Overview

Useful For

Determining the in vitro susceptibility of aerobic bacteria involved in human infections

Reflex Tests

Test ID	Reporting Name	Available Separately	Always Performed
BLA	Beta Lactamase	No, (Bill Only)	No
SUS	Susceptibility	No, (Bill Only)	No
RMALD	Ident by MALDI-TOF mass spec	No, (Bill Only)	No
HPCR1	H pylori + Clarithro Resistance PCR	No, (Bill Only)	No
MARP1	mecA PCR (Bill Only)	No, (Bill Only)	No

Additional Tests

Test ID	Reporting Name	Available Separately	Always Performed
MIC	Sensitivity, MIC	No, (Bill Only)	Yes

Testing Algorithm

When this test is ordered, the reflex tests may be performed at an additional charge.

All aerobically growing bacteria submitted will automatically have susceptibility testing performed and billed as appropriate. Antimicrobial agent appropriate to the organism and specimen source will be tested according to Mayo Clinic's practice and the laboratory's standard operating procedures.

If appropriate, testing for *mecA* will be performed by polymerase chain reaction (PCR) under MARP1 / *mecA*, Molecular Detection, PCR (Bill Only). Indications for *mecA* testing include inadequate growth by phenotypic antimicrobial susceptibility testing, lack of current organism breakpoints for oxacillin or cefoxitin, and assessment of discrepancies between cefoxitin and oxacillin phenotypic testing results.

In the event that an isolate of *Helicobacter pylori* does not grow from a client sample or does not grow for susceptibility testing, reflex testing for HPCR1 / *Helicobacter pylori* with Clarithromycin Resistance Prediction, Molecular Detection, PCR (Bill Only) may be added.

See Special Instructions to review tables that provide a listing of the antimicrobials routinely tested as well as antimicrobials that may be tested upon request. These tables are organized by isolate groups and are not all inclusive. Call 800-533-1710 and ask to speak to the Bacteriology Antimicrobial Susceptibility Testing Laboratory if the organism or antimicrobial of interest are not listed in these tables.

For test utilization options, see Helicobacter pylori Diagnostic Algorithm in Special Instructions.

Special Instructions

- Helicobacter pylori Diagnostic Algorithm
- Infectious Specimen Shipping Guidelines
- Aerobic Gram-Negative Bacilli Antimicrobials
- Additional Gram-Negative Bacteria Antimicrobials
- Staphylococcus, Enterococcus, Bacillus, and Related Genera Antimicrobials
- Additional Gram-Positive Bacteria Antimicrobials

Method Name

Minimum Inhibitory Concentration (MIC) by Agar Dilution

NY State Available

Yes

Specimen

Specimen Type

Varies

Ordering Guidance

Mayo Clinic Laboratories will not perform susceptibility testing on select agents (eg, *Bacillus anthracis*, *Brucella* species, *Burkholderia mallei*, *Burkholderia pseudomallei*, *Francisella tularensis*, and *Yersinia pestis*). Consult with your state health department or the CDC regarding antimicrobial susceptibility testing of such isolates.

Shipping Instructions

1. See Infectious Specimen Shipping Guidelines in Special Instructions.

2. Place specimen in a large infectious container and label as an etiologic agent/infectious substance.

Necessary Information

Organism identification and specimen source are required.

Specimen Required

Supplies: Infectious Container, Large (T146)

Container/Tube: Agar slant or other appropriate media

Specimen Volume: Organism in pure culture

Collection Instructions:

1. Perform isolation of infecting bacteria.

2. Organism must be in pure culture, actively growing. **Do not submit mixed cultures.**

Forms

If not ordering electronically, complete, print, and send a Microbiology Test Request (T244) with the specimen.

Reject Due To

Agar plate	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Varies	Ambient (preferred)		
	Frozen		
	Refrigerated		

Clinical and Interpretive

Clinical Information

Antimicrobial susceptibility testing (AST) determines the minimum inhibitory concentration (MIC) of antimicrobial agents. The MIC is a measurement of the activity of an antimicrobial agent against an organism. It is defined as the lowest concentration of an antimicrobial agent that inhibits growth of the microorganism. Clinical breakpoints are derived from a number of data including:

-The pharmacokinetics/pharmacodynamics of an antimicrobial agent

-The MIC distribution of a large number of isolates

-Clinical outcome data for a patient population treated with the antimicrobial of interest

AST should be performed on pure culture isolates of pathogenic bacteria (or those potentially pathogenic in special situations) grown from specimens that have been appropriately collected so as not to confuse clinically significant isolates with normal or contaminating microbiota. Susceptibility testing is indicated for any organism that contributes to an infectious process warranting antimicrobial chemotherapy if its susceptibility cannot be reliably predicted from the organism's identity.

The MIC obtained during AST is helpful in indicating the concentration of antimicrobial agent required at the site of infection necessary to inhibit the infecting organism. If clinical breakpoints exist, MICs are accompanied by interpretive categories (ie, susceptible, susceptible-dose dependent, intermediate, nonsusceptible, or resistant) when applicable.

Reference Values

Results are reported as minimal inhibitory concentration (MIC) in mcg/mL. Breakpoints (also known as "clinical breakpoints") are used to categorize an organism as susceptible, susceptible-dose dependent, intermediate, resistant, or nonsusceptible according to the Clinical and Laboratory Standards Institute (CLSI) guidelines.

In some instances an interpretive category cannot be provided based on available data and the following comment will be included: "There are no established interpretive guidelines for agents reported without interpretations."

Susceptible:

A category defined by a breakpoint that implies that isolates with an MIC at or below or a zone diameter at or above the susceptible breakpoint are inhibited by the usually achievable concentrations of antimicrobial agent when the dosage recommended to treat the site of infection is used, resulting in likely clinical efficacy.

Susceptible-Dose Dependent:

A category defined by a breakpoint that implies that susceptibility of an isolate depends on the dosing regimen that is used in the patient. In order to achieve levels that are likely to be clinically effective against isolates for which the susceptibility testing results (either MICs or zone diameters) are in the susceptible-dose dependent (SDD) category, it is necessary to use a dosing regimen (ie, higher doses, more frequent doses, or both) that results in higher drug exposure than that achieved with the dose that was used to establish the susceptible breakpoint. Consideration should be given to the maximum literature-supported dosage regimens, because higher exposure gives the highest probability of adequate coverage of a SDD isolate. The drug label should be consulted for recommended doses and adjustment for organ function.

Intermediate:

A category defined by a breakpoint that includes isolates with MICs or zone diameters within the intermediate range that approach usually attainable blood and tissue levels and/or for which response rates may be lower than for susceptible isolates.

Note: The intermediate category implies clinical efficacy in body sites where the drugs are physiologically concentrated or when a higher than normal dosage of a drug can be used. This category also includes a buffer zone, which should prevent small, uncontrolled, technical factors from causing major discrepancies in interpretations, especially for drugs with narrow pharmacotoxicity margins.

Resistant:

A category defined by a breakpoint that implies that isolates with an MIC at or above the resistant breakpoint are not inhibited by the usually achievable concentrations of the agent with normal dosage schedules and/or that demonstrate MICs that fall in the range in which specific microbial resistance mechanisms are likely, and clinical efficacy of the agent against the isolate has not been reliably shown in treatment studies.

Nonsusceptible:

A category used for isolates for which only a susceptible breakpoint is designated because of the absence or rare occurrence of resistant strains. Isolates for which the antimicrobial agent MICs are above or the zone diameters are below the value indicated for the susceptible breakpoint should be reported as nonsusceptible.

Note: An isolate that is interpreted as nonsusceptible does not necessarily mean that the isolate has a resistance mechanism. It is possible that isolates with MICs above the susceptible breakpoint that lack resistance mechanisms may be encountered within the wild-type distribution subsequent to the time the susceptible-only breakpoint was set.

Epidemiological Cutoff Value:

The MIC that separates microbial populations into those with and without phenotypically detectable resistance (non-wild-type or wild-type, respectively). The epidemiological cutoff value (ECV) defines the highest MIC for the wild type population of isolates. ECVs are based on in vitro data only, using MIC distributions. ECVs are not clinical breakpoints, and the clinical relevance of ECVs for a particular patient has not yet been identified or approved by CLSI or any regulatory agency.

When an ECV is reported, an interpretive category is not assigned, and the following comment will be included: "This MIC is consistent with the Epidemiological Cutoff Value (ECV) observed in isolates (WITH / WITHOUT) acquired resistance; however, correlation with treatment outcome is unknown."

(Clinical and Laboratory Standards Institute: Performance Standards for Antimicrobial Susceptibility Testing. 30th ed.

CLSI supplement M100. Clinical and Laboratory Standards Institute; 2020)

Interpretation

A "susceptible" category result and a low minimum inhibitory concentration value indicate in vitro susceptibility of the organism to the antimicrobial tested.

Refer to the "Reference Values" section for interpretation of various categories.

Cautions

In vitro susceptibility does not guarantee clinical response. Therefore, the decision to treat with a particular agent should not be based solely on the antimicrobial susceptibility testing result.

Clinical Reference

1. Jorgensen JH, Ferraro MJ: Antimicrobial susceptibility testing: a review of general principles and contemporary practices. Clin Infect Dis. 2009 Dec 1;49(11):1749-1755

2. Clinical and Laboratory Standards Institute: Performance Standards for Antimicrobial Susceptibility Testing. 30th ed. CLSI supplement M100. 2020:3-5, 254

3. Jenkins SG, Schuetz AN: Current concepts in laboratory testing to guide antimicrobial therapy. Mayo Clin Proc. 2012 Mar;87(3):290-308

Performance

Method Description

An agar dilution method is used for routine testing. The agar dilution method employs the use of antimicrobial agents incorporated in agar plates. The antimicrobial is added to agar in various concentrations depending upon levels attainable in serum, urine, or both. A standardized suspension of the organism is applied to the agar plates, which are incubated for a minimum of 16 to 18 hours at 35 degrees C. Complete inhibition of all but 1 colony or a very fine residual haze represents the end point. Daptomycin and tigecycline are tested by agar gradient diffusion.(Clinical and Laboratory Standards Institute: Methods for Dilution Antimicrobial Susceptibility Tests for Bacteria That Grow Aerobically; Approved Standard. 11th ed. CLSI standard M07. 2018)

PDF Report

No

Day(s) Performed

Monday through Sunday

Report Available

4 to 7 days

Specimen Retention Time

Bacterial isolates: 30 days.

Performing Laboratory Location

Rochester

Fees and Codes

Fees

- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact Customer Service.

Test Classification

This test has been cleared, approved or is exempt by the U.S. Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

CPT Code Information

87186-Sensitivity, MIC-per organism for routine battery

87181-Susceptibility per drug and per organism for drugs not in routine battery (if appropriate)

87185-Beta lactamase (if appropriate)

87077-Ident by MALDI-TOF mass spec (if appropriate)

87150-H pylori + Clarithro Resistance PCR (if appropriate)

87150-mecA PCR (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
ZMMLS	Susceptibility, Aerobic, MIC	50545-3

Result ID	Test Result Name	Result LOINC Value
ZMMLS	Susceptibility, Aerobic, MIC	21070-8