Streptococcus pneumoniae (LTR70663)

Edit Approved By: Van der Walt, Peet (10/24/2022) **Revision: 5.00**

Organism	**Streptococcus pneumoniae**
Clinical	*S. pneumoniae* can cause pneumonia, sepsis, meningitis, otitis media, and sinusitis. It has rarely been associated with urinary tract infections, osteomyelitis and skin/soft tissue infections. This organism can colonize the nasopharynx, especially of children.
Usual susceptibility pattern	Resistance to penicillin (both intermediate and high-level) is geographically variable. Penicillin intermediate and resistant isolates of *S. pneumoniae* exhibit decreased susceptibility to all oral cephalosporins. Amoxicillin retains the best coverage of all oral beta-lactams against penicillin intermediate strains of *S. pneumoniae*. Resistance to cefotaxime/ceftriaxone is rare but increasing. Rare strains have been described that are susceptible to penicillin but resistant to cefotaxime/ceftriaxone. Ceftazidime intrinsically has poor activity against *S. pneumoniae* and should not be used empirically for this organism. Resistance to macrolides and trimethoprim/sulfamethoxazole is common. Macrolide resistance may be due to target site modification or active drug efflux. Clindamycin resistance is increasing. Vancomycin tolerance (which may be due to defective autolytic activity) has been described. Quinolone resistance is increasing but may be difficult to detect as first step mutations may not be apparent by standard in vitro testing. Tigecycline has been proposed as an agent for *S. pneumoniae* but susceptibility testing still requires standardization as the E test method may overestimate resistance with MICs up to four fold higher than microbroth dilution. *S. pneumoniae* should be susceptible to linezolid.
Susceptibility method	VITEK2. Additional tests (Disc diffusion or Etest method) are performed using Mueller-Hinton agar with 5% sheep blood incubated in 5% CO_2 at 35°C for 20-24 hours. Recommend Etest method for mucoid strains. **Note:** For Etest use 0.5 McFarland suspension in broth. For mucoid strains use 1.0 McFarland. **Refer to S. pneumoniae Beta-Lactam Reporting Charts**

Susceptibility reporting

	CSF/ Brain	Blood	Sterile Body Site	Deep Eye	Urine	Other	Comments
Amoxicillin		2	2		✓	✓	**See Special Considerations** 2nd line if pen ≥0.12 µg/mL
Amoxicillin-Clavulanate (oral)						*	* Report (same as Amoxicillin) if Haemophilus (β lactamase +)/Moraxella/ S. aureus (MSSA) or anaerobes co-isolated
Cefotaxime	*	*	*	*	2	2	*Report if patient ≤3 months 2nd line if amox I/R or cefuroxime I/R and patient ≤3 months **See Special Considerations**
Ceftriaxone	✓	✓	✓	✓	2	2	Do not report if patient ≤1 month 2nd line if amox I/R or cefuroxime I/R **See Special Considerations**
Cefuroxime					✓	✓	**See Special Considerations**
Clindamycin			2	2		2	2nd line if pen ≥0.12 µg/mL **See Special Considerations**
Erythromycin				✓		✓	If erythromycin S and clindamycin I/R **see Special Considerations**
Imipenem		2	2		3	3	Etest method 2nd or 3rd line if cefotaxime or ceftriaxone I/R **See Special Considerations**
Levofloxacin		2	2	✓	2	2	Do not report if patient < 18 y (exception eye specimens) 2nd line if pen ≥0.12 µg/mL **See Special Considerations**
Moxifloxacin				✓			**See Special Considerations**
Meropenem	2	2	2		3	3	Etest method 2nd or 3rd line if cefotaxime or ceftriaxone I/R **See Special Considerations**
Penicillin	✓	✓	✓	✓		✓	**See Special Considerations**
Tetracycline						2	2nd line if pen ≥0.12 µg/mL Do not report if patient < 8 y **See Special Considerations**
TMP-SMX				✓	✓	✓	
Vancomycin	✓	✓	2	✓	3	3	3rd line if cefotaxime or ceftriaxone I/R If vanco nonsusceptible **see Special Considerations**

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Note

<table>
<tr><td>Deep eye specimens:</td><td>Perform susceptibility test if:
<table>
<tr><td>• vitreous fluid</td><td>• canaliculitis</td><td>• corneal ulcer / scrapings</td></tr>
<tr><td>• chamber aspirate</td><td>• endophthalmitis</td><td>• contact lens related infections</td></tr>
<tr><td>• intraocular fluid</td><td>• donor sclera</td><td>• ophthalmology clinic/ward</td></tr>
<tr><td>• keratitis</td><td>• chorioretinitis</td><td>• history of failure of therapy</td></tr>
<tr><td>• injury/surgery</td><td>• cornea</td><td>• preseptal/orbital cellulitis</td></tr>
</table></td></tr>
<tr><td>Superficial eye specimens:</td><td>Susceptibility testing of superficial eye specimens not routinely performed.
• Add comment:
“Susceptibility testing of topical antibiotics is not standardized and is not routinely performed on superficial eye infections.” &A89</td></tr>
</table>

Special considerations

<table>
<tr><td><u>Amoxicillin/ Cefuroxime/ Penicillin:</u></td><td>Refer to Streptococcus pneumoniae Beta-Lactam Reporting Charts</td></tr>
<tr><td rowspan="2"><u>Cefotaxime/ Ceftriaxone:</u></td><td>Refer to Streptococcus pneumoniae Beta-Lactam Reporting Charts</td></tr>
<tr><td>If patient ≤1 month report cefotaxime only.
If patient >1-3 months report cefotaxime and ceftriaxone.
If patient >3 months report ceftriaxone only.

Isolates exhibiting different interpretive categories to ceftriaxone and cefotaxime do exist although their prevalence is low. For these isolates ceftriaxone is often more susceptible than cefotaxime although the opposite has been described.</td></tr>
<tr><td><u>Clindamycin:</u></td><td>If clindamycin S/I and erythromycin I/R this may indicate inducible resistance. Check for inducible resistance with D test.
<table>
<tr><th>IF…</th><th>THEN….</th></tr>
<tr><td>D test is positive</td><td>• Report clindamycin R
• Add comment:
“This isolate is presumed to be resistant to clindamycin based on detection of inducible clindamycin resistance.”#A140</td></tr>
<tr><td>D test is negative</td><td>• Report clindamycin as tested</td></tr>
</table></td></tr>
</table>

Streptococcus pneumoniae, Continued

Special considerations (continued)

Erythromycin:	Erythromycin resistance predicts resistance to clarithromycin and azithromycin.
	If erythromycin S and clindamycin I/R confirm results. This may represent a rare mechanism of resistance. • Confirm clindamycin and erythromycin by disc diffusion and D test. • Consult Microbiologist
Imipenem/ Meropenem:	• **Refer to *Streptococcus pneumoniae* Beta-Lactam Reporting Charts** • Carbapenems have variable activity against Gram positive organisms. Must test each individually.
Levofloxacin/ Moxifloxacin:	First step mutations or efflux mediated mechanisms leading to quinolone resistance may not be detected by routine susceptibility testing using the current breakpoints.
	If levofloxacin S: • Add comment: "Partial resistance to quinolones may not be detected by standard susceptibility testing methods. Quinolones should be avoided or used with caution if history of recent quinolone use". **(23353)**
	Deep eye specimens: • Moxifloxacin susceptibility testing is available on VITEK2 AST-ST03 card but has not been validated. • Levofloxacin susceptible strains are predictably susceptible to moxifloxacin but moxifloxacin susceptible strains cannot be assumed to be susceptible to levofloxacin. **If** levofloxacin S and moxifloxacin S: • Report levofloxacin and moxifloxacin as S **If** levofloxacin S and moxifloxacin I/R: • Perform levofloxacin disc diffusion to confirm VITEK2 result • Consult Microbiologist
Tetracycline:	• Doxycycline and minocycline may have better activity than tetracycline, and may be reported on physician request. • Isolates that are susceptible to tetracycline are predictably susceptible to doxycycline and minocycline. • If tetracycline I/R – test doxycycline or minocycline separately at physician request.
Vancomycin:	• This organism should be susceptible to this antibiotic. Consult Supervisor if not susceptible. • If 'nonsusceptible', the organism ID and susceptibility should be confirmed by repeat testing. If confirmed, consider submitting isolate to a reference laboratory.

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Interpretation

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

Use **CLSI** interpretive document for ***Streptococccus pneumoniae***.

Refer to *Streptococcus pneumoniae* Beta-Lactam Reporting Charts

For cefuroxime, use the cefuroxime sodium (parenteral) MIC breakpoints.

For cefotaxime/ceftriaxone and penicillin:

CSF/CSF shunt, brain, deep eye: report **CLSI** meningitis breakpoints.

Blood, other sterile body sites: report both **CLSI** meningitis and non-meningitis breakpoints

All other isolates: report **CLSI meningitis, non-meningitis and oral** breakpoints. **Note:** oral breakpoints only apply to penicillin