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Treatment of Demodicosis with Pyoderma in Siberian Husky: A Case Study

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Abstract. A 1 year and 3 month female Siberian Husky dog with a body weight of 12.20 kg was checked with some complaints: pruritus, redness, hair loss, and scaling on the body. Physical examination showed the high intensity of pruritus on the forelimbs; erythema, alopecia on the forelimbs and hindlimbs, neck, thorax, and abdomen; scales on the cranial and caudal extremities; pustules on the medial hindlimbs; warm and swelling of the forelimbs. Direct microscopic examination using deep skin scrapings found the presence of *Demodex sp.* mites in large numbers in each field of view. Hematological test results revealed leukocytosis and neutrophilia. Impression smear which was followed by cytology found many neutrophil infiltrations, monocytes, and cocci bacteria inside and outside the neutrophil indicating a bacterial infection. Based on the anamnesis, physical examination, and laboratory tests, the dog was diagnosed with demodicosis accompanied by pyoderma with a fausta prognosis. The treatments given were ivermectin, amoxicillin, and topical therapy with sebazole® shampoo, diphenhydramine HCl, oclacitinib, and tolfenamic acid. Three weeks after treatments were the disappearance of pruritus and pustules, the reduction of erythema, and the growth of the hair. In addition, as laboratory confirmation, using deep skin scraping identified only 1-2 mites in each field of view.

Keywords: demodicosis; pyoderma; secondary infection; siberian husky

I. INTRODUCTION

Various diseases can infect dogs. Skin disease is one the infection which is very common in dogs. Based on the number of causative agents infecting the host, skin diseases are grouped into two types, namely single infection and multiple infections [1]. Several agents cause skin diseases such as ectoparasites, bacteria, and fungi [2].

Demodicosis is a skin disease caused by *Demodex* sp mites which have a shape of a carrot or cigar with a size of ± 250-300μm × 400 μm. The mites live in hair follicles and sebaceous glands. Under normal conditions, *Demodex* sp. does not harm the dog, but if the dog's immune system decreases then *Demodex* sp. will overgrow and cause skin diseases. Based on clinical signs, demodicosis is divided into

local and generalized. Localized demodicosis show hair loss on a small area, in one or some body part, usually the face and extremities, with erythema, scaling, and hyperpigmentation. While generalized demodicosis show hair loss on almost the entire body, and extremities, and are usually accompanied by secondary infections such as pyoderma. General lesions are almost the same as local lesions, but more severe and spread throughout the body[3].In this case study, the authors would like to inform on a case of demodicosis accompanied by a secondary infection (pyoderma).

II. MEDICAL RECORD

Signalement

The case is a dog named Amy, a Siberian Husky, female, 1 year and 3 months years old, weight 12.20 kg, and having black and white hair.

Anamnesis

Case dogs were brought to visit the Veterinary Internal Medicine Laboratory, Faculty of Veterinary Medicine, Udayana University on August 30, 2022. The dog first experienced redness accompanied by the hair loss on the right forelimb three weeks before they visited the lab. Two days after, it spread wider and the same lesion was found on the left forelimb. The owner also found several small lumps filled with pus on the inside of the right and left hindlimbs. The dog often licks the forelimbs. The dog previously had a history of skin problems in February and June 2022. It had a high-intensity itch with pustules on the medial hindlimbs. The dogs were never given anti-parasitic treatment but no further diagnosis was made so the cause of the disease was unknown. The dog tends to get skin problems every the beginning time of the rainy season. It was routinely bathed twice a week with C-One Anti Skin Disease Shampoo (C-One Shampoo®, PT. C-One Pet Care, Bandung). The dog was fed rice mixed with beef liver, stewed beef liver soup, and commercial dry food (Optima®, PT. Best in Show, Jakarta, Indonesia). It was kept in cages that were previously placed in a fairly humid room, but since the dog exhibited symptoms, it was moved to a place where gets more sunlight. Sometimes the dog is removed from the cage to take some exercise and sunlight. The dog was kept with two other dogs, but none of them showed the same symptoms.

Physical Examination

The dog's present status showed good results except that the temperature slightly increased i.e 39.5°C. The dog was seen to have pruritus on the forelimbs;

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Agustus 2022 Vol. 5 No.2: 41-52

erythema and alopecia on the forelimbs and hindlimbs, neck, thorax, and abdomen; scales on the forelimbs and hindlimbs; pustules on the medial hindlimbs; warm and swelling of the forelimbs (Figure 1).

Laboratory Examination

Deep skin scraping

Samples were taken by performing skin scrapings on the area of the lesion until a small amount of blood was seen [4]. The sample was put on an object glass, dripped with mineral oil, and covered with a cover glass. The sample was observed under a light microscope with 100× and 400× magnification. It was found the mites were shaped like carrots or cigars and had 4 pairs of short legs which matched the characteristics of *Demodex* sp. [5]. Eight to sixteen miles were discovered in each field of view and it was observed in 8 fields of view (Figure 2).

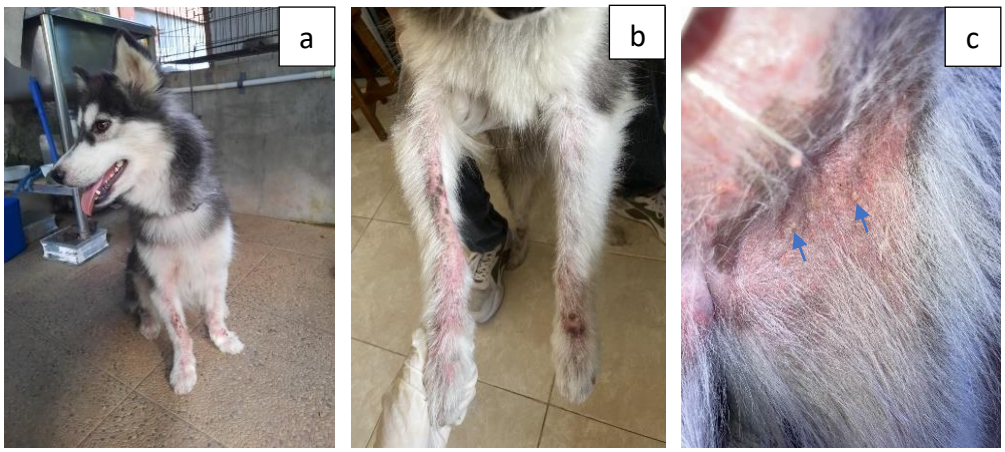

Figure 1. (a) Case dog,(b) Lesions on the extremities, (c) Pustules on the medial thighs of the hind legs

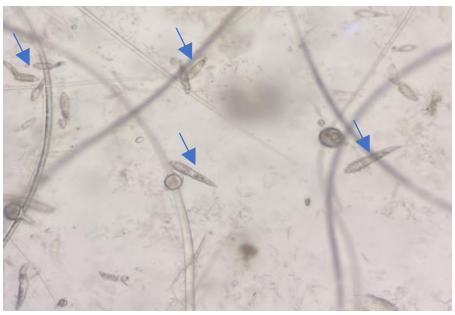

Figure 2. *Demodex* sp. (blue arrow). The figure was taken from Siberian Husky under a light microscope with 100× and 400× magnification.

Trichogram

A trichogram test is performed by pulling the hair around the lesion. The result found the presence of *Demodex* sp. and hair ends that look uneven or irregular indicating pruritus [6].

Impression smear and cytology

The object glasses were placed on the wet lesion and on the dog pustules that previously had been ruptured with a sterile needle. The samples were stained using Diff-quick staining and observed under a light microscope with magnifications of 100×, 400×, and 1000×. The cytology results obtained from the pustules showed a large number of neutrophil infiltration, monocytes, and cocci bacteria inside and outside the neutrophil which indicated the presence of a bacterial infection (Figure 3).

Tape acetate preparation and cytology

Transparent tape is attached to the skin that has a scale by pressing with the thumb and forefinger. The samples were stained with Diff-quick staining and observed under a light microscope at 100× and 400× magnification. The result only found a mite with a short body size and was identified as *Demodex corner* [7] (Figure 4).

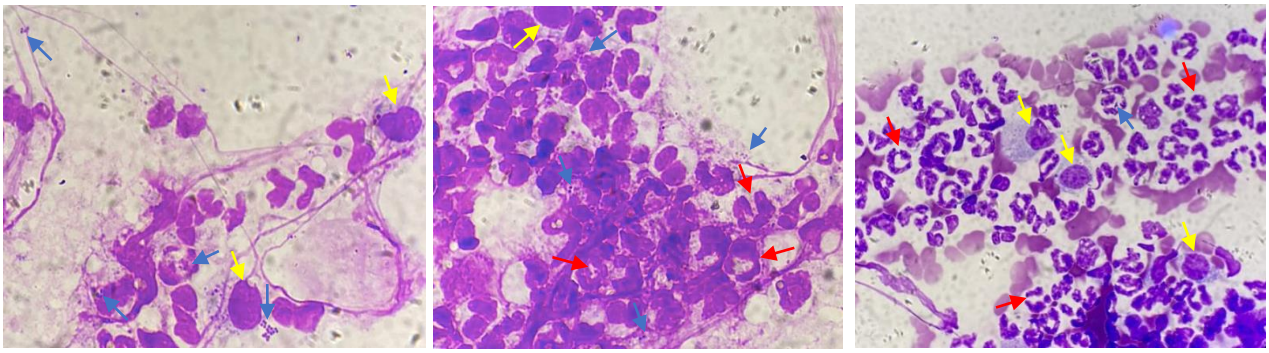

Figure 3. Cocci bacteria (blue arrows), neutrophils (red arrows), monocytes (yellow arrows). The figure was taken from Siberian Husky blood that were stainned using Diff-quick staining under a light microscope with magnifications of 100x, 400x and 1000x.

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Agustus 2022 Vol. 5 No.2: 41-52

Figure 4. *Demodex cornei on Siberian Husky.*

Bacterial culture

A bacterial culture test is carried out by taking a swab of pus on the part of the skin containing pustules, beforehand the pustules were ruptured using a sterile needle, and the pus that came out was then collected with a sterile cotton bud and then inserted into a tube containing transport medium. The sample was then sent to Balai Besar Veteriner (BBVet), Denpasar-Bali for bacterial identification. The results found *Staphylococcus* sp.

Hematology

The results of the Complete Blood Count (CBC) test are presented in Table 1.

Table1. Complete Blood Count (CBC) Test Result of The Dog

Parameter	Results	References*	Notes
Red Blood Cell (RBC) ($x10^{12}$/L)	8.5	4.5-8.5	Normal
Hematocrit (HCT) (%)	4.5	33.6-58.7	Normal
Hemoglobin (HGB) (g/dL)	15.7	10.5-20.1	Normal
Mean Corpuscular Volume (MCV) (fL)	58.3	63.0-78.3	Low
Mean Corpuscular Hemoglobin (MCH) (pg)	18.5	15.3-39.2	Normal
White Blood Cell (WBC) ($x10^{9}$/L)	27.9	4.0-17.6	High
Limfosit (%)	14	12-30**	Normal
Monosit (%)	4	3-10**	Normal
Neutrofil (%)	75	60-70**	High
Eosinofil (%)	7	2-10**	Normal
Basofil (%)	0	0-1**	Normal

*Sources: [8], **[9]

Diagnosis

Based on the anamnesis, physical examination, and confirmed by supporting tests such as deep skin scraping, trichogram, impression smear, tape acetate, cytology, hematology, and bacterial culture, the dog was diagnosed with demodicosis accompanied by pyoderma.

Prognosis

Based on the condition of the dog in general, the prognosis was fausta.

Treatments

The therapy given included causative therapy in the form of anti-parasitic ivermectin (Ivervet®, Vetanco, Buenos Aires, Argentina) with a recommended dose of 400 mcg/kg, and the amount injected was 0.5 mL subcutaneously with repeated intervals once a week. For secondary infections, the antibiotic was administered, namely, Amoxicillin (Longamox®, Vetoquinol, France) with a recommended dose of 7 mg/kg, and the amount injected was 0.6 mL intramuscularly and 48 hours later followed by the administration of Amoxicillin (Bintamox®, PT. Hexpharm Jaya Laboratories Bekasi, Indonesia) with a recommended dose of 10 mg/kg, ¼ of a tablet twice a day for 14 days. Topical causative therapy for the parasite and the bacteria, using sulfur and sodium salicylate (Sebazole®, Virbac, Nice, France), twice weekly.

Symptomatic therapy was given in the form of antihistamines, namely diphenhydramine HCl (Veterdryl®, PT. Duta Emperor Pharmacy, Solo, Indonesia) with a recommended dose of 2 mg/kg and the amount injected was 2.5 mL subcutaneously. Oral antihistamine diphenhydramine HCl (Sominal®, PT. Erlangga Edi Laboratories, Semarang, Central Java) was administered with a recommended dose of 2 mg/kg, 1 tablet twice a day for two weeks, followed by oclacitinib (Apoquel®), Zoetis, Jakarta, Indonesia) with a recommended dose of 0.4 mg/kg, 1 tablet and given twice a day for two weeks orally. In addition, symptomatic therapy in the form of antipyretics is tolfenamic acid (Tolfedine®, Vetoquinol, France) with a recommended dose of 4 mg/kg, and the amount injected was 1.2 mL intramuscularly.

III. DISCUSSION

From skin scraping examination, it was found *Demodex* sp mites were. in the form of eggs, larvae, nymphs, and adults. The two *Demodex* species found in this case are *Demodex canis* and *Demodex cornei*. However, only one*Demodex cornei* was discovered, so it can be ignored. *Demodex canis* has a long body

but not as long as *Demodex injai*. *Demodex canis* is known live in hair follicles and sebaceous glands [10] while *Demodex cornei* has a shorter body size and lives in the superficial layer of the stratum corneum [7], this was confirmed by the finding of *Demodex cornei* on examination of acetate tape in this case.

Clinical signs and symptoms that commonly appear in dogs suffering from demodicosis are alopecia, scale, erythema, accompanied by itching and pain [11]. Clinical signs and symptoms found in this case were pruritus, erythema, alopecia, scale, inflammation, and pustules. The degree of pruritus can vary in dogs with demodicosis. Pruritus frequently occurs when the dog has pyoderma. Erythema that occurs, in this case, is caused by an inflammatory process. The inflammatory process is often associated with the body's immunity, the histamine released causes blood vessels to vasodilate to increase blood flow to the infected area. Histamine makes capillary permeability increase so that plasma proteins that should remain in the blood vessels will easily come out into the tissues and cause reddish skin [12]. Alopecia is abnormal hair loss that may occur in part or all of the body, limited or diffuse, and symmetrical or asymmetrical. Alopecia can occur due to damage to hair fibers, dysfunction of hair follicles, and nutritional deficiencies [13]. Alopecia can also be caused by the presence of agents that induce pruritus in dogs, making dogs scratch or rub against walls and rough objects and initiate alopecia [14]. *Demodex* which has a predilection for hair follicles also causes hair loss resulting in alopecia. Scale is a loose collection of fragments of the horn layer (stratum corneum) that occurs due to the excessive formation of cells (keratinization)[15].

Excessive keratinization can be caused by physical damage such as friction [16]. In addition, excess keratinization is also the body's response to eliminate agents that adhere to the skin [17]. Pustules are small to large skin lesions with exudate in the form of pus [1]. Pustules can be formed because adjacent abscesses coalesce and result in pus-filled tissue under the skin [18]. Demodicosis is one of the main causes of secondary infection with pyoderma and *Staphylococcus* sp. is the most common bacteria infecting dogs infected with demodicosis [19].

Demodex population is affected by the immune system [20]. The immune system can detect and tolerate the presence of mites and has an effect in inhibiting mites proliferation and keeping the number of mites low and not causing

inflammation. Inflammation of the skin is also a process of recruiting immune cells such as T cells, neutrophils, and monocytes. T cells serve as destroying agents and the rest becomes residue on the skin. Several factors affect a dog's immune system, including stress, inadequate nutrition, and the presence of other comorbidities [21]. Skin diseases increase rapidly when the air is very humid or very hot so the environmental temperature is thought to be the main determining factor for the incidence of skin diseases[22]. Skin problems that occur in this case usually arise in the rainy season. The temperature and stress factors are thought to trigger the occurrence of demodicosis cases.

Based on the results of the impression smear examination, which found neutrophils, monocytes, and cocci bacteria inside and outside the neutrophil indicated the presence of a bacterial infection. This is following the results of bacterial culture that the dog was infected with *Staphylococcus* sp. A report stated that neutrophil infiltration in an exudate can be an indication of the occurrence of pyoderma[23].

The hematology test result showed a reduction in MCV (microcytic) and an enhancement in leukocytes (leukocytosis), especially neutrophils (neutrophilia). Mean Corpuscular Volume (MCV) is the average size of red blood cells. There were no indications of anemia in case dogs (normal RBC and HGB), but there are several breeds that have a low MCV, one of them is the Siberian Husky [24]. Meanwhile, the high percentage of neutrophils is an indication of acute inflammation. In acute inflammation, cytokines will stimulate an increase in the release of neutrophils into the blood circulation, resulting in neutrophilic conditions [25]. The increase in neutrophils can also indicate the presence of bacterial infection which is in line with the case infected by *Staphylococcus* sp. This is similar to the study conducted by Tsai et al. [26]that mentioned the results of the blood test of dogs infected with *Demodex* sp. still have eosinophil concentrations in the normal range.

Ivermectin is a broad-spectrum anti-parasitic that works by releasing GABA (Gamma Amino Butyric Acid) which prevents the neurotransmitter from causing paralysis in both young and adult nematodes also arthropods. In the treatment of mites, ivermectin cannot kill mite eggs so it must be repeated at appropriate intervals and doses [27]. Amoxicillin is a broad-spectrum bactericidal antibiotic that inhibits bacterial cell wall synthesis during cell

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Agustus 2022 Vol. 5 No.2: 41-52

division. Amoxicillin works by inhibiting the synthesis of mucopeptides in the bacterial cell wall causing a damaged barrier and osmotically unstable spheroplast [8]. Amoxicillin is a penicillin derivative, a beta-lactam antibiotic that is often used in cases of *Staphylococcus aureus* infection. Penicillins are highly effective in treating infections caused by *Staphylococcus*[28]. Sebazole® contains sulfur and sodium salicylate. Sulfur has a keratolytic effect, the ability of a chemical substance to damage the attachment of keratin to the corneum layer of the skin[29]. Sulfur works well if it is in the right concentration along with sodium salicylate [30]. Sodium salicylate is also a keratolytic agent that causes a decrease in skin pH and causes an increase in the amount of water that can be absorbed by keratin so that hydration of the stratum corneum also increases and desquamation occurs [31].

Diphenhydramine works by blocking histamine receptors in the body. Oclacitinib is a Janus kinase (JAK) inhibitor that targets specific pathways for cytokines involved in itching and inflammation [32]. The JAK1 enzyme is involved in the signaling and signal transduction of pro-inflammatory, pro-allergic, and pruritogenic cytokines associated with dermatitis [33]. Oclacitinib inhibits most of the JAK 1-dependent cytokines and effectively treats the clinical signs associated with dermatitis in dogs. Tolfenamic acid is a non-steroidal anti-inflammatory drug (NSAID) that can be used to treat chronic inflammation in dogs and cats. Tolfenamic acid shows a pharmacological effect similar to aspirin in inhibiting the release of prostaglandins. It also plays a role in inhibiting cyclooxygenase [8].

Three weeks after therapy, the dog showed good condition improvement. It is shown by the disappearance of pruritus and pustules, reduction of erythema, and the presence of hair growth. This was confirmed by a deep skin scraping examination which showed 1-2 mites per 1 field of view which was observed in 6 fields of view. Ivermectin is recommended to be continued every 2 weeks until the erythema disappears.

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