

Research Article

PREVALANCE, CLINICAL CHARACTERISTICS, POSSIBLE ETIOLOGICAL AND DIAGNOSTIC APPROACH IN DOGS WITH ACRAL LICK DERMATITIS

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ABSTRACT: Acral lick dermatitis (ALD) is a chronic irritating skin disease in dogs caused by excessive licking of specified skin areas. The objective of the present study was to investigate the clinical characteristics and diagnostic approach and to classify the possible etiologies of ALD in dogs. Case investigation for ALD included a recording of thorough history presenting, clinical signs and signs associated with the lesion, laboratory and orthopedic investigations, cytological examination, and biopsy/histopathology and hematology. Among the dermatological cases, the overall prevalence of ALD was 7.27%. Prevalence of ALD was higher in young (1-3 years) age group dogs predominantly in male dogs during winter months with temperature <20°C and Labrador retriever was the most commonly affected breed. Possible etiologies in 30 cases diagnosed with ALD were psychogenic triggers (19 cases, 63.33%) followed by only organic triggers (9 cases, 30%) and a combination of primary organic triggers with perpetuating psychogenic triggers (2 cases, 6.66%). The left forelimb (40%) followed by the right forelimb (13.33%) were the most affected limbs with ALD. Lesion characteristics observed were alopecia in 27 dogs (90%), circumscribed lesions in 16 dogs (53.33%), induration and firmness in 15 dogs (50%), ulceration in 14 dogs (46.66%), and moist lesions in 14 dogs (46.66%). The most common clinical signs associated with the disease were licking of paws in both organic and psychogenic triggers and additionally pruritus and erythema. Cytological examination of the lesions revealed chronic active inflammation in 24 cases and purulent inflammation in 6 cases. Histopathological findings of ALD lesion illustrated hyperkeratosis, acanthosis, and dermal fibrosis with vertical streaking. Stress polycythemia was a consistent finding recorded with only psychogenic triggers.

Key words: Acral lick dermatitis, Dogs, Organic triggers, Psychogenic triggers.

INTRODUCTION

Acral lick dermatitis (ALD) commonly known as lick granuloma is a self-entailing skin disease of dogs where the animal generates a localized alopecic, hyperplastic, fibrotic lesion often near carpus or hock areas through repeated biting, licking, or scratching resulting in ulceration and plaque formation (Shumaker 2019). Repeated licking associated with this condition is generally viewed as a compulsive disorder thus ALD is believed to constitute an animal model of obsessive-compulsive disorder (OCD) in humans (Goldberger and Rapoport 1991). The primary factors (organic and psychogenic causes) associated with this disease act as initiating cause of the licking whereas perpetuating factors (secondary bacterial infections, keratin foreign bodies, furunculosis, bony changes, and development of a secondary compulsive disorder/learned behavior) helps in continuing the licking tendency (Shumaker *et al.* 2008). A thorough dermatologic

examination along with a history, an orthopedic and neurologic examination, and laboratory work including blood counts and biochemistry, skin scrapings and hair plucks for dermatophyte cultures, trichography, cytology, and biopsy with histopathology can help in elucidating the primary triggers as well as the perpetuating factors of canine ALD (Shumaker 2019).

Skin problems among pets are the most common cause of hospital visits. The prevalence of compulsive disorders among humans in Punjab has been reported to have increased. A possible link is expected in companion animal ALD and OCD due to the human-animal bond (Goldberger and Rapoport 1991) as well as the similarity of behaviors associated with this disease and similar response to selective serotonin reuptake inhibitors. Thus, the study was planned to form a diagnostic approach to identify the potential triggering etiologies of canine ALD.

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MATERIALS AND METHODS

A total of thirty-two dogs with a chief complaint of chronic non-responsive lick wounds on one or more limbs at extremities were presented during 7 months. The prevalence rate of the disease was studied in these dogs in relation to temperature, relative humidity, sex, breed, and age of the dog. Out of the total affected ones, thirty dogs were selected for determination of etiological agent and further investigation. A single approach was followed in each subject for identifying the underlying triggers involved in the disease pathogenesis. The assessment started with signalment, complete history taking along with physical and clinical examination initially to give some direction for further investigation of the case. The detailed questionnaire which was used in the study is mentioned in Questionnaires 1 and 2.

A panel of tests that were carried out in each case presented for ALD diagnosis included fungal culture, impression smear, fine needle aspiration, skin scraping, and hematological analysis to rule out infectious (bacterial or fungal), neoplastic, parasitic triggers, and any other systemic ailment in dogs suffering from ALD. Further investigation was subjected to the individual case as per requirement. Where there was clinical evidence of possible endocrine or systemic disease, blood biochemistry, and thyroid function tests were carried out.

Diagnostics such as digital imaging was done in cases with a history of trauma, fracture fixation, or localized pain and included radiographs of the affected area, comprising at least two views. To deal with secondary bacterial infections, culture sensitivity testing of the lesion was performed in each case and along with the primary prompt treatment susceptible antibiotic was also given for two weeks. In cases where it was difficult to identify the primary prompt using the above diagnostic aids, a biopsy sample was collected from the lesion using a 5mm biopsy punch for histopathological examination. When the cases after thorough investigation did not fall under any category of etiologies, the cases were categorized under idiopathic form.

Statistical analysis

Hematological parameters (CBC) were analyzed using an unpaired T-Test by comparing hematological parameters of normal healthy dogs with both psychogenic and organic origin of ALD.

RESULTS AND DISCUSSION

The present study was conducted from September 2019 to March 2020 during which a total of 440 dogs were presented for dermatological disorders in Small Animal

Clinics, Guru Angad Dev Veterinary and Animal Sciences University, out of which 32 (7.27%) were suffering from ALD. Environment, breed, sex, and age were the major determinants reported to have had a marked influence on the variation and severity of skin diseases (Kumar and Haque 2015), therefore, the prevalence of ALD was studied concerning various factors as follows. It was observed that the overall occurrence of ALD was maximum during winter months *i.e.*, February (10.12%) followed by March (9.8%) and December (9.09%), minimum in months October (4.16%) and September (6.66%) (Table 1). The incidence of occurrence of OCD was highest during the winter months and mostly remitted following summer (Sinha *et al.* 2014). No relevant literature is currently available on the month-wise prevalence of ALD in dogs but one study conducted by de-Graaf *et al.* (2005) in a psychiatric epidemiologic study of human adults reported that panic disorder and generalized anxiety disorder were reported more frequently in winter than in other seasons and related this to the slower turnover of serotonin by the brain in winter months. The rate of production of serotonin by the brain is directly proportional to the duration of bright sunlight (Lambert *et al.* 2002).

Questionnaire 1. Questions which were asked to review owners in cases of acral lick dermatitis (under organic triggers).

- *Appetite of the dog
- *History of ectoparasites
- *Shampoo used for bathing
- *Frequency of bath
- *Speed of onset of lesions
- *Progression of the lesions
- *Was the dog showing any signs of pruritus elsewhere (licking/chewing/ rubbing/scratching)?
- *Any history of past or current skin infections or any history of otitis?
- *Any history of gastrointestinal disease that may support a food allergy?
- *Any seasonality to symptoms or seasonal exacerbations noted if the lesions were persistent for a year or more?
- *History of past or current skin infections
- *Seasonality
- *History of trauma to the affected leg
- *Any indication of joint pain

Effect of relative humidity and environmental temperature

Two groups were made based on mean temperature *i.e.*, months with mean temperature $\leq 20^{\circ}\text{C}$ and months with mean temperature $>20^{\circ}\text{C}$ (Table 1). Increased prevalence of ALD with a mean prevalence of 8.67% was seen in months with temperatures $\leq 20^{\circ}\text{C}$. Temperature extremes posed a risk to the health and well-being of persons with mental health and behavioral disorders (Wang *et al.* 2014). In animals, stress increases the likelihood of developing compulsive disorders, and these behavioral diseases have a direct impact on dermatological problems, culminating in a vicious cycle (Luescher 2003).

Sex wise prevalence

During this investigation, the prevalence of ALD was higher in male dogs (23, 71.87%) as compared to females (9, 28.12%). This study was in agreement with other studies that reported the predominance of male subjects versus females in ALD (Wynchank and Berk 1998, Kshama 2013, Katariya *et al.* 2018). This could be attributed to the fact that testosterone is a crucial factor in the development of behavior problems in dogs (Yalcin and Batmaz 2007, Sarma *et al.* 2013).

Questionnaire 2. Questions asked to the owners in case of acral lick dermatitis (psychogenic triggers).

- *If there were any other concurrent behavioral symptoms (eg, separation anxiety, noise phobia, tail chasing) that would support a primary compulsive disorder/OCD behavior?
- *Had there been any major changes to the dog's environment (recent move, new people/ babies/pet introduced into the house)?
- *Any recent deaths (family member or companion to the dog)?
- *How much exercise (walk, play) and socialization did the dog receive?
- *Was the dog kept indoors or outdoors?
- *How long was the dog left alone during the day?
- *Was the dog kept confined (crate, kennel/run)?
- *Were there other animals in the home?
- *What sorts of toys were available and are they used by the dog?

Age-wise prevalence

The age of affected dogs ranged from 1.5 years to 11 years. The most affected age group was the 1-3 years group (37.5%) followed by the 3-5 years (34.37%) and more than 5 years (28.12%) group (Table 2). The trends in the present study were similar to the previous findings (Kumar *et al.* 2006, Shyma and Vijayakumar 2011) that also reported the highest prevalence of dermatopathies in 1-3 years old dogs. It was observed that the least affected age group was less than 1 year of age (10.10%). Aggression as a behavior disorder has a wide range of prevalence. Aggression usually arises between the age of 2 and 3 years, however, it can occur in both geriatric and puppy dogs also (Yalcin and Batmaz 2007).

Breed wise prevalence

Labrador retriever (50%) was the most commonly affected breed with ALD followed by Golden Retriever (15.62%). Out of 32 dogs, 2 dogs were non-descript and remaining 30 dogs were subdivided into large breeds (n= 27; 84.38%) and small breeds (n= 3; 9.38%). In the present study, the majority of dogs belonged to large breeds (84.38%) which were similar to the findings of Wynchank (1999) where the maximum of dogs were large breeds and the most common large breeds were Doberman Pinscher (n=14); German Shepherd (n=14) and Labrador (n=7) in ALD (Table 3). The proportional incidence of behavioral problems varies with the breed (Pocta and Svoboda 2007), however, the most frequently exhibited behavioral disorder breeds are German shepherd, Terrier, mixed breed, and Anatolian sheepdog (Yalcin and Batmaz 2007). Sarma *et al.* (2013) also reported the incidence of dermatological disorders was higher in Spitz followed by Labrador, Pomeranian and non-descriptive. The other breeds like Doberman pinscher, Dalmatian, Boxer, Golden Retriever, etc. collectively represented 12.18%. The breed predilection to dermatological problems varied with the breed composition of the canine population in a particular region and the popularity of individual breeds (Pocta and Svoboda 2007). Large-breed dogs are more likely to develop ALD than small-breed dogs. Temperament characteristics, such as inherited fearfulness, are also likely to play a role in the formation of OCD (Luescher 2003).

Prevalent triggers of ALD in dogs

In the present study, thirty (30) dogs with ALD were selected for further diagnostic interventions. The maximum occurrence was reported with psychogenic triggers in 19 cases (63.33) followed by only organic triggers in 9 cases (30 %) and a combination that included

Table 1. Month wise prevalence of ALD cases in dogs in comparison to dermatological disorders.

Month	Case of Dermatological Disorders	Cases of ALD	Percent Prevalence	R.H (%)	Temperature (?C)
September	75	5	6.66%	77	29.3 (25.5- 33.1)
October	72	3	4.16%	68	24.5 (18.4- 30.6)
November	51	3	5.88%	68	20.5 (13.4– 27.6)
December	22	2	9.09%	78	11.6 (7.5- 15.8)
January	60	3	5%	78	11.6 (6.7- 16.6)
February	79	8	10.12%	71	15 (8.5– 21.5)
March	81	8	9.8%	71	18.7 (12.9- 24.5)
Total	440	32	7.27%	-	-

primary organic triggers with perpetuating psychogenic triggers were 2 cases (6.66 %) as presented in Table 4. Among organic triggers maximum occurrence was of atopic dermatitis 5 (16.66%), demodicosis 2 (6.66%), orthopedic 1 (3.33%), hypothyroidism 1 (3.33%), flea allergic dermatitis 1 (3.33%) and lymphoma 1 (3.33%) as presented in Table 5. The findings of the present study were in agreement with Luescher (2003) who reported that ALD is a compulsive disease with four contributory

factors, stress, genetic predisposition, medical problems, and conditioning. Mostly ALD cases have multi-factorial triggers with primary and perpetuating factors. Primary organic factors included allergic disorders, bacterial or fungal disease, parasitic disorders, previous trauma, joint disease, foreign body, neoplasia, neuropathy, or hormonal disorders (Denerolle *et al.* 2007) whereas primary psychogenic disorders included stereotypic or obsessive-compulsive disorder (OCD), anxiety, boredom, attention seeking, or stress and also added perpetuating factors as secondary bacterial infections, keratin foreign bodies, bony changes and development of a secondary compulsive disorder/learned behavior.

Table 2. Age wise prevalence of ALD in dogs (n=32).

Age	Male (n=23)	Female (n=9)	Overall Prevalence
0-1 year	0 (0%)	0 (0%)	0 (0%)
1-3 years	7 (30.4%)	5 (55.55%)	12 (37.5%)
3-5 years	10 (43.47%)	1 (11.11%)	11 (34.37%)
>5 years	6 (26.08%)	3 (33.33%)	9 (28.12%)

Table 3. Breed wise prevalence of ALD in dogs (n=32).

Breeds	Cases of ALD (N=32)	Percent prevalence (%)
Labrador	16	50
German Shepherd	1	3.125
Pitbull	1	3.125
Pomeranian	2	6.250
Pug	1	3.125
American Bully	2	6.250
Dalmatian	1	3.125
Mastiff	1	3.125
Golden Retriever	5	15.625
Non- Descript	2	6.250

Stress factors in ALD and possible causes of psychogenic triggers (n=19)

The psychogenic triggers with possible stress factors were studied in 19 dogs and observed separation anxiety in 8 cases (42.10%), construction in house 2 cases (10.5%), boredom in 1 case (5.26%), new family member 1 case (5.26%), death of companion dog 1 case (5.26%), new dog in family 1 case (5.26%), no access to physical activity 1 case (5.26%) and idiopathic 4 cases (21.05%) as presented in Table 6. A thorough and critical history is an important factor to determine the primary psychogenic factors responsible for triggering stereotypic or OCD resulting in licking behavior (Shumaker 2019). Dogs being left alone or changing in companionship, fright, boredom,

Table 4. Etiologies of ALD based on primary Triggers.

Primary triggers	No. of cases	Prevalence
Psychogenic	19	63.33
Organic	9	30.00
Combination (both organic and psychogenic)	2	6.66

anxiousness, etc are the major causes of ALD in dogs (Paterson *et al.* 2007).

Number of affected limbs and percent prevalence in dogs suffering from ALD

It was found that lesion on the left forelimb (40%) was more common followed by lesions on both left and right forelimb (23.33%), right forelimb (13.33%), all limbs (10%), left forelimb, and right hind limb (6.66%), right hind limb (3.33%) and left forelimb and left hind limb (3.33%) as shown in Table 7. The present result held similarities with Patel (2010) who suggested that mostly single limb is affiliated with ALD in dogs but in rare cases, multiple limbs could be involved. Most lesions are present anteriorly on the cranial distal aspect of the limbs (Patel 2010 and Shumaker 2019) and the cranial left carpal region is the primarily damaged site when there is only one unilateral lesion.

Clinical manifestations of lesions in dogs suffering from ALD

The dogs suffering from ALD revealed a wide variety of clinical manifestations. Clinical examination of 30 dogs with ALD revealed symptoms of erythema in 10 dogs (33.33%), alopecia in 27 dogs (90%), pus discharge in 3 dogs (10%), crusts/scabs in 3 dogs (10%), erosions in 8 dogs (26.66%), moist lesions in 14 dogs (46.66%), circumscribed lesions in 16 dogs (53.33%), induration and firmness in 15 dogs (50%) and ulceration in 14 dogs (46.66%) as presented in Table 8. The lick lesions in ALD are characterized by a hard, elliptical plaque with a saliva-pigmented border (Denerolle *et al.* 2007) raised, firm, alopecic nodules or plaques (Paterson *et al.* 2007) may be single or multiple nodules or plaques, with an eroded and/or ulcerated center and an elevated border, scaling, crustation, skin discoloration, and redness, sinus fistulas or discharging sinuses (Patel 2010).

The lesions were mostly found over cranial carpal, metacarpal, tarsal, and metatarsal areas and were of varying sizes ranging from 1 to 7 cm in length and breadth from 0.5 to 3cm and were mostly found in cranial carpal, metacarpal, tarsal and metatarsal areas. According to Paterson *et al.* (2007), lesions are usually single, oval, and unilateral, ranging from 2 to 6 cm in size, and are frequently present in the cranial carpal or metacarpal areas; however, rarely appear over the tarsal or metatarsal areas. Common clinical signs recorded in dogs suffering from ALD with various etiologies are presented in Table 9.

Licking of limbs without a body or systemic lesion was a notable clinical indication in all of the dogs with

psychogenic ALD triggers in the current study. The lick granuloma, history of environmental change, and erythematous to the ulcerative lesion on the cranial distal extremities of the dog with wet, indurated, and circumscribed appearance were the most common psychogenic triggers (n=19) (Fig. 1).

The most prevalent presentation of atopic dermatitis triggers (n=5) was erythema and licking/biting of extremities with body pruritus (Fig. 2). According to Favrot *et al.* (2010), pruritus was the most pathognomonic indication of atopic dermatitis in 61% of atopic dermatitis-affected dogs. Face rubbing and foot licking were the most common behaviors observed in dogs with atopic dermatitis.

Alopecia, lichenification, and hyper pigmentation of the lesion on the leg were the clinical characteristics seen in demodicosis trigger (n=2) in this study (Fig. 3). Hyperkeratosis may have developed as a result of cutaneous mechanical irritation produced by infesting mites, and alopecia may have developed as a result of inflammation and irritation induced by mites in the hair follicle (Muller *et al.* 1989). The release of proteolytic enzymes, histamine, leukotrienes, and different peptidases could all have a role in the pathophysiology of pruritus (Gibson *et al.* 1991, Scott *et al.* 1995).

The occurrence of flea allergic dermatitis (n=1) was characterized by severe pruritus and erythema, excoriation, and alopecia (Fig. 4) involving the posterior and ventral portions of the body, primarily the dorsal-lumbosacral region, which is comparable with findings of Noli and Beck (2007).

Polyphagia, polydipsia, heat-seeking, weight increase, and lick granuloma on the distal limb were all indicators of hypothyroidism trigger (n=1). Behavior is a nonspecific symptom that is frequently included in a list of clinical signs concomitant with the reduced metabolic rate or neurological problems.

Lymphoma (n=1) trigger symptoms included enlarged lymph nodes and persistent lick granuloma. A case-control study in dogs with cutaneous lymphoma (mycosis

Table 5. Prevalent etiologies of ALD in dogs (n=30).

Etiology	No. of cases	Per cent (%)
Psychogenic	19	63.33
Atopic	5	16.66
Demodicosis	2	6.66
Orthopaedic	1	3.33
Hypothyroidism	1	3.33
Flea Allergic Dermatitis	1	3.33
Lymphoma	1	3.33
Total	30	100

Table 6. Stress factors in ALD.

Stress factors	Number of cases (n=19)	Prevalence (%)
New dog in the family	1	5.26
Change of owners/owner left (separation anxiety)	8	42.10
Death of companion dog	1	5.26
New family member	1	5.26
Boredom	1	5.26
Construction in house	2	10.50
No access to physical activity	1	5.26
Not detected	4	21.05
Total	19	100

fungoides) found that dogs with atopic dermatitis were at an elevated risk (Santoro *et al.* 2007). However in this case cutaneous form was not involved. According to Shumaker (2019), neoplasia could be an underlying cause of ALD or chronic licking.

Limping on the affected limb, soreness to the touch, and lick wound on the affected limb were the clinical indicators noted in orthopedic (n=1) triggers. According to Paterson *et al.* (2007), a dog's licking over an area of discomfort could be due to trauma (fracture, dislocation), infection (particularly osteomyelitis), joint pain (septic or immune-mediated arthritis), osteochondritis dissecans lesions, or a localized pain reaction to an orthopedic implant.

Cytological examination

Cytology is a low-cost, simple-to-use, safe, and accurate method of diagnosis when compared to other procedures (Amores-Fuster *et al.* 2015). This is a basic diagnostic procedure and is quick, non-invasive and did not require any special equipment, and provided clinical information that could be helpful in the successful management of the cases (Paterson 2019). In the present study, a maximum of the ALD lesions were presented with chronic active inflammation (n=24) with the presence of neutrophils, macrophages, and multinucleated giant cells (Fig. 5). Cytology of impression smears and fine needle aspirates of the infected lesions indicated purulent inflammation (n=6) with the presence of a large number of RBCs, neutrophils, and macrophages (Fig. 6). Fine needle aspiration of the lymph node was performed in one case suspected of lymphoma and revealed the presence of immature cells with finely granular chromatin and visible nucleoli suggestive of early-stage lymphoma (Fig. 7). Deep bacterial pyoderma is the most common consequence of psychogenic acral lick dermatitis, and it affects the majority of patients regardless of the etiology or primary function (Giannouloupoulos and Saridomichelakis 2017).

Biopsy

Histological features of cases with acral lick granuloma include significant unusual epidermal hyperplasia, hyperkeratosis, and ulceration; dermal changes include perivascular inflammation with a mixed infiltrate, folliculitis, and furunculosis; and fibrosis (Patel 2010). Biopsy for histology was obtained from the affected area

Table 7. Number of affected limbs and percent prevalence in dogs suffering with ALD.

Number of limbs affected	Psychogenic (n=19)	Atopic (n=5)	Demodicosis (n=2)	Orthopaedic (n=1)	Hypo-thyroidism (n=1)	Flea allergic dermatitis (n=1)	Lymphoma (n=1)	Overall prevalence % (n=30)
Left fore limb (LF)	10(52.63%)		1(50%)	1(100%)				12(40%)
Right fore limb (RF)	2(10.52%)	1(20%)			1(100%)			4(13.33%)
Left hind limb (LH)						1(100%)		0
Right hind limb (RH)								1(3.33%)
LF+RF	3(15.78%)	3(60%)	1(50%)					7(23.33%)
LF+RH	2(10.52%)							2(6.66%)
LF+LH							1(100%)	1(3.33%)
LF+RH								
RF+LH								
LH+RH								
All limbs	2(10.52%)	1(20%)						3(10%)

Table 8. Clinical Observation of ALD lesion in dogs (n=30).

Clinical observations	Number of cases n=30	Percent prevalence
Erythema	10	33.33%
Alopecia	27	90%
Pus discharge	3	10%
Crusts/scales	3	10%
Erosion	8	26.66%
Moist	14	46.66%
Circumscribed	16	53.33%
Induration/firm	15	50%
Ulceration	14	46.66%

without being surgically prepared in dogs with ALD. Biopsy examination of the cases revealed hyperkeratosis, acanthosis, and dermal fibrosis with vertical streaking (Fig. 8). Acanthosis, follicular elongation, lymphoplasmacytic dermal inflammation, folliculitis, furunculosis, and vertical streaking fibrosis (Shumaker *et al.* 2008) with irregular hyperplasia of the epidermis, compact hyperkeratosis and parakeratosis with superficial dermal fibrosis (vertical streaking) and folliculitis accompanied with dilation of the apocrine gland (Kang *et al.* 2013) are some of the histopathological characteristics of ALD. The limitation of this study was less number of cases evaluated for histology via biopsy sampling as owner compliance is a big issue.

Hematological profiles

Complete hematology of dogs with both psychogenic (n=19) and organic (n=11) origin of ALD of different breeds was carried out and results were compared with the control group (n= 10) (Table 10).

The mean hemoglobin values of control, psychogenic and organic group dogs were 12.08±0.58g%, 14.11±0.34g%, and 13.1±0.47g%, respectively. The mean hemoglobin value in the psychogenic was significantly (p ≤ 0.05) higher than that of the control. There was no significant difference between the mean hemoglobin values of organic as compared to control and psychogenic as compared to organic groups.

The mean Total Erythrocyte Count (TEC) of psychogenic was significantly higher than the control (p ≤ 0.05) but there was no significant difference in the TEC of organic as compared to control and psychogenic as compared to organic groups. The mean Packed Cell Volume (PCV) of psychogenic dogs was significantly higher (p ≤ 0.05) as compared to control. However, there was no significant difference in PCV values in organic

Table 9. Most common clinical signs recorded in dogs suffering from ALD with various etiologies.

Etiology	Clinical signs
Psychogenic/behavioural	No body lesion, licking of limbs/paws, lick granuloma on one or both limbs
Atopic	Body pruritus, Erythema, Licking/ biting of limbs
Orthopaedic	Limping of affected limb, pain on touch, licking wound on affected limb
Demodicosis	Alopecia, lichenification, hyperpigmentation on limbs, licking
Flea allergic dermatitis	Pruritus on dorsoventral aspect of the body, lick lesion on distal extremities,
Hypothyroidism	Polyphagia, polydipsia, heat seeking, weight gain, lick granuloma
Lymphoma	Swollen lymph nodes, chronic lick granuloma

Vs control and psychogenic Vs organic.

The mean values of TLC of the psychogenic and organic groups did not differ from the control group also there was no significant difference between psychogenic Vs organic groups. The mean relative and absolute neutrophils, lymphocytes, and eosinophils count of control, psychogenic and organic group dogs are depicted in Table 10 and counts did not differ from their respective control values.

The present findings were in agreement with Irimajiri *et al.* (2006) who reported higher hemoglobin, RBC values, and PCV in dogs suffering from the compulsive disorder as compared to normal individuals. There are two possibilities for higher hemoglobin levels in dogs with ALD in the psychogenic group. The first is the stress theory, which states that stress, conflict, and frustration cause adrenaline secretion and compulsive behavior, leading to splenic contraction and polycythemia. The second theory is the primary polycythemia hypothesis which states that polycythemia is caused by intrinsic pathologic processes such as cardiovascular illness or an increase in erythropoietin due to renal problems such as neoplasia or bone marrow disease.

Anxiety disorders and chronic emotional stress have been linked to stress or benign polycythemia. These alterations result from elevation in histamine and epinephrine or a decrease in antidiuretic hormone which



Fig. 1. Lick granuloma on left forelimb in dog diagnosed with psychogenic trigger.



Fig. 2. Lick lesion on right forelimb diagnosed with atopic dermatitis trigger.



Fig. 3. ALD lesion on left forelimb in dog diagnosed with Demodicosis trigger.



Fig. 4. ALD lesion on right hind limb with flea allergic dermatitis trigger.

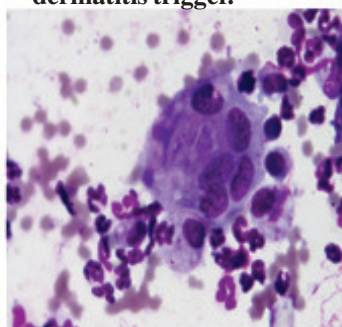


Fig. 5. Multinucleated giant cell – Granulomatous inflammation. Leishman stain X100.

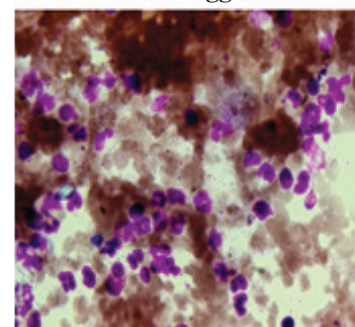


Fig. 6. Large number of neutrophils, R.B.Cs and macrophages suggestive of purulent inflammation. Leishman stain X100.

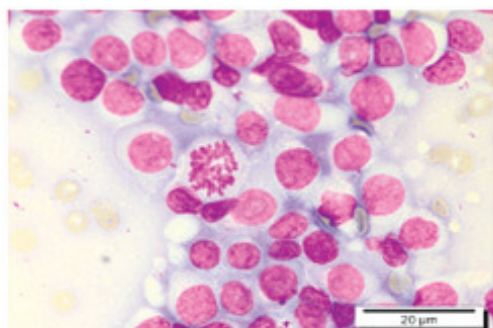


Fig. 7. FNAC of lymph node- showing lymphoblast cell along with mitotic figure suggestive of lymphoma. Leishman stain X100.

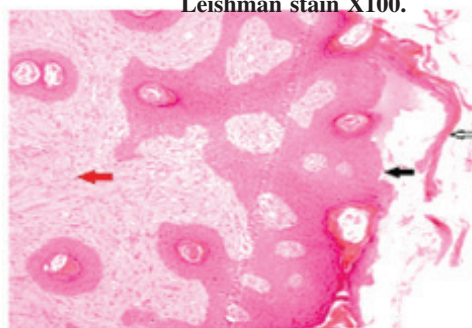


Fig. 8. White arrow depicts Hyperkeratosis, Black arrow depicts acanthosis, Red arrow depicts dermal fibrosis with vertical streaking. H & E X10.

in turn increases urine output and generates secondary hemoconcentration (Irimajiri *et al.* 2006). Polycythemia could be a direct cause of the compulsive, repeated behaviors seen in CD dogs. These canines may have already had an increase in RBC as a result of a main physiological condition that went unnoticed during a normal physical examination.

However, there was no significant difference in hemoglobin, RBC, and PCV values in dogs with ALD in the organic group as compared to control group dogs.

This could be due to the fact that there were fewer cases in this group, as well as the fact that the dogs in this group had underlying primary disorders such as demodicosis, lymphoma, hypothyroidism, etc.

This study attempted to overcome various limitations related to the method of diagnosis and assessment of acral lick dermatitis in dogs but several limitations are faced by authors that need to be considered for future research. The data generated will serve as first-hand information and opens up newer research avenues to validate it as an

Table 10. Hematological parameters (mean \pm SE) of Psychogenic group and Organic group dogs suffering with ALD.

Parameters	Mean \pm S.E.	Range	Mean \pm S.E.	Range	Mean \pm S.E.	Range
Hb (g/dl)	12.08 \pm 0.583 ^a	9.4-14.2	14.11 \pm 0.34 ^b	11-16.6	13.1 \pm 0.47	9.6-15.3
TEC ($\times 10^6 \mu\text{L}^{-1}$)	5.82 \pm 0.28 ^a	4.7-7.1	6.40 \pm 0.12 ^b	5.2-7.18	5.91 \pm 0.22	4.06-6.77
PCV (%)	37.64 \pm 1.84 ^a	28.2-44	43.25 \pm 1.13 ^b	35.7-55.3	40.04 \pm 1.39	28.4-45
TLC (μL^{-1})	13329 \pm 632.25	10000- 16410	14470 \pm 1187.53	6400- 24930	12164 \pm 892.40	8660- 17650
Absolute Neutrophil (μL^{-1})	10839 \pm 738.94	7400- 14440	11750 \pm 1092.69	5248- 22819	10253 \pm 643.55	7447- 14188
Absolute Lymphocyte (μL^{-1})	1719 \pm 208.92	544- 2692	2327 \pm 349.69	590- 6481	1703 \pm 288.53	591.2- 3883
Absolute Eosinophil (μL^{-1})	362 \pm 90.16	0-913	416 \pm 113.79	0-1396	207 \pm 102.93	0-1059

*Value with different superscripts in a row vary significantly ($p < 0.05$).

effective method for the diagnosis of acral lick dermatitis in dogs. However, the study needs further validation in terms of its limitation of sample size.

CONCLUSION

The instigating trigger of an acral lick lesion is multifaceted, involving a variety of probable underlying primary and perpetuating causes in addition to psychogenic triggers. Through history, lesion characteristics along with laboratory examination and cytology examination help in the accurate diagnosis of ALD in dogs. However cytological examination along with AST is a useful diagnostic tool for the identification of perpetuating triggers.

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