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)	382	100	0	0	–	–	–	53	63	–	–	–	–	–	–	–	97	–	–
Viridans (various species)	175	82	18	1	–	99	100	61	77	–	–	–	–	–	–	–	–	–	–
Strep. pneumoniae (c)	63	70d	–	30	93	92d	100	75	79	90	78	Doxy 69		–	98	–	–	–	–
Enterococcus (no species I.D.) **(e)**	1008	89	0	11	–	–	92	–	–	–	–	23	–	–	–	95	78	68	100
Enterococcus faecalis (e)	87	100	0	0	–	–	99	–	–	–	–	–	77	85	–	–	–	–	100
Enterococcus faecium (e)	115	22	0	78	–	–	35	–	–	–	–	–	90	60	–	–	–	–	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 98% 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. 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	80	100	100	100	100
Candida glabrata	61	100	95	84	–
Candida parapsilosis	20(c)	100	100	100	100
C. tropicalis	13(c)	100	100	92	92
Other Candida spp.	12(c)	100	100	(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 60% 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, 2017 - Dec 31, 2017

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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	26(c)	–	–	92	–	–	19	0	92	77	–	4	12	12	19	62	85	–
Acinetobacter baumannii	45(c,e)	–	76	–	–	–	67	–	–	78	–	73	73	76	60	69	62	–
Burkholderia cepacia complex (d)	12(c,e)	Ceftazidime 83%			–	Minocycline 75			–	58	–	–	–	–	–	–	46	–
Citrobacter freundii complex	107	0	0	89	0	84	100	82	96	99	99	95	94	100	97	96	86	95
Citrobacter koseri	116	0	94	97	96	99	100	97	100	100	100	99	100	100	99	99	99	90
Enterobacter aerogenes	123	0	0	81	0	80	98	80	98	100	98	98	98	100	99	100	98	24
Enterobacter cloacae complex	203	0	0	80	0	73	99	76	99	100	94	97	97	100	97	98	90	61
Escherichia coli	3606	50	49	95	85	88	83	82	100	100	100	90	89	100	77	77	69	97
Klebsiella oxytoca	154	0	69	92	72	92	97	92	100	100	100	96	94	99	97	98	85	88
Klebsiella pneumoniae	751	0	80	94	91	93	91	90	99	100	100	95	94	99	94	95	86	30
Morganella morganii	58	0	–	98	0	93	100	100	–	100	100	81	90	100	84	90	74	0
Proteus mirabilis	357	80	90	99	93	96	96	98	–	100	100	92	94	100	88	89	80	0
Proteus vulgaris	20(c)	0	71	100	0	–	100	100	–	100	100	100	100	100	95	95	100	0
Pseudomonas aeruginosa	475	–	–	95	–	–	93	85	90	92	–	94	99	96	91	87	–	–
Ps. aeruginosa CF mucoid (d)	129	–	–	92	–	–	78	80	75	81	–	–	93	66	71	–	–	–
Ps. aeruginosa CF non-mucoid (d)	82	–	–	78	–	–	76	71	70	77	–	–	79	56	63	–	–	–
Salmonella spp.	21(c)	86	–	–		91	–	–	–	–	–	–	–	–	85	–	91	–
Serratia marcescens	94	0	0	99	0	97	100	100	99	98	98	100	100	99	94	98	97	0
Stenotrophomonas maltophilia	55	–	–	–	–	–	–	–	–	–	–	–	–	–	–	86	96	–
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.
(e) Includes isolates from 2016.

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)	1726	(a)	77	77	100	60	76	98	99	75	94	100
MRSA (ONLY) (c)	389	0	0	0	100	11	56	95	97	22	94	100
MSSA (ONLY)	1337	(a)	100	100	100	74	82	98	99	90	95	100
Staph. lugdunensis	84	(a)	100	100	100	86	87	98	99	98	90	100
Staph. coagulase negative (other)	261	(a)	40	40	100	36	59	75	60	55	82	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, 78% of H. influenzae (n=110) 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,e)	Penicillin	Amp/sulbactam	Pip/tazobactam	Meropenem	Clindamycin	Metronidazole
Bacteroides fragilis	39	0	96	–	92	51	100
Bacteroides sp. NOT fragilis	28	0	80	–	93	57	100
Gram negative rods (other) (b)	33	72	100	–	100	53	100
Clostridium perfringens	16	88	100	–	100	44	100
Clostridium sp. NOT perfringens	34	82	100	–	97	50	100
Gram positive rods (other) (c)	31	100	100	–	100	93	–
Gram positive cocci	33	100	100	–	100	48 (d)	100
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 = 67)	
Drug	**%Susceptible**
Ciprofloxacin	56
Doxycycline	55
Erythromycin	96

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