MAYO CLINIC LABORATORIES

Test Definition: ANAES

Bacterial Culture, Anaerobic + Susc

Overview

Useful For

Diagnosing anaerobic bacterial infections

Directing antimicrobial therapy for anaerobic infections

Testing Algorithm

When this test is ordered the reflex tests may be performed at an additional charge. All bacterial organisms submitted will automatically have susceptibility testing performed and billed as appropriate. Antimicrobial agents appropriate to the organism and specimen source will be tested according to Mayo Clinic's practice and the laboratory's standard operating procedures.

See Anaerobic Bacteria Antimicrobials for a listing of the antimicrobials routinely tested in our laboratory as well as antimicrobials that may be tested upon request. Call 800-533-1710 and ask to speak to the Bacteriology Anaerobe Laboratory if the organism or antimicrobial of interest is not listed in this table.

Special Instructions

- Infectious Specimen Shipping Guidelines
- Anaerobic Bacteria Antimicrobials

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
ANAID	Anaerobe Ident	No, (Bill Only)	No
RMALA	Id MALDI-TOF Mass Spec Anaerobe	No, (Bill Only)	No
ISAN	Anaerobe Ident by Sequencing	No, (Bill Only)	No
PCRID	Identification by PCR	No, (Bill Only)	No
TISSR	Tissue Processing	No, (Bill Only)	No
BLA	Beta Lactamase	No, (Bill Only)	No
BATTA	Anaerobe Suscep Battery	No, (Bill Only)	No
SANA	Anaerobe Suscep per agent	No, (Bill Only)	No

Method Name

Conventional Culture Technique with Minimal Inhibitory Concentration (MIC) by Agar Dilution (if appropriate)

NY State Available

Yes

Specimen

Specimen Type
Varies

Shipping Instructions
Specimen should arrive within 72 hours of collection.

See Infectious Specimen Shipping Guidelines in Special Instructions for shipping information.

Necessary Information
Specimen source is required.

Specimen Required
Supplies: Anaerobic Transport Tube (T588)

Acceptable Sources: Deep tissues, sterile body fluids, abscesses, percutaneous transtracheal aspirates, suprapubic aspirations, or wounds

Collection Instructions: Specimen should be obtained by using a needle and syringe from a source not normally colonized by anaerobes.

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

Reject Due To

Swab	Reject

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Varies	Ambient (preferred)		

Clinical & Interpretive

Clinical Information
Anaerobic bacteria are the greatest component of the human body's normal bacterial flora. Anaerobes colonize the skin,

oral cavity, and genitourinary and lower gastrointestinal tracts, and generally do not cause infection. Their presence is important for vitamin and other nutrient absorption and in preventing infection with pathogenic bacteria.

When usual skin and mucosal barriers are compromised, in an anaerobic environment, these bacteria can behave as pathogens. Typical anaerobic infections include periodontitis, abdominal or pelvic abscesses, endometritis, pelvic inflammatory disease, aspiration pneumonia, empyema and lung abscesses, sinusitis, brain abscesses, gas gangrene, and other soft tissue infections.

Anaerobes grow aggressively in the body under anaerobic conditions and may possess a variety of virulence factors including capsules and extracellular enzymes. They also can develop resistance to antimicrobials by producing beta-lactamase and other modifying enzymes, and by alterations in membrane permeability and structure of penicillin-binding proteins. Susceptibility testing results are useful to clinicians because anaerobic bacteria are a significant cause of human infection, and they are often resistant to commonly used antimicrobials. *Bacteroides* and *Parabacteroides* species produce beta-lactamases. Ertapenem, metronidazole, and clindamycin are generally effective agents although resistance to clindamycin, and occasionally ertapenem, is increasing.

The minimal inhibitory concentration (MIC) obtained during antimicrobial susceptibility testing is helpful in indicating the concentration of antimicrobial agent required at the site of infection necessary to inhibit the infecting organism. For each organism-antimicrobial agent combination, the Clinical and Laboratory Standards Institute and/or the European Committee on Antimicrobial Susceptibility Testing provides interpretive criteria for determining whether the MIC should be interpreted as susceptible, susceptible dose dependent, intermediate, nonsusceptible, resistant, or epidemiological cutoff value.

Reference Values

No growth

Identification of probable pathogens

Susceptibility 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 breakpoint setting organizations, either the Clinical and Laboratory Standards Institute (CLSI) or the European Committee on Antimicrobial Susceptibility Testing (EUCAST), as applicable.

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."

Clinical and Laboratory Standards Institute (CLSI) Interpretive Category Definitions:

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. 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 or a zone diameter at or below the resistant breakpoint are not inhibited by the usually achievable concentrations of the agent with normal dosage schedules and/or that demonstrate MICs or zone diameters 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 after 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."

Wild-type (WT): An interpretive category defined by an ECV that describes the microbial population with no phenotypically detectable mechanisms of resistance or reduced susceptibility for an antimicrobial agent being evaluated.

Non-wild-type (NWT): An interpretive category defined by an ECV that describes the microbial population with phenotypically detectable mechanisms of resistance or reduced susceptibility for the antimicrobial agent being evaluated.

Note: MIC values for which ECV's are defined are not to be interpreted or reported as susceptible, intermediate or resistant but rather as WT or NWT. The ECV's should not be used as clinical breakpoints.(Clinical and Laboratory Standards Institute [CLSI]. Performance Standards for Antimicrobial Susceptibility Testing. 31st ed. CLSI supplement M100. CLSI; 2021:4-6, 268-269)

European Committee on Antimicrobial Susceptibility Testing (EUCAST) Interpretive Category Definitions:

S - Susceptible, standard dosing regimen: A microorganism is categorized as "Susceptible, standard dosing regimen", when there is a high likelihood of therapeutic success using a standard dosing regimen of the agent.

I - Susceptible, increased exposure*: A microorganism is categorized as "Susceptible, Increased exposure*" when there is a high likelihood of therapeutic success because exposure to the agent is increased by adjusting the dosing regimen or by its concentration at the site of infection.

R - Resistant: A microorganism is categorized as "Resistant" when there is a high likelihood of therapeutic failure even when there is increased exposure*.

*Exposure is a function of how the mode of administration, dose, dosing interval, infusion time, as well as distribution and excretion of the antimicrobial agent will influence the infecting organism at the site of infection.(The European Committee on Antimicrobial Susceptibility Testing. Breakpoint tables for interpretation of MICs and zone diameters. v11.0, 2021. Available at www.eucast.org)

Interpretation

Isolation of anaerobes in significant numbers from specimens collected under sterile conditions including blood, other normally sterile body fluids, or closed collections of purulent fluid indicates infection with those organisms.

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

For interpretation of various antimicrobial susceptibility interpretive categories (ie, susceptible, intermediate, resistant, or epidemiological cutoff value), see Reference Values.

Cautions

Specimens may be collected by needle and syringe aspiration or surgical drainage to avoid contamination with normal-flora anaerobes; such contamination would make interpretation of culture results impossible.

Specimens must be transported in anaerobic transport vials.

When antimicrobial susceptibilities are performed, 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. Rosenblatt JE, Brook I: Clinical relevance of susceptibility testing of anaerobic bacteria. Clin Infect Dis. 1993 Jun;16(Suppl 4):S446-S448

2. Summanen P, Baron EJ, Citron DM, et al: Wadsworth Anaerobic Bacteriology Manual. 6th ed. Star Publishing Co; 2002

3. Schuetz AN, Carpenter DE: Susceptibility test methods: anaerobic bacteria. In: Carroll KC, Pfaller MA, eds. Manual of Clinical Microbiology. 12th ed. ASM Press; 2019:1377-1397

4. Hall GS: Anaerobic Bacteriology. In: Leber AL, ed. Clinical Microbiology Procedures Handbook. Vol 1. 4th ed. ASM Press; 2016:section 4

5. 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

Appropriate specimens are inoculated onto blood agar, phenylethyl alcohol agar, and lysed blood agar containing gentamicin and vancomycin and into thioglycollate broth tubes. After 48 hours of incubation at 35 degrees C in an anaerobic atmosphere, colonies are identified using 1 or a combination of the following techniques: Gram stain, use of various differential media, aerotolerance testing, conventional biochemical tests, matrix-assisted laser desorption/ionization time-of-flight mass spectrometry, real-time polymerase chain reaction, or 16S ribosomal RNA gene sequencing.(Procop GW, Church DL, Hall GS, et al: The anaerobic bacteria. In: Koneman's Color Atlas and Textbook of Diagnostic Microbiology. 7th ed. Wolters; 2017:983-1073)

An agar dilution method is used for routine susceptibility testing. The antimicrobial is added to agar in various concentrations depending upon levels attainable in serum. A standardized suspension of the organism is applied to the agar plates, which are incubated anaerobically for 42 to 48 hours at 35 to 37 degrees C. The end point is that in which a marked reduction occurs in the appearance of growth on the test plate as compared to that of growth on the control plate. Examples of marked change include a change from confluent growth to a haze, less than 10 tiny colonies, or 1 to 3 normal-sized colonies.(Clinical and Laboratory Standards Institute [CLSI]. Methods for Antimicrobial Susceptibility Testing of Anaerobic Bacteria. 9th ed. CLSI standard M11. CLSI; 2018)

PDF Report

No

Specimen Retention Time

7 days

Performing Laboratory Location

Rochester

Fees & Codes

Test Classification

This test has been cleared, approved, or is exempt by the US 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

87075-Bacterial Culture, Anaerobic

87076-Anaerobe Ident (if appropriate)

87076-Id MALDI-TOF Mass Spec Anaerobe (if appropriate)

87153-Anaerobe Ident by Sequencing (if appropriate)

87150-Identification by PCR (if appropriate)

87176-Tissue Processing (if appropriate)

87185-Beta Lactamase (if appropriate)

87186-Antimicrobial Susceptibility, Anaerobic Bacteria, MIC (if appropriate)

87181-Anaerobe Susceptibility per agent (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC Value
ANAES	Bacterial Culture, Anaerobic + Susc	635-3

Result ID	Reporting Name	LOINC®
ANAES	Bacterial Culture, Anaerobic + Susc	635-3