Streptococci and Enterococci

Percent Susceptible	No. Tested (a)	Penicillin or Ampicillin			Cefuroxime	Ceftriaxone	Vancomycin	Erythromycin	Clindamycin	Meropenem	Trimethoprim/sulfa	Tetracycline (Doxycycline)	Gentamicin Synergy with Pen/Amp	Streptomycin Synergy with Pen/Amp	Moxifloxacin	Nitrofurantoin (UTI only)	Quinopristin/dalfopristin	Ciprofloxacin	Linezolid
		%S	%I	%R															
Streptococci																			
Grp. B (Strep. agalactiae) (b)	176	100	0	0	–	–	–	57	65	–	–	–	–	–	–	–	–	–	–
Viridans (various species) (c)	116	84	10	6	–	99	100	68	86	–	–	–	–	–	–	–	–	–	–
Strep. pneumoniae (d)	41	71e	0	29	92	97e	100	71	81	95	88	–	–	–	100	–	–	–	–
Enterococcus (no species I.D.) **(f)**	247	83	0	17	–	–	88	–	–	–	–	25	–	–	–	90	–	61	100
Enterococcus faecalis (f)	197	100	0	0	–	–	100	–	–	–	–	–	52	56	–	99	–	78	100
Enterococcus faecium (f)	96	20	0	80	–	–	34	–	–	–	–	47	89	64	–	35	79	0	99
Cost ($)		$	$	$	$	$	$	$	$	$$	$	$	$	$	$	$	$$$$	$	$$$

(a) Not all isolates tested against every antibiotic listed.
(b) Penicillin is the drug of choice for all beta hemolytic streptococci; penicillin resistance has not been documented.
(c) Clinically important species tested; MICs for penicillin and ceftriaxone performed on 113 strains.
(d) 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.
(e) Based on meningitis interpretive criteria (more conservative). Nonmeningitis interpretation is 95% for penicillin. Infectious diseases consultation is recommended for meningitis in penicillin-allergic patients or those with resistant ceftriaxone or cefotaxime results.
(f) 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 By Broth Microdilution (YeastOne, Trek Diagnostics)	No. Tested	Amphotericin B (a)	Caspofungin	Fluconazole	Itraconazole	Voriconazole
Candida albicans	113	100	97	98	98	98
Candida glabrata	76	100	99	79	41	86
Candida parapsilosis	18	100	100	100	100	100
C. krusei	6 b	100	100	50	100	100
Other Candida spp. (c)	19	100	100	88	89	89
Costs ($)		$$$$	$$$$	$	$	$$$$

(a) Suggested Ampho Resistant breakpoint MIC > or = 2 mcg/ml
(b) Data from <10 isolates may be statistically unreliable
(c) Includes C. tropicalis, lusitaniae, and others

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 β-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 33% and 62% 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
HOSPITAL & CLINICS
Stanford University Medical Center

CLINICAL MICROBIOLOGY LABORATORY

SUH ANTIBIOGRAM DATA FOR BACTERIAL AND YEAST ISOLATES

Jan 1, 2010 - Dec 31, 2010

Niaz Banaei, M.D., Director

Nancy Watz, CLS
Reference Technologist, Antibiotic Testing

Diane Getsinger, CLS
Reference Technologist, AFB/Mycology

Patricia Buchner, CLS
Reference Technologist, Anaerobes

Gram negative rods (a)

Percent Susceptible	PENICILLINS					CEPHEMS			LACTAMS			AMINOGLYC's			OTHERS			Urine Only	
	No. Tested (b)	Ampicillin	Piperacillin	Amp/Sulbactam	Pip/Tazobactam	Cefazolin	Cefotaxime	Cefepime	Aztreonam (c)	Imipenem	Meropenem	Gentamicin	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Trimeth/Sulfamethox	1ST GENERATION Ceph's [oral]	Nitrofurantoin
Achromobacter xylosoxidans	16	–	–	–	88	–	–	0	0	81	69	0	0	0	0	44	81	–	–
Acinetobacter baumannii	11	–	–	80	–	–	–	50	–	–	80	60	60	70	50	60	60	–	–
Burkholderia cepacia (d,e)	3	Ceftazidime 33%				–	Minocycline 67			–	67	–	–	–	–	–	100	–	–
Citrobacter freundii	32	0	–	0	90	0	86	100	79	100	100	97	100	100	97	97	81	–	94
Citrobacter koseri	27	0	–	0	100	100	100	100	100	100	100	100	100	100	100	96	100	–	73
Enterobacter aerogenes	39	0	–	0	70	0	65	100	85	100	100	100	100	100	95	95	97	–	5
Enterobacter cloacae	83	0	–	0	91	0	85	96	85	100	100	98	98	100	98	98	93	–	37
Escherichia coli	1022	47	–	61	90	83	89	96	89	100	100	88	87	99	74	74	67	–	94
Klebsiella oxytoca	41	7	–	85	100	66	100	100	100	100	100	100	100	100	95	95	93	–	71
Klebsiella pneumoniae	237	0	–	84	95	87	92	94	90	100	100	95	91	96	88	87	80	–	22
Morganella morganii	14	0	–	21	100	0	100	100	100	–	–	79	93	100	100	–	79	–	0
Proteus mirabilis	90	77	–	89	100	95	93	98	97	–	–	86	88	100	80	–	69	–	0
Proteus vulgaris (d)	4	0	–	75	50	0	–	100	100	100	100	100	100	100	100	100	50	–	0
Pseudomonas aeruginosa	354(f)	–	–	–	87	–	–	78	67	81	84	79	94	91	70	65	–	–	–
Ps. aeruginosa CF mucoid (e)	88(f)	–	84	Ticarcillin 81%			–	81	73	65	74	–	88	–	58	–	–	–	–
Ps. aeruginosa CF non-mucoid (e)	63(f)	–	76	Ticarcillin 61%			–	66	59	49	58	–	56	–	39	–	–	–	–
Salmonella spp. (d)	2	100	–	–	–	Ceftriaxone100%		–	–	–	–	–	–	–	100g	–	100	–	–
Serratia marcescens	58	0	–	0	100	0	100	100	100	97	97	100	93	100	91	97	95	–	0
Stenotrophomonas maltophilia	46	–	–	Ticarcillin/Clavulanate 42%			–		–	–	–	–	–	–	–	82	93	–	–
Cost		$$	$$	$	$$	$	$	$	$$$	$$$	$$	$	$	$	$	$	$	$	$

(a) Until final identifications are available, reports describe gram negative rods as lactose-fermenters (LF; such as E.coli, Klebsiella, Enterobacter, Citrobacter); non-lactose fermenters (NLF, such as Proteus, Serratia, Salmonella, Shigella), or non-fermenters (NF, such as Pseudomonas, Acinetobacter, Stenotrophomonas, and others, most of which are intrinsically more resistant to many antibiotics).
(b) Not all isolates tested against every antibiotic listed.
(c) 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).
(d) Data from isolate totals <10 may be statistically unreliable.
(e) Cystic fibrosis patient isolates tested by disk diffusion.
(f) Pseudomonas aeruginosa isolates not corrected for duplicates.
(g) Infectious Diseases consultation strongly recommended for determining treatment of Salmonella species recovered from blood.

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 (a)	Nafcillin, Oxacillin (b,c)	1st generation Cephems (c)	Vancomycin	Erythromycin	Clindamycin	Gentamicin	Trimeth/Sulfa	Moxifloxacin	Tetracycline (Doxy)	Linezolid
Staphylococcus aureus, ALL(b)	681	16	67	67	100	51	75	98	99	46	94	100
MRSA (ONLY) (c)	234	0	0	0	100	9	51	98	98	11	95	100
Staph. epidermidis (d)	3	0	0	0	100	0	0	33	67	0	–	–
Staph. lugdunensis	34	63	97	97	100	83	87	100	100	63	–	100
Staph. coagulase negative (other)	194	12	38	38	100	39	62	75	63	39	–	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 are ampicillin susceptible.

(a) Penicillin-resistant staphylococci should be considered resistant to all penicillinase-sensitive penicillins, including ampicillin, amoxicillin, mezlocillin, piperacillin and ticarcillin. β-lactamase sensitivity confirmed by request.
(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 µg/ml, currenlty interpreted sensitive, is associated with increased treatment failure.
(c) Oxacillin resistant staphylococci (MRSA & MRSE) should be considered resistant to all penicillins, cephalosporins, imipenem and beta-lactams including combinations with clavulanic acid, sulbactam and tazobactam. Oxacillin susceptibility predicts susceptibility to all other beta-lactams.
(d) Data from isolate totals <10 may be statistically unreliable.

Anaerobes (selected species)

Percent Susceptible by Etest (a)	No. Tested	Amp/sulbactam	Penicillin	Pip/tazobactam	Meropenem	Clindamycin	Metronidazole
Bacteroides fragilis	29	97	0	93	100	76	100
Bacteroides NOT fragilis	29	80	0	83	97	31	100
Gram negative rods (other) (b)	39	100	94	100	96	64	100
ALL Gram positive rods	37	100	84	100	100	81	97 (c)
Clostridium perfringens only	11	–	100	–	–	55	100
Gram pos rods NOT perfringens	26	100	77	100	100	73	96 (c)
Peptostreptococci	23	–	96	–	–	74 (d)	96
Cost ($)		$	$	$$	$$	$$	$

(a) Not all isolates tested with every drug
(b) 14 Fusobacterium spp., 18 Prevotella spp., 3 Porphymonas spp., and 4 other
c) Non-sporeforming anaerobic gram positive rods do not respond to metronidazole
(d) Notify Micro Lab to perform antibiotic susceptibility testing if clindamycin is being considered for a Peptostreptococcus; minimum 48 H for results

Campylobacter sp. (n = 19)	
Drug (mcg/mL)	% Resistant
Ciprofloxacin	37% R
Doxycycline	42% R
Erythromycin	0% R

M. tuberculosis (n = 8)	
Drug (mcg/mL)	% Resistant
Isoniazid (0.1)	0%
Rifampin (2)	0%
Ethambutol (25)	0%
Pyrazinamide	0%