Streptococci and Enterococci

Percent Susceptible	No. Tested (a)	Penicillin or Ampicillin			Cefuroxime	Ceftriaxone	Vancomycin	Erythromycin	Clindamycin (b)	Meropenem	Trimethoprim/sulfa	Tetracycline (Doxycycline)	Gentamicin Synergy with Pen/Amp	Streptomycin Synergy with Pen/Amp	Moxifloxacin	Nitrofurantoin (UTI only)	Levofloxacin (UTI only)	Ciprofloxacin (UTI only)	Linezolid
		%S	%I	%R															
Streptococci																			
Grp. B (Strep. agalactiae)	316	100	0	0	–	–	–	59	61	–	–	–	–	–	–	–	98	–	–
Viridans (various species)	176	83	16	1	–	99	100	61	83	–	–	–	–	–	–	–	–	–	–
Strep. pneumoniae (c)	47	77d	–	23	91	100d	100	66	91	96	77	–	–	–	100	–	–	–	–
Enterococcus (no species I.D.) **(e)**	729	89	0	11	–	–	91	–	–	–	–	24	–	–	–	94	74	66	99
Enterococcus faecalis (e)	88	100	0	0	–	–	97	–	–	–	–	–	77	74	–	–	–	–	99
Enterococcus faecium (e)	139	16	0	84	–	–	39	–	–	–	–	–	95	55	–	–	–	–	98
Cost ($)		$	$	$	$	$	$	$	$	$$	$	$	$	$	$	$	$$$$	$	$$$

(a) First isolate from each patient was included.
(b) Penicillin is the drug of choice for all beta hemolytic streptococci; penicillin resistance has not been documented. Clindamycin induction test performed on all beta hemolytic streptococci and S. pneumoniae.
(c) Penicillin-susceptible isolates are also susceptible to all other β-lactam agents. β-lactamase inhibitor combination drugs do not add additional efficacy to penicillin alone.
(d) Based on meningitis interpretive criteria (more conservative). Nonmeningitis interpretation is 100% for penicillin. Infectious diseases consultation is recommended for meningitis in penicillin-allergic patients or those with resistant ceftriaxone or cefotaxime results.
(e) If susceptible, ampicillin is the drug of choice when enterococci must be treated. Ampicillin susceptibility predicts piperacillin susceptibility. Nitrofurantoin or ampicillin is recommended for uncomplicated UTI. Serious infections (septicemia, endocarditis) require both a β-lactam agent and an aminoglycoside. Use vancomycin+aminoglycoside only if strain is ampicillin-resistant or patient is penicillin allergic. High level resistance to gentamicin also indicates lack of synergy for tobramycin, amikacin and kanamycin.

Candida

Percent Susceptible or Susceptible-Dose Dependent by Broth Microdilution Method	No. Tested	Amphotericin B (a)	Caspofungin	Fluconazole (b)	Voriconazole (b)
Candida albicans	83	100	100	95	98
Candida glabrata	55	100	96	90	–
Candida parapsilosis	22(c)	100	100	96	96
C. tropicalis	14(c)	100	100	86	93
Other Candida spp.	14(c)	100	79	(d)	100
Costs ($)		$$$$	$$$$	$	$$$$

(a) Based on suggested resistant breakpoint MIC ≥2 μg/ml.
(b) Susceptibe dose-dependend breakpoint MIC was used.
(c) Data from <30 isolates may be statistically unreliable.
(d) Species other than C. krusei are 100% susceptible; C. krusei is intrinsically resistant to fluconazole.

SITUATIONS FOR WHICH THE USE OF VANCOMYCIN IS APPROPRIATE AND ACCEPTABLE:

1. For treatment of serious infections due to β-lactam-resistant gram-positive bacteria. Clinicians should be aware that vancomycin is usually less active and less rapidly bactericidal than β-lactam agents for organisms that are susceptible to the β-lactams. Clinicians should also be aware that vancomycin sensitive MIC 2mcg/ml is associated with increased treatment failures.
2. For treatment of infections due to gram-positive organisms in patients with serious allergy to b-lactam-antibiotics.
3. Prophylaxis, (infused 60-120 min before the first incision), in penicillin-allergic patients, as recommended by the Amer. Heart Assoc., for endocarditis following certain procedures in patients at high risk for endocarditis. Cephalosporins are still recommended for non-allergic patients.
4. Prophylaxis for major surgical procedures involving implantation of prosthetic materials or devices, e.g., cardiac and vascular procedures and total hip replacements, at institutions with a high rate of infections due to MRSA or MRCoNS. Currently MRSA and MRCoNS rates are 23% and 57% at SHC, respectively. A single dose administered 60-120 min before surgery is sufficient unless the procedure lasts more than 6 hours, in which case the dose should be repeated. Prophylaxis should be dc'd after 2 doses maximum.

Stanford HEALTH CARE

CLINICAL MICROBIOLOGY LABORATORY

SUH ANTIBIOGRAM DATA FOR BACTERIAL AND YEAST ISOLATES

Jan 1, 2016 - Dec 31, 2016

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Gram negative rods

Percent Susceptible	PENICILLINS				CEPHEMS			LACTAMS				AMINOGLYC's			OTHERS			Urine
	No. Tested (a)	Ampicillin	Amp/Sulbactam	Pip/Tazobactam	Cefazolin [Urine Only]	Ceftriaxone	Cefepime	Aztreonam (b)	Imipenem	Meropenem	Ertapenem	Gentamicin	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Trimeth/Sulfamethox	Nitrofurantoin
Achromobacter xylosoxidans	23(c)	–	–	87	–	–	13	0	91	74	–	0	0	9	21	57	83	–
Acinetobacter baumannii	16(c)	–	56	–	–	–	31	–	–	50	–	43	43	50	19	25	31	–
Burkholderia cepacia (d)	10(c)	Ceftazidime 70			–	Minocycline 70			–	50	–	–	–	–	–	–	50	–
Citrobacter freundii complex	85	0	0	87	0	79	96	73	100	100	99	94	93	100	93	95	86	93
Citrobacter koseri	74	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	94
Enterobacter aerogenes	100	0	0	85	0	82	99	80	93	100	98	99	99	100	100	100	100	13
Enterobacter cloacae complex	224	0	0	82	0	75	99	83	99	99	90	97	97	100	96	98	92	49
Escherichia coli	3339	51	48	95	87	89	96	85	100	100	100	90	89	100	77	77	71	97
Klebsiella oxytoca	113	0	72	94	71	88	99	88	100	100	100	94	91	100	96	97	81	75
Klebsiella pneumoniae	741	0	79	95	92	92	97	90	100	100	100	94	94	100	94	96	85	31
Morganella morganii	54	0	5	100	0	87	100	100	–	100	100	85	93	100	85	87	68	0
Proteus mirabilis	262	78	91	100	93	97	100	100	–	100	100	89	90	100	86	88	78	0
Proteus vulgaris	12(c)	0	44	100	0	–	100	100	0	100	100	100	100	100	92	92	83	0
Pseudomonas aeruginosa	545	–	–	91	–	–	89	79	87	90	–	94	97	96	86	85	–	–
Ps. aeruginosa CF mucoid (d)	130	–	–	84	–	–	83	82	72	81	–	–	93	71	60	–	–	–
Ps. aeruginosa CF non-mucoid (d)	101	–	–	78	–	–	63	67	63	72	–	–	78	47	54	–	–	–
Salmonella spp.	22(c)	68	–	–		91	–	–	–	–	–	–	–	–	96	–	96	–
Serratia marcescens	113	0	0	97	0	95	98	95	98	97	97	97	94	100	93	98	96	0
Stenotrophomonas maltophilia	87	–	–	–	–	–	–	–	–	–	–	–	–	–	–	89	97	–
Cost		$$	$	$$	$	$	$	$$$	$$$	$$	$$	$	$	$	$	$	$	$

(a) First isolate from each patient was included.
(b) Unlike aztreonam, aminoglycosides have synergistic activity with β-lactams (ex: piperacillin, ampicillin) against aerobic gram negative rods and enterococci. Aztreonam should only be used for treating documented infections due to susceptible organisms in patients with anaphylactic reactions to β-lactams. In patients with renal insufficiency, aminoglycosides can be administered safely when doses are adjusted for patient's renal function. For information on dosing, including single daily dosing, please contact a Clinical Pharmacist (beeper # available from unit secretary).
(c) Data from isolate totals <30 may be statistically unreliable.
(d) Cystic fibrosis patient isolates tested by disk diffusion.

Interpretation of susceptibility results

Results are reported as minimum inhibitory concentrations (MICs), the minimum amount of drug needed to inhibit growth *in vitro*. Interpretive criteria are based on achievable serum levels. For certain antibiotics, the amount excreted into the urine via the kidneys is above the MIC, and the agent is effective clinically in this site even though reported as "resistant". Intermediate results (I), especially for beta-lactam agents, indicate that doses higher than standard recommendations may be effective. In other cases, "I" results indicate that the organism may be susceptible or resistant but the *in vitro* tests are not sensitive enough to determine specifically. For this antibiogram, Intermediate results are NOT included within the "%S" category.

Staphylococci

Percent Susceptible	No. Tested	Penicillin	Nafcillin, Oxacillin (b,c)	1st generation Cephems (c)	Vancomycin	Erythromycin	Clindamycin (d)	Gentamicin	Trimeth/Sulfa	Moxifloxacin	Tetracycline (Doxy)	Linezolid
Staphylococcus aureus, ALL(b)	1890	(a)	77	77	100	60	74	97	99	74	95	100
MRSA (ONLY) (c)	436	0	0	0	100	16	54	96	98	25	95	100
MSSA (ONLY)	1454	(a)	100	100	100	72	80	97	99	88	95	100
Staph. lugdunensis	79	(a)	92	92	100	84	87	100	100	98	94	100
Staph. coagulase negative (other)	350	(a)	43	43	100	35	57	76	60	61	80	100
Cost ($)		$	$$	$	$	$	$	$	$	$	$	$$$

Haemophilus Influenzae

For infections with β-lactamase-producing H. influenzae: cefuroxime, cefotaxime, trimethoprim/sulfamethoxazole, amoxicillin/clavulanate or azithromycin is recommended. Cefotaxime or ceftriaxone is drug of choice for CNS infections. At Stanford, 74% of H. influenzae (n=124) are ampicillin susceptible.

(a) Penicillin sensitivity confirmed by PCR per request. Penicillin-resistant staphylococci should be considered resistant to all penicillinase-sensitive penicillins, including ampicillin, amoxicillin, mezlocillin, piperacillin and ticarcillin.
(b) For empiric therapy where S. aureus is a potential pathogen, nafcillin and first generation cephalosporins are recommended drugs of choice for infections other than serious or systemic, for which vancomycin should be used until the susceptibility results are available. Vancomycin MIC 2 mg/ml, currenlty interpreted sensitive, is associated with increased treatment failure.
(c) Oxacillin resistant staphylococci (MRSA & MRSE) should be considered resistant to all penicillins, cephalosporins (except anti-MRSA cephalosporins), imipenem and beta-lactams including combinations with clavulanic acid, sulbactam and tazobactam. Oxacillin susceptibility predicts susceptibility to all other beta-lactams and cephalosporins.
(d) Clindamycin induction test performed on all staphylococcal isolates.

Anaerobes (selected species)

Percent Susceptible by Etest	No. Tested (a)	Penicillin	Amp/sulbactam	Pip/tazobactam	Meropenem	Clindamycin	Metronidazole
Bacteroides fragilis	39	0	not available		92	40	100
Bacteroides sp. NOT fragilis	31	0	not available		93	23	100
Gram negative rods (other) (b)	44	70	not available		98	81	100
Clostridium perfringens	19(e)	90	not available		–	63	100
Clostridium sp. NOT perfringens	39	68	not available		–	66	100
Gram positive rods (other) (c)	29(e)	100	not available		100	93	88
Gram positive cocci	39	100	not available		–	74 (d)	97
Cost ($)		$	$	$$	$$	$$	$

(a) Not all isolates tested with every drug
(b) Include Fusobacterium, Prevotella, Porphyromonas, & other.
c) Non-sporeforming rods include Actinomyces, Bifidobacterium, Lactobacillus, Propionebacterium, and others.
(d) Notify Micro Lab to perform antibiotic susceptibility testing if clindamycin is being considered for a Peptostreptococcus.
(e) <30 isolates may be statistically unreliable

Campylobacter sp. (n = 40)	
Drug (mcg/mL)	% Resistant
Ciprofloxacin	45% R
Doxycycline	50% R
Erythromycin	5% R

M. tuberculosis (n = 19)	
Drug (mcg/mL)	% Resistant
Isoniazid (0.1)	5% R
Rifampin (1)	5% R
Ethambutol (5)	0% R
Pyrazinamide (100)	5% R