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While used as a guide to select an effective antibiotic, Kirby-Bauer testing could not tell the clinician the exact concentration of antibiotic needed to achieve a therapeutic result. Now, by a quantitative method of susceptibility testing known as the minimum inhibitory concentration (MIC), the precise concentration of antibiotic required to inhibit growth of a pathogen can be determined.

Microbiology Guide to Interpreting Minimum Inhibitory Concentration (MIC)

Your IDEXX microbiology results will show the identity of the organism and the appropriate antibiotic sensitivity pattern against each organism. Most antibiograms will include MICs in order to determine the most effective antibiotic that will result in effective treatment.

This guide provides a detailed explanation of the following concepts important in implementing the MIC:

- The MIC number is the lowest concentration (in μg/ml) of an antibiotic that inhibits the growth of a given strain of bacteria. (See the “What Is an MIC?” section.)
- An MIC number for one antibiotic CANNOT be compared to the MIC number for another antibiotic. (See the “How Are MICs Used?” section.)
- The choice of antibiotic should be based on the MIC number, the site of infection and an antibiotic’s breakpoint. Consider safety, ease of use and cost when determining the optimum antibiotic.

One-Lab. You choose.

IDEXX allows you to choose when and where to test in order to deliver the very best in medicine, patient and client care.
How is the MIC reported?

Next to each antibiotic is the susceptibility interpretation: S (sensitive), I (intermediate) or R (resistant), followed by the MIC in μg/ml. Sensitive implies that the organism is inhibited by the concentration of drug that is achieved using the recommended dosage, intermediate includes isolates with MIC’s that approach usually attainable blood and tissue levels and for which response rates may be lower for susceptible isolates; and implies clinical efficacy in body sites where the drug is physiologically concentrated or when a higher than normal dosage of the drug can be used, and resistant implies that the organisms are resistant to the usually achievable serum drug levels. These interpretive standards have been established by the Clinical and Laboratory Standards Institute (CLSI), formerly the National Committee for Clinical Laboratory Standards (NCCLS).

When Are MICs Not Performed?

MICs are not performed when:
• The growth requirements of some organisms require the sensitivity testing to be performed by another method.
• Interpretive criteria is not available from CLSI. In these cases, recommended antibiotics will usually be reported based on clinical efficacy studies.
• The drug is known to be clinically ineffective against the organism, regardless of the in vitro results.

If you would like testing for a particular drug that is not listed, please note in the history box of the Request Form, or contact the Laboratory, and we will perform the test if we are able.

How are MICs used?

The breakpoint and range of dilutions differ by drug and bacterial species (see chart). Therefore, comparing MICs of different antibiotics is not based solely on the numerical value but on how far the MIC is from the breakpoint, the site of the infection and other considerations, such as the age, species and health of the animal. Possible side effects of the drug, price, frequency and route of administration are also important factors.

Antibiotic breakpoint is the dilution where bacteria begin to show resistance.

In vitro efficacy of amoxicillin-Clavulanic acid

In vitro efficacy of cefepime (predicts first generation cephalosporins, except cefazolin)

Our consultants are always available to help you interpret test results.

Class-reference antibiotics

Some antibiotics are used to determine the susceptibility of other antibiotics in the same class. For example, the presence of methicillin-resistant staphylococci (MRS) is tested in the laboratory with oxacillin and not methicillin. The name MRS is used because of convention over years of use in scientific articles and textbooks.

Antibiotics

When selecting an antibiotic, keep in mind that other factors in addition to the MIC are important. The location of the infection is important because lipid-soluble drugs reach higher levels in the tissue than they do in serum. Drugs excreted by the kidney reach much higher bladder levels than serum levels. Also, some drugs are more effective against gram-negative bacteria than gram-positive bacteria and vice versa. Species considerations are also important because certain antibiotics are toxic in some species.

For example: A strain of Escherichia coli has an MIC of 2 μg/ml for amoxicillin and an MIC of 8 μg/ml for cephalexin. Looking at the dilutions for amoxicillin, at 2 μg/ml this strain of E. coli is four dilutions away from the breakpoint. For cephalexin, the same strain of E. coli at an MIC of 8 μg/ml is two dilutions away from the breakpoint. So, based on MICs, this strain of E. coli is more susceptible to amoxicillin than cephalexin. Other factors to take into consideration are the site of the infection, the animal’s health, frequency and route of administration and cost of the antibiotic.

An antibiotic breakpoint is the dilution where bacteria begin to show resistance.

In vitro efficacy of cephalexin (predicts first generation cephalosporins, except cefazolin)
What is an MIC?

The MIC, or minimum inhibitory concentration, is the lowest concentration (in μg/mL) of an antibiotic that inhibits the growth of a given strain of bacteria. At IDEXX, a commercial automated system is used to determine MICs. A quantitative method of susceptibility testing, an MIC helps determine which class of antibiotic is most effective. This information can lead to an appropriate choice of an antibiotic that will increase chances of treatment success and help in the fight to slow antibiotic resistance.

How is the MIC reported?

Next to each antibiotic is the susceptibility interpretation: S (sensitive), I (intermediate) or R (resistant), followed by the MIC in μg/mL. Sensitive implies that the organism is inhibited by the serum concentration of the drug that is achieved using the recommended dosage; intermediate includes isolates with MIC’s that approach usually attainable blood and tissue levels and for which response rates may be lower than for susceptible isolates; and implies clinical efficacy in body sites where the drug is physiologically concentrated or when a higher than normal dosage of the drug can be used; and resistant implies that the organisms are resistant to the usually achievable serum drug levels. These interpretative standards have been established by the Clinical and Laboratory Standards Institute (CLSI), formerly the National Committee for Clinical Laboratory Standards (NCCLS).

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