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Short communication

Microbiology of Otitis externa in dogs reveals wide variation in Staphylococcus species

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Abstract

Bacterial infections are a major cause of otitis externa in dogs, with *Staphylococcus* species frequently implicated. This study analyzed samples from 24 dogs with otitis externa to identify the *Staphylococcus* species involved. The isolates included *Staphylococcus pseudintermedius*, *Staphylococcus schleiferi*, *Staphylococcus simulans*, and *Staphylococcus haemolyticus*. While *S. pseudintermedius* and *S. schleiferi* are well-recognized pathogens in canine otitis externa, *S. simulans* and *S. haemolyticus* are rarely reported. Given their zoonotic potential, these findings emphasize the importance of further investigations to clarify the microbiology of otitis externa and to identify the pathogens of greatest clinical relevance.

Keywords

dogs, otitis externa, Staphylococcus

Otitis externa is a common clinical condition in dogs. In hospital settings, prevalence has been reported to range from 7.30% (O'Neill et al., 2021) to 18.14% (Manju et al., 2018). Among dermatological cases, prevalence has been estimated at approximately 14% (Singh et al., 2024). The etiological factors of otitis externa include allergies, ectoparasites, bacterial and fungal infections, and endocrine disorders.

Among bacterial pathogens, *Staphylococcus* species are the most commonly isolated, particularly *Staphylococcus pseudintermedius / intermedius* (Lyskova et al., 2007; Tesin et al., 2023; Miszczak et al., 2023; Nocera et al., 2023). Other reported bacteria include *Proteus* spp., *Klebsiella* spp., and *Escherichia coli*. Notably, most bacteriological studies on otitis externa were conducted during the 2010s. To address this gap, the present study aimed to identify the predominant *Staphylococcus* species in dogs with otitis externa.

This study was conducted at College of Veterinary Science, Rampura Phul, Guru Angad Dev Veterinary and Animal Sciences University, Punjab, India between January and July 2024. Twenty-four dogs diagnosed with otitis externa were included. Ear swabs were collected and transported on ice to the laboratory within one hour. Samples were cultured on Brain Heart Infusion (BHI) agar and incubated at 37 °C for 24 h. Colonies were purified and identified using Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS; Bruker Daltonics Inc., Bremen, Germany) at the Department of Microbiology, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India. Confirmed *Staphylococcus* isolates underwent antimicrobial susceptibility testing via the disc diffusion method (Kirby–Bauer). Results were interpreted according to the Clinical and Laboratory Standards Institute guidelines (CLSI Vet 01S Ed7:2024 and CLSI M100 Ed34:2024). Veterinary-specific standards were used where available; otherwise, human standards were applied. The zone size standards employed are summarized in Table I.

Antibiotic (Concentration)	*Staphylococcus* species				*Escherichia coli* and *Klebsiella pneumominae*		
		Sensitive	Intermediate	Resistant	Sensitive	Intermediate	Resistant
Gentamicin (10 µg)	All Staphylococci	≥15	13-14	≤12	≥16	13-15	≤12
Enrofloxacin (5 µg)	All Staphylococci	≥23	17-22	≤16	≥23	17-22	≤16
Ciprofloxacin (5 µg)	All Staphylococci	≥21	16-20	≤15	≥26	22-25	≤21
Tetracycline (30 µg)	All Staphylococci	≥19	15-18	≤14	≥15	12-14	≤11
Trimethoprim-Sulfamethoxazole (1.25/23.75 µg)	All Staphylococci	≥16	11-15	≤10	≥16	11-15	≤10
Cefoxitin (5 µg)	Other Staphylococci	≥25	-	≤24	≥18	15-17	≤14
Oxacillin (1 µg)	S. pseudintermedius and S. schleiferi	≥18	-	≤17	Not available		
Penicillin (10 units)	All Staphylococci	≥29	-	≤28	Not available		
Clindamycin (2 µg)	All Staphylococci	≥21	15-20	≤14	Not available		
Amikacin (30 µg)	Not available				≥20	17-19	≤16
Amoxyclav (20/10 µg)	Not available				≥18	14-17	≤13

Table I. Zone size (in mm) interpretation criteria used in Antimicrobial susceptibility assay (CLSI Vet 01S Ed7:2024; CLSI M100 Ed34:2024).

From the 24 otitis externa cases, 26 bacterial colonies were isolated. Twenty-two samples yielded a single colony type, while two produced two distinct colonies. Of these, MALDI-TOF MS successfully identified 11 isolates: 9 *Staphylococcus* species, 1 *Escherichia coli*, and 1 *Klebsiella pneumoniae*. Among the *Staphylococcus* isolates, 4 were *S. pseudintermedius*, 2 *S. schleiferi*, 1 *S. intermedius*, 1 *S. simulans*, and 1 *S. haemolyticus*.

Antimicrobial susceptibility testing revealed that all *S. pseudintermedius* and *S. schleiferi* isolates were resistant to oxacillin. One *S. pseudintermedius* isolate showed additional resistance to penicillin, enrofloxacin, ciprofloxacin, and tetracycline. The *S. simulans* isolate was susceptible to all antibiotics tested. The results are detailed in Table II.

Isolate No.	Name of bacterial Isolate	GEN	EX	CIP	TE	COT	CX	OX	P	CD	AK	AMC
31	*Staphylococcus pseudintermedius*	S	S	S	R	S	-	R	R	S	-	-
33	*Staphylococcus pseudintermedius*	S	S	S	S	S	-	R	S	S	-	-
38	*Staph intermedius*	S	S	S	S	S	-	R	S	S	-	-
43	*Staphylococcus pseudintermedius*	S	R	R	R	S	-	R	R	S	-	-
44	*Staphylococcus pseudintermedius*	S	S	S	S	S	-	R	S	S	-	-
46	*Staphylococcus haemolyticus*	S	R	R	R	S	R	-	R	S	-	-
47	*Staphylococcus schleiferi*	S	S	S	S	S	-	R	S	S	-	-
49	*Staphylococcus simulans*	S	S	S	S	S	S	-	S	S	-	-
50	*Staphylococcus schleiferi*	S	S	S	S	S	-	R	S	S	-	-
37	*Escherichia coli*	R	R	R	R	S	R	-	-	-	S	R
45	*Klebsiella pneumoniae*	S	S	R	S	S	S	-	-	-	I	S

Table II. Antimicrobial susceptibility pattern of bacterial isolates (S=Sensitive, R=Resistance, I=Intermediate). GEN= Gentamicin, EX= Enrofloxacin, CIP= Ciprofloxacin, TE= Tetracycline, COT= Trimethoprim-Sulfamethoxazole, CX= Cefoxitin, OX= Oxacillin, P= Penicillin, CD= Clindamycin, AK= Amikacin, AMC= Amoxyclav.

The predominance of *S. pseudintermedius* in this study aligns with previous findings. For instance, Tesin et al. (2023) reported that 54.72% of otitis externa cases in Serbia were due to *S. pseudintermedius*, with more than half of isolates resistant to tetracycline, amoxicillin, and penicillin. Miszczak et al. (2023) described similar findings in Poland, while in Italy, Nocera et al. (2023) reported *S. pseudintermedius* in 33.3% of diseased dogs and 46.1% of healthy dogs. Notably, the same study identified *S. pseudintermedius* in the nasal swabs of owners of three affected dogs, reinforcing concerns about its zoonotic potential (Carroll et al., 2021; Moses et al., 2023). Although humans are typically considered transient carriers (Guardabassi et al., 2003; Nocera et al., 2023), the risk of transmission warrants attention.

Two *S. schleiferi* isolates were detected, resistant only to oxacillin. This species has been reported in otitis externa and pyoderma cases of dogs (Lee et al., 2019; Nguyen et al., 2023). Zoonotic transmission has been occasionally documented, including a 2023 case in which *S. schleiferi* was isolated from a dog with otitis externa and its immunocompetent owner, who subsequently developed septic shock (Nguyen et al., 2023). Kumar *et al.* (2007) isolated *S. schleiferi* from an immunocompromised male with infective endocarditis (Kumar *et al*., 2007).

The detection of *S. simulans*, susceptible to all tested antibiotics, is noteworthy as it is rarely reported in veterinary medicine. To our knowledge, this may represent the first report of *S. simulans* associated with canine otitis externa. In humans, *S. simulans* is responsible for skin and urinary tract infections (Drobenuic *et al*., 2021).

Finally, *S. haemolyticus* was isolated and found resistant to fluoroquinolones, tetracyclines, cefoxitin, and trimethoprim-sulfamethoxazole. Reports of *S. haemolyticus* in dogs are limited (Ruzauskas et al., 2014). In humans, this species has been associated with infections of the skin, urinary tract, meninges, and bloodstream (Eltwisy et al., 2022).

Conclusions

In this study, Staphylococcus pseudintermedius, S. schleiferi, S. intermedius, S. simulans, and S. haemolyticus were isolated from dogs with otitis externa. While S. pseudintermedius, S. intermedius, and S. schleiferi are established pathogens in such cases, S. simulans and S. haemolyticus appear to be rare findings. Further investigations are warranted to better understand the microbiology of otitis externa and to identify the most clinically significant pathogens.

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Conflict of interest

None to declare

Authors contributions

Conceptualization: MS; Methodology: MS; Investigation: MS, JPY; Writing original draft preparation: MS; Writing, review and editing: MS, JPY; Project administration: MS, JPY.

All authors have read and agreed to the published version of the manuscript.

Data availability

The data generated is already analysed and discussed in the manuscript.

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