spitäler schaffhausen

Clinical pharmacy service in an Intensive Care Unit for adults

Focus on antibiotics

Jahrestagung SGI / GSASA Donnerstag, 14.09.2017

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Conflict of Interest

financial interest or as an owner: no

activities for the

I have no potential conflict of interst to report

other fundings/donations: no

personal entanglement: nein

Foederatio Pharmaceutica Helvetiae FPH Fortbildungsprogramme

Introduction ICU Spitäler SH

- Interdisciplinary
- 8 beds
- Category C
- Key data 2015
  - Staff: 27.4 nurses, 3.3 physicians
  - Entries: 667
  - Length of stay (d): 3.3 +/-6
  - Ventilation (hours per bed): 2389
  - Total of shift work: 7277
- PDMS (Software COPRA), since 2004

Clinical pharmacy Service

Clinical pharmacists take care of the appropriate, secure and cost-effective use of medication in collaboration with physicians and nurses.

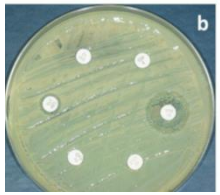
The activities are:

- **patient**-oriented (e.g. education / counselling)
- **process**-oriented (assuring the adequate supply with medication)
- **therapy-**oriented (optimizing the medication therapy)

Clinical pharmacy Service SH: Activity

10 o’clock - office clinical pharmacy:
preparing the ICU ward round

11 o’clock - microbiology laboratory:
recording the results, discussing them with laboratory assistants



11.45 o’clock - ICU:
discussing the new results from microbiology / potentially a need to modify the antibiotic therapy

typical examples from hospital in Schaffhausen

Mrs K.S., 62 y

- 23.6.2017: Total laparoscopic Hysterectomy (TLH) and bilateral adnexectomy because of cervix carcinoma
- 30.06.2017: revision laparoscopy because of trokar hernia and ureter leakage because of necrotic ureter and 4-quadrants-peritonitis
- subsequently: septic shock with multiple organ dysfunction syndrome

antibiotic therapy?

Therapy (as of Friday, 30.06.17)

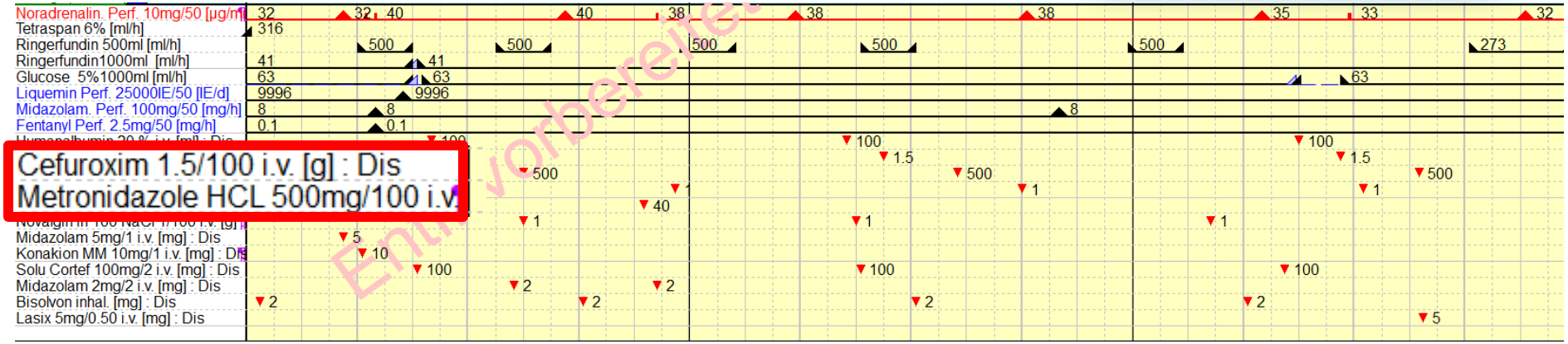

EMPFEHLUNGEN
ZUR
ANTIBIOTIKA-THERAPIE

6. Auflage
November 2012

Antibiotikagruppe:

Anästhesie: Dr. U. Denzler (8-540)
Chirurgie: Dr. B. Boldog (8-719)
Gynäkologie: PD Dr. Th. Roos (8-312)
Innere Medizin: Prof. Dr. S. Rüttimann (8-114)
Dr. H. Besrour (8-124)
Klin. Pharmazie: Fr. Dr. C. Gräflein (8-417)
Fr. I. Vogel (8-439)
Spitalhygiene: Hr. C. Conrad (8-509)
Mikrobiologie: Fr. M. Wehrli (8-419)

spitäler schaffhausen



Microbiological results (I)

Auftragsnummer: 803911 **Datum:** 30.06.2017 21:21 **Befundtyp:** Mikrobiologie

Dr.Breitling

Endbefund
Untersuchungsauftrag
Fragestellung : Allg. Bakteriologie
Klinische Diagnose : Keine Schwangerschaft, keine Harnwegsinfektsymptome
Antibiotikabehandlung : Cefuroxim
Antibiotikabehandlung : Metronidazol
Sonstige Angaben : Probe 1
Untersuchungsauftrag
Material : Punktat
Untersuchungsauftrag
Lokalisation : Fluüssigkeit aus em Bauchraum
Position : intraoperativ
Kommentar zum Auftrag:
Dr.Breitling

Mikroskopische Untersuchungen

Grampräparat	Gramnegative Stäbchen	viel
	Leukozyten	mässig

Kulturelle Untersuchungen

Kultur aerob	Wachstum
Kultur anaerob	Kein Wachstum

1. E. coli viel

AntibiogrammS = sensibel I = intermediär R = resistent f = folgt

	1.
Amoxicillin	S
Amoxicillin/Clavulansäure	S
Ceftazidim	S
Cefuroxim	S
Ciprofloxacin	S
Cotrimoxazol	S
Imipenem	S
Piperacillin/Tazobactam	S
Tobramycin	S

Microbiological results (II)

Auftragsnummer: 804074 **Datum:** 02.07.2017 00:37 **Befundtyp:** Mikrobiologie **Status:** Endbefund **Befundempfäng...** ipschir

```
Untersuchungsauftrag
Fragestellung                  : Allg. Bakteriologie
Antibiotikabehandlung          : Cefuroxim
Antibiotikabehandlung          : Metronidazol
Untersuchungsauftrag
Material                       : Trachealsekret

Mikroskopische Untersuchungen
Grampräparat                    Gramnegative Stäbchen                    wenig
                                Leukozyten                               wenig
Kulturelle Untersuchungen
Kultur aerob                    Wachstum
```

Discussion with the laboratory assistant:
Have tests already been carried out to identify the «gram negative germ»?
- Catalase positive
- Oxidase positive

ICU: clinical pharmacy ward round Monday 3.07.2017

- patient intubated and mechanical ventilation
- Unstable circulation, strong need of volume and norepinephrine

- reason?
- need for modification of the antibiotic therapy? If yes, which antiobic?

Discussion in the ICU

- Cefuroxime + Metronidazole for the «bowel infection»: okay
- pulmonary situation? Antibiotic therapy of the identified gram negative bacteria?

Yes!

- Antibiotics against Pseudomonas which were in stock in Schaffhausen:
  - Imipenem / Cilastatin
  - Tobramycin
  - Ciprofloxacine
  - *currently unavailable: Pip/Taz, Ceftazidime*

Choice of antibiotic: **characteristics of the patient**

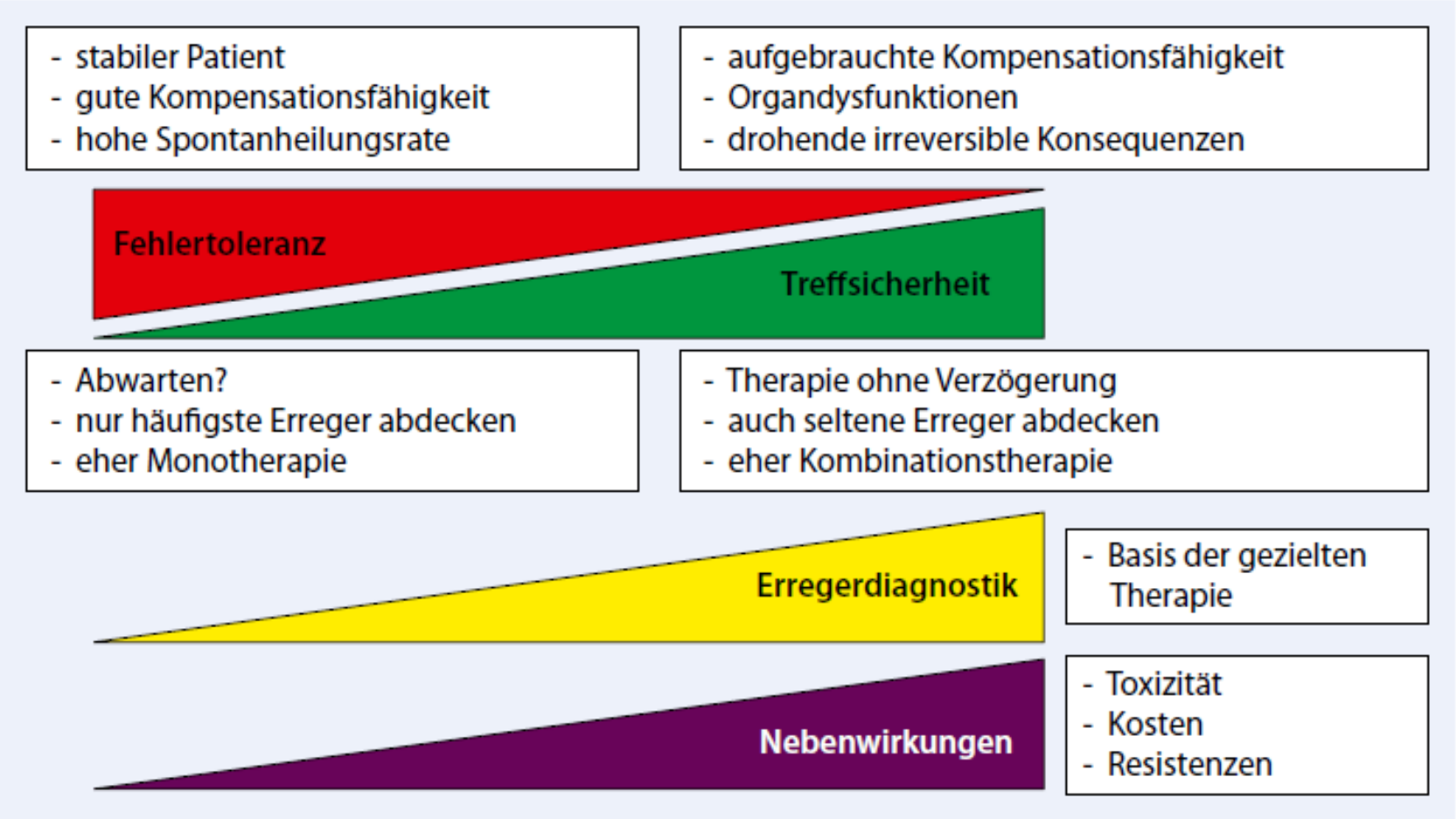
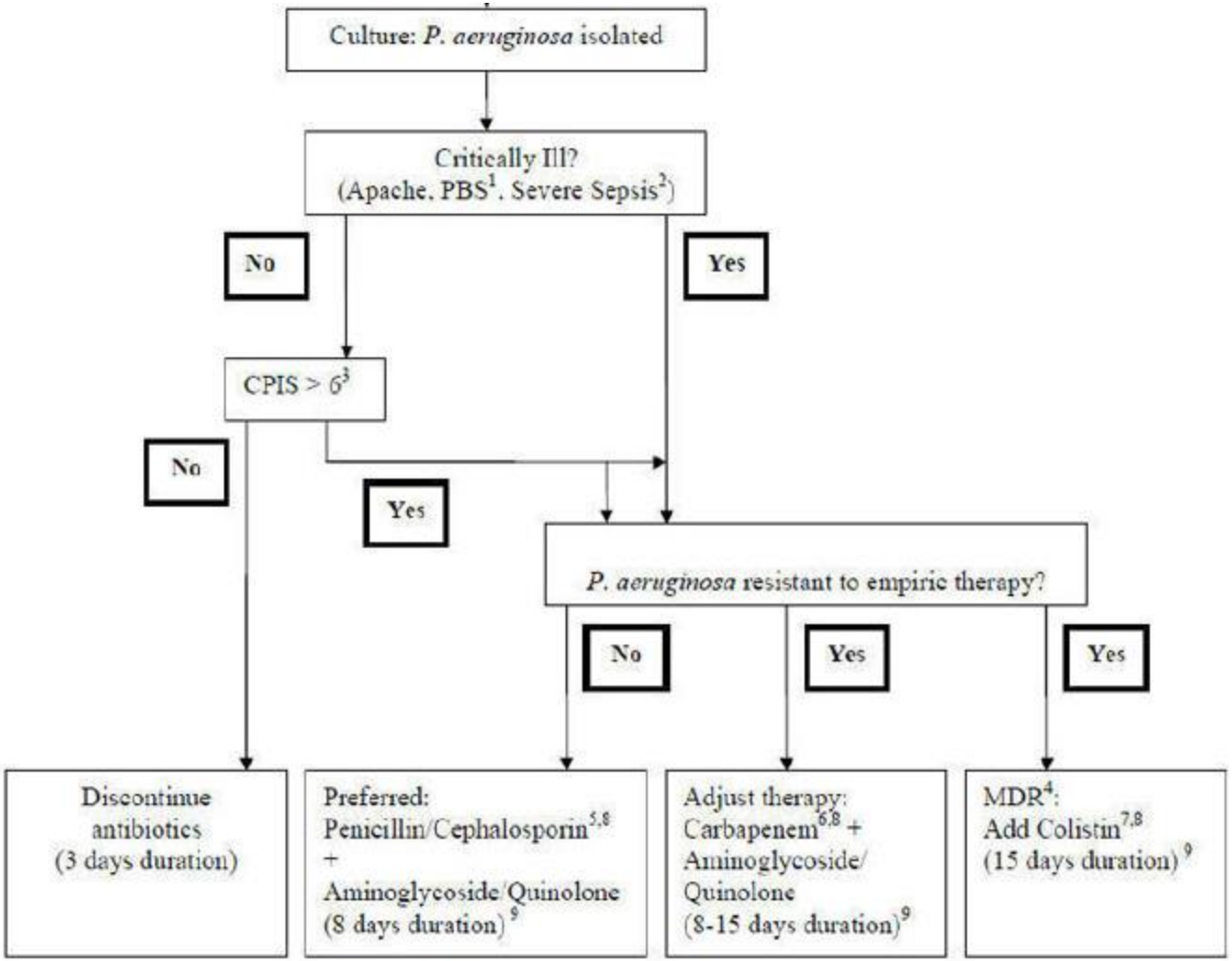


Abb. 1 ▲ Aspekte der kalkulierten Therapie

Kees MG, Med Klin Intensivmed Notfmed 2013; 108: 125-130



1 PBS = Pitt Bacteremia Score (139)
2 Severe Sepsis = sepsis with organ dysfunction (hypotension, hypoperfusion)
3 CPIS = Clinical Pulmonary Infection Score (106)
4 MDR = Multidrug resistant=resistant to antipseudomonal penicillins, cephalosporins, carbapenems, quinolones
5 Extended spectrum penicillin or antipseudomonal cephalosporin (Table 1)
6 Antipseudomonal carbapenem = imipenem, meropenem, doripenem
7 Add colistin as inhalation or parenteral therapy to the most active combination therapy.
8 Local antibiotic susceptibility patterns within that institution should be considered.
9 Duration of beta-lactam therapy should be 8-15 days. The aminoglycoside/quinolone can be discontinued at 3-5 days based on results from in vitro susceptibility testing and clinical responses

www.antimicrobe.org/new/b112.asp

Choice of antibiotic: **Literature**

UpToDate®

GENERAL PRINCIPLES OF TREATMENT — The following principles apply to the management of serious *P. aeruginosa* infections:

- The risk of antibiotic resistance, both intrinsic and acquired, is an important consideration when selecting empiric or directed therapy.
- Combination therapy is indicated in certain high-risk patients and in severe infections.
- Prompt initiation of antimicrobial therapy is important, as delayed therapy correlates with increased mortality.
- Source control is important. All infected catheters and removable devices should be removed, abscesses should be drained, and obstructions should be relieved whenever possible.

Choice of antibiotic: **resistance data Switzerland**

Antibiotic resistance data

The number of laboratories sending data to anresis.ch varies over time. Therefore data may not be comparable between years.

Definition of selection | Modify query
New query | Footnotes

Results:

Selected Criteria:

Microorganism: **Pseudomonas aeruginosa;** Antibiotic: **all;** Time interval: **2016;** Region: **Switzerland Nord-East;** Age: >=**15;** In-/outpatient: **hospitalized;** Anatomic localization: **all;**

Drug	2016			
	Susceptible %	Intermediate %	Resistant %	n
Aminoglycoside	77.9	2.2	19.9	1603
Carbapenem	58.3	4.5	37.2	1590
Cefepime	86.8	0.3	12.9	1469
Ceftazidime	83.3	0.0	16.7	1583
Ciprofloxacin	76.1	5.6	18.3	1584
Piperacillin-tazobactam	83.9	0.1	16.1	1412

Note: Due to rounding, the sum of susceptible, intermediate and resistant samples may differ from 100%.

Choice of antibiotic: **resistance data SH**

Imipenem / Cilastatin:

Jahr	*Pseudomonas aeruginosa*												*S. aureus*
	CH all		CH Mid		West CH		Ost CH all		SH all		SH Blut		Resistenz gegen Imipenem = Resistenz gegen **Flucloxacillin**.
	R+I	n	R+I	n	R+I	n	R+I	n	R+I	n	R+I	n	
2004									7	54	0	2	
2005									7	86	0	2	
2006									5	92	0	1	
2007									8	93	0	2	
2008	22	7989	9	2794	21	2731	37	2464	11	95	11	9	
2009	22	8211	20	2829	16	2329	37	3053	6	111	12	8	
2010	19	9003	10	2946	18	3260	30	2797	8	149	0	3	
2011	20	9929	11	3306	25	3386	21	3237	11	109	50	2	
2012	20	9662	14	3036	24	3124	21	3502	7	161	0	1	
2013	28	10682	25	3736	25	3458	34	3468	9	116	0	1	
2014	30	11436	25	3921	29	3919	36	3596	17	153	0	2	
2015	30	12177	nd		nd		43	1988	8	141	0	3	
2016	29	10720	nd		nd		39	1874	12	146	0	2	

Wehrli M., interne Resistenzstatistik SSH 2016

Choice of antibiotic: **resistance data SH**

Tobramycin

Jahr	*Pseudomonas aeruginosa*							
	CH all		Ost CH all		SH all		SH Blut	
	R+I	n	R+I	n	R+I	n	R+I	n
2004					0	54	0	2
2005					5	86	0	2
2006					0	92	0	1
2007					1	93	0	2
2008	14	8320	12	2497	1	95	0	9
2009	12	8603	13	3090	3	111	0	8
2010	13	9402	14	2809	2	117	0	3
2011	14	10147	13	3248	6	70	0	2
2012	13	9826	12	3518	3	161	0	1
2013	14	10691	17	3452	2	116	0	1
2014	14	11425	21	3618	1	153	0	2
2015	11	12193	23	2005	0	141	0	3
2016	11	10749	20	1888	1	146	0	2

Ciprofloxacine

Jahr	*Pseudomonas aeruginosa*							
	CH all		Ost CH all		SH all		SH Urin	
	R+I	n	R+I	n	R+I	n	R+I	n
2004					7	54	7	26
2005					11	85	10	48
2006					7	92	7	52
2007					4	94	5	44
2008	16	8366	18	2477	4	93	3	36
2009	15	8675	17	3078	4	111	8	51
2010	14	9432	17	2765	6	149	6	71
2011	15	10352	16	3249	13	109	18	62
2012	17	10102	19	3224	9	161	13	101
2013	18	11006	21	3489	3	116	6	69
2014	17	11557	21	3619	11	153	7	68
2015	16	12342	22	2161	6	141	8	76
2016	15	10905	22	1868	1	146	0	75

Wehrli M., interne Resistenzstatistik SSH 2016

Choice of antibiotic and dose

patient 65kg
creatinine (3.7.17): 160µmol/l (eGFR 29ml/min)

Imipenem/Cilastatin 1000mg loading dose,
after that 3x 500mg i.v. +

Tobramycin 1x 180mg i.v. (ca. 3mg/kgKG),
if necessary adapt corresponding the plasma level

Microbiological results (III) one day later

Auftragsnummer: 804074 **Datum:** 02.07.2017 00:37 **Befundtyp:** Mikrobiologie **Status:** Endbefund **Befundempfäng...** ipschir

```
Untersuchungsauftrag
Fragestellung                  : Allg. Bakteriologie
Antibiotikabehandlung          : Cefuroxim
Antibiotikabehandlung          : Metronidazol
Untersuchungsauftrag
Material                       : Trachealsekret

Mikroskopische Untersuchungen
Grampräparat                    Gramnegative Stäbchen                          wenig
                                Leukozyten                                     wenig
Kulturelle Untersuchungen
Kultur aerob                    Wachstum


 1. Pseudomonas aeruginosa                  mässig
 2. Candida albicans                        wenig

-------------------------------------------------------------------------------------------------
AntibiogrammS = sensibel    I = intermediär   R = resistent   f = folgt
-------------------------------------------------------------------------------------------------
                                   1.
Ceftazidim                         S
Ciprofloxacin                      S
Imipenem                           S
Piperacillin/Tazobactam            S
Tobramycin                         S
```

Microbiological results (III) one day later

Auftragsnummer: 804186 **Datum:** 03.07.2017 00:35 **Befundtyp:** Mikrobiologie **Status:** Endbefund **Befundempfäng...** ipschir

```
Endbefund
Untersuchungsauftrag
Fragestellung                  : Allg. Bakteriologie
Antibiotikabehandlung          : Cefuroxim
Antibiotikabehandlung          : Metronidazol
Untersuchungsauftrag
Material                       : Blutkultur peripher punktiert

Mikroskopische Untersuchungen
Grampräparat aerobe Blutkultur Gramnegative Stäbchen                          nachweisbar
Kulturelle Untersuchungen
Blutkultur aerob                Wachstum
Blutkultur anaerob              kein Wachstum nach 7 Tagen


 1. Pseudomonas aeruginosa                  nachweisbar

-------------------------------------------------------------------------------------------------
AntibiogrammS = sensibel    I = intermediär   R = resistent   f = folgt
-------------------------------------------------------------------------------------------------
                                  1.
Ceftazidim                        S
Ciprofloxacin                     S
Imipenem                          S
Piperacillin/Tazobactam           S
Tobramycin                        S
```

from 4.7.2017: patientin on hemofiltration

Dosage of the antibiotics?

- Tobramycin: according to literature, env. half of the dose
  our recommendation: 1x 180mg i.v./d (the same as to date, if necessary adapt corrsponding TDM)

			Datum	05.07.2017 14:05	10.07.2017 15:48	13.07.2017 15:56
			Befundtyp	Zentrallabor	Zentrallabor	Zentrallabor
			Status	Endbefund	Endbefund	Endbefund
			Befundempfäng	ipschir	ipschir	ipschir
	Name	Einheit	Referenz	Wert		
▼ Medikamente						
	Tobramycin Tal	mg/l	Therapeutischer	0.7	0.8	0.7

- Imipenem/Cilastatin: according to literature, normal dose
  our recommendation: increase to 4x 500mg i.v./d

Summary case 1

- Due to interdisciplinary teamwork, the therapy can be discussed and optimised related to choice of drug, dose, monitoring
- Because of closely working together with the microbiology laboratory, the antibiotic therapy can be adapted rapidly
- Resistance data can help in the selection of initial therapy

Mrs H.M., 63 y

- 28.6.2017: sepsis with complicated myometritis and infection in lesser pelvis with fibrinous all-quadrants-peritonitis unknown etiology
  - Status after copper-IUD for 20 years
- Diagnostic hysteroscopy and curettage, drainage insertion transvaginal to douglas (29.6.17)

- arterial hypertension
- chronic venous insufficiency both sides (Widmer III)
- adipositas per magna (128kg, 165cm)
- alcoholism until 2016

29.6.2017

29.06.17 - 30.06.17 26

Dok.-Unterbrechung

LEP Doku. speziell

T-Kern BD SpO2 PCWP

NIB

T-Peri HF AF ZVD

letzter Stuhl: 0 ? Herz-Rhyt.

Rea VES

Grenz. Peripherie

BedV A Beatmung

SpUS Pos.-Wechsel

Labor Sz-Score/ZOPA

Bilanz B Urin/Std

Atmng M IST Bilanz

Noradrenalin. Perf. 10mg/50 [µg/min]

Rin+Kal [ml/h]

Ringerfundin 500ml [ml/h]

Ringerfundin 500ml [ml/h]

Ringerfundin 500ml [ml/h]

NaC+Kal [ml/h]

Magnesium Sulfat 20 % 24mmol/30 [

Propofol Perf. 1000mg/50 [mg/h]

Liquemin Perf. 25000IE/50 [IE/d]

Co-Amoxi Mepha 2.2/100 i.v. [g] : Dis — 3x 2.2g i.v.

Vibravenoes 100mg/100 i.v. [mg] : Dis — 2x 100mg i.v.

Cordarone 150mg/100 i.v. [mg] : Dis

Propofol 20mg/2 i.v. [mg] : Dis

Midazolam 2mg/0.40 i.v. [mg] : Dis

Morphin HCL 2.5mg/0.25 i.v. [mg] : Di

Vento 1.25/Atrov.250mcg inhal. [ml] :

Lasix 20mg/2 i.v. [mg] : Dis

Aufnahme: 29.06.2017 16:50 von: OPS

Ro-Thorax auf IPS

Microbiological results (I)

Erfassung: 28.06.2017 15:16
Abnahme: 28.06.2017 14:10

Auftragsstellung

Material	Urethra (Abstrich)
Fragestellung	Chlamydia trachomatis / Gonokokken PCR

Spezielle Untersuchungen

Chlamydia trachomatis PCR	**negativ**
Gonokokken PCR	**negativ**

Erfassung: 28.06.2017 15:16
Abnahme: 28.06.2017 14:10

Auftragsstellung

Material	Vagina (Abstrich)
Fragestellung	Allg. Bakteriologie

Mikroskopische Untersuchungen

Grampräparat	**Mikroorganismen**	**nicht nachweisbar**
	Leukozyten	**wenig**
	Plattenepithelien	**wenig**
	Clue Cells	**nicht nachweisbar**

Kulturelle Untersuchungen

Kultur aerob	**Wachstum**

1. **Normale Vaginalflora** **wenig**

Microbiological results (II)

Erfassung: 29.06.2017 16:31
Abnahme: 29.06.2017 16:06

Auftragsstellung

Material	Fremdmaterial, Spirale, intraoperativ
Fragestellung	Allg. Bakteriologie
Antibiotikabehandlung	Keine
Sonstige Angaben	Probe 2

Kommentar zum Auftrag:

Dr,Breitling

Kulturelle Untersuchungen

Kultur aerob	**Kein Wachstum nach 14 Tagen**
Kultur anaerob	**Kein Wachstum nach 14 Tagen**

Erfassung: 29.06.2017 16:31
Abnahme: 29.06.2017 16:16

Auftragsstellung

Material	Douglas-Punktat, Punktat Douglas, intraoperativ
Fragestellung	Allg. Bakteriologie
Antibiotikabehandlung	Keine

Mikroskopische Untersuchungen

Grampräparat	**Grampositive Kokken**	**wenig**
	Leukozyten	**mässig**

Kulturelle Untersuchungen

Kultur aerob	**Kein Wachstum**
Kultur anaerob	**Wachstum**

1. **Anaerobe Mischflora** **wenig**
   Informationen zur Resistenzsituation von anaeroben Bakterien sind in der Analysenliste vom Labor (Intra-/Internet) unter dem Begriff Anaerobier zu finden.

ICU: clinical pharmacy ward round
Thursday, 29.6.17

discussion

- Stop tetracycline, because there is no evidence of atypical bacteria (Chlamydia)
- Dose of Co-Amoxi in this patient?

NRS 2002	3	Gewicht	Gewicht	Datum	Vis	BMI	Gr. cm	BMI	Cal	kCal
			128.1	29.06.2017	agas		165	47		2530

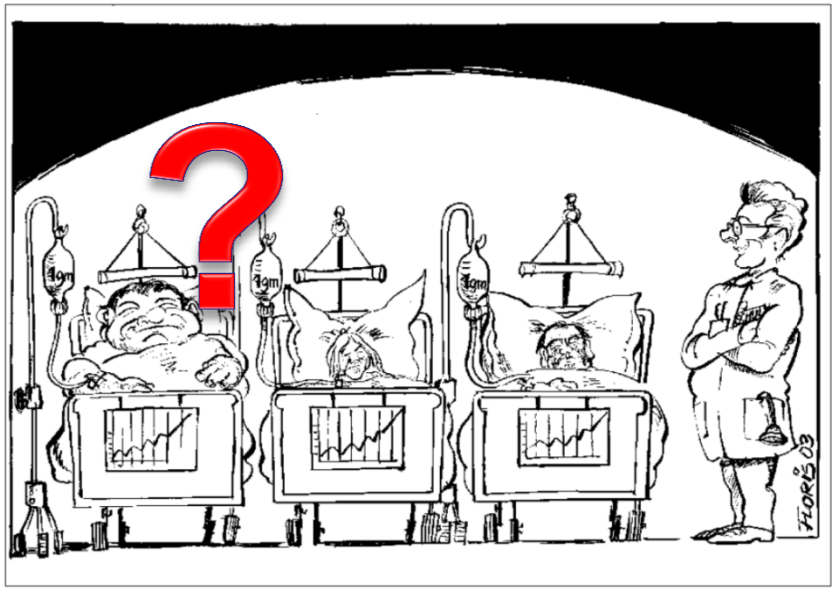


Abb. 3. One size fits all

Sörgel F., Chemotherapie Journal 2003; 3: 65-70

Recommondation (Literature)

Beta-lactams

Despite widespread use, there is very little information regarding appropriate dosing of beta-lactams in obese patients. Lower concentrations have been observed in obese patients receiving conventional doses of beta-lactam antibiotics. Beta-lactams can experience alterations in both V_d and overall clearance in obese patients, which may suggest standard doses are no longer sufficient to achieve target attainment (40–60% T > MIC) for bacteria with higher MICs (1,15).

Our recommondation:
Co-Amoxi 3 to 4x
2.2g i.v./d

Clinicians should consider higher dosing of beta-lactam antibiotics to effectively treat infections in obese patients.

Dosing should at the very least be on the upper end of recommended doses or the highest effective dose safely administered with minimal side effects (Table 3). To ensure target attainment for resistant infections, extended or continuous infusions can be utilized.

Trucker CE, Clinical obesity 2014; 4: 287-295

Continuation of case report

- Clinical deterioration with fever, increasing dyspnea/tachypnea, increasing signs of inflammation
- Analysis of

Material	Trachealsekret
Fragestellung	Allg. Bakteriologie
Antibiotikabehandlung	Amoxicillin/Clavulansäure

Mikroskopische Untersuchungen

Grampräparat	**Leukozyten**	**viel**
	Gramnegative Stäbchen	**wenig**

Kulturelle Untersuchungen

Kultur aerob	**Wachstum**

1. **Enterobacter cloacae-Komplex** **mässig**
   Der Stamm bildet hohe Mengen an AmpC-Betalactamase (dereprimiert). Der Keim ist dadurch resistent auf Penicilline, 1., 2. und 3. Gen. Cephalosporine, Piperacillin/Tazobactam und Aztreonam. Carbapeneme und 4. Gen. Cephalosporine bleiben in der Regel empfindlich.
   Multiresistenter Keim, Spitalhygiene kontaktieren!

Antibiogramm	S = sensibel I = intermediär R = resistent
	1.
Amoxicillin	R
Amoxicillin/Clavulansäure	R
Cefepime	I
Ceftazidim	R
Cefuroxim	R
Ciprofloxacin	S
Cotrimoxazol	S
Doxycyclin	S
Ertapenem	R
Imipenem	I
Piperacillin/Tazobactam	R
Tigecyclin	S
Tobramycin	I

Change to Cotrimoxazole: dose?

- lipohilic molecule

Table 4 Lipophilicity (9,48)

Hydrophilic	Lipophilic
Penicillins	Fluoroquinolones
Cephalosporins	Macrolides
Monobactams	Clindamycin
Carbapenems	Linezolid
Aminoglycosides	Vancomycin
Polymyxins	Tetracyclines
Fosfomycin	Tigecycline (glycylcyclines)
Daptomycin	Trimethoprim-sulfamethoxazole
	Rifamycins
	Chloramphenicol

- Predominantly renal elimination
- Renal function of the patient is good
- Severe infection
- Strongly (!) resistant bacteria

Trucker CE, Clinical obesity 2014; 4: 287-295

Table 2 Recommendations for body weight formulas and weight-based drugs (9,10)

Body weight	Equation	Weight-based drug recommendations
IBW	Men: 50 kg + 2.3 kg/each inch over 5 feet Women: 45.5 kg + 2.3 kg/each inch over 5 feet	Acyclovir Amphotericin (lipid-associated) Flucytosine Isoniazid Pyrazinamide Rifampin
ABW or LBW	IBW + 0.4 (ABW – IBW) Men: 1.1 × Wt (kg) – 128 (Wt^2 (kg)/(100 × Ht (m))^2 Women: 1.07 × Wt (kg) – 148 (Wt^2 (kg)/(100 × Ht (m))^2	Acyclovir Amikacin Ganciclovir Gentamicin Streptomycin Tobramycin Trimethoprim-sulfamethoxazole
TBW	Patient's actual weight	Amphotericin (conventional) Daptomycin Quinupristin-dalfopristin Telavancin Vancomycin Voriconazole

Ideal body weight (IBW): a weight that is believed to be maximally healthful for a person, based chiefly on height and gender.
Adjusted body weight (ABW): based on the theory that as certain percentage (25–40%) of body weight greater than IBW is metabolically active tissue.
Lean body weight (LBW): a person's body weight minus fat, which can be roughly calculated by measuring height, weight, girth and gender.

Our patient:
IBW: 57 kg
ABW: 86 kg
TBW: 128 kg

Trucker CE, Clinical obesity 2014; 4: 287-295; http://www.globalrph.com/ibw_calc.htm

Our recommendation

- Choose the higher standard dose (3x 2 Ampoules Bactrim forte i.v.)
- + Metronidazole (because of the detection of the anaerobic bacteria)
- contact isolation precautions

Summary case 2

- Support the physicians in the selection of the dose of the antibiotics by
  - Search of scientific literature
  - Pharmacocinetic calculations

Clinical pharmacists support

- Definition of the dose (renal function, dialysis, weight, TDM) and interval
- Change the medication in the case of side effects
- Search for alternatives in the case of shortages
- Check the interactions
- Search the literature
- Definition of the length of the therapy
- Selection of reasonable microbiological investigations
- Provide consumption statistics, resistance data
- …the physicians by assisting to «think of…»

«think of»

- Change urinary catheter during the antibiotic therapy?
- Search for a thrombus in case of positive blood culture of central catheter?
- Endocarditis excluded in case of detection of staphylococcus aureus in urine samples?
- Vaccination after splenectomy
- Take more blood cultures after detection of yeasts
- Check the liver enzymes in case of Rifampicin
- TDM Vancomycin / Aminoglycosides
- etc

Clinical pharmacy service in an Intensive Care Unit for adults

Additional benefit for all!

- Relief the physicians (search the literature, contact the microbiology laboratory, test for interaction…)
- Optimal care for the patient (focus infectiology)
- Teaching for the resident physicians
- Contribution against the resistance development
- A fascinating job for clinical pharmacists