Recurrent Superficial Pyoderma Caused by Mixed Infection of *Proteus mirabilis* and *Staphylococcus pseudointermedius* in a Yorkshire Terrier Dog

Hyo-Hoon JEONG and Tae-Ho OH†

College of Veterinary Medicine, Kyungpook National University, Daegu 702-701, Korea

(Accepted: Sep 09, 2011)

**Abstract** : An 8-year-old spayed Yorkshire Terrier Dog was presented to the Veterinary Teaching Hospital of Kyungpook National University because of the recurrent superficial pyoderma. At the presentation, pustules and papules were present throughout the body. Numerous rods with a few cocci were observed on impression smears and they were confirmed to be *Proteus mirabilis* and *Staphylococcus pseudointermedius* consecutively. The patient was treated with systemic enrofloxacin and amoxicillin-clavulanic acid based on the results of antimicrobial sensitivity tests with once a week basis 4% chlorhexidine shampoo. An excellent clinical response was achieved in 2 weeks of therapy and the lesions were fully resolved in 6 weeks. The possibility of *P. mirabilis* infection should not be overlooked by clinicians in dogs with recurrent superficial pyoderma although it’s been considered to be rare.

**Key words**: dog, mixed infection, *P. mirabilis*, pyoderma, *S. pseudointermedius*.

**Introduction**

Pyoderma is a common bacterial skin infection in dogs (5,7,16). Although canine pyoderma is usually caused by *S. intermedius* (1,9,11), which has been reclassified as *S. pseudointermedius* (3,13), *Escherichia coli*, *P. mirabilis* and *Pseudomonas* sp. can transiently colonize the skin and may occasionally become involved in pyoderma (5,15). However, it is rare to isolate these organisms if specimens for culture are obtained correctly and they are often isolated in deep pyoderma in which there is concurrent *S. pseudointermedius* infection (5). A rare case of canine recurrent pyoderma caused by mixed infection of *P. mirabilis* and *S. pseudointermedius* is described in this report.

**Case**

An 8 year old, spayed Yorkshire Terrier dog weighing 1.7 kg was presented to the Veterinary Teaching Hospital of Kyungpook National University with the signs of recurrent superficial pyoderma. The patient had been treated with various antifungal and antibiotic drugs for years owing to the relapses of dermatological problems previously at a local clinic. At the presentation, diffuse alopecia, variable degrees of erythema, scales, papules, pustules, crusts, epidermal collarettes as well as hyperpigmentation with mild pruritus and seborrhea were observed throughout the body including the inguinal, axillary, abdominal and dorsal regions (Fig 1). Other than dermatological symptoms, the dog was healthy.

The extensive dermatological examinations including skin scrapings, acetate tape preparations, direct impression smears of the pustules and papules and bacterial and fungal cultures were performed with basic hematological examinations and thyroid hormone assay. The CBC results showed a mild chronic inflammatory response with the number of lymphocytes increased slightly. The serum chemistry values and the total T4, fT4 and total T3 values were in normal ranges. Skin scrapings from various sites including feet and ears contained no ectoparasites. Numerous rods and relatively small numbers of cocci were...

†Corresponding author.
E-mail : thoh@knu.ac.kr

Fig 1. Inguinal region of the dog with recurrent superficial pyoderma caused by mixed infection of *P. mirabilis* and *S. pseudointermedius*. Note papules, pustules, crusts, epidermal collarettes and hyperpigmentation.
Recurrent Superficial Pyoderma in a Yorkshire Terrier Dog

observed on direct impression smears of papules and pustules (Fig 2). For bacterial culture, a sterile swab was taken from three unruptured pustules or papules. Intact pustules or papules were ruptured using a sterile needle and the contents were absorbed on the swab and inoculated to blood agar and tryptic soy agar. The organisms were grown for 18 hours at 37°C aerobically. There were 2 different organisms isolated. One was identified and confirmed to be *S. pseudointermedius* on the bases of gross appearance, pigment, hemolytic pattern, and the results of Gram stain, catalase and coagulase tests, and biotyping using the API STAPH-IDENT System® (bioMerieux Co., France) and Biolog Microstation® (Biolog Inc., USA). The other was confirmed to be *P. mirabilis* based on the typical swarming motility, results of Gram stain and biotyping using Biolog Microstation® (Biolog Inc., USA). No fungi were found in both cytology and culture.

The dog was initiated on systemic antibiotics consisting of intramuscular injection of enrofloxacin (Baytril®, Bayer, USA) at 5 mg/kg once daily and oral amoxicillin-clavulanic acid (Clavamox®, Pfizer, USA) 22 mg/kg twice daily based on the results of the antimicrobial susceptibility tests (Table 1) with once a week basis 4% chlorhexidine shampoo (Chlorhexiderm®, DVM Pharmaceuticals, USA). An excellent clinical response was achieved in 2 weeks of therapy and the lesions were fully resolved in 6 weeks (Fig 3). An additional 2 weeks of treatment was continued past complete clinical resolution to prevent relapse.

**Discussion**

Most cases of canine pyoderma are secondary to a definable underlying cause such as allergic skin disease, ectoparasite infections, keratinization defects and immunodeficiencies (2,5,15). However, in a small proportion of cases of canine pyoderma, it is not possible to define the underlying cause, which is called idopathic recurrent pyoderma (5). The typical feature of the idiopathic recurrent pyoderma is that it responds completely to the systemic and topical antimicrobial therapy but relapses within a few weeks. No specific underlying causes were suspected considering the clinical history and the results of physical and hematological examinations at presentation but it was not conclusive in this case. A follow up with continuous diagnostic evaluations are required to find any possible primary cause monitoring clinical response of the patient to the therapy and relapses of the symptoms.

The gram-negative bacillus, *P. mirabilis* is considered to be one of the transient microorganisms which do dot multiply on normal skin of most of animals (15). Transient organisms may be cultured from skin but are not considered to be important unless they become involved in a pathologic process as secondary invaders. There are various reports on the isolation of
Pseudomonas spp. from dogs with chronic otitis externa, otitis media and pyoderma (6,14,16,17) whereas no case has been reported on isolation of P. mirabilis from canine pyoderma to the authors’ knowledge so far due to the scarcity of the disease. Further study is required to elucidate the incidence rate and pathogenesis of pyoderma associated with mixed infection of P. mirabilis.

The clinical signs and lesions of P. mirabilis complicated pyoderma were different from those of general pyodermas caused by S. pseudointermedius. The odor and color of the pus may vary according to the causative organisms. For example, pustules caused by P. aeruginosa infection produce a lighter-colored pus with a distinctive odor compared to those by S. pseudointermedius infection. However, the color or odor of the contents of the pustules may vary in mixed infections indicating that the clinical features can not reflect the causes of pyoderma accurately when it comes to the mixed infection without cytology and bacterial culture.

Combined use of systemic antibiotics including enrofloxacin (Baytril® Bayer, USA) and amoxicillin-clavulanic acid (Clavamox®, Pfizer, USA) yielded an excellent clinical response in 2 weeks of therapy. The dermatological signs were completely disappeared in 6 weeks of therapy without any adverse effects associated with prolonged use of antibiotics. On antimicrobial susceptibility tests, P. mirabilis was shown to have developed resistance to most of the antibiotics except enrofloxacin, which may attribute to the premature cessation of antibiotic therapy given previously whereas S. pseudointermedius was resistant to ampicillin and lincosamides. Pedersen et al. (12) have reported the antimicrobial resistance in bacteria from diagnostic samples from dogs in Denmark recently. It was shown that Proteus vulgaris and P. mirabilis were susceptible to ciprofloxacin and gentamicin and resistant to colistin and tetracycline showing variable levels of resistance to other antimicrobials. The fluoroquinolones seem to be a reasonable choice in the treatment of pyoderma caused by P. mirabilis infection as shown in this case as in cases associated with P. aeruginosa infection (2,5,8). However, the antimicrobial susceptibility tests should always be performed prior to the prescription in recurrent pyoderma to choose the right antibiotic and decrease the resistance development.

Adjunctive topical therapy with 4% chlorhexidine shampoo (Chlorhexiderm®, DVM Pharmaceuticals, USA) once a week basis also might have contributed in clinical improvement. The topical chlorhexidine shampoos have been used commonly in cases of canine and feline pyoderma (4) and also have been proven effective in vitro against S. pseudointermedius, M. pachydermatis as well as P. aeruginosa although it took much longer for microbial elimination for P. aeruginosa when compared to S. pseudointermedius (10). It would be worthwhile to investigate the efficacy of topical including chlorhexidine against P. mirabilis to elucidate the possibility to be able to eliminate the infection without giving the systemic antibiotics, which will decrease the cost and adverse effects of prolonged use of systemic antimicrobials in cases of recurrent pyoderma.

Conclusion

Recurrent superficial pyoderma caused by mixed infection of P. mirabilis and S. pseudointermedius in a dog. The clinicians should consider the possibility of implication of gram-negative transient microorganisms other than P. aeruginosa in cases of recurrent superficial pyoderma although the incidence rate is low.

References

요크셔테리어종 개에 발생한 *Proteus mirabilis*와 *Staphylococcus pseudointermedius* 혼합 감염에 의한 재발성표재성농피증 증례

정효훈 · 오태호¹
경북대학교 수의과대학

요 약: 8세의 중성화 수술을 한 요크셔테리어종견이 재발성표재성농피증을 호소하여 경북대학교 수의과대학 부속동물병원에 내원하였다. 내원 당시 전신에 다수의 농포와 구진이 관찰되었다. 농포의 입착도말염색 표본에서 다수의 간균과 상대적으로 적은 수의 구균이 함께 관찰되어, 각각 세균을 분리 동정한 결과 *Proteus mirabilis*와 *Staphylococcus pseudointermedius*으로 확인되었다. 4% 농도의 클로로헥시딘 샴푸 약용과 항생제감수성시험 결과에 의한 전신 enrofloxacin과 amoxicillin-clavulanic acid 치료를 병행한 결과 2주 후에는 임상증상이 현저히 개선되었고, 6주 후에는 임상증상이 완전히 사라졌다. 본 증례는 개에서 일반적인 항생제 치료에 응답하지 않는 재발성농피증의 경우 그림이 혼합감염 가능성을 시사하였다.

주요어: 개, 혼합감염, *P. mirabilis*, 동폐증, *S. pseudointermedius*