

CONTAGIOUS COMMENTS

Department of Epidemiology

Bugs and Drugs

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Updates to this year's Bugs and Drugs

The addition of the MSK (Musculoskeletal) PCR Panel:

The MSK PCR Panel may be ordered on bone tissue, bone aspirate, synovial fluid, synovial tissue, and other deep MSK aspirates from patients with suspicion for infection. After other testing (cultures) is processed, the Cepheid MRSA/SA SSTI PCR assay will be performed, which will detect the presence of *Staphylococcus aureus* and *Methicillin Resistant Staph aureus* (MRSA). This assay is performed 7 days a week, 24 hours a day, with a 3-hour turnaround time. Afterwards, *Kingella kingae* PCR will be performed on MRSA, *S. aureus* negative specimens from children less than 5 years old with results available 2 pm the following day (Mon-Fri).


The addition of *Trichomonas vaginalis* PCR:


Trichomonas vaginalis testing was converted from immunoassay to PCR. This change provides increased sensitivity and has allowed us to expand our sources to include first stream urines on females and males in addition to female vaginal specimens.


Antimicrobial tables:


Antimicrobial tables have been color coded to indicate which drug/bug combinations are most desirable from a treatment perspective. Color coding is used to designate appropriate empiric treatment selections for each bug-drug combination similar to the "Sanford Guide for Antimicrobial Therapy". This change was made to assure that the handbook provides maximum value to clinicians.


Note: With the increase use of MalDI-TOF and sequencing technologies, we are seeing greater diversity in the identification of organisms in the Microbiology laboratory. CHCO has chosen to report "like" organisms into clinically relevant groups or complexes.


 Blue shaded boxes indicate first-line therapy, with susceptibility between 75-100%. This medication has good penetration, limited side-effects and overall strong susceptibilities.


 Green shaded box indicates second-line choice with susceptibility between 75-100%, but not first choice due to overly broad-spectrum, toxicities, or both. May be appropriate as initial therapy before specific bacteria has been identified.


 Yellow shaded box indicates susceptibility between 50-74%. Not initial treatment of choice but can be used if other medications are not available, patient has significant allergies, or susceptibility known.

 Pink shaded box indicates susceptibility for these medications is less than 50%. Consult ID prior to using these medications and/or use only if known susceptible.

 - Colorless box with a dash is a drug-bug combination that is not tested per policy.

 R Pink box with an R indicates this organism is known to have intrinsic resistance to this antibiotic.

 S Green box with an S indicates that this organism is known to be susceptible to this antibiotic.

 () Colorless box with parenthesis around the number indicates that a smaller number of organisms were used for the data collection

Please also note that comments in the footnotes of the tables have been updated with important interpretive information.

TABLE 1. Gram Positive Organisms: Staphylococcus (% Susceptible)
Antimicrobial Susceptibilities at Children's Hospital Colorado – 2018

ORGANISMS	NUMBER OF ISOLATES TESTED	ANTIMICROBIALS			
		Vancomycin	Clindamycin	Trimethoprim / Sulfa	Oxacillin*
<i>Staph aureus</i> (MSSA)	632	100	81	99	100
<i>Staph aureus</i> (MRSA)	236	100	74	98	R
<i>Staph epidermidis</i>	154	100	-	64	36
<i>Staph hominis</i>	35	100	-	76	54

Testing by Microscan Microtiter Panel.

* Includes agents: Nafcillin/Dicloxacillin/Methicillin. **If susceptible, also susceptible to cefazolin/cephalexin and beta lactam + beta lactamase combinations. If susceptible, this does not infer susceptibility to clindamycin; please see specific clindamycin results.**

Oxacillin resistance in *Staphylococcus spp.* predicts resistance to ALL beta-lactams including penicillins, carbapenems, β -lactam/ β -lactamase inhibitor combinations, cepheems (except for cephalosporins with anti-MRSA activity, namely ceftaroline).

Confirmation of MRSA is done by PBP2, Cefoxitin Screen or Microscan Panel.

Cefoxitin is tested as a surrogate for oxacillin. Oxacillin susceptible or resistant is based on the Cefoxitin Screen result.

Clindamycin susceptibility is not determined by Cefoxitin Screen or oxacillin resistance.

The Inducible Clindamycin Test detects inducible clindamycin resistance, due to the *erm* genes.

The isolate is presumed resistant to clindamycin when the Inducible Clindamycin Test is positive.

**TABLE 2A. Gram Positive Organisms - Streptococcus and Enterococcus
(% Susceptible)**

Antimicrobial Susceptibilities at Children's Hospital Colorado – 2018

ORGANISMS	NUMBER OF ISOLATES	ANTIMICROBIALS				
		Penicillin	Ampicillin/ Amoxicillin	Vancomycin	Clindamycin	Ceftriaxone
<i>Strep. anginosus</i> Group ¹ – Invasive*	(27)	93**	-	100	85	100
<i>Strep. mitis</i> ¹ – Invasive*	47	57 ⁺	-	100	96	96
Viridans Strep Group ¹ - Invasive*	(23)	61 ⁺⁺	-	100	91	83
Beta Strep Group A ¹ – Invasive	(28)	S	S	S	86	S
Beta Strep Group B ¹	(15)	S	S	S	67	S
Beta Strep Group B ¹ (prenatal screens)	400	S	S	100	61	S
<i>Enterococcus faecalis</i> ²	154	-	100	100	-	-
<i>Enterococcus faecium</i> ²	32	-	66	99	-	-

¹Testing is by Sensititre microtiter panel. ²Testing is by Microscan microtiter panel.

Streptococci:

The Inducible Clindamycin Test (D-test) detects inducible clindamycin resistance due to the *erm* gene. For streptococci, resistance to clindamycin is presumed when the D-Test is positive.

* Most penicillin non-susceptible streptococci that fall into the intermediate MIC range (0.25 to 2 µg/mL) may be treatable with high dose ampicillin/amoxicillin.

**Of the penicillin non-susceptible *S. anginosus* isolates tested, 3.5% were intermediate and 3.5% were resistant.

⁺ Of the penicillin non-susceptible *Strep. mitis* group isolates tested, 38% were intermediate and 5% were resistant.

⁺⁺ Of the penicillin non-susceptible *viridans streptococci* tested, 22% were intermediate and 17% were resistant.

Streptococci susceptible to penicillin are also susceptible to ampicillin.

Enterococci

Combination therapy should be used in serious *Enterococcus spp.* Infection (endocarditis & bacteremia).

Gentamicin Synergy Screen – *E. faecalis* = 83% susceptible

Gentamicin Synergy Screen – *E. faecium* = 87% susceptible

Gentamicin Synergy Screens on VRE isolates show 67% are susceptible at CHCO.

One new VRE patient was identified in 2018. For therapy choices, ID consult recommended.

TABLE 2B. Gram Positive Organisms: Streptococcus pneumoniae (% Susceptible)
 Antimicrobial Susceptibilities at Children's Hospital Colorado - 2018

Source	Number of isolates	ANTIMICROBIALS						
		Penicillin [^] (Nonmeningitis breakpoint)	Penicillin [^] (Meningitis breakpoint)	Ceftriaxone (Nonmeningitis breakpoint)	Ceftriaxone (Meningitis breakpoint)	Clindamycin	Trimethoprim/Sulfa	Vancomycin
CSF*	(7)	NA	86	NA	100	-	-	100
Blood or Sterile Aspirate	52	94	77	94	88	88	83	100
Respiratory	73	95	60	97	89	90	66	100

Testing is by Sensititre microtiter panel.

* Patients with pneumococcal meningitis should be started on vancomycin and ceftriaxone until susceptibilities are available.

^ Refer to organism specific susceptibility. Isolates in the intermediate category to penicillin may be treated with high dose ampicillin/amoxicillin unless in the CNS.

S. pneumoniae isolates that are susceptible to penicillin are also susceptible to ampicillin (and amoxicillin if oral choice is appropriate).

Ceftriaxone susceptibility **does not** imply susceptibility to oral cephalosporins.

TABLE 3. Gram Negative Organisms, Non-Urine (% Susceptible)
Antimicrobial Susceptibilities at Children's Hospital Colorado – 2018

ORGANISMS	NUMBER OF ISOLATES	ANTIMICROBIALS					
		Ampicillin / Amoxicillin	Cefazolin	Cefotaxime	Gentamicin	Trimethoprim / Sulfa	Ciprofloxacin
<i>Haemophilus influenzae</i> ^{1*} Beta-lactamase testing – all isolates	137	No further testing is routinely performed for beta-lactamase <u>negative</u> isolates. These isolates are considered ampicillin susceptible.					
<i>Haemophilus influenzae</i> ^{1*} Beta-lactamase positive (52) and sterile sites (6)	58	20	-	100	-	-	-
<i>Escherichia coli</i> ²	117	50	83	83	98	66	81
<i>Enterobacter cloacae</i> complex ²	54	R	R	IB [^]	98	93	96
<i>Klebsiella pneumoniae</i> ²	63	R	95	100	97	90	98
<i>Klebsiella oxytoca</i> ²	40	R	70	88	85	85	100
<i>Serratia marcescens</i> ²	(26)	R	R	IB [^]	100	100	98
<i>Salmonella species</i> ²	32	88	-	97	-	97	-
<i>Shigella species</i> ²	(6)	100 ³	-	100	-	67	-

¹Tested by Sensititre microtiter panel. ²Tested by Microscan microtiter panel. ³Tested by E-test strip.

* 137 *Haemophilus influenzae* isolates were tested for beta-lactamase production; 54 (40%) were negative and therefore considered to be ampicillin susceptible. *Haemophilus influenzae* isolates that tested positive for beta-lactamase production are still considered susceptible to ampicillin-sulbactam or amoxicillin-clavulanic acid.

^ When IB is indicated above, the organism may have an inducible beta-lactamase. Although the MIC may indicate susceptibility, beta-lactams should only be used in combination with a drug from another class to which the organism is susceptible. Cefepime and meropenem are exceptions and may be used alone.

TABLE 4. Gram Negative Organisms Isolated from Urine (% Susceptible)
Antimicrobial Susceptibilities at Children's Hospital Colorado – 2018

ORGANISMS	NUMBER OF ISOLATES	ANTIMICROBIALS										
		Ampicillin / Amoxicillin	Ampicillin/Sulbactam	Cephalothin*	Cefuroxime	Cefotaxime	Gentamicin	Nitrofurantoin	Trimethoprim / sulfa	Ciprofloxacin	Cefepime	Ceftazidime
<i>E. coli</i>	1564	55	62	69	94	96	94	98	74	90	97	-
<i>Enterobacter cloacae</i> complex	35	R	R	R	R	IB^	100	37	94	100	100	-
<i>Klebsiella pneumoniae</i>	145	R	81	88	90	91	91	92	81	91	94	-
<i>Klebsiella oxytoca</i>	51	R	75	73	84	94	92	94	88	98	98	-
<i>Proteus mirabilis</i>	73	82	93	90	96	97	90	R	86	95	99	-
<i>Citrobacter freundii</i> complex	(21)	R	R	R	R	IB^	90	100	90	100	100	-
<i>Pseudomonas aeruginosa</i>	41	R	R	R	R	R	83	R	R	76	85	90

Testing by Microscan microtiter panel.

* Cephalothin results are a surrogate to predict susceptibility to the oral cephalosporin agents: cephalexin, cefuroxime, cefpodoxime, and cefdinir. Notably for lower tract infection, low level resistance can often be overcome by high-end dosages due to high concentrations of these agents in the urine.

^ When IB is indicated above, the organism may have an inducible beta-lactamase. Although the MIC may indicate susceptibility, beta-lactams should only be used in combination with a drug from another class to which the organism is susceptible. Cefepime and meropenem are exceptions and may be used alone.

TABLE 5. Non-Enterobacteriaceae (% Susceptible)
Antimicrobial Susceptibilities at Children’s Hospital Colorado– 2018

ORGANISMS	NUMBER OF ISOLATES	ANTIMICROBIALS										
		Ceftazidime	Aztreonam	Tobramycin	Minocycline	Trimethoprim / Sulfa	Ciprofloxacin	Gentamicin	Cefepime	Pip/Tazobactam	Levofloxacin	Meropenem
<i>Pseudomonas aeruginosa</i>												
• Non CF ¹	169	92	81	-	-	-	84	83	92	99	-	-
• CF-mucoid ²	(14)	79	57	57	-	-	50	-	-	-	-	71
• CF-nonmucoid ²	(16)	94	88	81	-	-	69	-	-	-	-	69
<i>Stenotrophomonas maltophilia</i> ²	(11)	9	-	-	100	64	-	-	-	-	55	-

¹ Non-CF testing performed by Microscan microtiter plate.

² Cystic fibrosis (CF) *Pseudomonas spp.* isolates and *S. maltophilia* isolates tested by E-test.

TABLE 6. Candida species (% Susceptible)
Antimicrobial Susceptibilities at Children’s Hospital Colorado– 2018

ORGANISMS	NUMBER OF ISOLATES	ANTIFUNGALS						
		5-Flucytosine	Amphotericin	Fluconazole	Itraconazole	Micafungin	Posaconazole	Voriconazole
<i>Candida albicans</i>	(6)	NI	NI	100	NI	100	NI	100
<i>Candida parapsilosis</i>	(8)	NI	NI	100	NI	100	NI	100
<i>Candida glabrata</i>	(6)	NI	NI	100 (SDD) *	NI	83	NI	NI
<i>Candida lusitaniae</i>	(3)	NI	NI	NI	NI	NI	NI	NI

Testing performed at University of Colorado Microbiology lab by microbroth dilution.

NI – No interpretative criteria available

* SDD - Susceptible Dose Dependent

The susceptible dose dependent category implies that susceptibility of an isolate is dependent upon the dosing regimen that is used in the patient. It is necessary to use a dosing regimen (higher doses, more frequent doses or both) that results in high drug exposure. ID consult recommended.

Please Note: *C. krusei* is intrinsically resistant to fluconazole (isolates not tested).

Yeast susceptibilities were performed from the following sources:

- Blood – 6
- Sterile Aspirate- 6
- Stool – 1
- Wound – 1
- Urine – 4
- Respiratory –1
- Tongue – 1

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