Case Report

A Case of *Staphylococcus pseudintermedius* in a Dog

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Abstract

This report presents a case of deep pyoderma in a 5-year-old dog presented with widespread skin lesions, anorexia, and poor general condition. Microbiological examination of skin scrapings isolated Staphylococcus pseudintermedius. The isolate was determined to be susceptible to amoxicillin-clavulanic acid, enrofloxacin, erythromicin, gentamicin, lincomycin, cefoperazone, rifamicin, cefoxitin, kanamycin, cefotaxime and trimethoprim-sulfamethoxazole, and resistant to oxytetracycline, vancomycin and doxycycline. Although initial treatment with amoxicillin-clavulanic acid based on the antibiogram showed temporary improvement, symptoms recurred; the subsequent combination of enrofloxacin and trimethoprim-sulfamethoxazole was ineffective. Due to the progressive deterioration of the patient's general condition, euthanasia was performed. The failure to achieve the expected clinical response despite using susceptible antibiotics was attributed to the chronicity of the disease, the widespread nature of the lesions, the patient's dehydration, and a weakened immune system limiting antibiotic efficacy.

Keywords: Dog, *Staphylococcus pseudintermedius*, Pyoderma, Antibiotic Resistance, Zoonosis.

Introduction

Staphylococci are frequently isolated in routine veterinary diagnostics (Sareyyüpoğlu et al., 2013). *Staphylococcus intermedius*, first described by Hajek (1976), has been defined as part of the normal skin and mucosal flora in various animals, including dogs, cats, pigeons, minks, horses, foxes, raccoons, goats, and gray squirrels (Vandenesch et al., 1995). Recent studies have shown that isolates phenotypically identified as *S. intermedius* actually belong to three different species: S. intermedius, *S. pseudintermedius* (Devriese et al., 2005), and *Staphylococcus delphini,* collectively referred to as the *Staphylococcus intermedius* group (SIG) (Bannoehr et al., 2007; Sasaki et al., 2007). According to this new classification, the species colonizing and causing infections in dogs and cats is not *S. intermedius*, but *S. pseudintermedius;* whereas *S. intermedius* primarily colonizes pigeons (Sasaki et al., 2007; Perreten et al., 2010).

S. pseudintermedius is a part of the commensal natural flora of the normal skin, hair follicles, and nasal, oral, and anal mucosae of healthy dogs (Rubin and Chirino-Trejo, 2011). However, it acts as an opportunistic pathogen in the presence of predisposing factors such as disruption of the skin

barrier, atopic dermatitis, surgical procedures, or immunosuppression. As a zoonotic and opportunistic bacterium, *S. pseudintermedius* is most commonly associated with animal diseases such as pyoderma, otitis externa, and keratoconjunctivitis (Tolar et al., 2006; Wang et al., 2012; Meroni et al., 2019; Roken et al., 2022). Pyodermas in dogs generally develop depending on local or systemic factors (Bubnov, 2025). Although the normal skin microbiota maintains tissue homeostasis, the disruption of the epithelial barrier for various reasons (allergic, hormonal, or traumatic) sets the stage for the overgrowth of opportunistic pathogens, allowing them to penetrate from the surface to deeper layers and cause purulent infections known as pyoderma. Localized crusted lesions have been observed in dogs, particularly in the inguinal and axillary regions (Summers et al., 2012; Yu and Vogelnest, 2012). Lesions usually begin on the fore and hind legs, groin, and axillary region. This situation may be due to these areas being more humid and providing a suitable environment for the proliferation of bacterial microorganisms (Grice and Segre, 2011).

Material and Method

The subject of this case report is a 5-year-old dog admitted to the Mehmet Akif Ersoy University Animal Hospital. In the case history, it was reported that the animal was kept in a garden and was presented to the hospital after widespread lesions developed on various parts of its body. Clinical examination revealed a deteriorated general condition, anorexia, secondary dehydration, and marked weakness due to inappetence (Figures 1 and 2).



Figure 1. Cutaneous lesions localized to the head region of the dog.



Figure 2. Generalized cutaneous lesions distributed throughout the body of the dog.

After evaluating the patient's general clinical status, a comprehensive laboratory examination was performed. Blood samples were collected under appropriate conditions for laboratory analysis. Serum biochemical analyses were performed using appropriate reagents with the DiaSys Respons 910 (Germany) autoanalyzer. Hematological analyses of blood samples collected in EDTA tubes were conducted using the Edan H60 Vet blood count device. For histopathological examination, skin tissue samples obtained from the lesions were fixed in 10% neutral buffered formalin for 3 days at room temperature. Following fixation, the tissues were processed through a graded ethanol series (70%, 80%, 90%, 96%, and 100%) for dehydration, cleared in xylene, and embedded in paraffin wax using a standard tissue processing system. Paraffin-embedded tissue blocks were sectioned at 5 µm thickness using a rotary microtome and mounted glass slides. The sections were then dried at 37–40°C overnight to ensure proper adhesion.

For hematoxylin–eosin staining, sections were first deparaffinized in xylene (2 × 5 min) and rehydrated through a descending alcohol series (100%, 96%, 80%, 70%) to distilled water. Slides were stained with Harris hematoxylin for 5–7 minutes, followed by rinsing in running tap water. Subsequently, sections were counterstained with eosin for 1–3 minutes, dehydrated through ascending alcohol series, cleared in xylene, and coverslipped using a permanent mounting medium.

Results

The analyses revealed an increase in leukocyte (WBC) and neutrophil (NEU) values (Table 1).

Table1. Results of hematological parameters.

Parameter	Result	Reference Range
WBC (10^9/L)	40.50	6.00 - 17.00
NEU (10^9/L)	38.16	3.62 - 12.30
NEU %	94.3	52.0 - 81.0
LYM (10^9/L)	1.20	0.83 - 4.91
LYM %	2.9	12.0 - 33.0
MON %	0.9	2.0 - 13.0
RBC (10^9/L)	6.46	5.10 - 8.50
HGB (g/L)	151	110 - 190
HCT %	47.5	33.0 - 56.0
PLT (10^9/L)	252	117 - 490

Serum levels of albumin (ALB), globulin, albumin/globulin ratio, glucose, alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), creatinine (Crea), blood urea nitrogen (BUN), gamma-glutamyl transferase (GGT), total bilirubin, and total protein were measured (Table 2).

Table 2. Results of selected biochemical parameters.

Parameter	Result	Reference Range
ALB (g/dL)	2.05	2.90 - 3.80
ALP (U/L)	316	11 - 162
AST (U/L)	60	11 - 54
ALT (U/L)	32	24 - 97
BUN (mg/dL)	21	9 - 27
CREA (mg/dL)	0.70	0.40 - 1.80
GLUC (mg/dL)	65.1	61 - 115
TP (g/dL)	7.21	5.40 - 7.20

S. pseudintermedius was isolated from the microbiological culture performed on skin scrapings and hair samples. Antimicrobial susceptibility testing determined that the agent was resistant to oxytetracycline, doxycycline, and vancomycin. In contrast, it was found to be susceptible to the amoxicillin-clavulanic acid combination, erythromycin, gentamicin, enrofloxacin, lincomycin, cefoperazone, rifamycin, trimethoprim-sulfamethoxazole, cefoxitin, and kanamycin (Table 3).

Table 3. Antibiotic susceptibility and resistance profile of *S. pseudintermedius*.

Antibiotic	Susceptible	Resistant
Amoxycillin + Clavulanic Acid (AMC)	X	
Erythromycin (E)	X	
Gentamicin (G)	X	
Enrofloxacin (ENR)	X	
Lincomycin (L)	X	
Cefoperazone (CFP)	X	
Rifamycin (RF)	X	
Oxytetracycline (OTC)		X
Trimethoprim / Sulfamethoxazole (SXT)	X	
Doxycycline (DO)		X
Cefoxitin (FOX)	X	
Kanamycin (K)	X	
Cefotaxime	X	
Vancomycin		X

Histopathological examination of lesioned skin samples revealed characteristic features consistent with pyoderma. In superficial lesions, the epidermis showed varying degrees of acanthosis, spongiosis, and orthokeratotic to parakeratotic hyperkeratosis. The dermis exhibited moderate to marked inflammatory cell infiltration, predominantly composed of neutrophils, along with lymphocytes, plasma cells, and occasional macrophages. In some areas, a mixed inflammatory infiltrate with increased mononuclear cells was evident. Perivascular dermatitis was commonly noted, accompanied by vascular dilation and congestion. In some sections, dermal edema and extravasation of erythrocytes were present, reflecting ongoing inflammation and vascular damage (Fig.3).

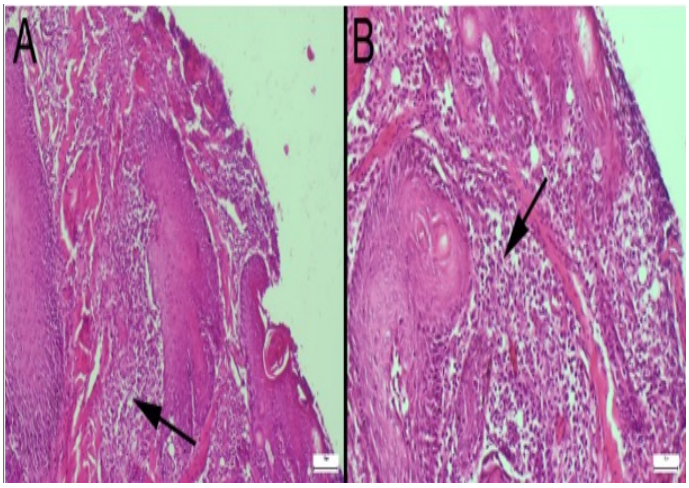


Figure 3. Histopathological appearance of the lesioned area. Marked inflammatory reaction in the dermal area (arrow), HE, scale bars= 100µm for A and 50µm for B.

Based on these findings, supportive therapy was initiated alongside an amoxicillin-clavulanic acid combination administered intramuscularly (IM) for 7 days, dosed according to the animal's body weight. During the first four days of treatment, a significant improvement was observed in the skin lesions and general clinical status; however, within the following three days, the lesions deteriorated again, and it was found that the appetite, which had initially improved, decreased once more.

For this reason, as a second-line treatment, a trimethoprim-sulfamethoxazole combination (in syrup form) was administered in the morning, and enrofloxacin was administered intramuscularly (IM) in the evening. However, no significant improvement in clinical findings was observed during this treatment process; on the contrary, a progressive worsening of the patient's general condition occurred. At this stage, euthanasia was performed in accordance with the owner's consent.

Discussion

S. pseudintermedius is a natural part of the skin and oral flora of healthy dogs (Wang et al., 2013). The pharynx, rectum, nose, and skin are among the most frequently colonized areas in dogs (Somayaji et al., 2016). Although humans are not natural hosts for this bacterium, it is reported that transient colonization can develop in individuals in contact with pets (Carroll et al., 2021).

In one study, it was reported that 46% of owners of dogs with deep pyoderma carried strains genetically identical to those in their dogs (Guardabassi et al., 2004). These data are consistent with literature findings indicating that transmission primarily occurs from dogs to humans, as the agent is a member of the natural flora of dog skin (Guardabassi et al., 2004). Transmission routes include direct physical contact as well as indirect exposure occurring through the home environment (Wang et al., 2013). Close contact situations, such as dogs licking their owners' faces or sharing the same bed, have been reported to increase the risk of infection in humans (Somayaji et al., 2016). While the agent frequently leads to bite wound infections in humans, it can also be the cause of serious invasive conditions such as surgical site infections, bacteremia, pneumonia, and brain abscesses (Wang et al., 2013; Somayaji et al., 2016). Particularly, comorbidities such as diabetes, peripheral vascular disease, and cardiovascular disease are among the important predisposing factors for these invasive infections (Somayaji et al., 2016; Ubiergo and Castro, 2021). Furthermore, the frequent confusion of this agent with *S. aureus* in microbiology laboratories frequently leads to the underdiagnosis (Sasaki et al., 2007; Perreten et al., 2010) or misidentification of cases in humans (Ubiergo and Castro, 2021).

The most significant public health concern regarding zoonotic transmission is the transfer of methicillin-resistant *S. pseudintermedius* (MRSP) strains (Tamakan and Göçmen, 2019). These resistant strains not only limit treatment options but also carry the risk of transferring resistance genes from canine isolates to human pathogen staphylococci through horizontal gene transfer (Guardabassi et al., 2004). Given the zoonotic potential of the agent and its capacity to transfer resistance genes, determining the antibiotic susceptibility profiles of strains isolated from dogs is of critical importance for both animal and public health.

The tetracycline group resistance detected in our study is consistent with many studies reported in the literature. Research has indicated that the agent is highly resistant to this antibiotic group, emphasizing that this resistance tends to increase over time (Hartmann et al., 2005; Morris et al., 2006; Lyskova et al., 2007; Vanni et al., 2009; Zamankhan Malayeri et al., 2010; Wang et al., 2012; Göçmen et al., 2020; Jung et al., 2020; Wang et al., 2022). Conversely, Müştak et al. (2020) detected tetracycline resistance in approximately half of the isolates, reporting a partially susceptible profile to this antibiotic group. In contrast, Keskin Yılmaz and Baş (2024) obtained results differing from our findings by reporting that canine isolates were susceptible to oxytetracycline.

Our findings regarding susceptibility to amoxicillin-clavulanic acid, enrofloxacin, and gentamicin parallel many international studies. It has been reported in research that these agents show high efficacy against canine isolates and that susceptibility rates are maintained at high levels (Vanni et al., 2009; Chrobak et al., 2011; Wang et al., 2012; Nocera et al., 2023). Indeed, Morris et al. (2006) supported our findings by reporting that susceptibility to gentamicin is highly preserved. Similarly, Chrobak et al. (2011) stated that all methicillin-susceptible strains were susceptible to amoxicillin-clavulanic acid and cephalothin, while resistance to gentamicin and ciprofloxacin remained at very low levels. The high gentamicin susceptibility detected in our study also aligns with other research reporting that staphylococci isolated from dogs are completely susceptible to this antibiotic (Hartmann et al., 2005; Lyskova et al., 2007). However, in the case in question, gentamicin treatment was not preferred due to the presence of severe dehydration associated with anorexia and malnutrition at the time of the patient's admission.

However, Müştak et al. (2020) detected a certain level of resistance to the amoxicillin-clavulanic acid combination, while Keskin Yılmaz and Baş (2024) partially diverged from our findings by reporting widespread resistance, especially to the use of amoxicillin alone. Nevertheless, although the amoxicillin-clavulanic acid combination was found to be susceptible in the antibiogram test in our case, clinical symptoms were observed to intensify again after the fourth day of treatment.

Loeffler et al. (2007) and Morris et al. (2006) have drawn attention to the possibility of resistance developing against enrofloxacin in chronic or resistant cases. However, in our case, although the agent was found to be susceptible to enrofloxacin according to the antibiogram results, no significant clinical improvement could be achieved in the second-line treatment. This situation is thought to be due to the chronicity of the case.

The trimethoprim-sulfamethoxazole susceptibility detected in our study is consistent with studies that found this agent effective in the literature (Morris et al., 2006; Vanni et al., 2009; Wang et al., 2012; Saputra et al., 2017; Göçmen et al., 2020; Müştak et al., 2020). In this case, the use of a trimethoprim-sulfamethoxazole combination together with enrofloxacin was preferred for second-line treatment because an adequate clinical response could not be obtained from the first-choice amoxicillin-clavulanic acid combination and the possibility of resistance development was considered.

Similarly, the susceptibility detected in our study against rifamycin, cefoxitin, cefoperazone, kanamycin, and cefotaxime is consistent with studies reporting that the agent is highly susceptible to these agents, and our findings are supported by the literature (Morris et al., 2006; Chrobak et al., 2011; Wang et al., 2022; Nocera et al., 2023).

On the other hand, the high erythromycin and lincomycin (clindamycin) susceptibility we detected in our study contrasts with the high resistance rates reported in the literature for these drugs. This, along with a study conducted in Poland reporting significant resistance to clindamycin, supports the uniqueness of our findings (Morris et al., 2006; Hauschild and Wójcik, 2007; Wang et al., 2012; Saputra et al., 2017; Wang et al., 2022; Nocera et al., 2023).

Lastly, the vancomycin resistance detected in our study was recorded as rare and noteworthy data that showed inconsistency with research reporting full susceptibility or no resistance to this drug in canine isolates (Vanni et al., 2009; Chrobak et al., 2011; Saputra et al., 2017; Jung et al., 2020; Nocera et al., 2023). Additionally, Müştak et al. (2020) emphasized that all isolates were fully susceptible to amikacin and that this agent could be an alternative treatment option in resistant cases.

Conclusion

In conclusion, although susceptibility to the relevant antibiotics was detected in the antibiogram, the expected clinical response could not be achieved in our study. This situation is thought to be related to the fact that the disease had become chronic at the time of the case's admission to our clinic, the lesions were spread throughout the body, and the general condition was deteriorated. Furthermore, it was considered that dehydration due to the inability to feed and the weakening of the immune response may have limited the effectiveness of the antibiotics determined to be susceptible.

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