Proteus vulgaris - Proteus penneri - Proteus hauseri (LTR62582)

Edit Approved By: Solomon, Natalia (05/19/2022) **Revision: 7.00**

Organism

Proteus vulgaris / Proteus penneri / Proteus hauseri

Clinical

These organisms are found in a variety of environmental sources and may be part of the normal flora of the gastrointestinal tract. *P. vulgaris* and *P. penneri* are associated with nosocomial infections especially of the urinary tract. They may also cause infections (wounds, abscesses, and bacteremia) in immunocompromised patients who have received prolonged antibiotic therapy.

Usual susceptibility pattern

These organisms produce an inducible chromosomal cephalosporinase (Class A – cefuroximase) and are resistant to ampicillin and first/second generation cephalosporins (not cefoxitin). They remain susceptible to beta lactam/beta lactamase inhibitor combinations such as amoxicillin-clavulanate, ticarcillin-clavulanate and piperacillin-tazobactam. MICs to cefotaxime and especially to ceftriaxone may be elevated. Induction and hyperproduction of the chromosomal enzyme results in resistance to 3rd generation cephalosporins (although ceftazidime may still test susceptible in vitro, it is not recommended if hyperproduction of the chromosomal enzyme is suspected). Cefepime and aztreonam may test susceptible in this setting but should be avoided or used with caution.

Although extended spectrum beta-lactamase (ESBL) may be found in these organisms, conventional ESBL testing is not reliable due to interference by the chromosomal cephalosporinase. Cefepime +/- clavulanate acid may detect an ESBL enzyme.

These organisms are usually susceptible to aminoglycosides, TMP-SMX, quinolones, and carbapenems. (Exception: May exhibit decreased susceptibility to imipenem (decreased affinity to PBP2) that does not affect other carbapenems.) *P. vulgaris complex* are resistant to nitrofurantoin, tetracycline and colistin. *P. penneri* is chloramphenicol resistant, whereas other *Proteus spp.* are susceptible.

Susceptibility method

VITEK2. Additional tests (Disc diffusion or Etest method) are performed using Mueller-Hinton agar incubated in ambient air at 35°C for 16-20 hours.

Note: For Etest use 0.5 McFarland suspension in saline.
For mucoid strains use 1.0 McFarland.

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Susceptibility reporting

	CSF/ Brain	Blood/ Sterile Body Site/ Endovascular Catheter	Urine	Other	Comments
Amikacin		3	3	3	3rd line if gent and tobra I/R Disc diffusion
Amoxicillin/ Clavulanate oral			✓	✓	**See Special Considerations**
Amoxicillin/ Clavulanate IV		✓		✓	Only report if ceftriaxone S Report same as AMC oral
Ampicillin	R	R	R	R	
Cefazolin		R	R	R	
Cefixime			R		
Ceftriaxone	*	*			*Only report if I/R. If I report as R.
Ciprofloxacin		✓	✓	✓	Do not report in patients < 18 y
Ertapenem		✓	2	2	2nd line if pip/taz or cipro or TMP-SMX I/R If S do not report in patients < 3 months **See Special Considerations**
Gentamicin	*	✓**	✓	✓**	* Report only in neonates (< 1 month) ****See Special Considerations**
Meropenem	✓	✓	2*	2*	2nd line if pip/taz or cipro or TMP-SMX I/R * Report 1st line in neonates (< 1 month) **See Special Considerations**
Nitrofurantoin			R		Add comment: For uncomplicated lower UTI only #f1
Piperacillin/ Tazobactam		2* †		2*	2nd line if AMC IV R and ceftriaxone S *Report if *P. aeruginosa* co-isolated and ceftriaxone S † For bloods report if I/R and ceftriaxone S **See Special Considerations**
TMP-SMX	*	✓	✓	✓	* Report only at physician request
Tobramycin		2*	2	2*	2nd line if gent I/R ***See Special consideration**

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Special considerations

Amoxicillin/ Clavulanate oral:	A MIC of 8/4 µg/mL is at upper limit of susceptibility. This may be adequate to achieve reasonable pharmacodynamics in urine but may not be optimal for non-urinary sites. For all non-urinary sites if MIC 8/4 µg/mL and interpretation is S add comment: "This isolate tests at the upper limit of susceptibility for amoxicillin/ clavulanate. Clinical failure may occur despite in vitro susceptibility".#A315 **I/R VITEK 2** results are not recommended due to a card limitation. Perform an alternate method prior to reporting of results
Ertapenem / Meropenem:	If reporting ertapenem and meropenem add comment: "Imipenem has intrinsically low activity against this organism." #A375
Gentamicin/ tobramycin:	Organisms testing at upper limit of susceptibility (4µg/mL) may not achieve optimal pharmacokinetics/pharmacodynamics. **For non-urine isolates:** If MIC 4.0 µg/mL add comment: "This isolate tests at the upper limit of susceptibility for gentamicin. Clinical failure may occur despite in vitro susceptibility". #A312 **or** "This isolate tests at the upper limit of susceptibility for tobramycin. Clinical failure may occur despite in vitro susceptibility"#A313 **or** "This isolate tests at the upper limit of susceptibility for both gentamicin and tobramycin. Clinical failure may occur despite in vitro susceptibility". #A314
Piperacillin/ tazobactam:	Do not report as S if ceftriaxone or ceftazidime I/R (≥2µg/mL) as piperacillin/tazobactam is not recommended if either an extended spectrum beta-lactamase (ESBL) and/or a cephalosporinase is present.

Interpretation

For Etest, report actual MIC result. For interpretation (S, I, and R) report according to nearest higher doubling dilution **(Appendix 1)**.

Use **CLSI** interpretive document for **Enterobacterales**.

For Beta-lactam drugs – Refer to Beta-lactam Resistance Detection Charts.
For Amoxicillin/Clavulanate, gentamicin and tobramycin – Refer to Special Considerations