

basic requirements for the microbiological laboratory comparing Germany - Mongolia

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Medical Care Center
Dr. Eberhard & Partner Dortmund (ÜBAG)
www.labmed.de

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Microbiological diagnostics – reliable results:

*Quality of microbiological results is highly dependent on the quality of specimen – specimen must be suitable for the desired examination !
Even the best laboratory diagnostics is not capable, to compensate incorrect collection of specimen!*

(Germany: Microbiological-Infectiological Quality standards: MIQ)

praeanalytics ● laboratory ● postanalytics



... the weakest chain-link is decisive !

● **suitable specimen for local wound infections**

- **swabs:**

for wound, nose, urogenital ...
"... material from the depth of the wound!"
thick, rigid swab with transport-media



> **swab into culture media, tight closing of tube !**

> **in-between storage: room temperature**

● **pneumonia and urinary-tract-infection**

- **sterile 30 ml-tube**

for bronchoscopic material, sputum, urine ...
"... bronchic secretion is better than sputum,"



for respiratory- and urinary-tract-samples:

> **in-between storage: cold – temperature about 4 ° C**

... also environment: hygiene-management !

▶ **swabs**

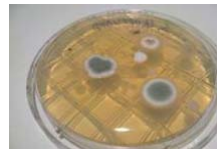
for surfaces, corners difficult to access ...

▶ **sterile tubes**

for liquids, small particles ...

▶ **RODAC-plates / culture media for surfaces ...**

after incubation:
germination-number and
identification of bacteria



Check, if the current disinfection-management is effective and successful !

basic: quality management

a quality-management must be established in microbiological labs:

- the range

... discription of ALL (!) relevant prodedures in SOP's



- the implementation

... is everyone familiar with the main rules / diagnostic methods?

● Microbiological-Infectiological Quality Standards !

newest knowledge concerning microbiological diagnostics
... including main target, epidemiology, detection-methods, indication for microbiological diagnostics ...



basic: laboratory rooms / infrastructure

● suitable arrangements / environments:

- no complicated delivery-ways for goods

(no stairs, short ways, good closing doors, enough storing place for incoming goods and waste)

- sufficient electric- and water-installation

(less plug connectors for very sensitive (!) equipment)

- sufficient working ventilation facilities

(as less as possible air-contamination with mould; income of mould possible by passive ventilation)



basic: diagnostic equipment

● inoculation loops

- reusable loops: decontamination by flame-scarfing
(single-use 10µl loops are more comfortable and shure!)

● incubators

- proper technical condition must be guaranteed!
(routine: 37 ° C / yeasts: 30 ° C / Campylobacter: 42 ° C)
- temperature-check every morning: protocol sheet
(same should be done with refrigerators used for diagnostic methods; storage of media, testkits etc.)



Temperature-documentation Incubators tolerance: ± 1°C*		Number: F 007
Laboratorium für Medizin Diagnostik Dr. Eberhard & Partner		Date: 19.02.08
desired value:		Version: 3.1
internal equipment-number:		Page: 1 of 1
month / year:		Document Number: F 007
Temperature	tolerance	Temperature

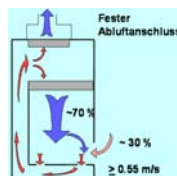
● microscope

- adjusted and cleaned every day

● laminar air flow / working bench ?

- necessary only for relevant "high-risk"-specimen!
- proper technical condition must be guaranteed!
(connection to ventilation-facility, if possible)
- ... only for examination and not a writing place!

**filtering system with signs of failure: call service!
otherwise no proper protection of staff – BIOHAZARD !**



basic: identification

- **API-method: ... easy, well experienced, mostly valid**
 - interpretation by the staff (subjective)
 - some known problems with detection of bacteria
(gram (+) bacilli, Streptococci etc.)

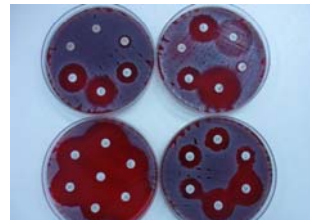


- **automatisation: ... faster, more sensitive and specific**
 - interpretation by an photometer (objective)
 - revision of the results by an "Expert-Program"
(software suggests plausibility-checked identifications of bacteria: Quality management!)

basic: susceptibility testing

- **agar diffusion: ... well experienced, mostly valid**
 - ... but not always easy - interpretation!
(“in vitro- vs. in vivo-effectiveness” of antibiotics! indicates problems:
e.g. Oxacillin-testing for MRSA)

Staff has to be the „Expert“: checking important rules !
e.g. *Staphylococcus aureus*:
if MRSA, all β -Lactames and Carbapenems are resistant



basic: results / reports / statistics

- **communicated as handwritten sheets**
(patient-data, identification and susceptibility-testing)
- **if necessary: comments on important results**
(e.g. MRSA, VRE, other MDR-bacteria)
- **afterwards putting results into a software program**
(documentation, statistical evaluation and periodically sendings to governmental health-institutions)
- **... the target should be: paperless documentation!**



- **... current statistics:**
 - are sometimes not available
 - or not very detailed, sometimes deficient
 - and not unitized between hospitals/medical centers

The current solutions may be sufficient enough
at the moment, but:

**Implementing a more intensive management of healthcare-associated infections (larger amount of specimen !)
this would cause a lot additional manual work !**

- **advantagous in the future:**
 - **usage of a LIS (Laboratory-Information-System)**
(documentation of diagnostic steps - printing of results)

"basic" and "advanced":

What is the difference between microbiological Laboratories in urban and rural areas in Mongolia?

The "basics" should be fulfilled everywhere!

... otherwise you may get wrong results
... antibiotic treatment may not be effective

... otherwise it means wasting money!

advanced: requirements for bigger Laboratories

- **amount of specimen in bigger microbiological labs**
 - **evaluating more than 50 specimen a day**
(from own or cooperating hospitals or medical centers or outpatients)
- **quality management**
 - **documentation (SOP's) must be profound**
(International standards: accreditation?)
 - **set terms of susceptibility-testing**
(which spectre of antibiotics for the bacteria-groups?)
 - **assure the availability of all these substances**
 - **and then: establish this as a "standard"**
(... ideally in all microbiological laboratories)

... a challenge!

● **diagnostic equipment**

- get more experience with automated systems !
- automatisisation: faster, more sensitive and specific !
- the „Expert“ is included
(modern kind of identification and susceptibility-testing:
VITEK *BioMerieux*®/Phoenix *BectonDickinson*®/MicroScan *Siemens*®)

interpretation by a photometer (objective):
software verifies the measured values and give some suggestions for changing the values!

- identification by mass-spectrometry (MALDI-TOF) ?
(within minutes !)



● **results / reports / statistics: workflow with a LIS:**

- arrival of specimen (acceptance-area of lab):
- plausibility-check



- enter specimen-data into the LIS
- label the specimen-vials and the form
(with a unique LAB-number: barcode)



- Data for "Resistant" or "Sensitive"?

(Comment belonging to the data if "resistant" or "sensitive" would be helpful/necessary - specially for those who are working with these statistics!

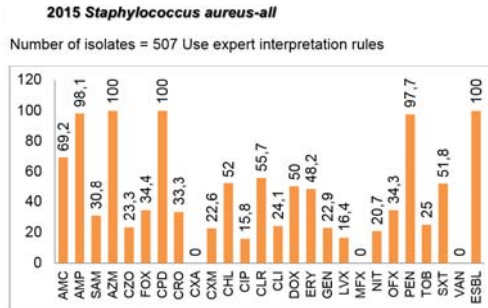
I suppose these data show "resistant" bacteria ...)

Example

Staphylococcus aureus:

- AMC, SAM, CZO, FOX, CPD, CRO, CXA and CXM usually identical!

- why ESBL (100%)?



... ESBL only relevant for gram-negative Bacteria!

Example

Klebsiella spp.:

- AMP must be 100 % resistant
(natural resistance)

- AMP and SAM should be identical

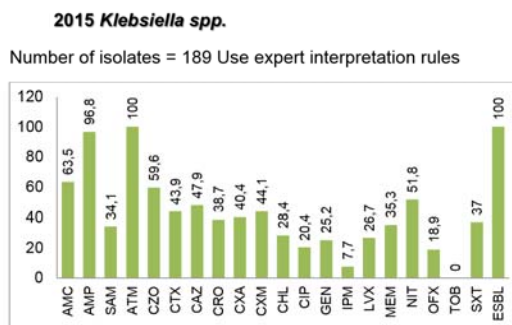
- CTX usually close to ESBL

(here 43,9 % vs. 100 % ?)

-IMP and MEM must be quite the same

(IMP: 7,7 > too high ; MEM: 35,3 > much too high!)

... ESBL 100 % ?



● Germany: increasing cases of MRGN (Gram-Negative) !

Abnahmedatum: o. Ang.

Klinische Angaben:

UNTERSUCHUNGSMATERIAL:

Abstrich rectal

ANGEFORDERTE UNTERSUCHUNGEN:

Multiresistente gramnegative

Erreger (MRGN)

R E S U L T A T E :

NACHGEWIESENE KEIME:

1. Klebsiella pneumoniae

(mäßig viel)

CAVE! Multiresistenz! (4MRGN)

2. Klebsiella pneumoniae

(vereinzelt)

CAVE! Multiresistenz! (4MRGN)

3. Klebsiella pneumoniae

(wenig)

CAVE! Multiresistenz! (4MRGN)

CAVE! Panresistentes Isolat!

BEMERKUNG:

Multiresistenz 3MRGN bzw. 4MRGN:
Resistenz gegenüber 3 bzw. 4 der Anti-
biotikagruppen Acylureidopenicilline,
Cephalosporine der 3./4. Generation,
Carbapeneme und Fluorchinolone.

HINWEIS zum Infektionsschutzgesetz:

Folgende hier nachgewiesenen Keime
sind aufgrund ihrer Resistenz in der
Liste der gemäß §23 IfSG zu erfassen-
den Erreger aufgeführt:

* Klebsiella pneumoniae

ANTIBIOGRAMME

	1.	2.	3.
Ampl-/Amoxicillin	R	R	R
Piperacillin	R	R	R
Amoxicillin+Clavulans.	R	R	R
Ampicil.+Sulbactam	R	R	R
Piperacil.+Tazobactam	R	R	R
Cefuroxim	R	R	R
Cefotaxim/Ceftriaxon	R	R	R
Ceftaridim	R	R	R
Imipenem	R	R	I
Meropenem	R	R	R
Gentamicin	R	R	R
Tobramycin	R	R	R
Amikacin	I	I	I
Fosfomycin	S	R	R
Ciprofloxacin	R	R	R
Levofloxacin	R	R	R
Cotrimoxazol	R	R	R
Tigecyclin	R	R	R
Chloramphenicol	R	R	R
Colistin	S	S	R

(S=sens. I=interm. R=resistent)

conclusion

main target microbiology: fast and correct results !

- laboratories should become better equipped
- all needed reagents must be available (!)
- determine standards for microbiological diagnostics
- interests should be bundled / specialized
- the network of knowledge should be improved
- go on training doctors, microbiologists and staff



Mongolian Emergency Service
Hospital Hygiene Project

**All participants should work hand in hand !
... but also have to remember hand disinfection!**



Please support your hygiene-management !

Thank you for your attention!