Diagnostic microbiology in veterinary dermatology: present and future

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1. Introduction

Diagnostic microbiology is often viewed by veterinary practitioners as a service provider rather than a core component of the veterinary healthcare team. However, its role extends far beyond accurate sample analysis and result reporting. The laboratory plays a critical part throughout the diagnostic process, from guiding proper specimen collection to supporting the interpretation of antimicrobial susceptibility testing (AST) results. This latter step is especially important, as misinterpretation can negatively impact both antimicrobial stewardship and patient care. Furthermore, diagnostic microbiology contributes to stewardship efforts by generating evidence and tools to inform antimicrobial selection. This lecture will highlight: (i) how misinterpretation of AST results can compromise clinical outcomes, and (ii) how microbiology research can address the limitations of current AST methods and enhance result interpretation in the future, with a focus on veterinary dermatology.

2. How AST misinterpretation can impact patient cCare

2.1. Limited predictive value of AST

Broth microdilution and disk diffusion are widely used to determine antimicrobial susceptibility, with results interpreted using clinical breakpoints that classify isolates as susceptible or resistant. However, these *in vitro* methods have limitations. They do not account for host-specific factors such as immune status, co-morbidities, strain virulence, or compliance. As a result, AST provides only a probabilistic estimate of treatment success. The “90–60 rule” highlights this uncertainty: roughly 90% of infections with susceptible strains respond to standard treatment, but up to 60% of infections with resistant strains may still result in clinical cure. Misinterpreting AST, especially when the patient is improving despite reported resistance, can lead to premature changes in therapy. Clinical improvement should always be considered alongside laboratory data when assessing treatment efficacy.

2.2. Breakpoint limitations: species and dosage

AST interpretation relies on clinical breakpoints established by the CLSI, which are often derived from human data or generalized across animal species. Many veterinary-specific breakpoints are lacking, particularly for cats and for commonly used antibiotics in small animal dermatology. Moreover, breakpoints are dosage-specific; applying them to regimens with different dosing can result in misleading interpretations. For example, the breakpoint for amoxicillin-clavulanate was established based on a dose of 11 mg/kg, yet the drug is often administered at higher doses (up to 25 mg/kg) in clinical practice. Breakpoints also assume systemic administration; thus, they are not applicable to topical therapy, where drug concentrations far exceed MICs, potentially making AST irrelevant in that context.

2.3. Polymicrobial Cultures

Interpreting AST from polymicrobial cultures, which are relatively cmmon in skin and ear infections, is another challenge. Testing and reporting susceptibility profiles from mixed flora may lead to overtreatment with broad-spectrum antibiotics. AST should be reserved for dominant pathogens isolated in pure or predominant culture. Diagnostic laboratories should help guide clinicians by highlighting the most clinically relevant organisms and avoiding unnecessary reporting of background flora.

3. Research advancements to improve AST interpretation

3.1. Reassessing breakpoints for definition of MRSP

Methicillin resistance in staphylococci is typically inferred via a surrogate antibiotic, oxacillin. The current breakpoint for MRSP (oxacillin MIC ≥ 0.5 µg/mL) was adopted without clinical validation and is much lower than the breakpoint for MRSA. Our research has shown that certain MRSP strains with low-level oxacillin resistance remain susceptible *in vitro* and clinically responsive to β-lactams like cephalexin and amoxicillin-clavulanate. These findings suggest that rigid application of the current MRSP expert rule (i.e. oxacillin-resistant isolates should be reported as resistant to all veterinary β-lactams) could result in overcalling resistance and unnecessary escalation to critically important antimicrobials (e.g., fluoroquinolones) or off-label human drugs (e.g., linezolid). Reassessing the MRSP breakpoint could support better antimicrobial stewardship and preserve β-lactams as viable first-line options in veterinary dermatology.

3.2. Genotypic methods for AST

A major drawback of conventional AST is the 48-hour turnaround time, which deters clinicians and clients from requesting testing. Genotypic approachessuch as PCR or LAMP assays can offer faster results by detecting resistance genes directly. However, genotypes do not always predict phenotypes. Nonfunctional genes, unknown resistance mechanisms, or gene expression variability can cause discrepancies between genotype and phenotype. Furthermore, detecting resistance genes in commensal or contaminant organisms can lead to false positives. These limitations underscore the importance of good sampling practices, such as targeting pustules or deep tissue sites, to improve test reliability.

3.3. Point-of-Care (PoC) testing

To improve turnaround time and accessibility, several PoC AST tests have been developed. Systems like Speed-Biogram™ and Flexicult® Vet enable in-clinic culture and susceptibility testing with results in ~24 hours. While useful for rapid preliminary assessment, these tools may struggle with polymicrobial samples and can generate false resistance results. Confirmatory testing in accredited labs remains necessary for complex cases. We recently developed a rapid colorimetric LAMP assay targeting *S. pseudintermedius* and key resistance genes (erm(B), mecA, spsL). The test, which costs under €8 per sample and requires minimal equipment, delivers results in ~90 minutes. Validation against standard diagnostics showed excellent performance on cultured samples, and promising—but less consistent—results in direct clinical use. This tool could support timely therapy decisions, especially in settings with high MRSP prevalence, and reduce inappropriate use of broad-spectrum antimicrobials.

4. Conclusions

Diagnostic microbiology plays a pivotal role in veterinary dermatology. Misinterpretation of AST can compromise stewardship efforts and negatively impact patient outcomes.

Research-driven updates to interpretive criteria, including reconsideration of MRSP breakpoints, are urgently needed. Advances in rapid diagnostics, such as genotypic PoC tools, offer promising solutions to the limitations of conventional methods, though they still present technical and interpretive challenges. Better integration of microbiology into clinical decision-making will enhance stewardship, preserve treatment options, and support both animal and public health.

References

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