

CPE / ESBL-CARBA screening

New NordicAST document



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CPE / ESBL-CARBA?

- CPE = carbapenemase-producing Enterobacteriaceae
 - *Klebsiella pneumoniae*, *E. coli*, *Enterobacter cloacae*...
- ESBL-CARBA = carbapenemases
 - Enzymes that hydrolyze carbapenems (meropenem, imipenem, ertapenem, doripenem)
- Three groups
 - A: KPC
 - B: NDM, VIM and IMP
 - D: OXA-48



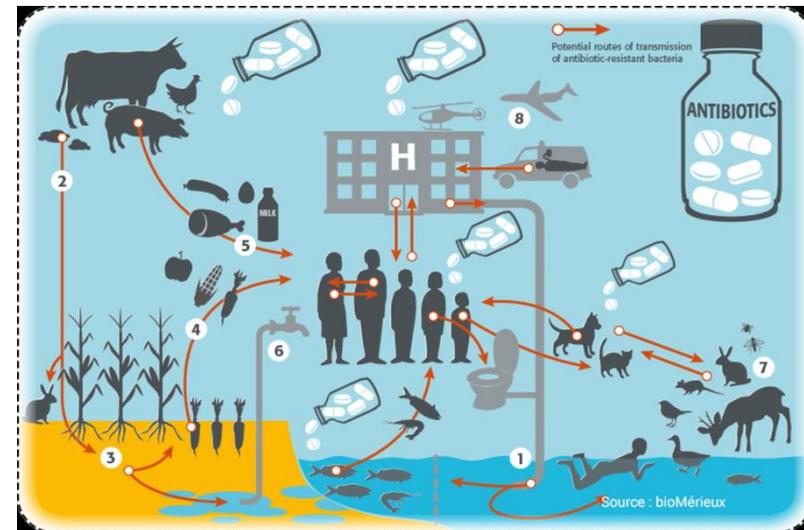
Why CPE screening?

- CPE carriage may cause difficult to treat infections – known carrier status may lead to correct antibiotic treatment earlier
- Prevent patient-to-patient transmission and CPE outbreaks in hospitals



How to become CPE carrier?

- In hospitals
 - From the hospital environment (equipment...)
 - Patient-to-patient transmission (outbreaks)
- In the community
 - Close contact with carriers
 - Animals, food, water?
 - Travel outside Nordic countries



ESBL/CPE import

- Travel
 - 30% colonized by ESBL after travelling
 - Risk factors: travel to India, South-East Asia og North-Africa
- Health tourism and hospitalization outside Nordic countries (ESBL-CARBA)
- Immigration...



Östholm-Balkhed *et al.* J Antimicrob Chemother 2013; 68: 2144-53
Kumarasamy *et al.* Lancet Infect Dis 2010; 10: 597-602

The NordicAST CPE screening document

- **Recommendations on laboratory methods for CPE / ESBL-CARBA screening**
- Which method to choose?
 - Culture-based screening?
 - Direct molecular screening?
 - Both?



http://www.nordicast.org/d/4288?store_referer=true

Who to screen?

- **See national/local infection control policies for:**
 - Indication for screening
 - Sampling sites (a feecal/rectal sample should always be taken)
 - Number and interval of screening samples
 - Consequences of a positive or negative result

Culture-based screening

- What are we looking for?
 - Do we aim to find all ESBL-CARBA/CPE strains?
 - What about species other than Enterobacteriaceae (*P. aeruginosa* and *Acinetobacter* spp.)?
- How?
 - Selective in-house or commercial media?
 - Non-selective media with antibiotic discs?
 - Which and how many media do you need?
 - Enrichment broth?
 - Time of incubation?



Challenges and conciderations

- The level of carbapenem resistance varies, and one media will not detect all CPE strains
- Decreased susceptibility to carbapenems may be due to chromosomally encoded mechanisms such as AmpC-production combined with changes in the outer membrane permeability or efflux-pumps (specificity?)
- The use of an enrichment broth may increase sensitivity, but it takes an extra day to achieve a result
- Prolonged incubation time (from 18-24h to 48h) may increase sensitivity, but reduce specificity – and takes an extra day.

Selective chromogenic media (I)

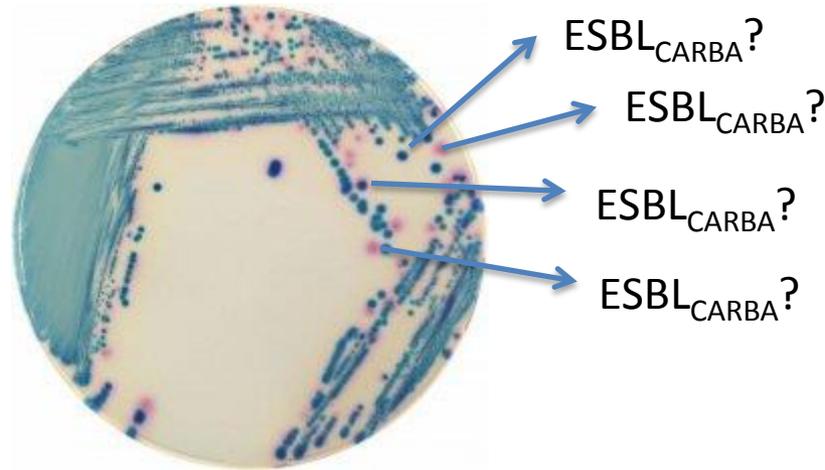
- $ESBL_A$:
 - ChromID ESBL (BioMerieux)
 - Brilliance ESBL (Oxoid)
 - CHROMagar ESBL (Chromagar)
 - Chromatic ESBL m/ESBL supplement (Liofilchem)
- $ESBL_A + ESBL_{M-C}$:
 - Chromatic ESBL + AmpC supplement (Liofilchem)
 - CHROMagar C3GR (Chromagar)

Selective chromogenic media (II)

- $ESBL_{CARBA}$:
 - ChromID CARBA (BioMerieux)
 - Brilliance CRE (Oxoid)
 - CHROMagar KPC (Chromagar)
 - Chromatic CRE (Liofilchem)
- $ESBL_{CARBA-D}$ (OXA-48):
 - ChromID OXA-48 (BioMerieux)
 - Chromatic OXA-48 (Liofilchem)
- $ESBL_{CARBA}+ESBL_{CARBA-D}$ (OXA-48):
 - ChromID CARBA SMART (BioMerieux)
 - mSuperCARBA (Chromagar)

Challenges and limitations (I)

- $ESBL_A$ media:
 - $ESBL_{CARBA-D}$ (OXA-48) will not be detected
 - Identification of $ESBL_{CARBA}$ isolates takes 48 h

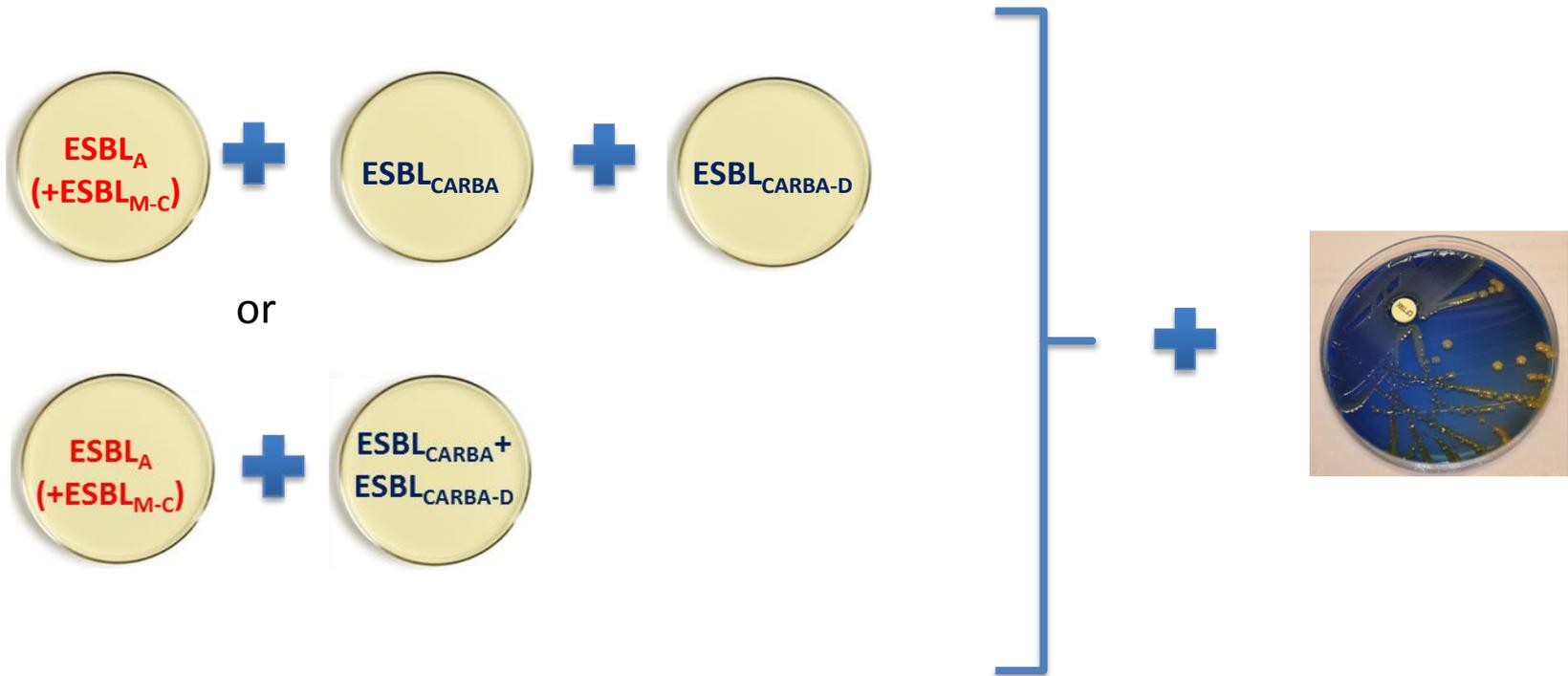


- $ESBL_A + ESBL_{M-C}$ media:
 - Low specificity due to species hyperproducing chromosomally encoded AmpC

Challenges and limitations (II)

- $ESBL_{CARBA}$ media:
 - Low sensitivity for the detection of $ESBL_{CARBA-D}$ (OXA-48)
- $ESBL_{CARBA-D}$ (OXA-48) media:
 - Low sensitivity for detection of $ESBL_{CARBA-A}$ & $ESBL_{CARBA-B}$
- $ESBL_{CARBA} + ESBL_{CARBA-D}$ (OXA-48) media:
 - High sensitivity for ESBL-CARBA detection!

Possible strategies...



- Suspected CPE colonies must be confirmed!

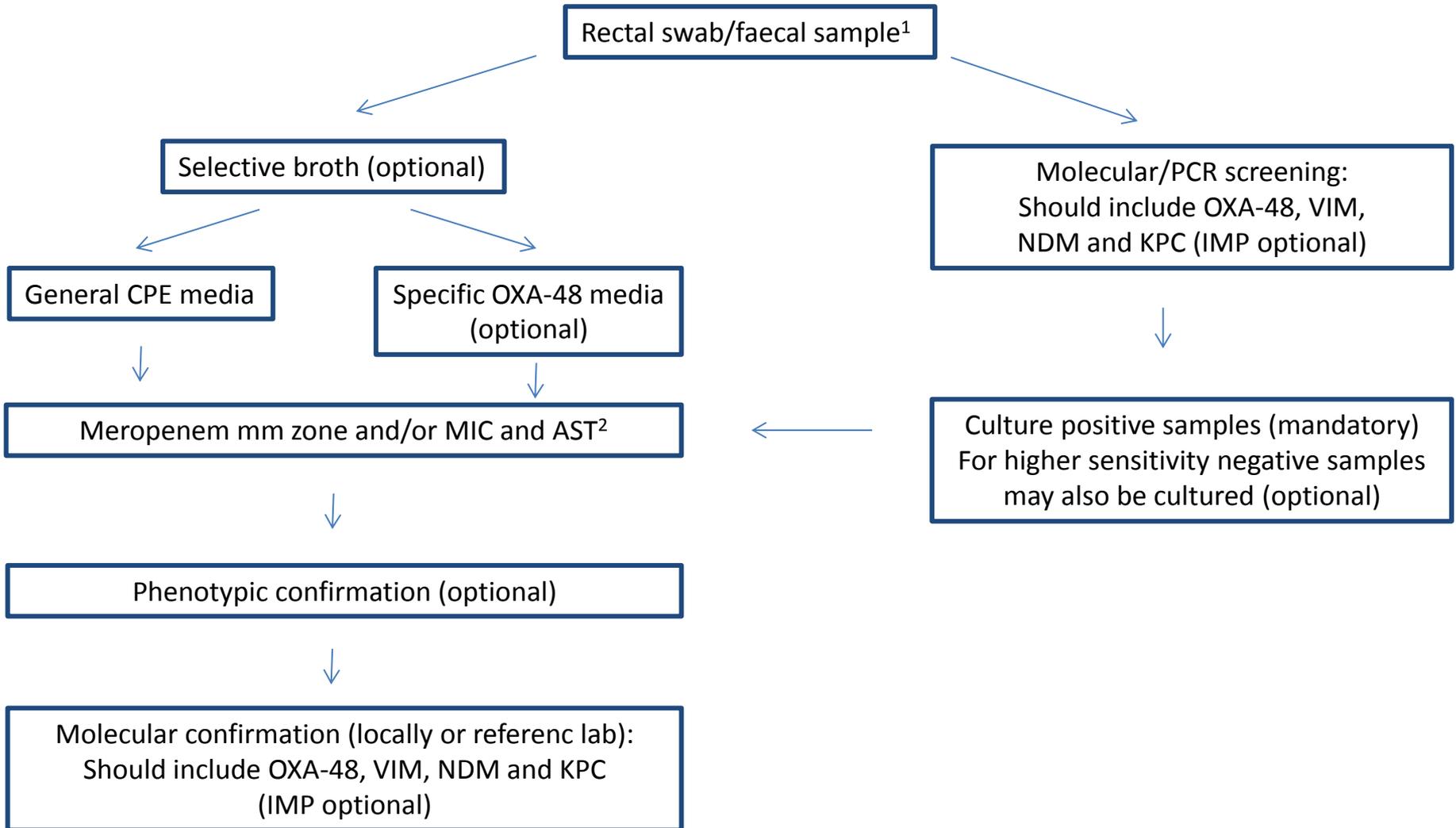
Confirmation of suspected CPE

- Identification to the species level
- Decreased susceptibility to meropenem should be confirmed by DD and/or MIC
- Phenotypic confirmation testes:
 - Synergy tests (e.g. ROSCO discs)
 - CarbaNP
 - Maldi-TOF
- Final confirmation by detection of an ESBL-CARBA encoding gene
 - Should include detection of KPC, OXA-48, NDM, VIM (IMP)

Direct molecular screening

- Advantages:
 - Short turnaround time
 - Higher sensitivity than culture-based methods
 - Disadvantages:
 - The range of detectable strains are limited to those targeted by the chosen assay
 - Difficult to validate assays in low-endemic settings
 - Higher costs?
- Should be used in combination with culture-based methods

CPE (ESBL-CARBA)



1 CPE-screening must include a rectal swab or faecal sample. Other relevant sites may also be sampled.

2 According to EUCAST/NordicAST recommendations.

Thank you for your attention!

