

How to read a Microbiology - Culture and Sensitivity Report

1	Source: Sputum	Ward: ED
	Preliminary Gram stain: Moderate WBCs, few epithelial cells, many gram-positive cocci	
01	<i>Staphylococcus epidermis</i>	Status: Final 2
01	<i>S. epidermis</i>	
Drug	MIC	Interps
Amoxicillin/clavulanate (c,d)	<=4/2	R
Ampicillin/sulbactam (c,d)	<=8/4	R
Ampicillin	9	BLAC
Azithromycin	>4	R
Cefazolin	<=8	R
Cefepime	16	R
Cefotaxime (c,e) 8	<=8	R
Cefotaxime (c,e)	>32	R
Cephalothin	<=8	R
Chloramphenicol	<=8	S
Ciprofloxacin	>2	R
Clindamycin	>2	R
Erythromycin	>4	R
Gentamicin	<=4 3	S 4
Imipenem (c)	<=4	R
Levofloxacin	>4	R
Linezolid	<=2	S
Nitrofurantoin	<=32	
Norfloxacin	>8	R 5
Ofloxacin	>4	R
Oxacillin	>2	R
Penicillin	8	BLAC 6
Rifampin	<=1	S
Synercid	<=1	S
Tetracycline	<=4	S
Trimethoprim/sulfamethoxazole	<=2/38 7	S
Vancomycin	<=2	S

Culture and Sensitivity Report Key

1. Denotes the original Gram stain information—Many times, semiquantitative information will be provided about the quality of the specimen before the final pathogen is known. In sputum cultures, there may be comments such as “heavy growth, many WBCs, many red blood cells (RBCs), many or few epithelial cells, etc.” A quantitative bacterial count (e.g., >100,000 CFU/mL) is typically provided when it is a urine specimen but may also be provided for other specimens on request.
2. Indicates that this is the final report—Sometimes, if the C&S has not been confirmed, it will list a status of *pending*.
3. Represents the minimum inhibitory concentration (MIC) for the drug listed—In this case, the MIC is ≤4 mcg/mL, which means susceptible based on national laboratory guidelines. The susceptibility definition varies based on the organism and the antibiotic being tested.
4. Location of the susceptibility results—In this case, S = susceptible, I = intermediate, and R = resistant.
5. Because this strain of *S. epidermidis* is oxacillin resistant, it is classified as MRSE or methicillin-resistant *S. epidermidis*.
6. BLAC—This indicates that this strain of *S. epidermidis* produces beta-lactamase.
7. When two MICs are listed, this means that the MIC is different for each drug in the combination product. In this case, the MIC for trimethoprim is ≤2 mcg/mL, whereas the MIC for sulfamethoxazole is ≤38 mcg/mL.
8. These letters refer to supplemental comments on the report (not shown).

TABLE 32-6. Examples of Microbiological Testing Limitations

EXAMPLE	COMMENTS
An ESBL-producing organism (usually <i>E. coli</i> or <i>Klebsiella</i> spp.) that is susceptible to ceftiofloxacin	<ul style="list-style-type: none"> • Ceftiofloxacin is stable to breakdown by ESBLs in vitro; however, there have been clinical failures reported and it should not be used for treatment • Other antibiotics that should not be used to treat a documented ESBL infection include any cephalosporin, such as ceftiofloxacin, extended-spectrum penicillins, and aztreonam • In some cases, fluoroquinolones may have in vitro activity • Clinical failure can also occur with these agents • The primary treatment of choice for an infection caused by an ESBL-producing organism is typically a carbapenem
An MRSA susceptible to sulfamethoxazole/trimethoprim	<ul style="list-style-type: none"> • It is very common for an MRSA strain to be listed as susceptible to sulfamethoxazole/trimethoprim on the C&S report • The site of infection should be considered in this case, along with whether or not the strain is community acquired (typically resistant to beta-lactams only) or hospital acquired (typically resistant to multiple classes of antibiotics) • For example, this antibiotic may be appropriate to treat a community-acquired MRSA skin and soft tissue infection but would not be the ideal treatment choice for an ICU patient with MRSA bacteremia
An <i>Enterococcus</i> spp. that is susceptible to cephalosporins	<ul style="list-style-type: none"> • Cephalosporins may appear to be effective against these organisms based on laboratory results, but clinically they are not effective in treating enterococcal infections • The combination of trimethoprim/sulfamethoxazole also may appear effective against these organisms in the laboratory but will not be effective in a patient • In general, susceptibility testing for these organisms can be misleading • Infections due to <i>Enterococcus</i> are commonly treated with ampicillin or vancomycin, often combined with gentamicin
Aminoglycosides and synergy	<ul style="list-style-type: none"> • Specifically applies to <i>Enterococcus</i> bacteria • The lab may report synergy testing for gentamicin and streptomycin • Ampicillin, penicillin, and vancomycin and an aminoglycoside can be an effective, synergistic combination especially in enterococcal endocarditis • Gentamicin was also commonly used in conjunction with vancomycin or another beta-lactams for the treatment of MRSA endocarditis, but this practice has fallen out of favor (see new MRSA guidelines)

ESBL = extended-spectrum beta-lactamase; ICU = intensive care unit; MRSA = methicillin-resistant *Staphylococcus aureus*.

TABLE 32-4. To Treat or Not to Treat?

QUESTION	ANSWER
Is the positive culture from a normally sterile site?	<ul style="list-style-type: none">• A sterile site is an area of the body where bacterial or fungal organisms are not likely to be found• Examples include blood, spinal fluid, and internal organs• A positive culture from these sites may be highly suggestive of an infection, unless contamination of the specimen is suspected• A positive culture should always be evaluated in conjunction with clinical symptoms and other diagnostic results
Is the positive culture from a nonsterile site?	<ul style="list-style-type: none">• A positive culture from a nonsterile site may or may not be indicative of an infection and needs to be reviewed in the context of the patient's clinical presentation• Pulmonary secretions and sputum cultures represent the biggest challenges in treating a patient for infection• Sputum is not considered to be a sterile body fluid• Cultures that are obtained from the patient coughing up sputum or tracheal secretions from the upper part of an endotracheal tube (ET) may be contaminated with oral flora and are typically not optimal for use in diagnosing infection• These cultures may falsely grow bacteria and fungus that are not the true infecting pathogens• Sputum samples obtained from a bronchoscopy (deep into the lungs) are more accurate in terms of diagnosis
What risk factors are present that predispose the patient to developing an infection?	<ul style="list-style-type: none">• Infections can occur when the host's immune system or natural defenses are compromised• Burn patients are at high risk for developing systemic candidiasis because their damaged skin serves as portal of entry into the blood for bacteria and fungus• Neutropenic cancer patients and HIV positive patients are also at high risk for infections, due to their compromised immune systems• In these patients, bacteria or fungus may not grow from all cultures; therefore, the majority of therapy will be empiric
Is the pathogen in question normally present in healthy individuals?	<ul style="list-style-type: none">• A pathogen that is typically present in the human body may represent the patient's normal flora
Does the patient have other signs and symptoms of infection present?	<ul style="list-style-type: none">• Refer to the previous section on clinical signs and symptoms of infection for more information

HIV = human immunodeficiency virus.

TABLE 32-2. Signs of an Infection

SIGN	DESCRIPTION
Fever	<ul style="list-style-type: none">• Body temperature above 38°C (100.4°F)• Not all patients will present with a fever• Elderly patients may actually present with hypothermia, which is defined as a temperature <36°C (96.8°F)
Hypotension	<ul style="list-style-type: none">• Systolic blood pressure <90 mm Hg• The cause may be dehydration or sepsis• Patients with less severe infection or underlying hypertension may not develop hypotension
Tachycardia	<ul style="list-style-type: none">• Heart rate above 100 beats per minute• Some patients may have underlying tachycardia due to cardiac sources or secondary to medication
Tachypnea	<ul style="list-style-type: none">• Rapid breathing of >20 breaths per minute or a PaCO₂ of <32 mm Hg (for patients on mechanical ventilation)• Patients with infection tend to become acidotic and rapid breathing increases pH in attempt to return it to the normal range• Patients with underlying respiratory diseases (such as chronic obstructive pulmonary disease) may have a low baseline respiratory rate and their compensatory response in breathing may not result in high respiratory rate
White blood cells (WBCs)	<ul style="list-style-type: none">• Abnormal WBC count• WBC counts may begin to trend upward past the normal range, usually 4,000 to 12,000 cells/mm³ (this is known as <i>leukocytosis</i>)• There may also be a <i>left shift</i>, which is an increase in immature neutrophils (also known as <i>bands</i>)• Some medications, such as steroids, can also cause leukocytosis• Chemotherapy patients may have the opposite effect and have extremely low neutrophils (a type of WBC), which is usually expressed through the term <i>neutropenia</i>• Patients with neutropenia are at high risk for developing an infection
Procalcitonin (PCT)	<ul style="list-style-type: none">• A biological marker that increases in response to certain bacterial infections and has been shown to be useful in guiding antibiotic therapy• Normal PCT levels in a person without infection are usually below 0.5 ng/mL• Existing literature has demonstrated that utilization of PCT to guide antibiotic therapy is associated with a reduction in antibiotic use with no overall effect on clinical outcomes or length of stay in the ICU or hospital• PCT is not a stand-alone test and should not replace clinical judgment and evaluation of patients• Additional tests are needed to confirm infection
Positive culture	<ul style="list-style-type: none">• Isolation of the causative organism(s) from a specimen can confirm infection