How to Use a Clinical Antibiogram

TIPS FOR CORRECTLY USING AN ANTIBIOGRAM IN YOUR VETERINARY PRACTICE

What is antimicrobial susceptibility testing?

Growth of a susceptible microorganism can be inhibited by direct exposure to an antimicrobial in the laboratory setting. Clinical and Laboratory Standards Institute (CLSI) guidelines define the clinically relevant minimum inhibitory concentration (MIC) of antimicrobial that should inhibit growth of a microorganism. This is referred to as the MIC breakpoint. If the microorganism is able to grow at drug concentrations at or above that breakpoint concentration, the microorganism is considered resistant to that drug. Microorganisms whose growth is inhibited as expected are susceptible to that drug.

What are antibiograms?

Antibiograms provide an overall profile of susceptibility testing results for a specific microorganism to an array of antimicrobial drugs. Antibiograms reflect aggregate results from many individual microorganism-drug susceptibility tests. They can be compiled at the level of a clinic, hospital, health system, region, or state. Antibiograms are updated periodically (e.g., annually) to reflect the most recent susceptibility test results. Some antibiograms show a single susceptibility percent for a microorganism, and some display susceptibility by specimen type (e.g., *E. coli* from urine or blood) because different antimicrobials might be used to treat the same microorganism in different body sites (e.g., Table 1).

Aggregate susceptibility profiles are reported on an antibiogram as the percent of tests in which a specific microorganism (e.g., *E. coli*, *P. aeruginosa*) was susceptible to a specific antimicrobial drug. The number of isolates tested should also be reported. For example, the sample antibiogram data in Table 1 show 78% of 32 canine *S. intermedius* ear isolates were susceptible to amikacin.

Table 1: Example data from a clinical antibiogram

Antimicrobial	*S. intermedius* Ear (Canine)	*S. intermedius* Skin (Canine)
Amikacin	78% (n=32)	80% (n=156)
Amoxicillin/clavulanate	69% (n=32)	Not tested
Ampicillin	22% (n=32)	19% (n=37)
Cefazolin	69% (n=32)	76% (n=149)
Ceftiofur	79% (n=30)	78% (n=69)

What should an antibiogram look like?

CLSI published the guidelines, "Analysis and Presentation of Cumulative Antimicrobial Susceptibility Test Data." These guidelines should be used when developing an antibiogram. They recommend compiling the antibiogram at least annually, including only the first isolate of a given bacterial species per patient in each antibiogram period, and including only organisms for which >30 isolates were tested in the period analyzed. If <30 isolates are obtained in the period analyzed, isolates collected over a wider time period can be included. Alternatively, when few clinical isolates are available from a single clinic, a regional antibiogram might be developed, including antimicrobial susceptibility testing data from clinics

within a specified geographic area. The time period and source population should be clearly indicated on the antibiogram document. Veterinarians can request a clinic-specific or regional antibiogram from their referral laboratory. Refer to the CLSI guidelines when making the request to ensure that the antibiogram is compiled correctly.

When, and how, should I use an antibiogram?

Each antibiogram reflects a specific patient population according to the source of the included isolates. For example, the University of Minnesota (UMN) Veterinary Medical Center antibiogram reflects those patients that presented to the teaching hospital for care. This population of pets is often sicker, has received more courses of antibiotics, and is more likely to have challenges with recurrent or refractory infections. An antibiogram for a general practice or group of general practices in the same geographic area would reflect patients that are more likely healthier and perhaps received few or no antibiotic courses before specimen collection.

Antibiograms only provide situational awareness of antimicrobial susceptibility profiles in a certain area or patient population. They do not predict the susceptibility profile of an individual patient infection. Published prescribing guidelines and culture and sensitivity (C&S) testing should be used alongside an antibiogram. Antibiograms should not dictate which antimicrobial is used to treat an infection, but they can be used to guide veterinarians in selecting the best empiric antimicrobial treatment when C&S testing is pending. If generated with consistent methodology and routinely over time, antibiograms can also be used to track antimicrobial resistance trends within clinics and geographic areas over time.

What else should I know about using an antibiogram?

- Because MIC values are not included in an antibiogram (only % susceptible), subtle trends toward resistance below the breakpoint MIC are not reflected.

- Data do not take into account patient factors, such as history of infection or past antimicrobial use. Resistance patterns for certain drugs vary significantly by patient age, and a patient's underlying medical condition may affect how well an antimicrobial works.

- Data are the result of single microorganism-antimicrobial combinations and, therefore, do not show trends in cross-resistance of microorganisms to other drugs. Nor do they reveal synergistic properties of antimicrobials used in combination.

- Data might not be generalizable to specific patient populations.

Resources and References

UMN Veterinary Medical Center antibiogram at
https://www.health.state.mn.us/diseases/antibioticresistance/animal/vmcantibiogram.pdf

Minnesota Department of Health, About Antibiograms.
https://www.health.state.mn.us/diseases/antibioticresistance/abx/antibiograms.pdf

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