Infektionen auf der PICU

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PICU, Medizinische Universität Wien


KINDERINTENSIVSTATION
ZUTRITT NUR NACH AUFFORDERUNG
BITTE LÄUTEN
KINDERKLINIK INTENSIVSTATION

- Infektionen,
  die zu einer PICU-Aufnahme führen

- Spezielle Infektionen auf der PICU


Septic Shock

Sepsis

Sepsis is a major cause of morbidity and mortality in the paediatric population and can be very challenging to diagnose and manage

Practice Guideline > Pediatr Crit Care Med. 2020 Feb;21(2):e52-e106.

doi: 10.1097/PCC.0000000000002198.

Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children

Annually, There Are More Deaths In Children Due To Sepsis Than Cancer.

Each year, in the US, more than **75,000** children will develop severe sepsis and about **7,000** of these children will die. Consequently, if sepsis is suspected, action needs to be taken immediately because a child can die of sepsis **within hours.**

han
ıit
is.

Bakterielle Infektionen

Bakterielle Infektionen - Prädisponierende Faktoren

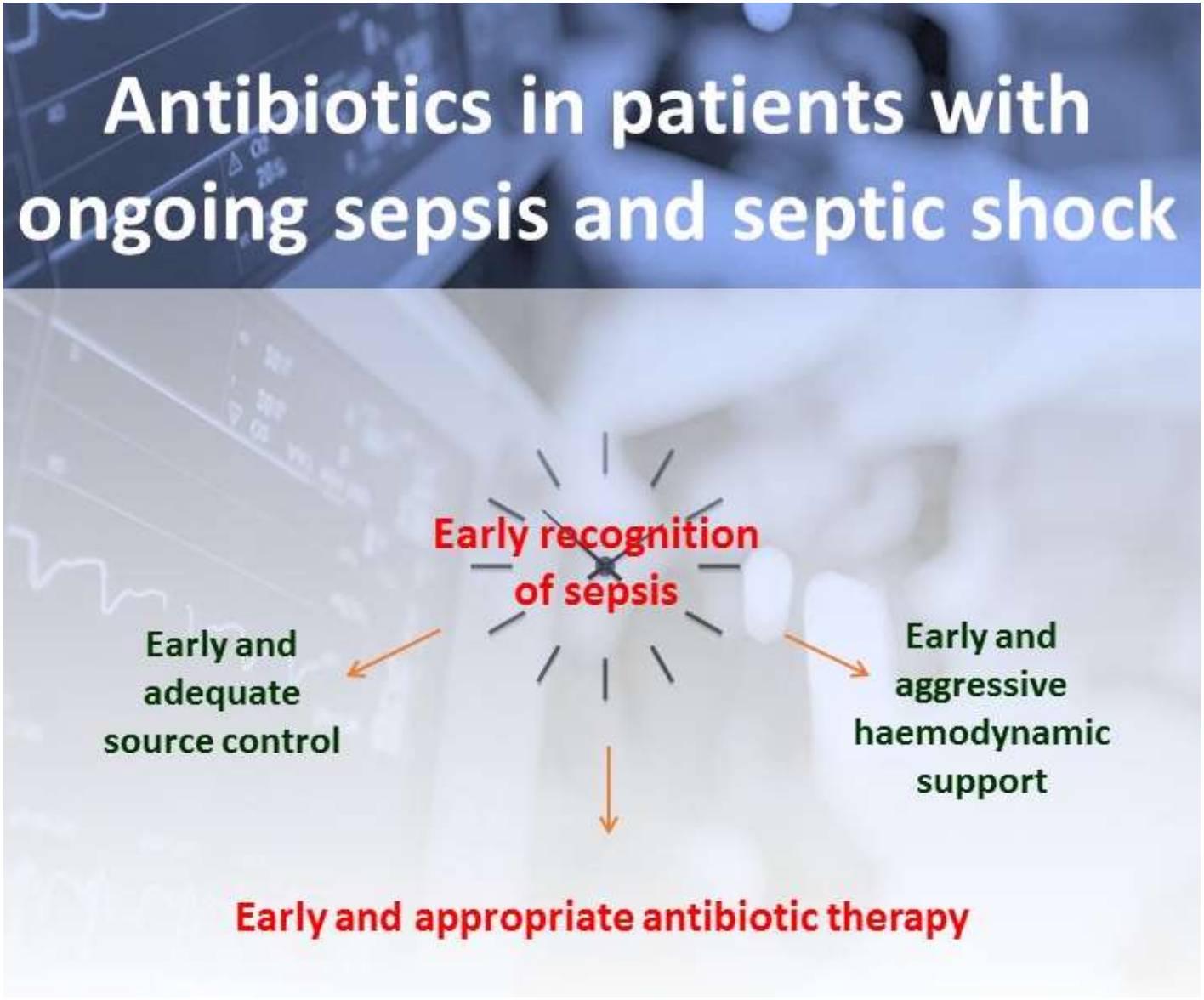
- Frühgeburt, geringes Geburtsgewicht
- Alter < 1 Jahr
- nicht geimpft

- Grunderkrankung
  - Immundefekt
  - Milz-Dysfunktion
  - angeborener Herzfehler
  - primäre Organdysfunktion (z.B. renal, hepatisch, pulmonal)
  - intravsculärer Fremdkörper

SEPSIS ist ein **KLINISCHER NOTFALL**

frühzeitiges Erkennen und **frühzeitige Therapie**

verbessern das Outcome

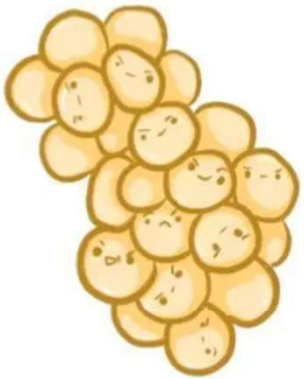

Antibiotics in patients with ongoing sepsis and septic shock
Early recognition of sepsis
Early and adequate source control
Early and aggressive haemodynamic support
Early and appropriate antibiotic therapy

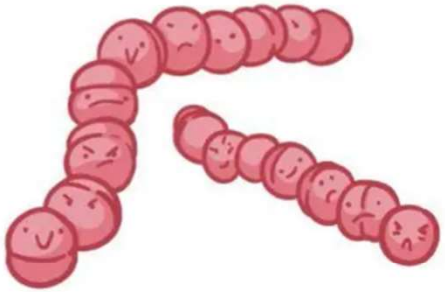

BD BACTEC™

- Drainage eines Abszesses oder eines lokalen Infektionsherdes
- Debridement von nekrotischem Gewebe
- Entfernung eines infizierten Fremdkörpers

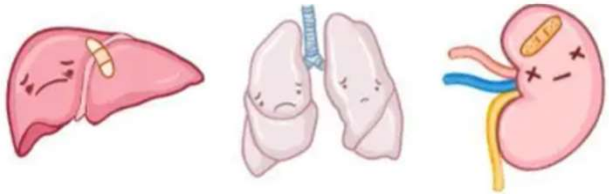
TOXIC SHOCK SYNDROME (TSS)

* ACUTE CONDITION caused by BACTERIAL INFECTION





* LIFE THREATENING
  ↳ INVOLVES MULTIPLE ORGAN SYSTEMS



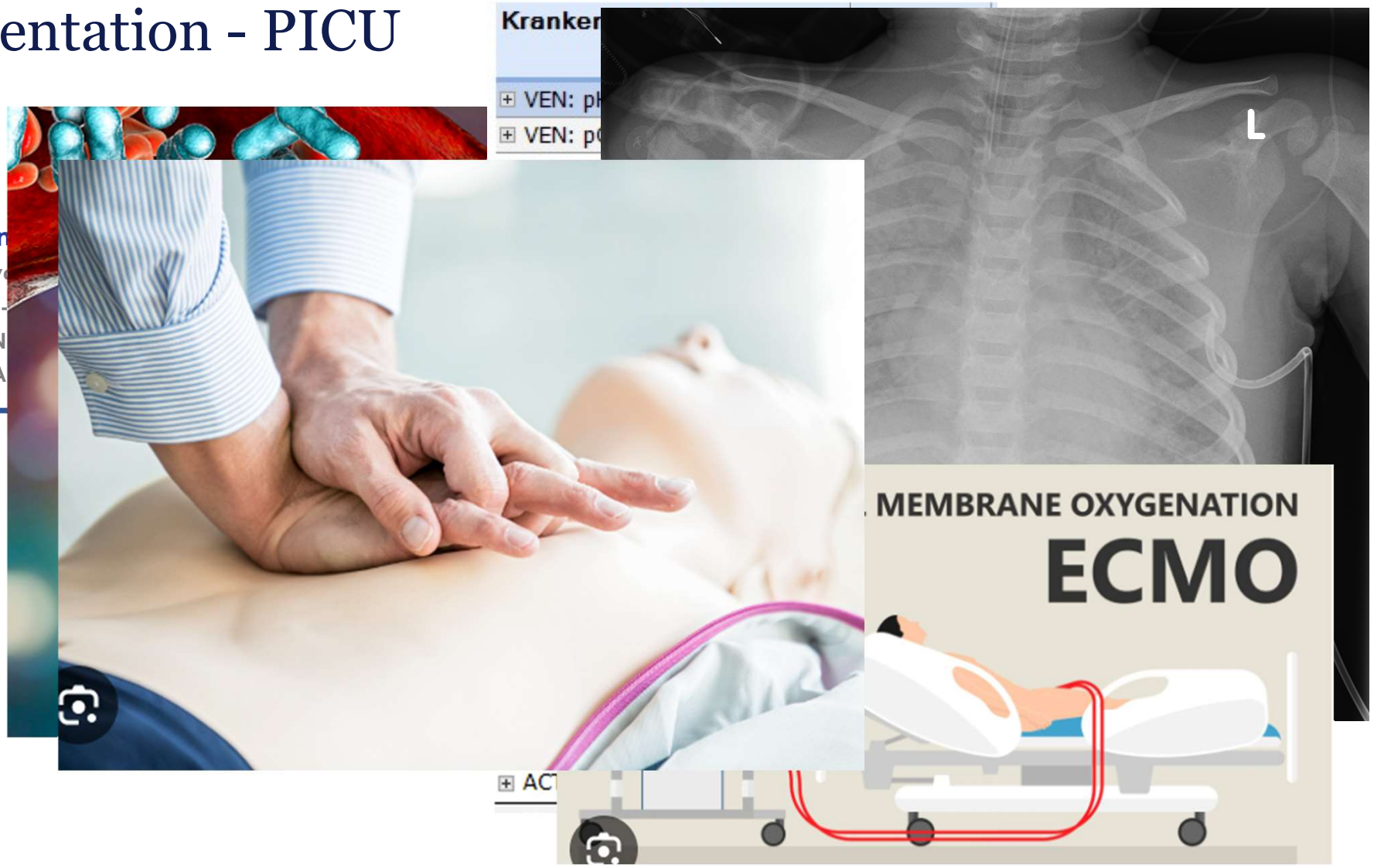
Fallbericht - PICU

- 02/2023 admission PICU
  - Rettung
  - respiratorische Insuffizienz
- Alter: 21 Monate, 16 kg, männlich
- Anamnese:
  - keine chronischen Erkrankungen
  - Fieber seit 6 Tagen, Husten, Scharlach vor 2 Wochen
  - klinische Verschlechterung zuhause → Eltern rufen Rettung

Case presentation - PICU

03:20 arrival

CPR, bag mask ventilation, no vascular access



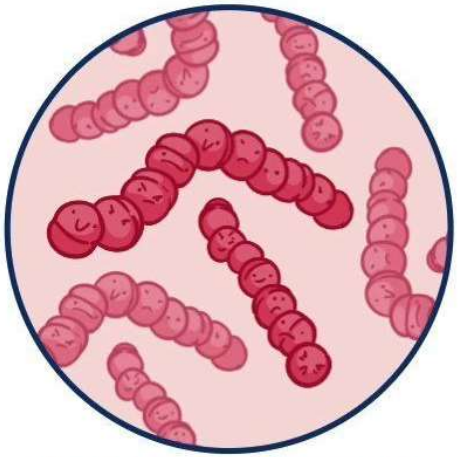
Frage ans Auditorium

Welche Bakterien können ein Toxic Shock Syndrome verursachen?

- A) Streptokokken der viridans Gruppe
- B) Streptokokkus pyogenes und Staphylokokkus aureus
- C) Neisseria meningitidis
- D) Streptokokkus pneumoniae
- E) Gruppe B Streptokokken

TOXIC SHOCK SYNDROME

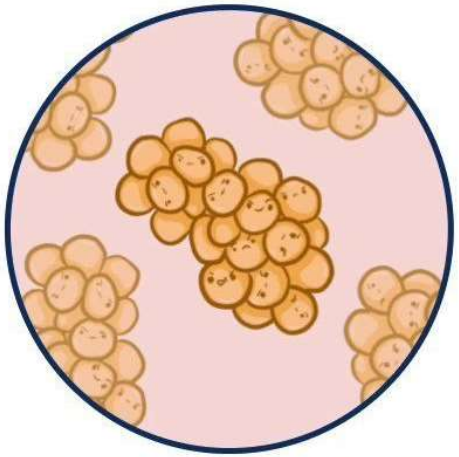
RARE FORM of SEPTIC SHOCK caused by BACTERIA



STREPTOCOCCUS PYOGENES

↓

STREPTOCOCCAL TSS



STAPHYLOCOCCUS AUREUS

↓

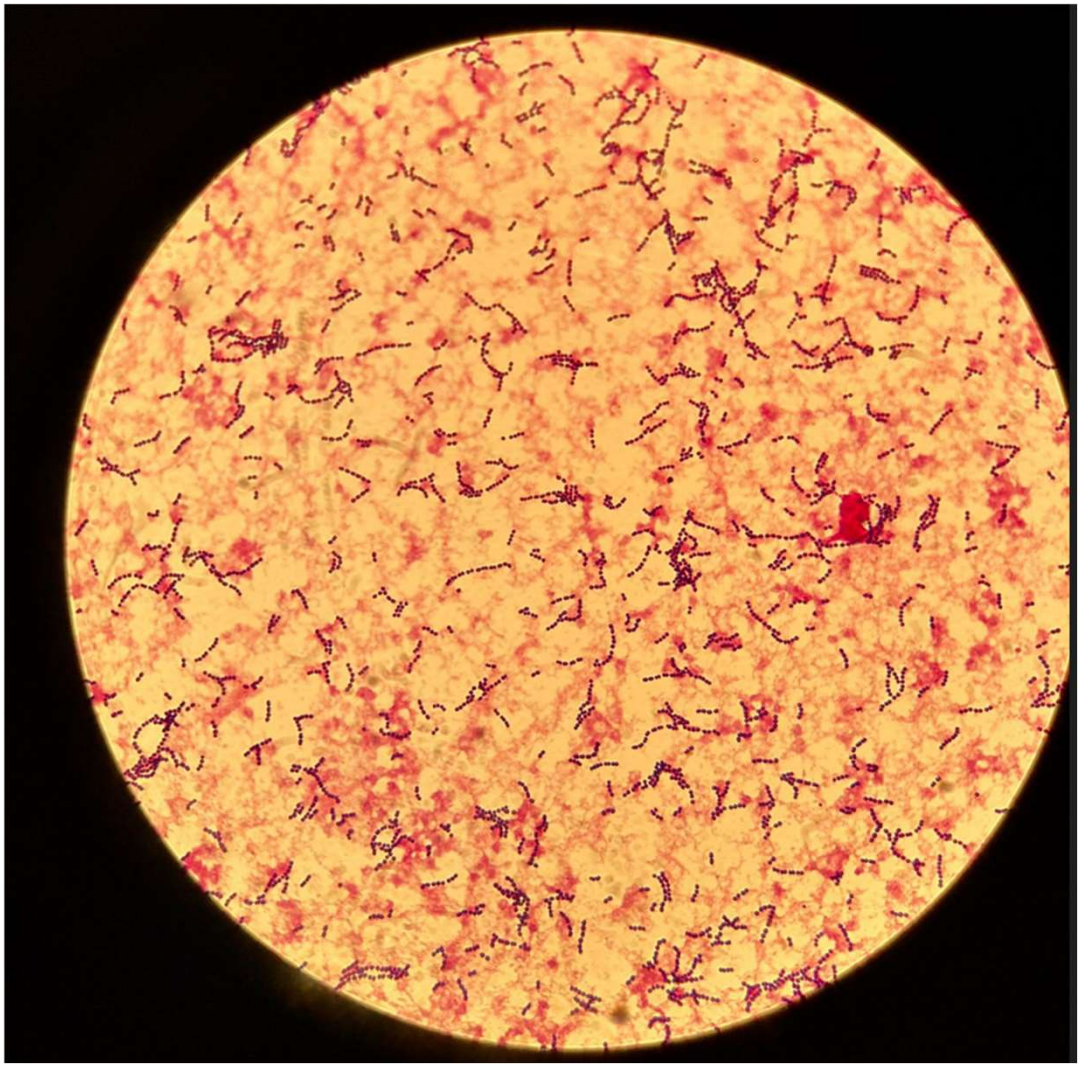
NON-STREPTOCOCCAL TSS

Fallbericht

Kulturergebnis #:

ß-haemolysierende Streptokokken Gruppe A

Antibiogramm	
Penicillin-G	+
Levofloxacin	+/-
Erythromycin	+
Clindamycin	+
Doxycyclin	+



Streptococcal toxic shock syndrome – case definition

1. Isolation of GAS
   - A. From a sterile site (definite case)
   - B. From a non-sterile site (probable case)
2. Clinical signs of severity
   - A. Hypotension AND
   - B. Two or more of the following clinical and laboratory abnormalities:
     - a. Fever (>38.5°C)
     - b. Rash (diffuse macular erythema with subsequent desquamation)
     - c. Renal impairment
     - d. Coagulopathy (platelets <100 or DIC)
     - e. Liver function abnormalities
     - f. ARDS
     - g. Extensive tissue necrosis (including necrotizing fasciitis)

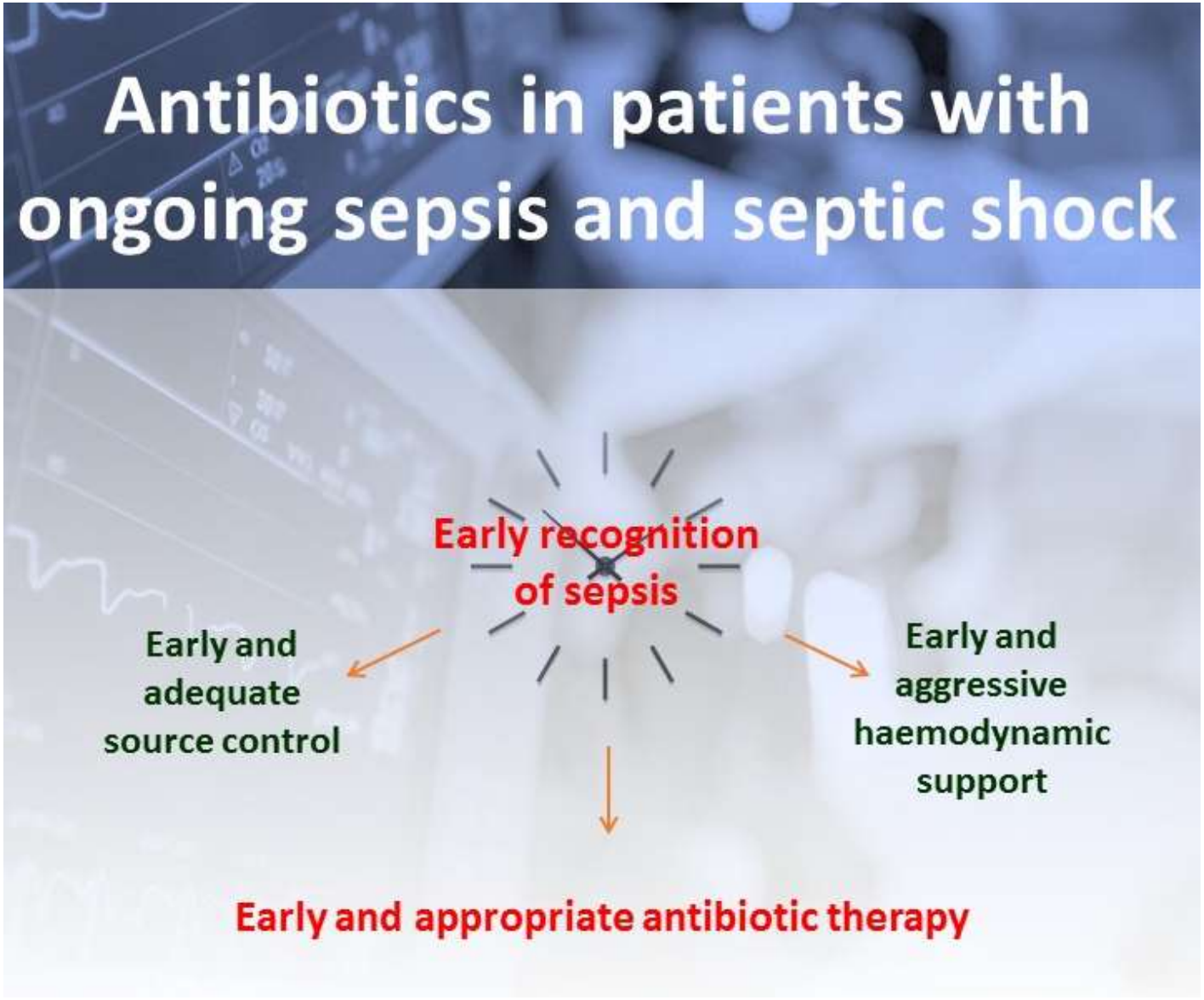
CDC Case Definition:
Toxic Shock Syndrome (Other than Streptococcal)
Meets all the following 5 clinical criteria:

1. Fever: > 38.9 C
2. Hypotension: sBP <90mmHg
3. Rash: diffuse macular erythroderma
4. Desquamation, 1–2 weeks after onset of rash
5. Involvement of 3 or more systems:

- GI: vomiting or diarrhea
- MSK: severe myalgias or CK twice upper limit of normal
- Liver: bilirubin, ALT, AST twice upper limit of normal
- Renal: BUN or Cr twice upper limit of normal, or sterile pyuria >5 WBC/hpf
- Platelets <100
- CNS: disorientation or altered LOC without focal neurologic signs


Toxic Shock
Syndrome

Toxic shock syndrome Management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Journal of Infection (2017) 74, S147—S152

ELSEVIER

BIAM
British Infection Association

www.elsevierhealth.com/journals/jinf

Toxic shock syndrome – the seven Rs of management and treatment

Amanda L. Wilkins [a], Andrew C. Steer [a,b,c,d], Pierre R. Smeesters [d,e,f], Nigel Curtis [a,b,c,*]

the seven Rs of managing toxic shock syndrome

1	Recognise	Early recognition - can be subtle
2	Resuscitation	Aggressive fluids, consider inotropes
3	Remove source	Surgical debridement
4	Rational antibiotics	Consider need for MRSA cover
5	Role of adjunctive Rx	Clindamycin, FFP, IVIG
6	Review progress	Continue to review
7	Reduce risk	Consider prophylaxis for contacts

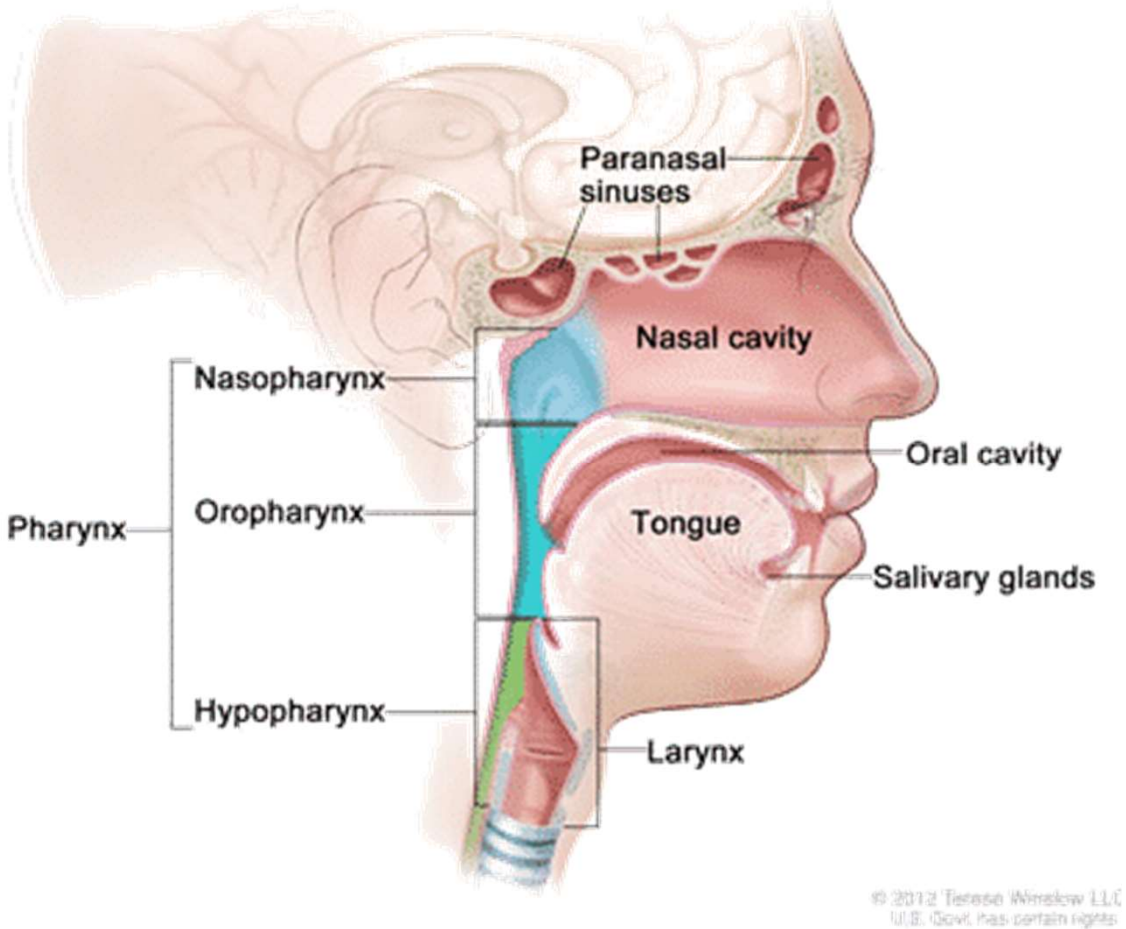
Therapie - Toxic shock syndrome

- Identifikation und Sensibilitätstestung der Bakterien

- empirische antibiotische Therapie
  - septischer Schock
- TSS
  - Antistaphylokokken ß-Laktam-Antibiotikum
  - Protein Synthesis-inhibierendes Antibiotikum (z.B. Clindamycin, Linezolid)
  - Vancomycin (MRSA-Verdacht)
- Anpassung der antibiotischen Therapie nach Antibiogramm

- IVIG

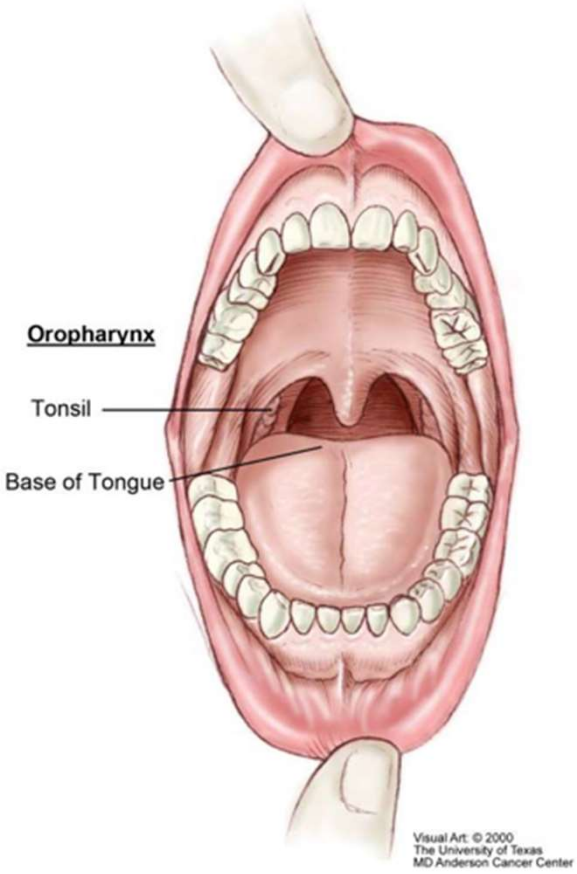
Oropharyngeale und Halsinfektionen

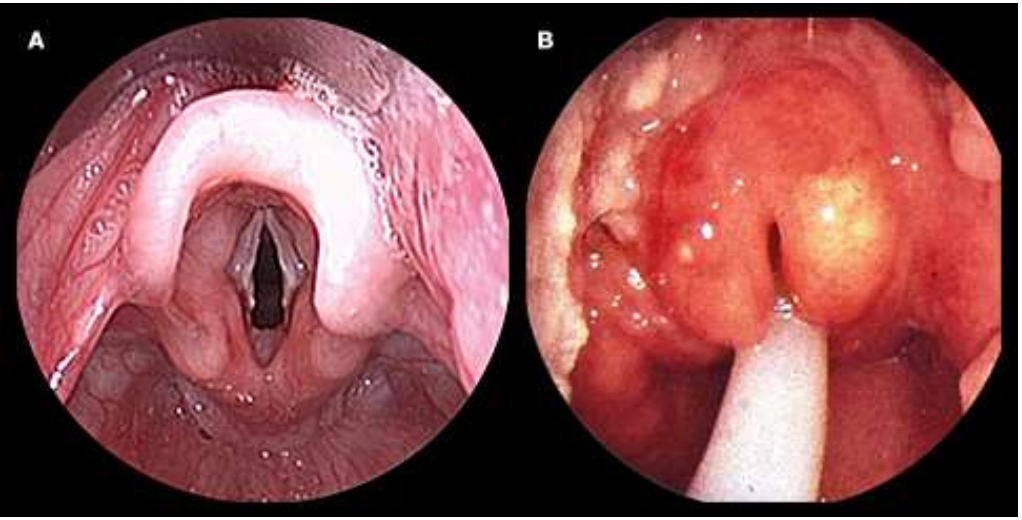


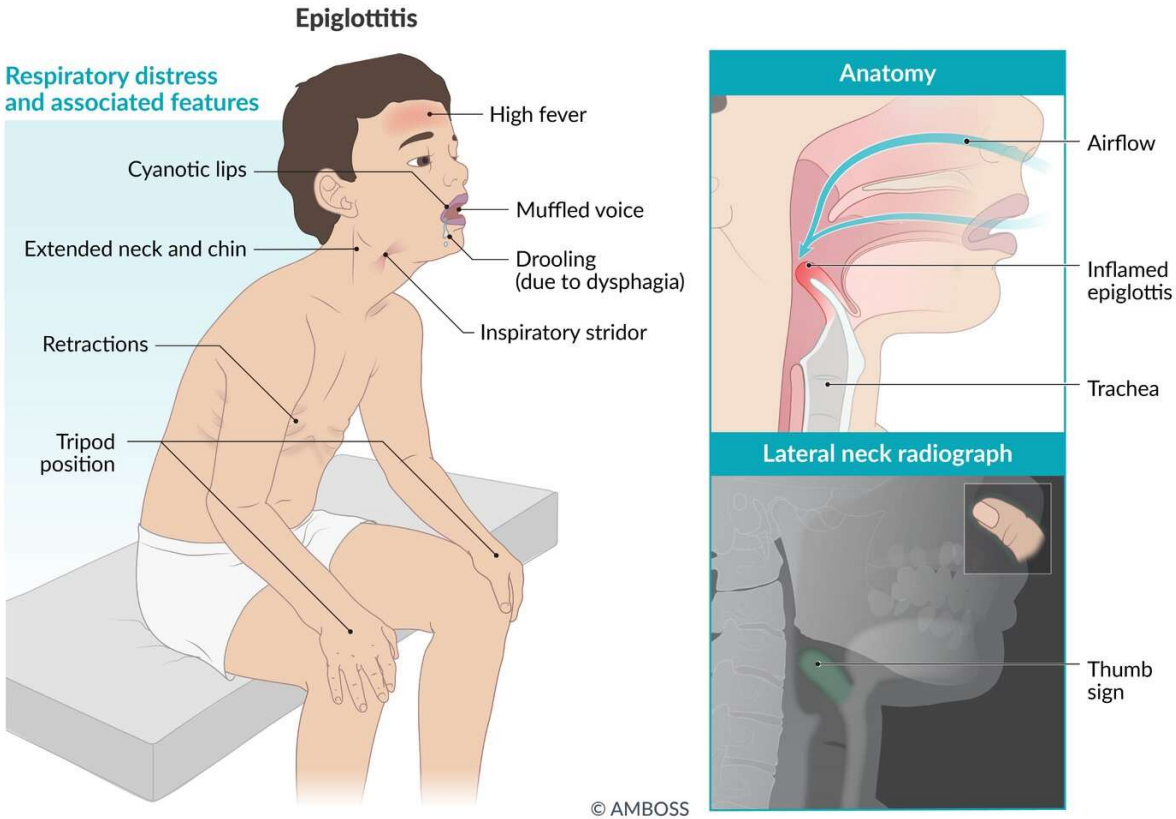
AIRWAY MANAGEMENT

Oropharyngeale und Halsinfektionen

- Atemwegsobstruktion
- Sepsis/Septischer Schock
- Beteiligung der mediastinalen Strukturen





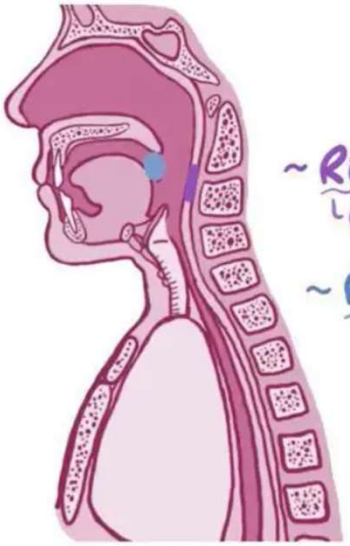


H. influenzae (ungeimpft)
Streptocccus pneumoniae

erfahrene:r Intubateur:in
IV Antibiotika

RETROPHARYNGEAL + PERITONSILLAR ABSCESS

└ COLLECTION of PUS



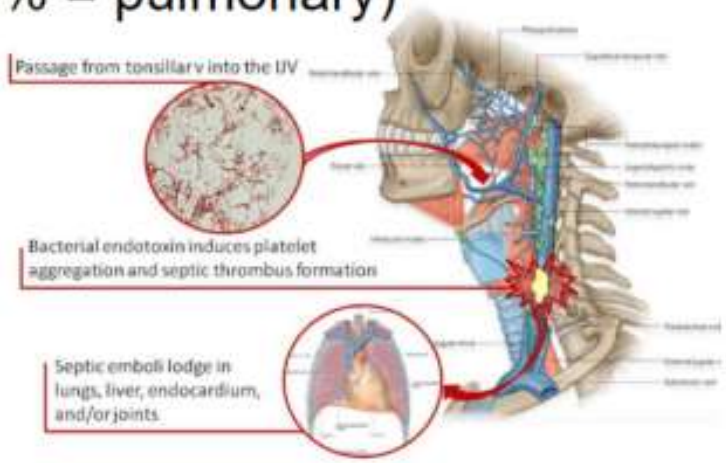
~ RETROPHARYNGEAL ABSCESS
└ BEHIND THE PHARYNX

~ PERITONSILLAR ABSCESS
└ AROUND THE TONSILS (PALATINE TONSILS)

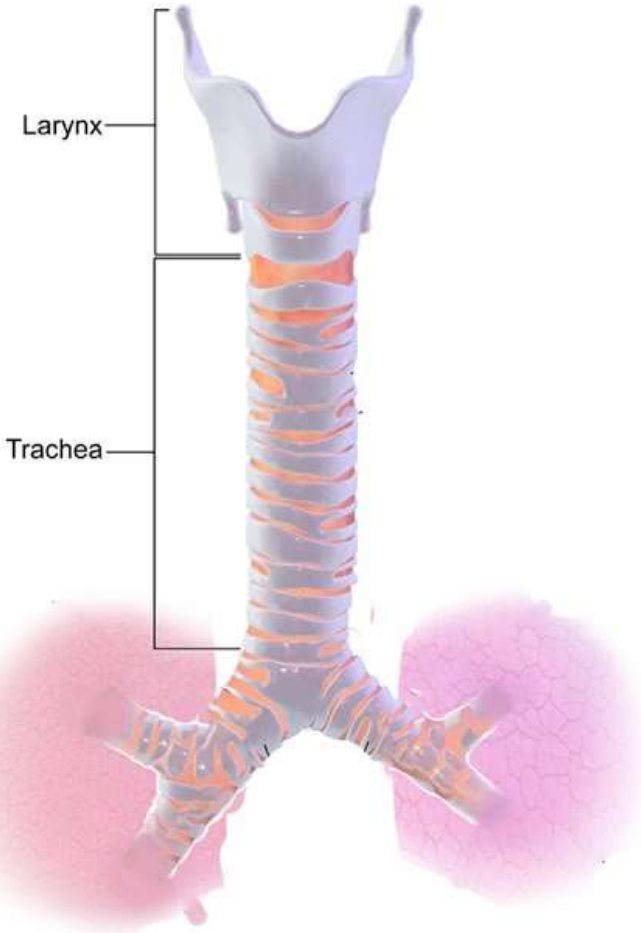
S. pyogenes, S. aureus, Anaerobier
IV-Antibitoika

Operative Drainage - HNO

1. **Lemierre's** = thrombophlebitis of IJ
   carotid sheath invasion
2. recent hx **pharyngitis**
3. **Septic emboli** (97% = pulmonary)
4. **Fusobacterium**



Bacterial Tracheitis



Normal

Bacterial Tracheitis

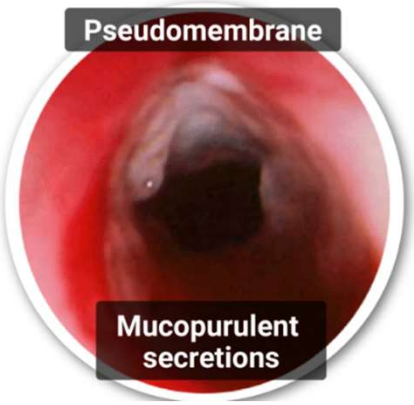
Looks similar to croup

But...toxic appearing

Airway emergency

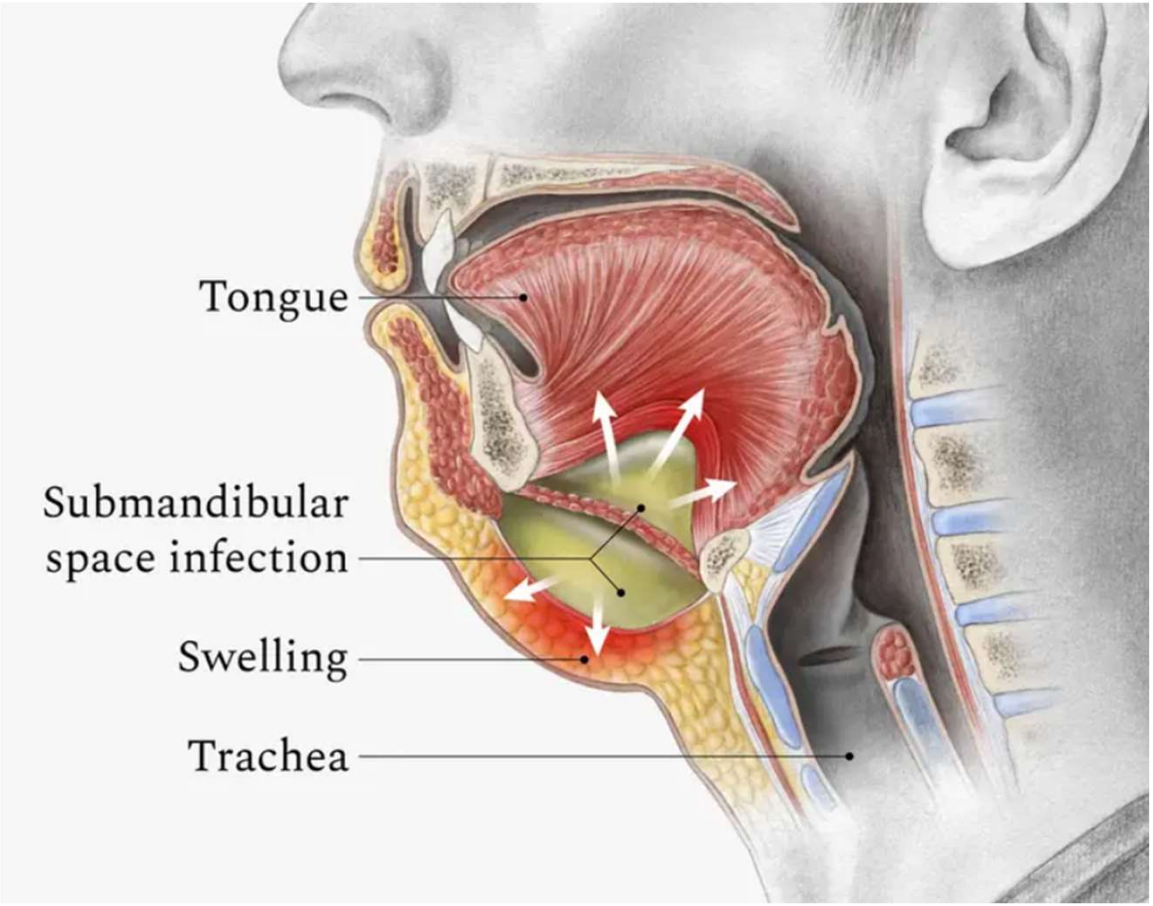
Clinical
- Usually younger children
- Fever
- Barking cough
- Stridor

Rapid progression



Management
- Aggressive airway management (in OR)
- IV antibiotics (broad spectrum)
- IV fluids
- Bronchoscopy

Ludwig‘s Angina



- polymikrobiell
orale Anaeorobier
S. aureus
Streptokokkus viridans

- IV-Antibiotika

- rasche operative Drainage

KLINISCHER NOTFALL

frühzeitiges Erkennen und **frühzeitige Therapie**

verbessern das Outcome

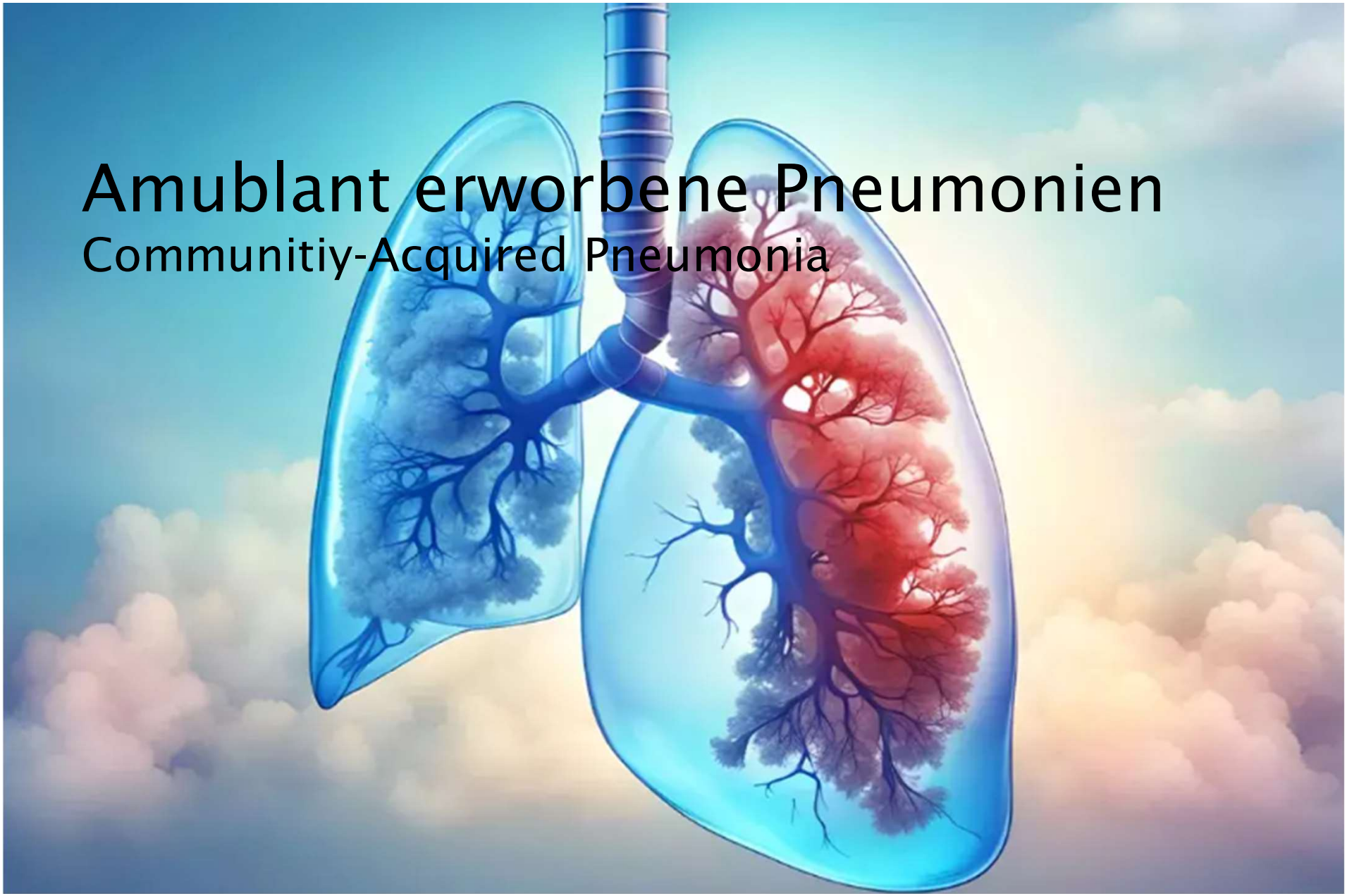
AIRWAY MANAGEMENT

Frage ans Auditorium

Welche Unterstützung kann zum Airway management bei oropharyngealen und Halsinfektionen notwendig sein?

- A) HNO
- B) Bronchoskop
- C) Anästhesie
- D) OP-Setting
- E) alle der genannten

Airway Management



Amublant erworbene Pneumonien

Communitiy-Acquired Pneumonia

Paediatric Respiratory Reviews 26 (2018) 41–48

Contents lists available at ScienceDirect

Paediatric Respiratory Reviews

journal homepage:

Review

Childhood community-acquired pneumonia: A review of etiology- and antimicrobial treatment studies

Gerdien A. Tramper-Stranders *

Department of Pediatrics, Franciscus Gasthuis & Vlietland, Rotterdam, The Netherlands
Department of Neonatology, Erasmus University Medical Center-Sophia Children's Hospital, Rotterdam, The Netherlands

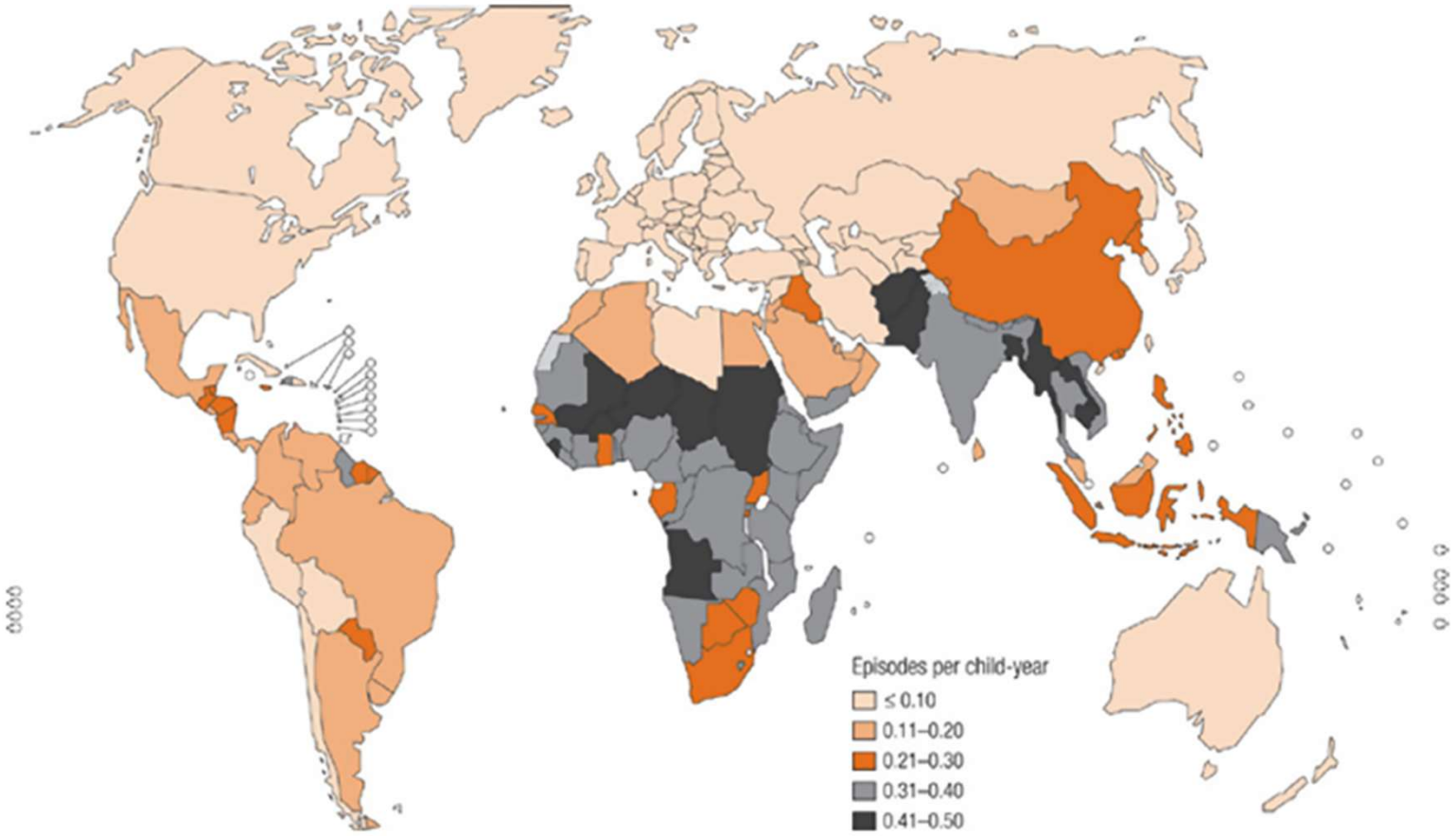


Fig. 1. Incidence of pneumonia in children <5 years. Rudan et al, WHO 2008 [4]. Reprinted with permission [4].

Ambulant erworbene Pneumonie

- Weltweit eine der Hauptursachen für Mortalität und Morbidität bei Kindern < 5 Jahren

- Viren
- Bakterien
  - Streptocccus pneumoniae
  - Staphylococcus aureus

Age Group	Common Pathogens	Empiric Antimicrobials
0–3 mo[a]	Group B streptococcus *Listeria monocytogenes* *Bordetella pertussis* Viruses (in particular, respiratory syncytial virus, influenza) *Chlamydia trachomatis* *Mycoplasma hominis* *Ureaplasma urealyticum* *Treponema pallidum*	Ampicillin and aminoglycoside or third-generation cephalosporin No antimicrobials for most viruses in this age group Macrolides for atypical pneumonias Penicillin for *T. pallidum*
>4 mo–5 y	Viruses: adenovirus, influenza, parainfluenza *Streptococcus pneumoniae* *Staphylococcus aureus*	Oseltamivir for influenza Ampicillin for susceptible *S. pneumoniae*; third-generation cephalosporin for presumed resistant *S. pneumoniae* or *Haemophilus influenza* Vancomycin or clindamycin for suspected *S. aureus*
> 5 years	*S. pneumoniae* *Mycoplasma pneumoniae* *Chlamydophila pneumoniae* Viruses	Ampicillin for susceptible *S. pneumoniae*; third-generation cephalosporin for presumed resistant *S. pneumoniae* Macrolide addition for presumed atypical pneumonia Vancomycin or clindamycin for suspected *S. aureus*

Kritierien für ICU-Aufnahme

- invasive **Beatmung**, Intubation
- noninvasive Beatmung

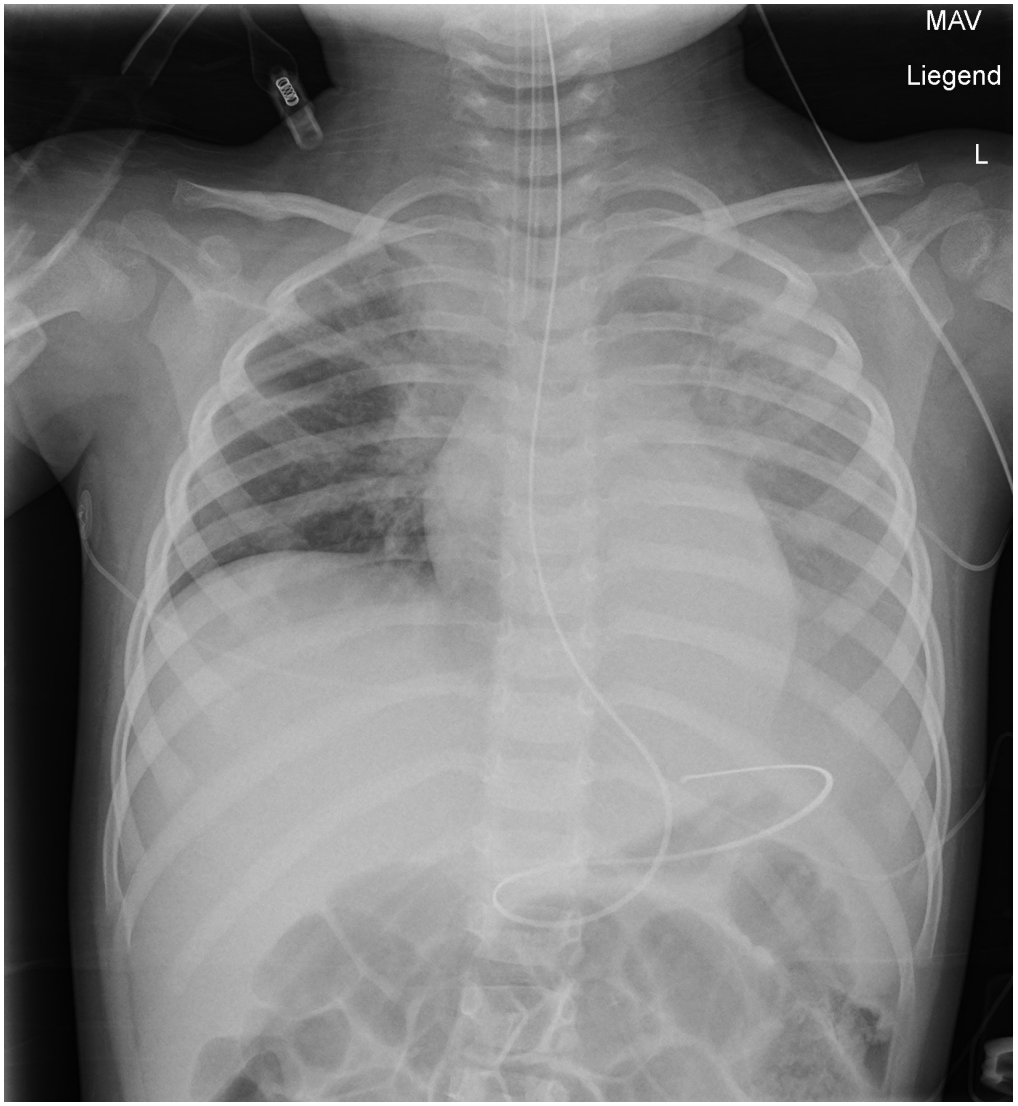
- **drohendes respiratorisches Versagen**
  - deutlich erhöhte Atemarbeit
  - wiederholte Apnoen

- **kardiovaskuläres Versagen**
  - anhaltende Tachykardie
  - Blutdrucksupport

- **veränderter mentaler Status**
  - Hyperkapnie, Hypoxie

Komplikationen

- Pleuraerguss/Empyem
- Nekrotisierende Pneumonie
- Lungenabszess
- Sepsis/septischer Schock
- ARDS

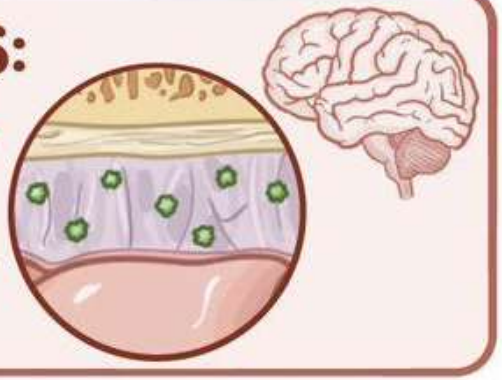


ZNS Infektionen

CENTRAL NERVOUS SYSTEM INFECTION

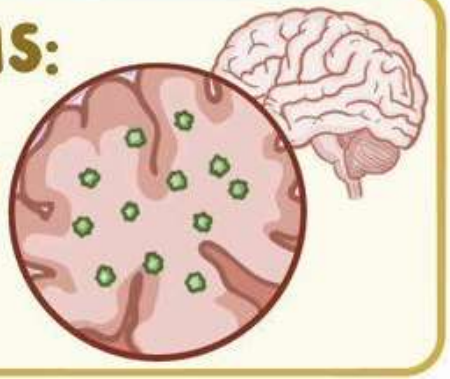
MENINGITIS:

* PATHOGENS INFECT MENINGEAL LAYERS



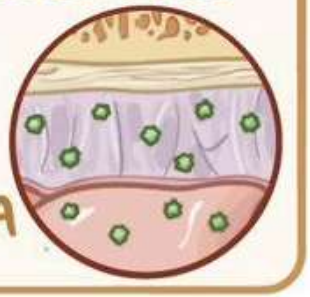
ENCEPHALITIS:

* PATHOGENS INFECT BRAIN PARENCHYMA



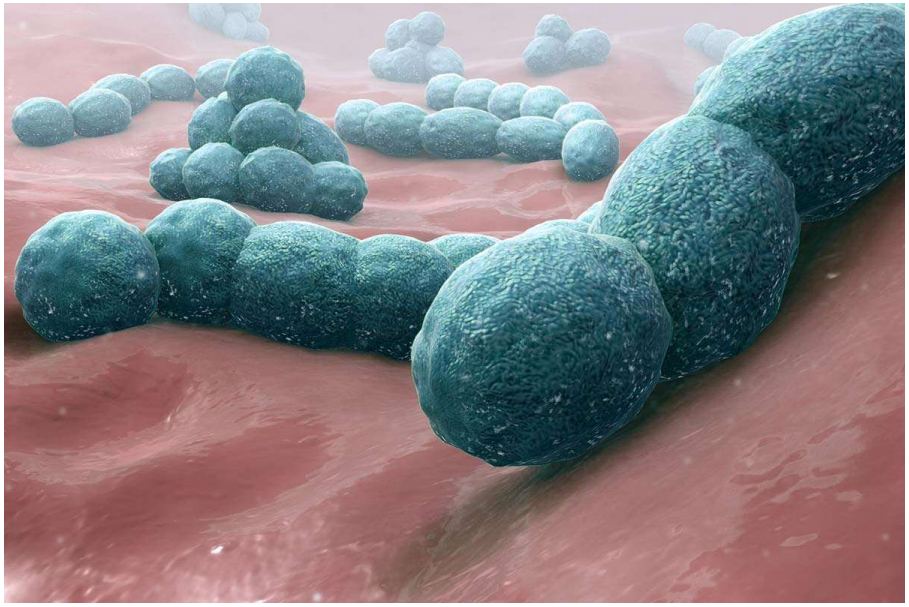
MENINGOENCEPHALITIS:

* INFECTION STARTS in MENINGES, SPREADS to BRAIN PARENCHYMA



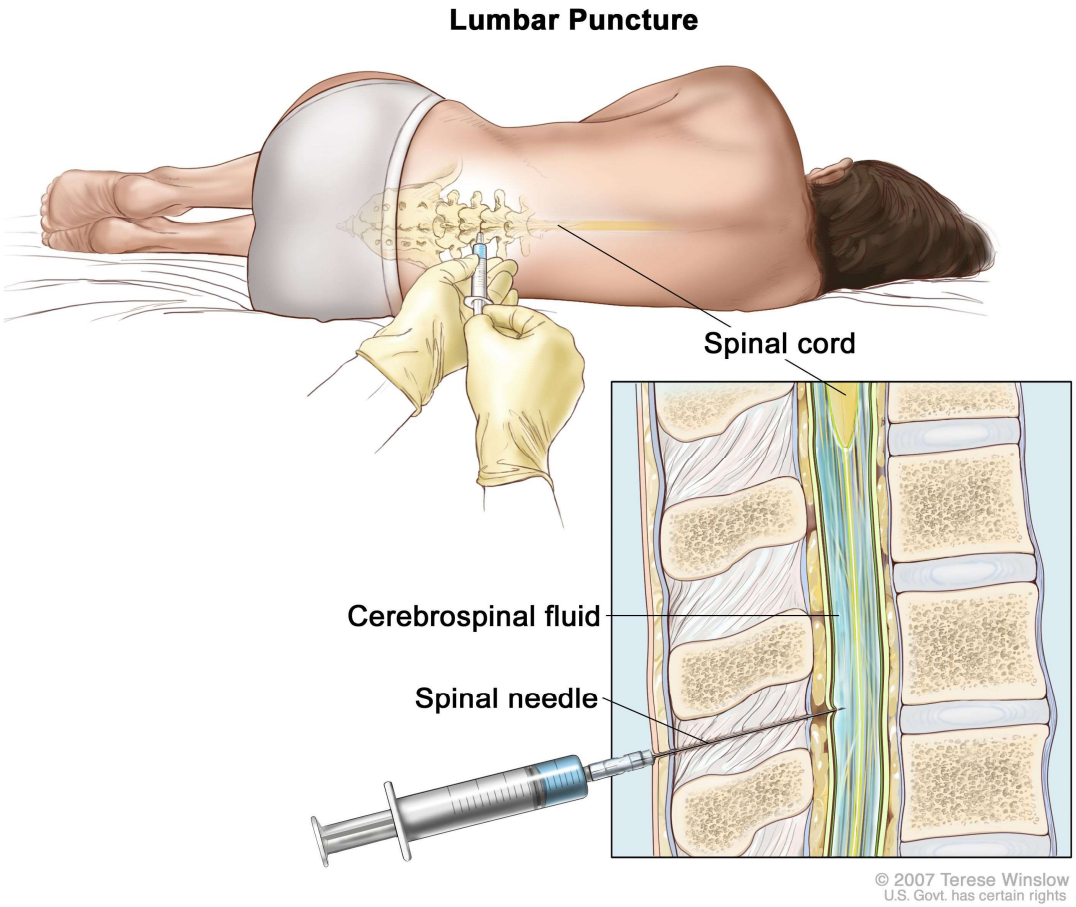
ABSCESS:

* PATHOGENS WALL THEMSELVES OFF in BRAIN




BD BACTEC™

Untersuchungen



- Liquorstatus
  - Zellzahl, Glucose, Protein
  - Sermun-Glucose-Differenz
- Bakt. Kultur, Gramfärbung
- PCR auf Viren (Enterovirus, HSV)
- „Meningitis Panel“
- Tuberculose-Kultur

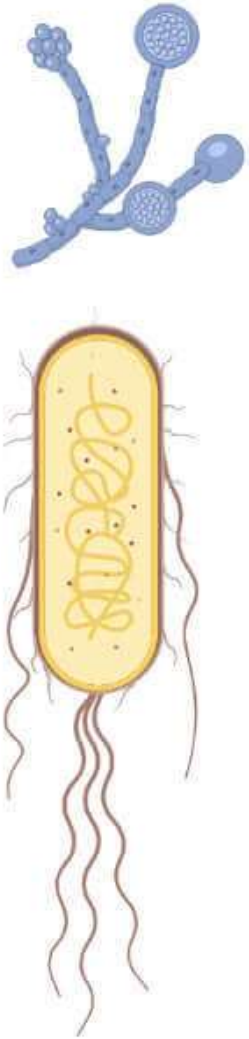
- SIADH/Diabetes insipidus
  - Monitoring Harnausscheidung, Bilanz, Elektrolyte

Table 15.4 Common Causes of Meningitis in the Intensive Care Unit

Age Group, mo	Microorganisms	Empiric Antibiotics
<2	Enterovirus Group B streptococcus *Listeria monocytogenes* Enteric Gram-negative rods Herpes simplex virus[a]	Ampicillin and aminoglycoside or cefotaxime Acyclovir[a]
>2	*Streptococcus pneumoniae* *Neisseria meningitidis*	Third- or fourth-generation cephalosporin and vancomycin

[a] Consider in babies ≤4 weeks, particularly in those presenting with seizures or vesicles.

Nosocomial Infections (Hospital Acquired Infections)



Frage ans Auditorium

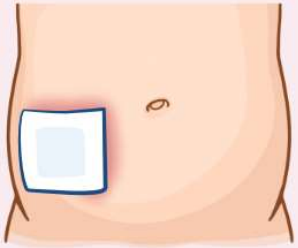
Was sind die Hauptursachen für nosokomiale Infektionen?

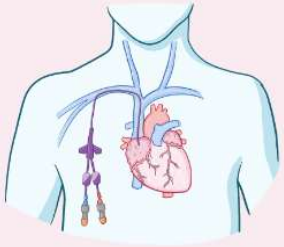
- A) Harnkatheter
- B) operative Eingriffe
- C) zentrale Gefäßkatheter
- D) invasive Beatmung
- E) alle der genannten

CAUSES

URINARY CATHETERS
↳ URINARY TRACT INFECTIONS

SURGICAL PROCEDURES
↳ SURGICAL SITE INFECTIONS





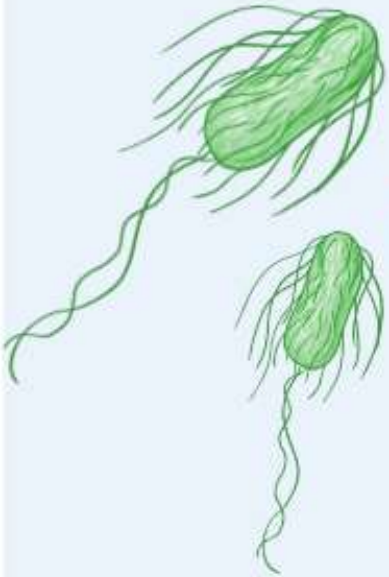
CENTRAL VENOUS CATHETERS
↳ BLOODSTREAM INFECTIONS

MECHANICAL VENTILATION
↳ PNEUMONIA

TYPES

MOST COMMON:

STAPHYLOCOCCUS AUREUS



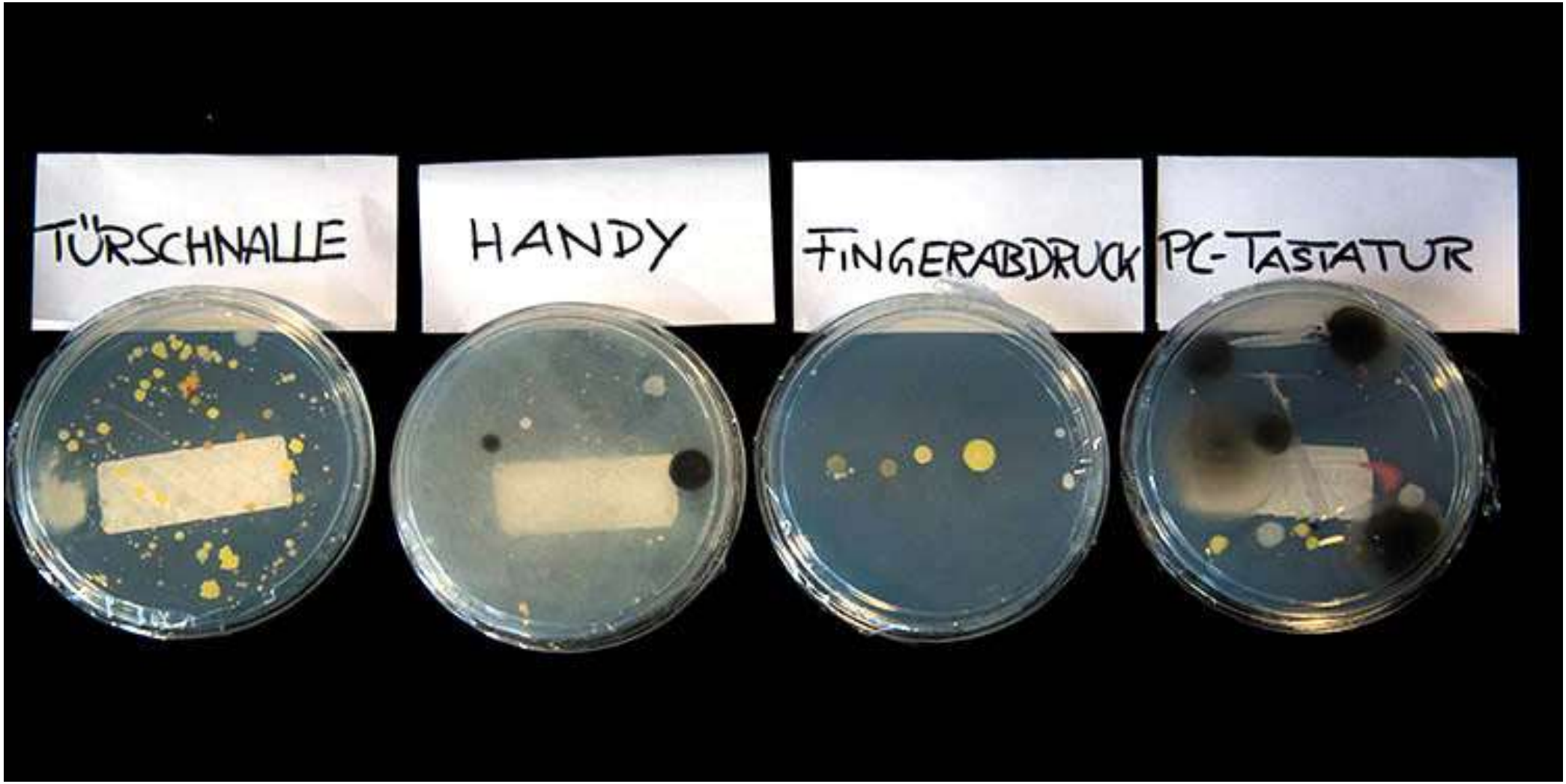
OTHER COMMON PATHOGENS:

ESCHERICHIA COLI

ENTEROCOCCI

CANDIDA


PREVENTION
IS BETTER
THAN
CURE


TÜRSCHNALLE
HANDY
FINGERABDRUCK
PC-TASTATUR

PREVENTION

FREQUENT HAND HYGIENE

PROPER PPE USE

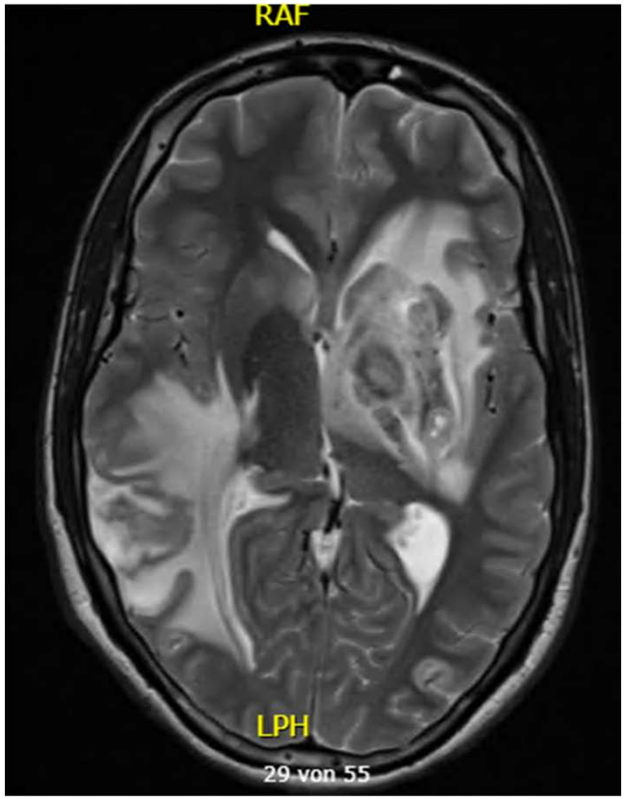
REMOVE INDWELLING DEVICES ASAP

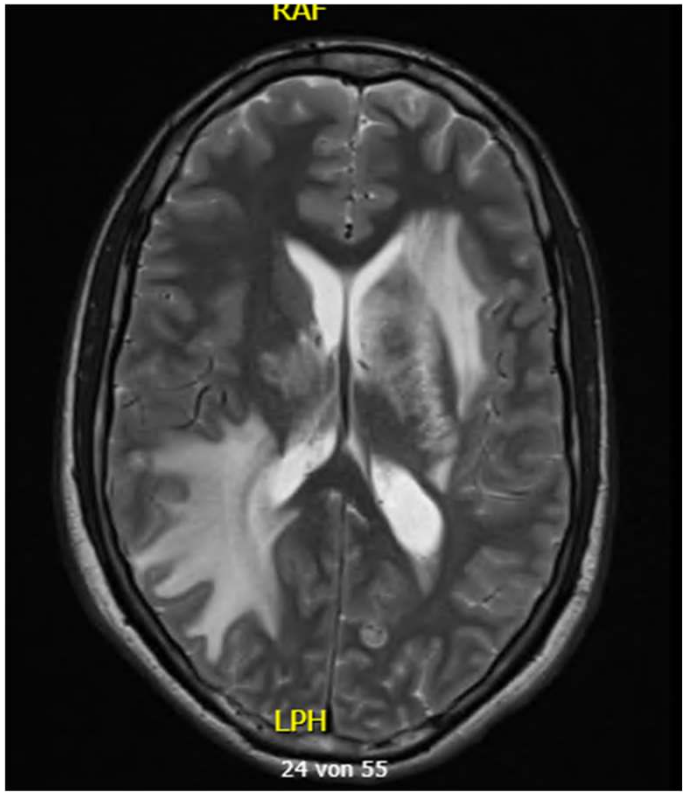
APPROPRIATE ANTIMICROBIAL USE

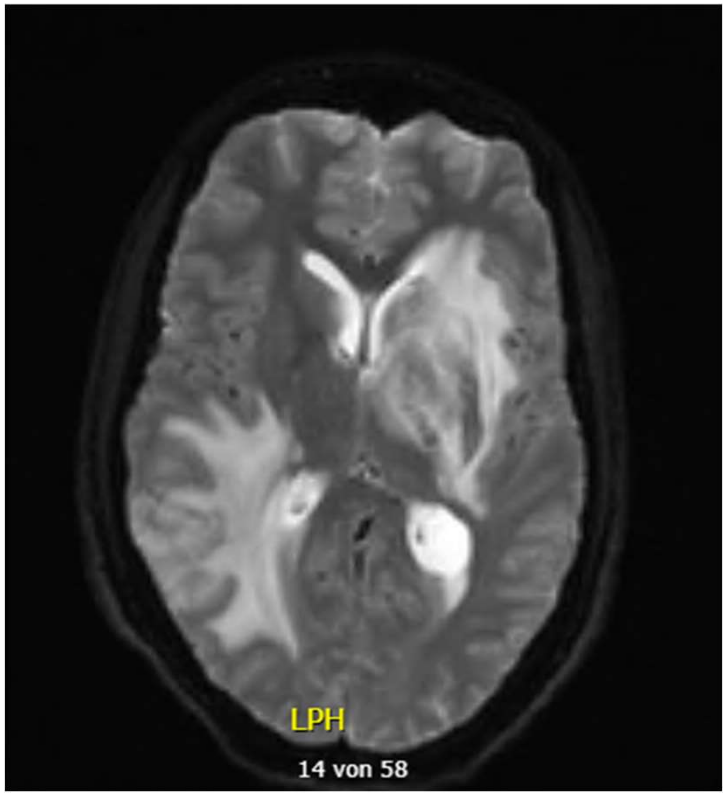
ROUTINE DISINFECTION

Fallpräsentation

- 17 Jahre
- seit 3 Wochen starke Kopfschmerzen und Erbrechen
- seit 2 Tagen deutlich schläfriger → Vorstellung







Zystische Raumforderung temporoparietal rechts und Stammganglienbereich li

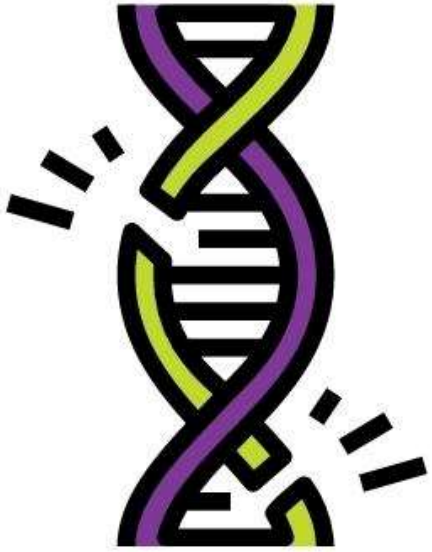
Fall

- verzögerte verbale Antwort, Meningealzieichen, positives Lasque-Zeichen
- plötzliche Somnolenz, hämodynamisch und respiratorisch instabil
- → ad cCT → diffuses Hirnödem mit Hirndruckzeichen
- → EVD zur Entlastung und Hirndruckmanagement

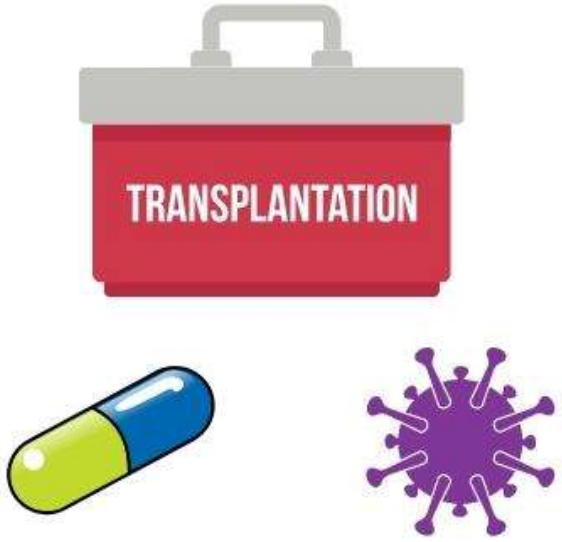
- **cerebrale Toxoplasmose bei HIV-Infektion/AIDS**


INFECTIOUS DISEASES IN THE
IMMUNOCOMPROMISED HOST

People with weakened immune systems are IMMUNOCOMPROMISED



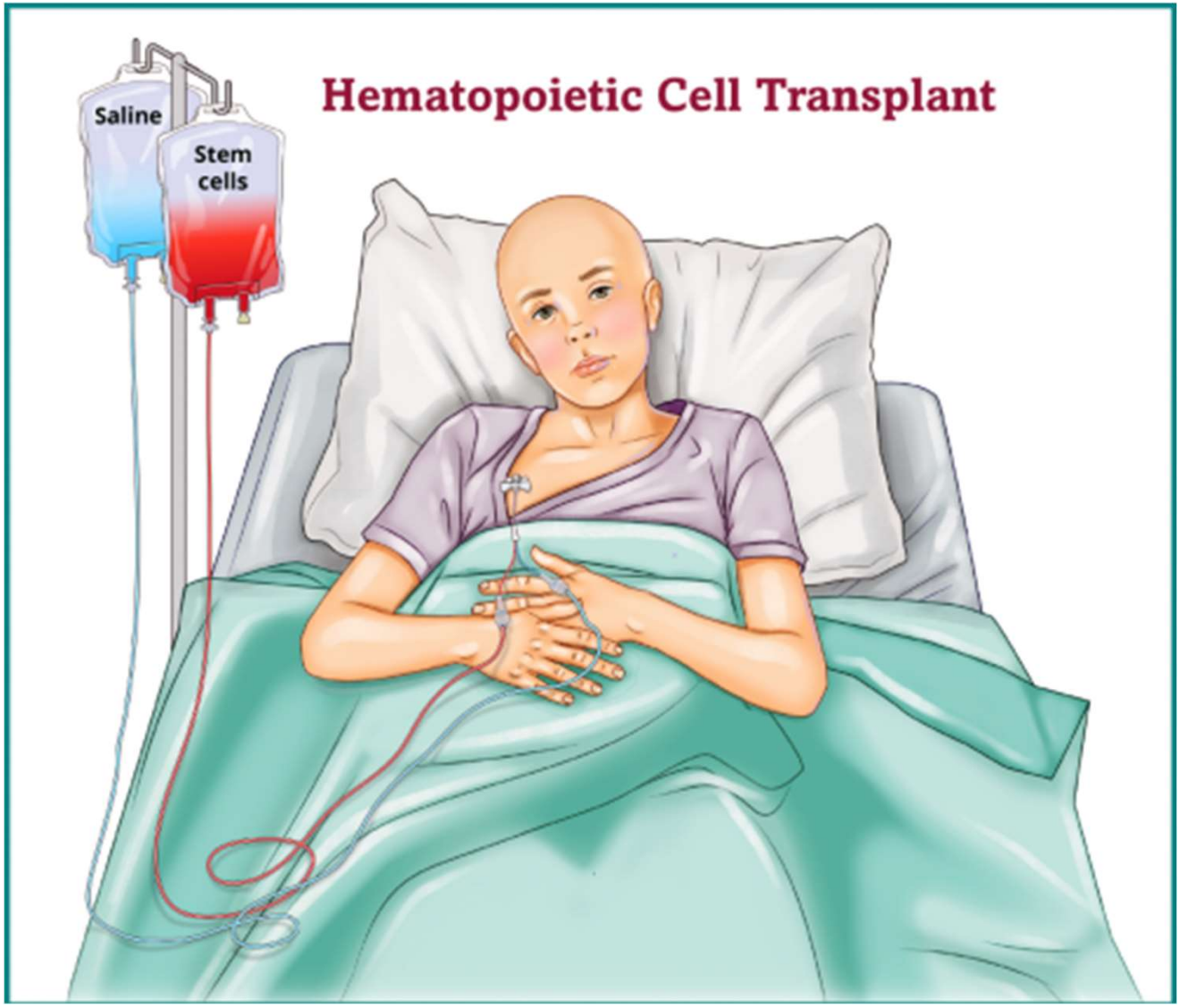
Primary Immunodeficiency



Secondary Immunodeficiency

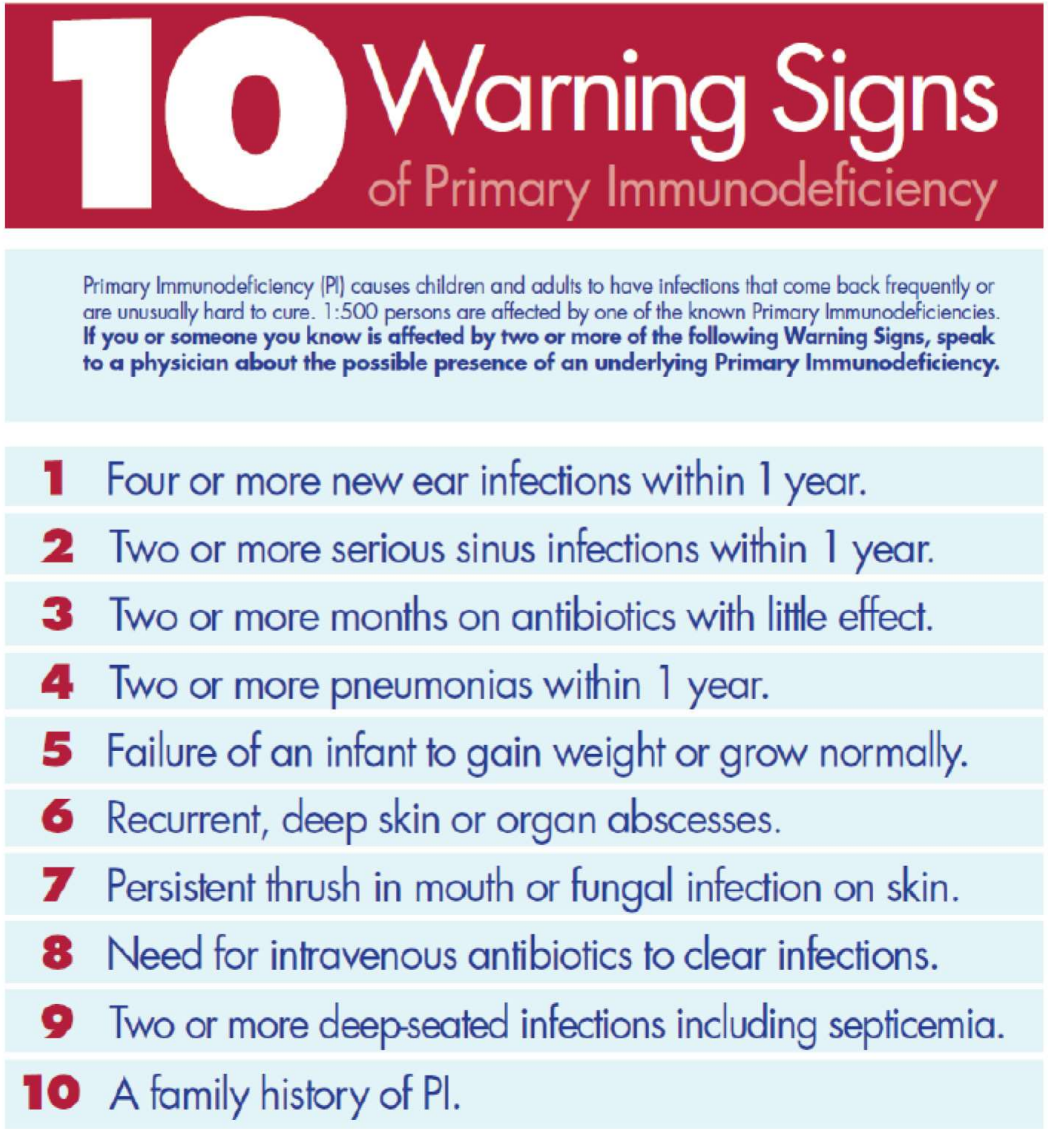
Immune Deficiency Foundation


HIV - Test
Type of specimen
HIV Infection
Screening test
CPV 380
CPX 070
Confirmatory te
CPX 025
Stat


Hematopoietic Cell Transplant
Saline
Stem cells

— Awareness —

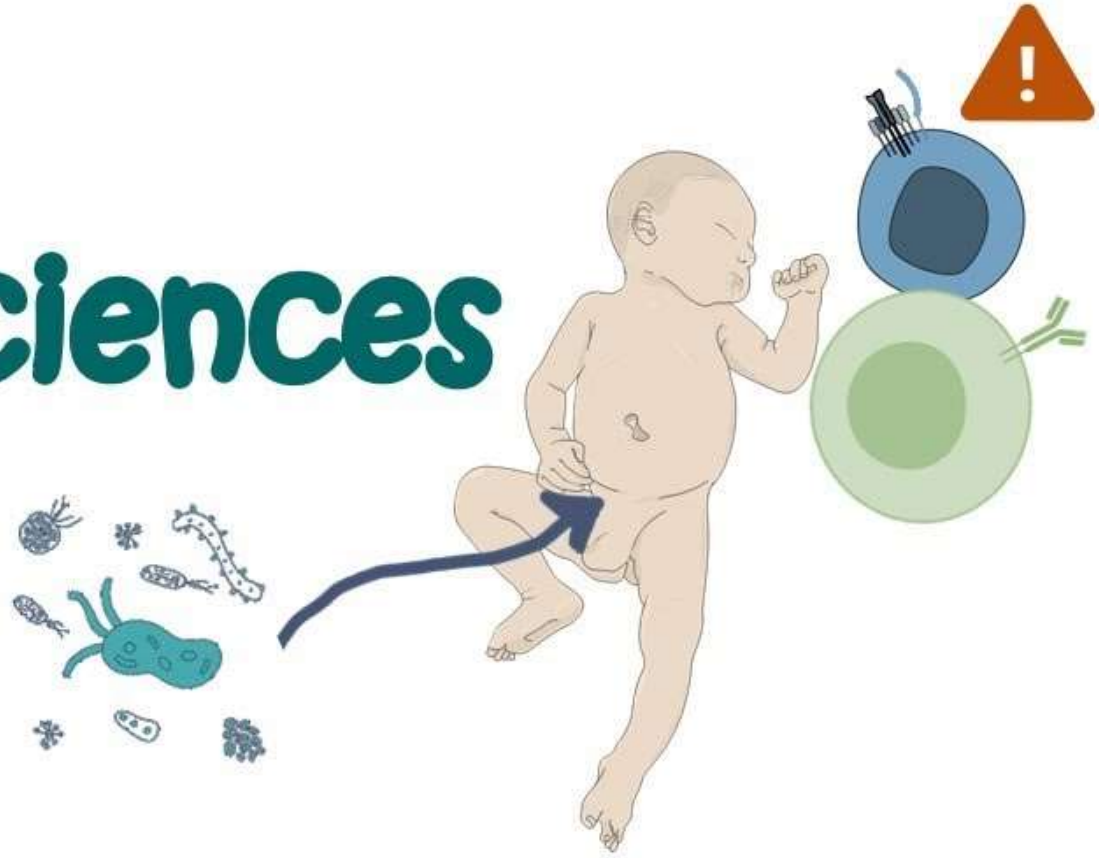
PRIMARY IMMUNODEFICIENCY DISEASE



Source: Jeffrey Modell Foundation

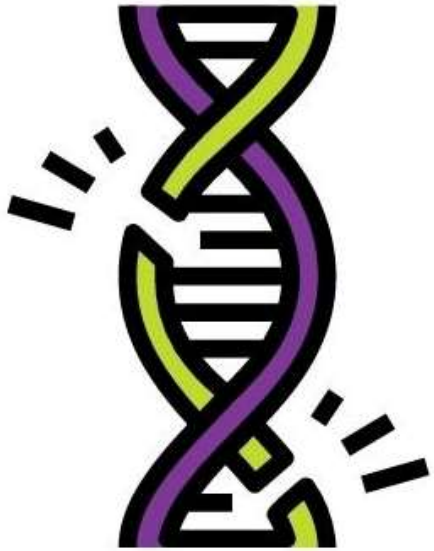
Severe Combined ImmunoDeficiences

SCID



Facts und Management

- daran denken – Abklärung einleiten



- atypische/opportunistische Infektionen
- fulminanter Verlauf
- rasche und aggressive antiinfektive Therapie
  - antibiotisch, antifungal, antiviral

- Prophylaxe (antibiotisch, antifungal, antiviral, PCP)
- Isolation
- ev. CMV-negative Blutprodukte, Transfusionskriterien

- Onkologie, Immunologie, Transplant, Infektiologie

Antiinfektiva/Antibiotika

“can safe lives, but at the same time exert harm to the individual”

Critically ill children

wise decision-making

for or against antibiotic treatment

even more than others

Clinical Infectious Diseases

MAJOR ARTICLE

Antibiotic Indications and Appropriateness in the Pediatric Intensive Care Unit: A 10-Center Point Prevalence Study

Kathleen Chiotos,[1,2,3] Jennifer Blumenthal,[4,5] Juri Boguniewicz,[6] Debra L. Palazzi,[7] Erika L. Stalets,[8] Jessica H. Rubens,[9] Pranita D. Tamma,[9] Stephanie S. Cabler,[10] Jason Newland,[10] Hillary Crandall,[11] Emily Berkman,[12] Robert P. Kavanagh,[13] Hannah R. Stinson,[1,3] and Jeffrey S. Gerber[2,3]

[1]Division of Critical Care Medicine, Department of Anesthesiology and Critical Care, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA; [2]Division of Infectious Diseases, Department of Pediatrics, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania, USA; [3]Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, USA; [4]Division of Infectious Diseases, Department of Pediatrics, Boston Children's Hospital, Boston, Massachusetts, USA; [5]Division of Critical Care Medicine, Department of Anesthesiology, Critical Care, and Pain Medicine, Boston Children's Hospital, Boston, Massachusetts, USA; [6]Section of Infectious Diseases and Epidemiology, Department of Pediatrics, University of Colorado School of Medicine, Aurora, Colorado, USA; [7]Infectious Diseases Division, Department of Pediatrics, Baylor College of Medicine, Houston, Texas, USA; [8]Division of Critical Care Medicine, Department of Pediatrics, University of Cincinnati College of Medicine, Cincinnati, Ohio, USA; [9]Division of Infectious Diseases, Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA; [10]Division of Infectious Diseases, Department of Pediatrics, Washington University in St. Louis, St. Louis, Missouri, USA; [11]Division of Pediatric Critical Care, Department of Pediatrics, University of Utah, Primary Children's Hospital, Salt Lake City, Utah, USA; [12]Division of Pediatric Critical Care Medicine, Department of Pediatrics, Seattle Children's Hospital, University of Washington School of Medicine, Seattle, Washington, USA; and [13]Division of Pediatric Critical Care Medicine, Department of Pediatrics, Penn State University College of Medicine, Hershey, Pennsylvania, USA

Ein Drittel der kritisch kranken Kinder auf der PICU hat eine unangemessene Antibiotikatherapie


Adverse
effect
public
symptoms
users
minimally
putative
found
related
effect
hormonal
clinical
perforatum
disease
pharmacology
untreatable
harmful
herbal
drug
gangrene
admissible
manufacturers
chemotherapeutic
perforation
potentiate
decrease
physician
medication
thalidomide
colonoscopy
vaccine
experience
adverse
nonsurgical
tenfluramine
therapeutic
health
irreversible
reaction
distinction
surgery
medicine
medical
mortality
autism
side
damage
information
level
macroscopic
studies
interaction
pharmacokinetics
number
protease
bystander
attenuated
dermatitis
due
patient
system
supplements
noninvasive
procedure
contraindicated
cancer
eczema
function
enzymes
morbidity
voluntary
subcommittee
rofecoxib
trials
litigations
professional
products
iatrogenic
dosage
malaise
change
invasive
reversible
implants
cytochrome
taking

GLOBAL ACTION PLAN
ON ANTIMICROBIAL RESISTANCE

World Health Organization

Pediatric Drugs (2021) 23:39–53
https://doi.org/10.1007/s40272-020-00426-y

REVIEW ARTICLE

Optimizing the Use of Antibiotic Agents in the Pediatric Intensive Care Unit: A Narrative Review

Jef Willems[1] · Eline Hermans[2,3] · Petra Schelstraete[4] · Pieter Depuydt[5] · Pieter De Cock[1,3,6]

Accepted: 24 October 2020 / Published online: 10 November 2020

www.nature.com/pr

REVIEW ARTICLE OPEN

Antibiotics in critically ill children—a narrative review on different aspects of a rational approach

Nora Bruns[1] and Christian Dohna-Schwake[1,2]✉

Pediatric Research (2022) 91:440–446; https://doi.org/10.1038/s41390-021-01878-9

6 Schlüsselfragen zur Antibiotikatherapie auf der PICU

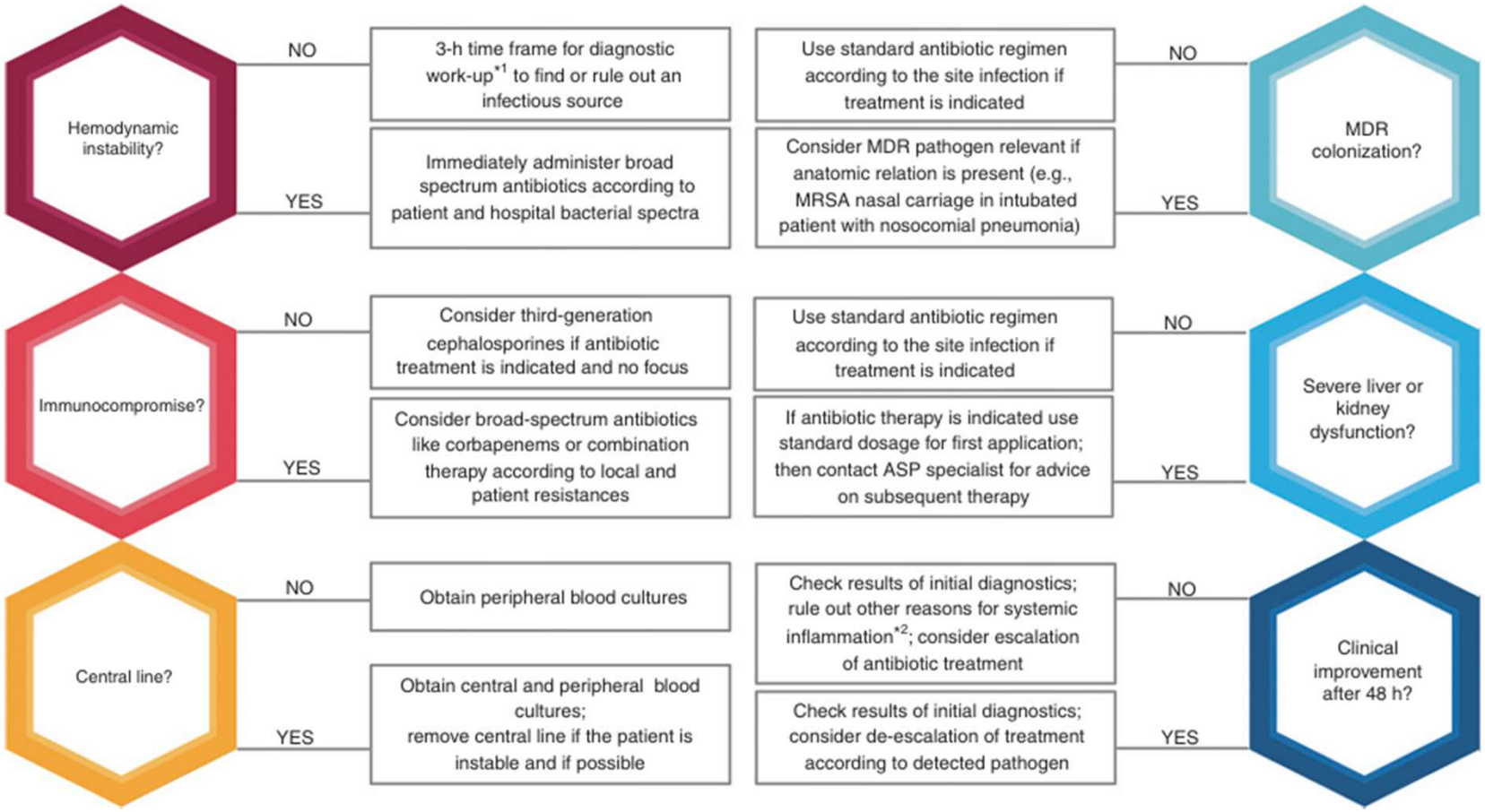
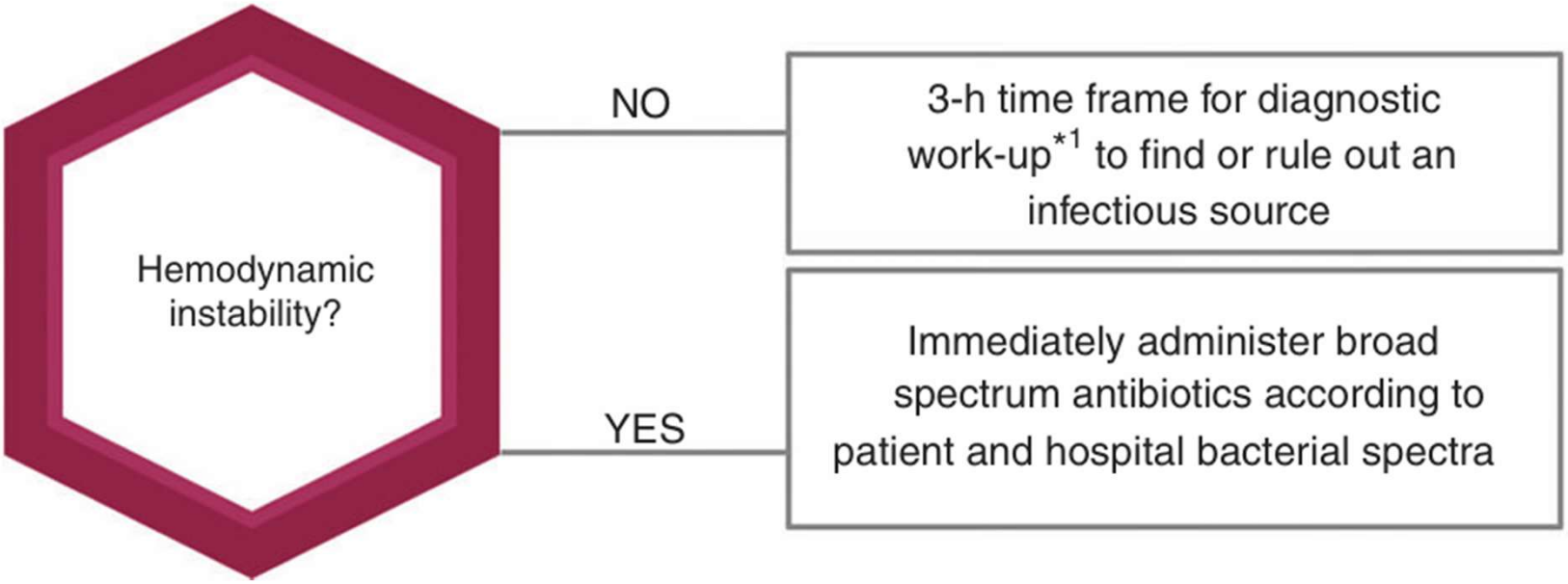


Fig. 1 Key questions to guide decision-making in antibiotic treatment in critically ill children. N. Bruns and C. Dohna-Schwake

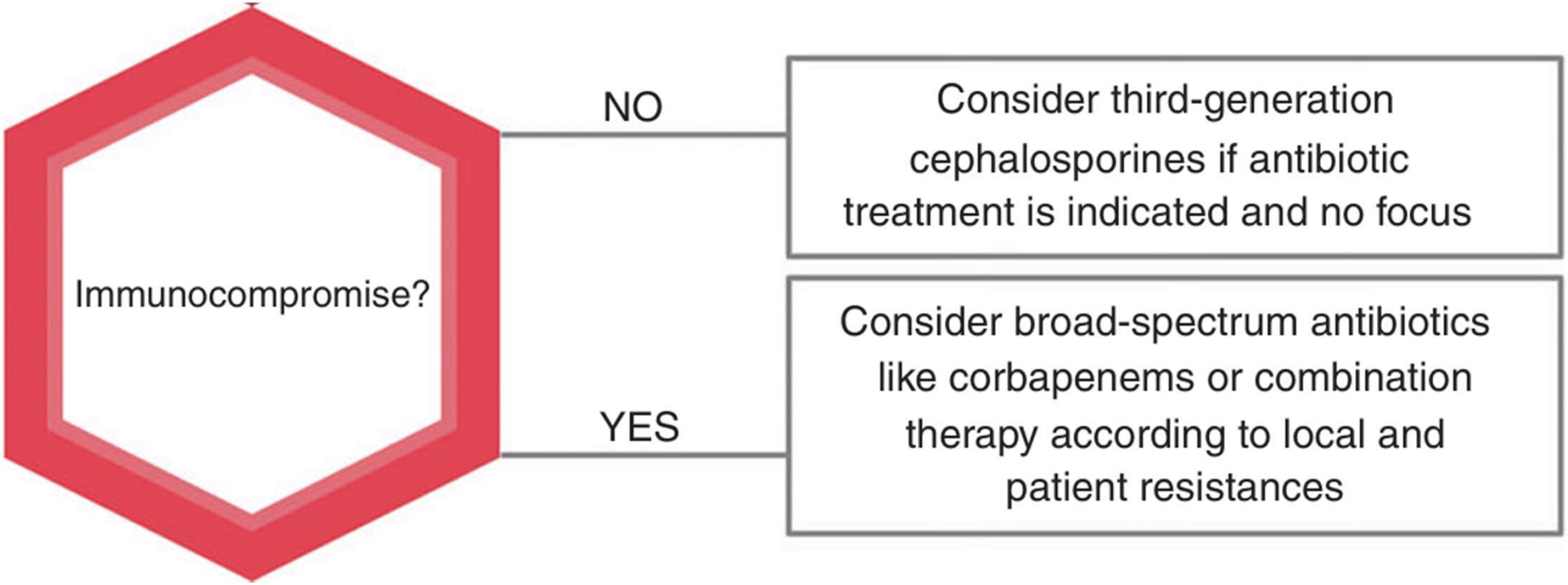
1. Schlüsselfrage



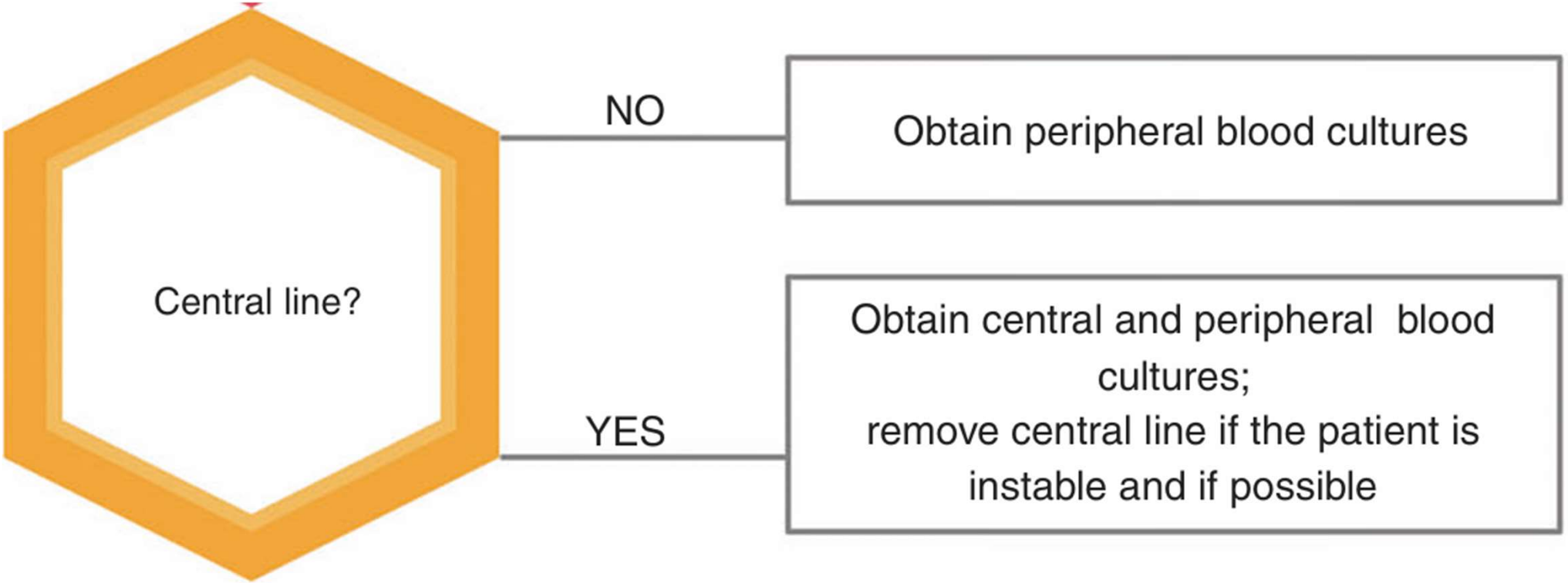
Practice Guideline > Pediatr Crit Care Med. 2020 Feb;21(2):e52-e106.
doi: 10.1097/PCC.0000000000002198.

Surviving Sepsis Campaign International Guidelines for the Management of Septic Shock and Sepsis-Associated Organ Dysfunction in Children

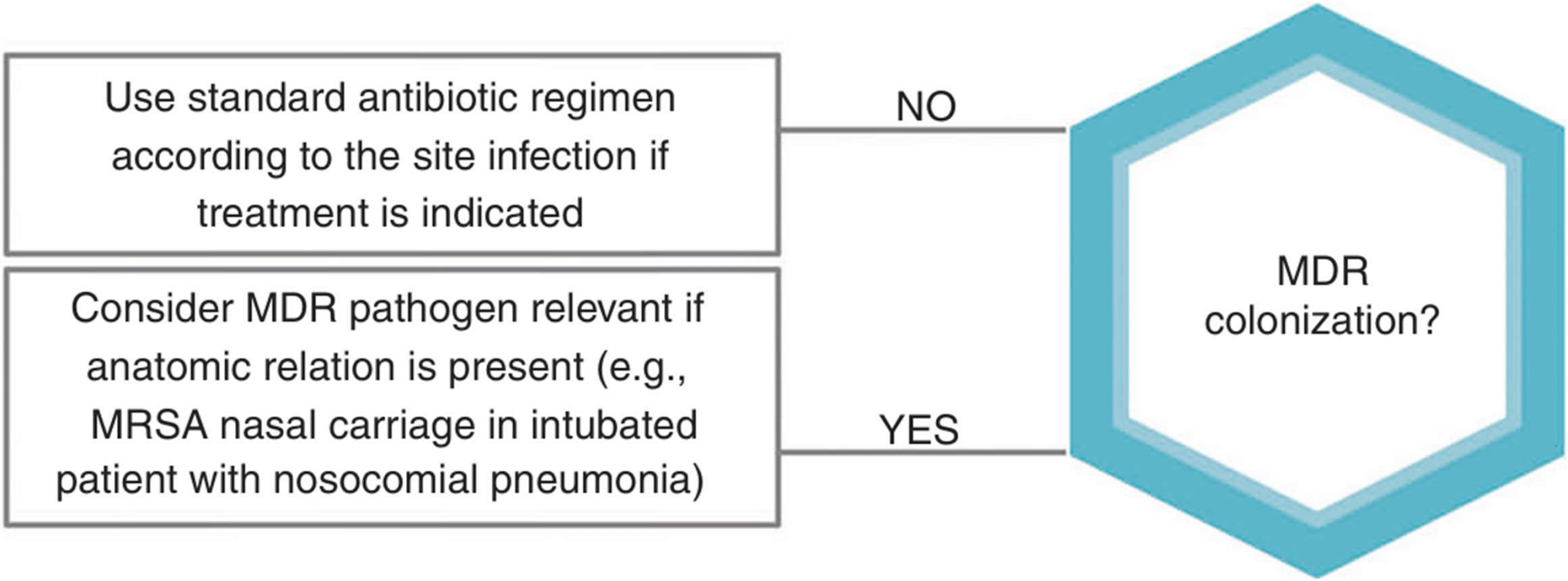
2. Schlüsselfrage



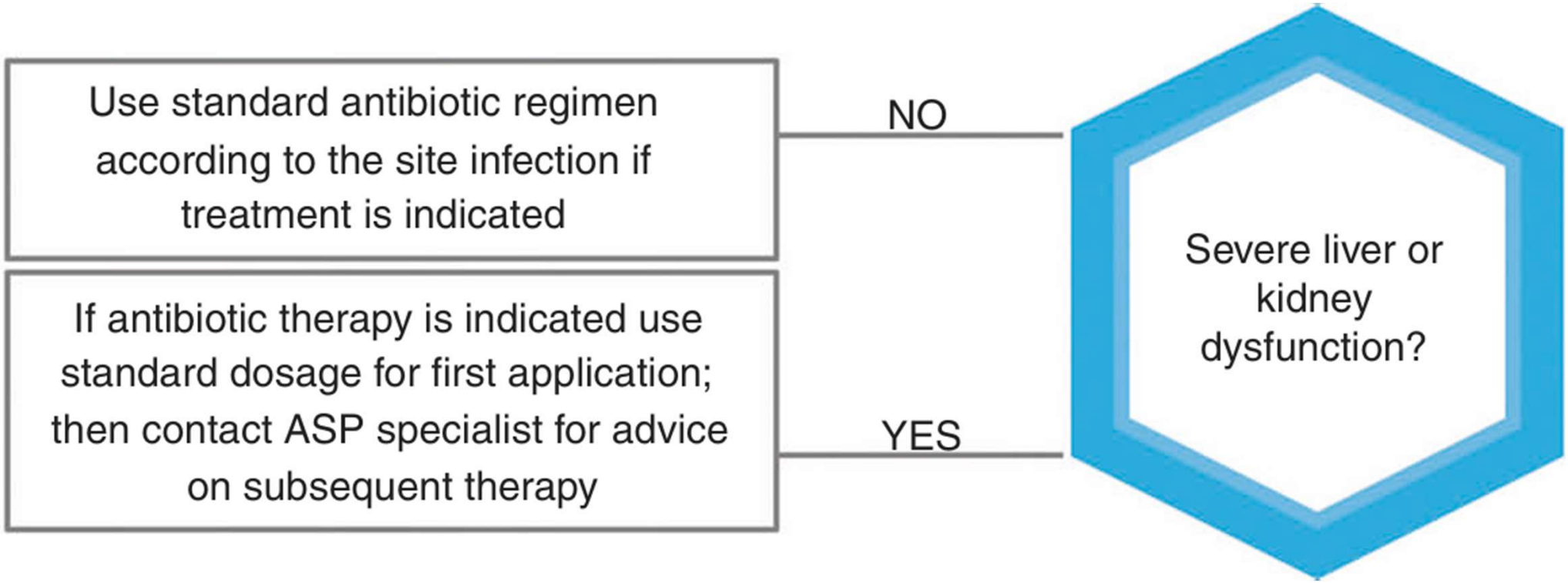
3. Schlüsselfrage



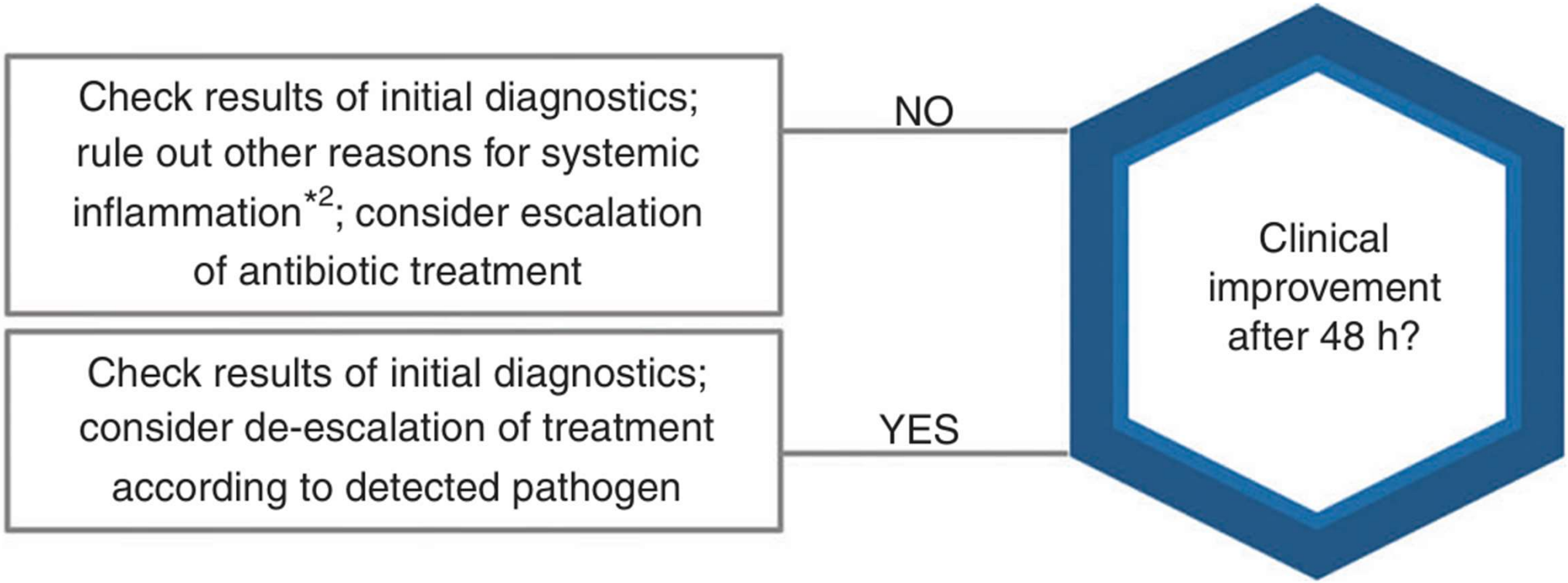
4. Schlüsselfrage



5. Schlüsselfrage



6. Schlüsselfrage



6 Schlüsselfragen zur Antibiotikatherapie auf der PICU

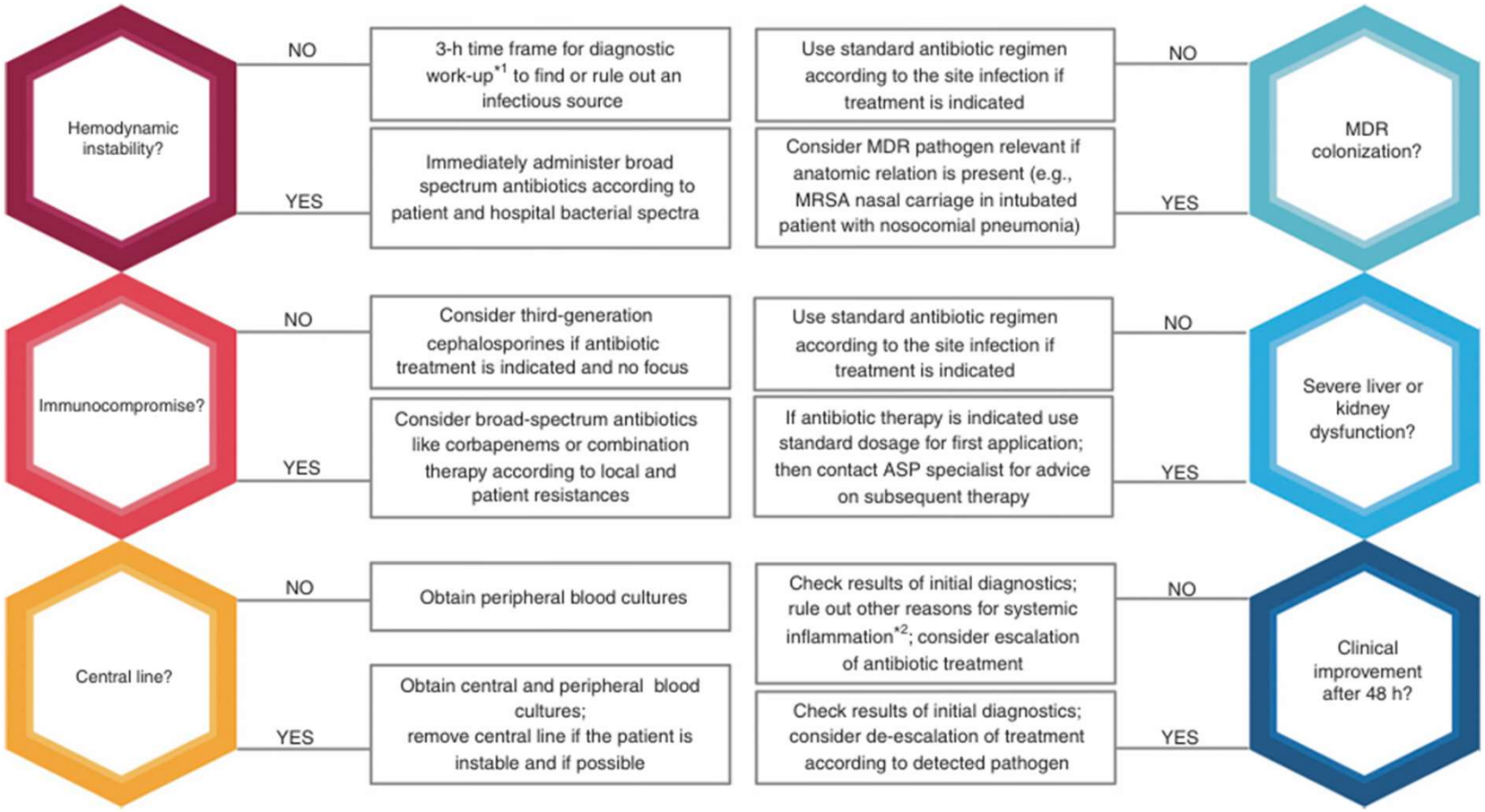
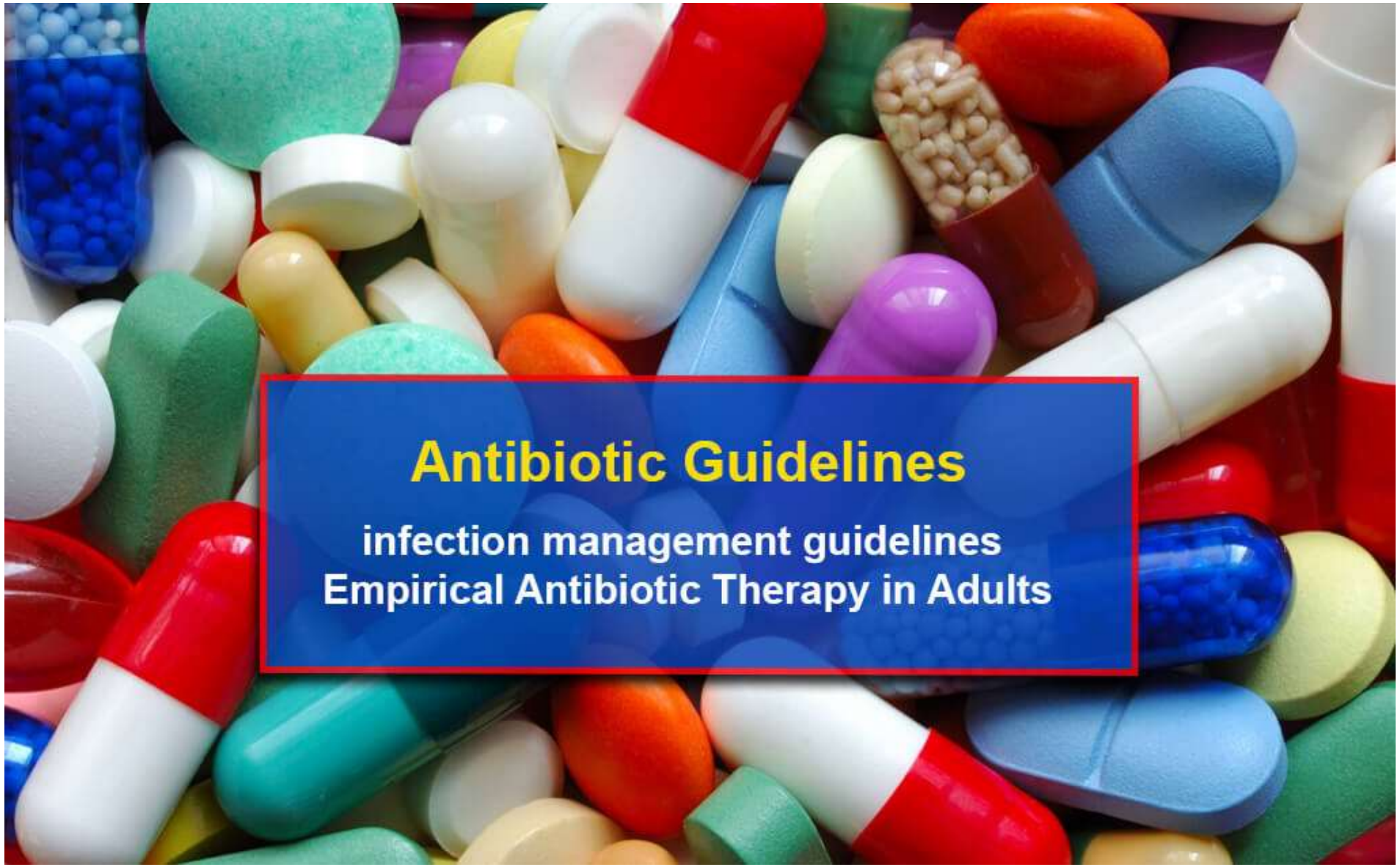


Fig. 1 Key questions to guide decision-making in antibiotic treatment in critically ill children. N. Bruns and C. Dohna-Schwake


Antibiotic Guidelines
infection management guidelines
Empirical Antibiotic Therapy in Adults


Antibiotic stewardship
Enhancing infection prevention and control
Controlling the source of infection
Prescribing antibiotics when they are truly needed
Prescribing appropriate antibiotic(s) with adequate dosages
Using the shortest duration of antibiotics based on evidence
Reassessing treatment when culture results are available
Supporting surveillance of AMR and HAIs and monitoring of antibiotic consumption
Educating staff
Supporting an interdisciplinary approach

Take home message

- Infektionen, die zur PICU-Aufnahme führen
- Spezielle Infektionen auf der PICU
  - Immunsupprimierte Kinder
  - Nosokomiale Infektionen

- Adäquate Antibiotikatherapie
- Keimspektrum
- Antibiotika-Therapieempfehlungen

Vielen Dank für Ihre Aufmerksamkeit

Dr. Anna Aichinger

Pädiatrische Intensivstation (PICU), MedUni Wien

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