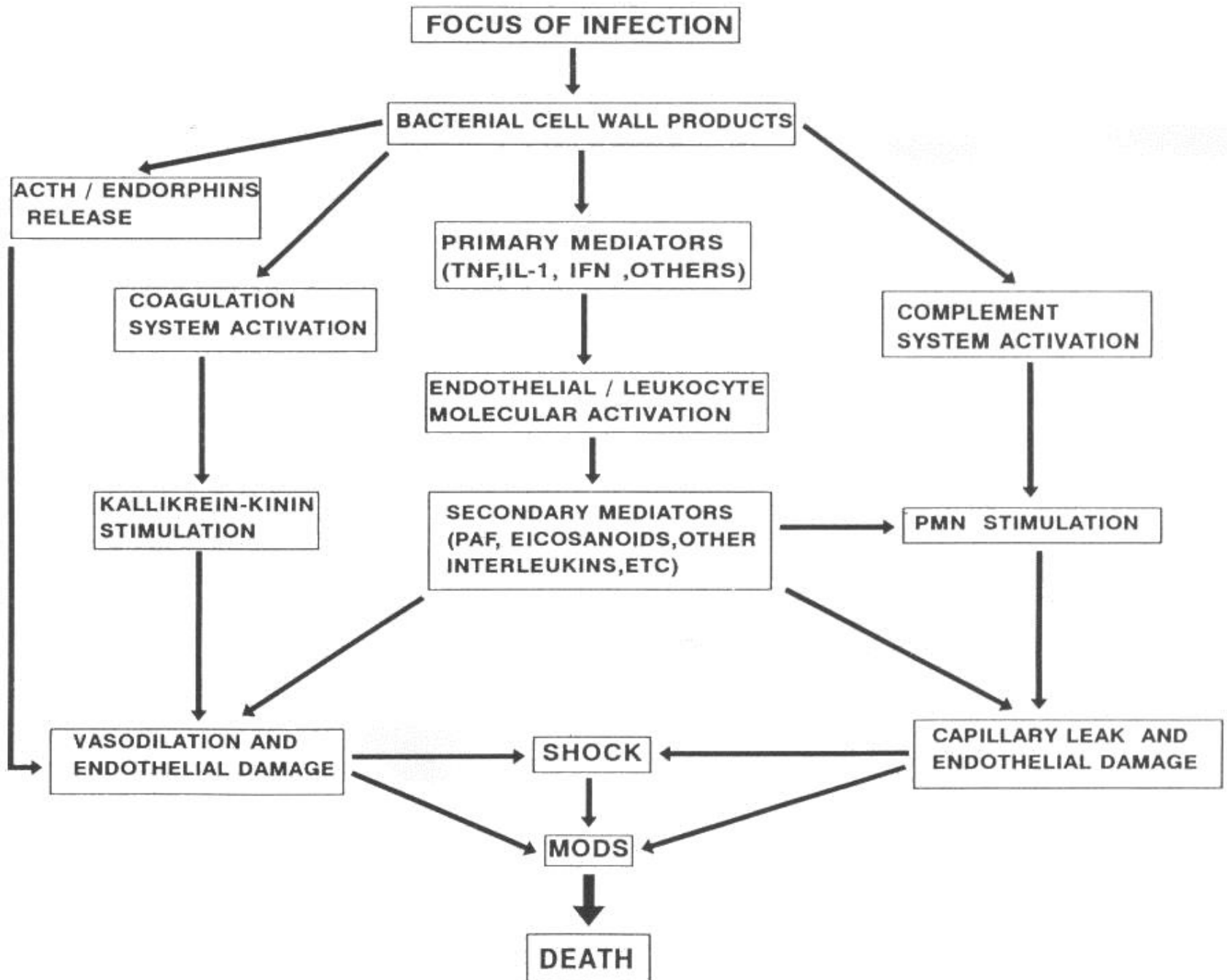
Infection/
Trauma

SIRS

Sepsis

Severe Sepsis







Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock, 2012

SURVIVING SEPSIS CAMPAIGN CARE BUNDLES

TO BE COMPLETED WITHIN 3 HOURS:

- 1) Measure lactate level
- 2) Obtain blood cultures prior to administration of antibiotics
- 3) Administer broad spectrum antibiotics
- 4) Administer 30 mL/kg crystalloid for hypotension or lactate ≥ 4 mmol/L

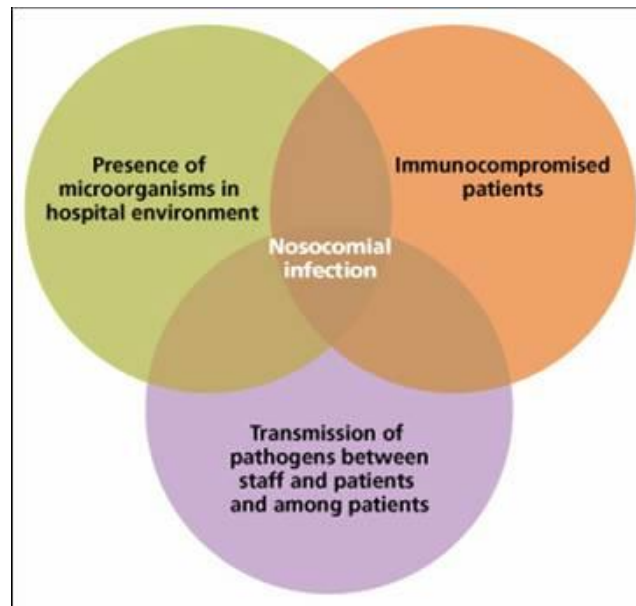
TO BE COMPLETED WITHIN 6 HOURS:

- 5) Apply vasopressors (for hypotension that does not respond to initial fluid resuscitation) to maintain a mean arterial pressure (MAP) ≥ 65 mm Hg
- 6) In the event of persistent arterial hypotension despite volume resuscitation (septic shock) or initial lactate ≥ 4 mmol/L (36 mg/dL):
 - Measure central venous pressure (CVP)*
 - Measure central venous oxygen saturation (ScvO₂)*
- 7) Remeasure lactate if initial lactate was elevated*

*Targets for quantitative resuscitation included in the guidelines are CVP of ≥ 8 mm Hg, ScvO₂ of $\geq 70\%$, and normalization of lactate.

Nosocomial infection = Healthcare Associated Infection

- **Definition** – infection not present at the hospital admission and becoming clinically evident after ≥ 48 hours (in most cases)
- Bacterial, viral and fungal etiology



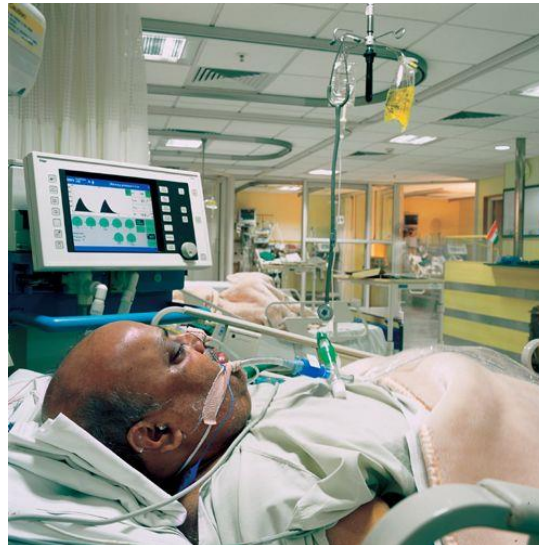


HAI in the ICU – risk factors

- Advanced age
- Severe underlying disease
- Neutropenia
- Immunosuppression
- Intravascular catheters
- Intubation and mechanical ventilation
- Prolonged ICU stay
- Prostheses
- Foreign bodies

Risk factors – cont.

- Bladder catheters and wound drains
- Nasogastric tubes
- Neurological disease with impaired consciousness
- Stress ulcer prophylaxis





HAI in critically ill patients

- Ventilator-associated pneumonia (VAP)
- Catheter-related infection
- Sinusitis and tracheobronchitis
- Wound infection
- Tertiary peritonitis and other intra-abdominal infection (infected pancreatic necrosis, abscesses...)
- *Clostridium difficile* colitis
- Urinary tract infection
- Acalculous cholecystitis
- Primary gram-negative bacteraemia
- Endocarditis, arthritis, meningitis...



Ventilator-associated pneumonia

- **Early** (2 - 4 days) and **late-onset** (\geq 5 days of ICU stay) **VAP**
- Diagnostic criteria :
- New or progressive infiltrate plus \geq 2 of following :
 - fever
 - leukocytosis or leukopenia
 - purulent sputum
- Invasive procedures – bronchoalveolar lavage (BAL) and protected specimen brush (PSB)



Catheter-related *bloodstream* infections (CRBSI)

- **Central venous** > peripheral > arterial lines
- For central lines : femoral > internal jugular > subclavian vein
- Clinical criteria :
- Fever
- Catheter dwell time exceeds 3 days
- Signs of local (exit-site) infection
- Positive blood cultures from the intravascular line and from blood taken peripherally at the same time



Prevention of infection - general

- General (environmental) preventive measures :
 - **hand hygiene**
 - gloves, gowns and *face masks*
 - isolation, cohorting
 - cleanliness
 - specific architecture and layout of the ICU environment



Prevention of VAP

- **Avoiding intubation**
- Oral hygiene
- Aspiration of subglottic secretions
- Semi-recumbent body position (45° angle)
- Cautious enteral feeding
- Stress ulcer prophylaxis in indicated patients
- *Selective decontamination of the digestive tract (SDD)*
 - short-term systemic cephalosporin plus long-term enteral polymyxin, tobramycin and amphotericin

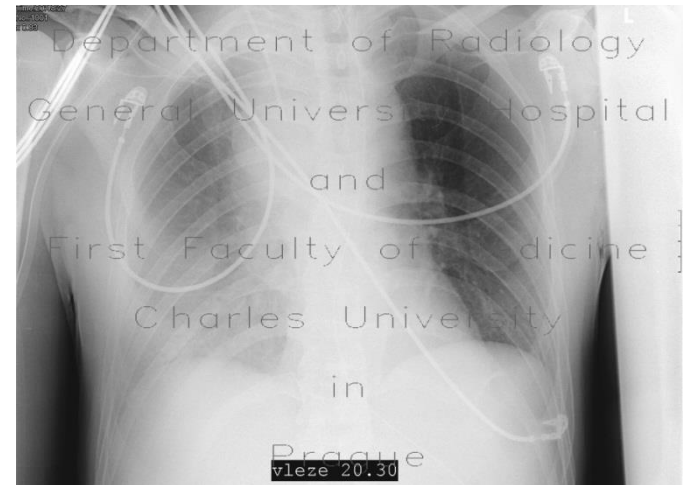
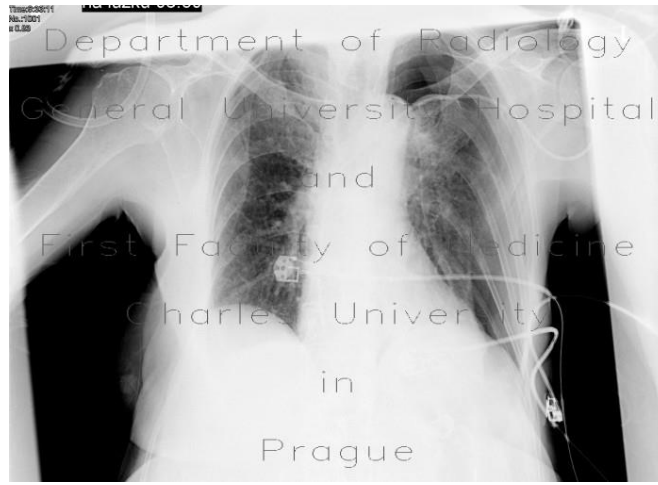
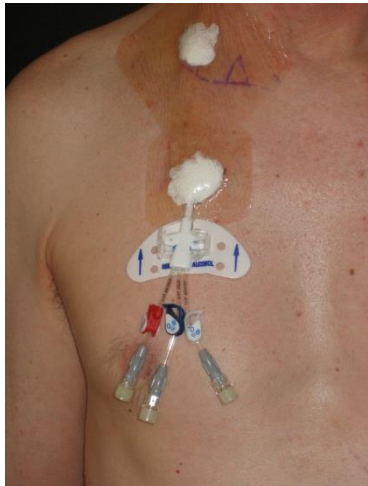


Prevention of CRBSI

- Avoiding femoral route
- Antibiotic / silver impregnated catheters
- Tunneling catheters
- **Aseptic technique**
 - handwashing plus alcohol disinfection
 - barrier precautions
 - use of proper skin antiseptic agent (chlorhexidine)
 - nurse empowered to stop unsafe practice
- Use of ultrasound

Prevention of CRBSI – cont.

- Post-insertion care
- Avoiding parenteral nutrition
- **Removal of CVC** whenever indicated





What to consider prior to administration of antibiotics ?

- Underlying pharmacodynamics and pharmacokinetics
 - penetration of an antibiotic agent
 - bactericidal x bacteriostatic antimicrobials
 - time-dependent killing (β -lactams and glycopeptides)
 - concentration-dependent killing (aminoglycosides and fluoroquinolons)
 - post-antibiotic effect
- Local protocols for initial antibiotic regimen
- **Source control** of particular infections (abscess...)

Reassessing initial management



- Questions :
 - Is antibiotic treatment necessary at all ? (*day 2-3*)
 - Should I change the initial strategy ? (*whenever*)
 - Was the treatment successful (should I stop ATB) ?
- Length of antibiotic therapy : (*day 7-10*)
 - there is **no standard duration**
 - factors regarding the patient (immune status, organ dysfunction...)
 - properties of the pathogen (virulence, site of infection...)



Reduction in selection of MDR pathogens

- Limit unnecessary antibiotic administration
 - education, local **guidelines**
 - local guidelines
 - switch to narrow-spectrum antibiotic when culture results are available !
- Optimise antibiotic effectiveness
 - joint ICU rounds with **microbiologist**
 - combination of antibiotics for certain infections
 - antibiotic cycling / rotation
 - adequate duration of antimicrobial treatment



Rules regarding antibiotic use

- Empirical ATB therapy should be started **without delay in septic patients**
- MDR bacteria are not expected in absence of previous antibiotic use
- Only antibiotics not prescribed in the previous 2 weeks should be considered
- The antibiotic regimen should be targeted based on rapidly obtained direct tests and **modified according to microbiologic findings**
- Use a combination of antibiotics when appropriate
- Prolonging ATB therapy does not prevent recurrence

