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 (UTI only)	Linezolid
		%S	%I	%R															
Streptococci																			
Grp. B (Strep. agalactiae) (b)	210	100	0	0	–	–	–	59	67	–	–	–	–	–	–	–	–	–	–
Viridans (various species) (c)	198	79	21	0	–	99	100	67	88	–	–	–	–	–	–	–	–	–	–
Strep. pneumoniae (d)	59	78e	–	22	90	95e	100	78	79	93	76	–	–	–	100	–	–	–	–
Enterococcus (no species I.D.) **(f)**	809	89	0	11	–	–	93	–	–	–	–	20	–	–	–	90	–	66	100
Enterococcus faecalis (f)	78	100	0	0	–	–	99	–	–	–	–	–	74	83	–	–	–	–	100
Enterococcus faecium (f)	87	13	0	87	–	–	21	–	–	–	–	60	96	57	–	–	86	–	100
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 195 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 97% 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	77	100	100	96	96	96
Candida glabrata	47	100	100	81	51	89
Candida parapsilosis	16	100	100	94	100	100
C. krusei	4 b	100	100	0	50	100
Other Candida spp. (c)	24	100	100	92	96	96
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 25% and 53% 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, 2012 - Dec 31, 2012

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Gram negative rods (a)

Percent Susceptible	PENICILLINS					CEPHEMS			LACTAMS			AMINOGLYC's			OTHERS			Urine Only	
	No. Tested (b)	Ampicillin	Piperacillin	Amp/Sulbactam	Pip/Tazobactam	Cefazolin [Urine Only]	Ceftriaxone	Cefepime	Aztreonam (c)	Imipenem	Meropenem	Gentamicin	Tobramycin	Amikacin	Ciprofloxacin	Levofloxacin	Trimeth/Sulfamethox	1ST GENERATION Ceph's [oral]	Nitrofurantoin
Achromobacter xylosoxidans	33	–	–	–	83	–	–	7	0	87	73	0	0	3	7	40	80	–	–
Acinetobacter baumannii	23	–	–	78	–	–	–	74	–	–	83	78	78	78	74	83	78	–	–
Burkholderia cepacia (d)	7(e)	Ceftazidime 86%				–	Minocycline 71			–	57	–	–	–	–	–	71	–	–
Citrobacter freundii	67	0	–	0	90	0	81	100	77	100	100	90	91	100	91	93	72	–	79
Citrobacter koseri	57	0	–	0	100	100	100	100	100	100	100	100	100	100	100	100	98	–	40
Enterobacter aerogenes	95	0	–	0	91	0	85	99	80	90	100	100	100	100	99	98	97	–	10
Enterobacter cloacae	165	0	–	0	93	0	75	99	91	98	99	99	99	100	95	95	96	–	37
Escherichia coli	2497	48	–	61	92	84	93	97	92	100	100	89	90	100	77	78	64	61	95
Klebsiella oxytoca	102	0	–	75	92	68	96	98	93	100	100	99	100	100	98	99	91	–	80
Klebsiella pneumoniae	459	0	–	85	94	93	93	96	91	99	99	98	95	99	92	92	86	–	25
Morganella morganii	36	0	–	9	100	0	81	100	100	–	100	81	92	100	11	83	61	–	0
Proteus mirabilis	233	77	–	87	100	73	97	99	100	–	100	91	93	100	87	89	75	–	0
Proteus vulgaris	4(e)	0	–	50	100	0	–	100	100	–	100	100	100	100	100	100	100	–	0
Pseudomonas aeruginosa	322	–	–	–	94	–	–	87	76	78	88	87	93	93	79	76	–	–	–
Ps. aeruginosa CF mucoid (d)	372(f)	–	79	Ticarcillin 73%			–	79	72	72	78	–	86	–	58	–	–	–	–
Ps. aeruginosa CF non-mucoid (d)	343(f)	–	77	Ticarcillin 71%			–	70	66	64	72	–	61	–	44	–	–	–	–
Salmonella spp.	10	70	–	–	–	Ceftriaxone 90%		–	–	–	–	–	–	–	60	–	90	–	–
Serratia marcescens	81	0	–	0	100	0	95	100	98	99	100	100	96	100	89	96	98	–	0
Stenotrophomonas maltophilia	103	–	–	–	–	–	–	–	–	–	–	–	–	–	–	87	96	–	–
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) Cystic fibrosis patient isolates tested by disk diffusion.
(e) Data from isolate totals <10 may be statistically unreliable.
(f) Not corrected for duplicates.

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 (d)	Gentamicin	Trimeth/Sulfa	Moxifloxacin	Tetracycline (Doxy)	Linezolid
Staphylococcus aureus, ALL(b)	1197	19	75	75	100	54	71	97	99	73	94	100
MRSA (ONLY) (c)	299	0	0	0	100	8	44	95	96	22	92	100
MSSA (ONLY)	898	43	100	100	100	69	80	98	99	90	95	100
Staph. lugdunensis	88	53	98	98	100	83	85	100	100	98	–	100
Staph. coagulase negative (other)	307	15	47	47	100	41	62	79	64	56	–	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, 83% 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. Penicillin sensitivity confirmed by PCR.
(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.
(d) Clindamycin induction test performed on all staphylococcal isolates.

Anaerobes (selected species)

Percent Susceptible by Etest (a)	No. Tested	Amp/sulbactam	Penicillin	Pip/tazobactam	Meropenem	Clindamycin	Metronidazole
Bacteroides fragilis	28	100	0	100	96	75	96
Bacteroides NOT fragilis	31	81	0	87	98	32	100
Gram negative rods (other) (b)	41	100	100	100	100	86	100
ALL Gram positive rods	43	97	76	97	97	74	81 (c)
Clostridium perfringens only	10	–	100	–	–	90	100
Gram pos rods NOT perfringens	33	96	67	96	97	70	76 (c)
Peptostreptococci	21	–	85	–	–	95 (d)	95
Cost ($)		$	$	$$	$$	$$	$

(a) Not all isolates tested with every drug
(b) 21 Fusobacterium spp., and 21 Prevotella
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 = 33)	
Drug (mcg/mL)	% Resistant
Ciprofloxacin	39% R
Doxycycline	48% R
Erythromycin	3% R

M. tuberculosis (n = 19)	
Drug (mcg/mL)	% Resistant
Isoniazid (0.1)	10%
Rifampin (2)	0%
Ethambutol (25)	0%
Pyrazinamide	0%