# Clinical Studies on Canine Pyoderma with Special Reference To its Diagnosis and Treatment

THESIS

SUBMITTED TO THE

RAJENDRA AGRICULTURAL UNIVERSITY

BIHAR

( FACULTY OF VETERINARY SCIENCE )

PUSA, ( SAMASTIPUR )

In partial fulfilment of the requirements

FOR THE DEGREE OF

Master of Veterinary Science

( VETERINARY MEDICINE )


By

*Arun Kumar*

( Registration No. - M/Vety. Med./19/1998-99 )

Department of Veterinary Medicine

BIHAR VETERINARY COLLEGE

PATNA - 800 014


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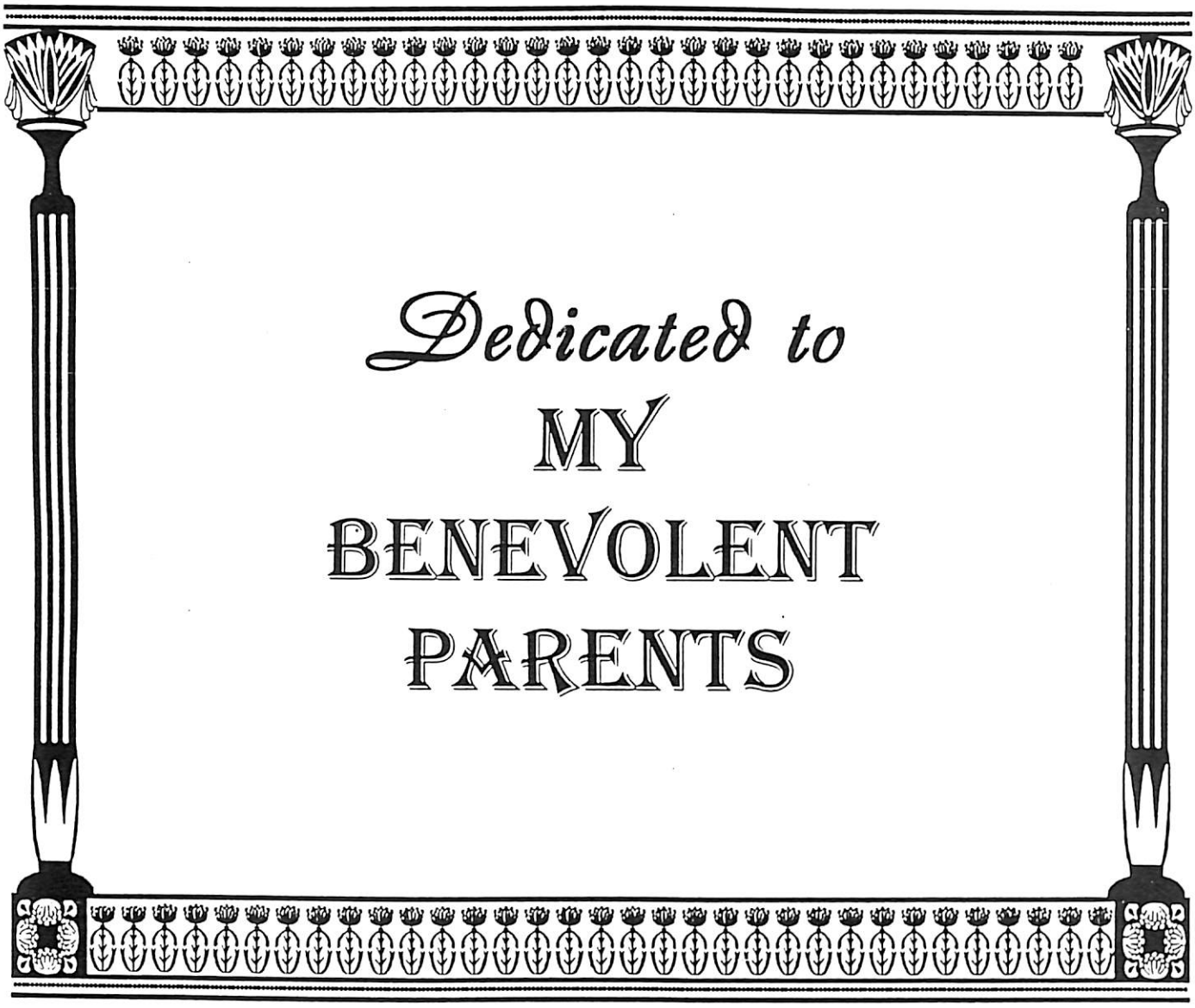

*Dedicated to*

MY

BENEVOLENT

PARENTS

Acc. 12921
Date 30-3-2002

**DR. V. K. SINHA**
M.V.Sc., Ph.D.
Head, Deptt. of Epidemiology
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# CERTIFICATE – I

This is to certify that the thesis entitled "**CLINICAL STUDIES ON CANINE PYODERMA WITH SPECIAL REFERENCE TO ITS DIAGNOSIS AND TREATMENT** " submitted in partial fulfilment of the requirements for the **Degree of Master of Veterinary Science (Veterinary Medicine) of the faculty of Post-graduate studies, Rajendra Agricultural University, Bihar**, is the record of bonafide research carried out by **Dr. Arun Kumar** under my supervision and guidance. No part of the thesis has been submitted for any other Degree or Diploma.

It is further certified that such help or information received during the course of this investigation and preparation of the thesis have been duly acknowledged.

30/12/2000

**(V. K. Sinha)**
Major Advisor

Endorsed : 30.12.2000

*Chairman / Head of the Department*

# CERTIFICATE – II

We, the undersigned, members of Advisory Committee of **Dr. Arun Kumar**, a candidate for the degree of **Master of Veterinary Science** with **Major in Veterinary Medicine,** have gone through the manuscript of the thesis and agree that the thesis entitled " **CLINICAL STUDIES ON CANINE PYODERMA WITH SPECIAL REFERENCE TO ITS DIAGNOSIS AND TREATMENT** " may be submitted by **Dr. Arun Kumar** in partial fulfilment of the requirement for the Degree.

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# CERTIFICATE – III

This is to certify that the thesis entitled " **CLINICAL STUDIES ON CANINE PYODERMA WITH SPECIAL REFERENCE TO ITS DIAGNOSIS AND TREATMENT**" submitted by **Dr. Arun Kumar** in partial fulfilment of the requirements for the degree of **Master of Veterinary Science (Vet. Medicine) of the faculty of Post-graduate studies, Rajendra Agricultural University, Bihar** was examined and approved on ....16.-.01.-.2002..... .

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*Place* :- Patna

*Date* :- 30/12/2000

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# Chapter-1

# *Introduction*

# INTRODUCTION

Skin diseases are usually accepted to be the largest single group of conditions encountered in small animal practice (Thoday, 1981). Skin is considered as mirror of internal body condition. It indicates the health status of the animal. The skin represents the anatomical boundary and principal organ of communication between the animal and its environment. It protects the animal from physical, chemical and microbial injury and also helps the animal to perceive cold, heat and pain. It help in the synthesis of Vitamin D and also have insulating qualities due to fat storage.

Many resident and transient bacteria alongwith ectoparasites remain present on the normal skin of dogs. Changes in the local resistance helps in proliferation of opportunistic pathogens on skin resulting in bacterial, parasitic, fungal and non-specific dermatitis.

Among the skin infection in dogs, bacterial dermatitis or pyoderma occupy a very prominent place. Higher incidence has been reported by workers from different countries (Warin, 1965). Pyoderma is a clinical condition which results due to pyogenic bacterial infections of the skin (Pal *et al.*, 1991). It is defined as any purulent skin disease, either primary, or secondary to an existing condition (Austin, 1978). There is accumulation of pus inside the

skin (Hill and Moriello, 1994). Pyoderma is most frequently observed in canine population (Ihrke, 1983, 1987). It is a significant skin problem in dogs (Kral and Schwartzman, 1964).

The lesions of pyoderma vary according to nature and distribution of the infection. It includes erythematous papules, pustules, cysts, folliculitis, furuncles and fistulous tracts (Baker, 1987). Vesicular and pustular lesions are very common. There is exudation of pus and serum which may dry-off to form yellow crusts. Deep pyoderma may be characterized by ulceration and sinus formation. Pruritus, alopecia and erythema may be present (Chakrabarti, 1986).

Pyoderma usually occurs as a result of another underlying disorder or predisposing condition which include hypersensitivity, ectoparasites, metabolic and immunological disorders, endocrine imbalance, trauma, malnutrition, debilitating disease, seborrhea, allergy, etc. (Kiel, 1974; Ihrke, 1987 and Mason, 1991). Appropriate management of pyoderma depends on establishing a correct diagnosis, and applying a knowledge of pathogenesis, predisposing causes, lesion classification and available treatment (Hill and Moriello, loc.cit.). Thus to achieve a proper diagnosis, different scientistshave classified pyoderma into - surface, superficial and deep depending on depth of skin involvement.

Not much information is available in India on various factors involved in canine bacterial dermatitis, specially on

microorganisms causing pyoderma (Patil *et al.*, 1999b). It is however reported that predominant bacteria in pyodermic dogs were coagulase positive *Staphylococcus* spp. and in some cases coagulase negative *Staphyloccus* spp. (Nesbitt and Schmitz, 1977; Krogh and Kristensen, 1981; Amine-Khodja *et al.*, 1983, Kunkle, 1987; Awad-Masalmeh and Jurinka, 1988 and Patil *et al.*, loc.cit.). Other bacteria include *Streptococcus* spp., *Micrococcus* spp., *Pseudomonas* spp., *Proteus* spp., *Klebsiella* spp. and *E. coli*. Hence, objective of present investigation is to isolate various microorganisms causing pyoderma specially under climatic condition prevailing at Patna in Bihar state.

Pyoderma is an eminent problem for the pet lovers, since dog is their best companion. It helps them by guarding, watching, tracking, hunting and detecting drugs and explosives. Dog is also kept for purpose of show, so it must always look beautiful. Dog suffering with pyoderma gives an unpleasant look, emits bad odour due to infection caused by pyogenic bacteria and simultaneously may be a potent source of infection to human beings specially children. So, immediate treatment of pyoderma is essential.

No rational treatment of pyoderma is carried out under the field condition. Since under field condition the treatment includes indiscriminate use of antibiotics and sulpha drugs, the resistant strains of the organism are expected to develop. It also leads to further fungal infection causing complexity of the problem. Successful therapy depends upon the correct diagnosis, use of an

appropriate antibiotic given at an effective dosage, sufficient duration of therapy, elimination of predisposing factors and avoidance of corticosteroids (Codner, 1988b). Hence, to avoid indiscriminate use of antibiotics and to select correct antimicrobial agent, isolation and identification of microbes and in-vitro drug sensitivity is essential.

Leucocytosis and neutrophilia is found associated with pyoderma. Histopathological studies also aid in the proper diagnosis of pyoderma. The ultimate aim of the present investigation is to provide suitable package to field veterinarians.

Keeping the above mentioned points into consideration the present study was undertaken with following aims and objectives : -

1. To study the prevalence of bacterial dermatitis (pyoderma) in domesticated dogs.
2. To study the effect of breed, sex, age and season on the occurrence of pyoderma.
3. Isolation and identification of various causative organism for this malady.
4. To carry out in-vitro sensitivity of the isolates for selection of drug for the treatment.
5. Haematological studies and histopathological studies of skin.
6. Formulation of rational and supportive therapy if needed for the disease.

# Chapter-2

# Review of Literature

# REVIEW OF LITERATURE

Pyoderma is a common bacterial skin disease of dogs. Despite this, pyoderma is frequently misdiagnosed and managed inappropriately. Not much information is available in India regarding etiology and treatment of canine pyoderma. However, relevant information whatever available from India and abroad are summarized here.

## INCIDENCE

Chakrabarti *et al.* (1983) reported 40 percent cases of superficial pyoderma and 60 percent cases of deep pyoderma out of 20 clinical cases of canine pyoderma. Superficial pyoderma was mostly found on the abdomen of the young dogs.

Kumar (1988) revealed 37.81, 23.27, 20.36 and 18.54 percent incidence of bacterial dermatitis, dermatophytic infection, mange mites and non-specific dermatitis, respectively in dogs presented at Small Animal Clinic of Punjab Agricultural University, Ludhiana.

Gupta *et al.* (1989) observed 18.9 percent incidence of bacterial dermatitis out of total dermatological disorders in a clinical survey of skin diseases at Ludhiana.

Misquita and Jagadish (1989) depicted 50, 25 and 25 percent of surface, superficial and deep pyoderma, respectively out of 12 clinical cases of canine pyoderma. The majority (66%) were non-

descript dogs. Seventy five percent of the animals were male and the average age was 34.7 months.

Kamboj (1991), in a clinical survey of dogs presented at Small Animal Clinic, P.A.U., Ludhiana, observed an overall 17.05 percent incidence of canine dermatitis. Of the total dermatitis cases incidence of bacterial dermatitis accounted for 40.24 percent, maximum being in January followed by May. Dogs of age group 0-6 month were most frequently affected, while females showed more incidence of pyoderma than male. Mixed breeds (66.19%) were more susceptible to pyoderma than pure breeds (33.81%). In pure breeds Spitz was mostly affected. Bacterial dermatitis was most common in dogs with short hair (51.90%). Abdominal region (41.99%) was more prone for the infection.

Khosla *et al.* (1991) found canine pyoderma due to Gram-positive cocci to be more common in dogs of 1 to 5 years of age.

Pal *et al.* (1993b), in a study on 229 cases of pyoderma in dogs of West Bengal, revealed higher incidence of superficial pyoderma (68.55%) than deep pyoderma (31.45%), of which skin fold pyoderma predominated. Percentage incidence was more in younger (0-12 month) age and older (72 months and above) age groups, in males than females (sex ratio of 2.5:1), in German shepherd (30.58%) and Doberman Pinscher (20.10%) than other breeds. Month related incidence revealed highest cases of pyoderma during September (25.76%) correlating with high rainfall and relative humidity.

Aujla *et al.* (1997) reported 9.31 percent incidence of skin diseases out of total clinical cases of dogs, of which 31.31 percent were attributable to bacterial dermatitis. Females (70.59%) were more susceptible to pyoderma than male (29.41%). Dogs upto 2 years of age (26.48%) were mostly affected. Pure breed dogs (76.48%) were more prone to pyoderma than mixed breeds (23.52%). The back (29.41%), hind legs (20.58%) and the abdomen (17.64%) were reported to have relatively greater predilection for bacterial dermatitis.

Patil *et al.* (1999b) carried out epidemiological studies on 50 dogs suffering with pyoderma and found that dogs aged between 1 and 4 years (46%) were commonly affected followed by dogs aged between 4 and 8 years (28%). Long haired breeds (86%) were more prone to pyoderma than short haired breeds (14%). Males (62%) were more susceptible than females (38%). External parasitic infestation (34%) and traumatic injury (28%) were reported to be the main predisposing cause of pyoderma.

## ISOLATION AND ANTIBIOGRAM

Breen (1973) isolated *Staphylococcus* spp. and *Proteus* spp. from a case of pyoderma and found the isolates sensitive to chloramphenicol and neomycin.

Guilhon and Barnabe (1997) in a study on 10 cases of canine pyodemodicosis reported isolation of staphylococci and *Pseudomonas aeruginosa.*

Done (1974) isolated P*seudomonas aeruginosa* (earlier *E.Coli* was isolated) in pure culture from a case of dry eczema. The bacteria was sensitive to streptomycin, gentamicin and carbenicillin which after a week became resistant to streptomycin, neomycin and gentamicin.

Guilhon *et al.* (1974) during his six years study of bacterial flora of pyodermatitis reported isolation of staphylococci from 85 percent cases.

Krogh and Kristensen (1976) studied the normal microflora of skin in 10 dogs by taking swab from 10 different sites of body. *Micrococcus* spp., alpha haemolytic streptococci and *Acinetobacter* spp. were consistently isolated. *Staphylococcus aureus* was isolated from 9 dogs and S*taph. epidermidis* from 7 dogs. Beta haemolytic streptococci, *Corynebacterium* spp., *Bacillus* spp., *E.coli*, *Pseudomon*as spp., *Proteus mirabilis* and *Alcaligenes* spp. were sporadically present.

Ciric *et al.* (1977) isolated S*taphylococcus* spp., *Proteus mirabilis* and *E.coli* from 4 cases of generalized pyoderma in dogs. Staphylococci were found resistant to streptomycin, penicillin, tetracycline, erythromycin, sulfonamide and bacitracin.

Nesbitt and Schmitz (1977) in a study on 195 cases of primary and secondary pyoderma and otitis in dogs isolated coagulase positive staphylococci in 88 percent and coagulase negative

staphylococci in 7 percent cases. Other organisms isolated, includes streptococci in 26 percent, *Clostridium* spp. in 26 percent and *Proteus* spp. from 13 percent cases. All the isolates were highly sensitive to chloramphenicol, erythromycin, gentamicin and oleandamycin. While, sensitivity to ampicillin, tetracycline and streptomycin were 48, 53 and 38 percent, respectively.

Willemse (1979) isolated 28 strains of coagulase positive staphylococci, 9 strains of haemolytic streptococci and other bacterial strains from 53 cases of canine pyoderma. There were also 3 cases of mixed infection of streptococci, *E.coli*, *Clostridium* spp and *Staphylococcus* spp. were sensitive to most of the major antimicrobials, except trimethoprim and sulfonamide.

Krogh and Kristensen (1981) cultured swabs taken form 40 dogs with suppurative skin disorders and reported *Staphylococcus aureus* 98% (55% pure culture), beta haemoloytic streptococci 30%, gram negative rods 30%, *Staph. epidermidis* 15% and *Micrococcus spp.* 13%. Acute moist dermatitis, impetigo and 'bacterial hypersensitivity' gave pure cultures of *Staph. aureus* in all cases but one. Organisms isolated were most sensitive to chloramphenicol, followed by ampicillin, fusidate and tetracyclines.

Amine-Khodja *et al.* (1983) isolated 493 bacterial isolates from cases of pyodermatitis and found *Staph. aureus* (64%) as major isolate followed by *E. coli* (10%), non-haemolytic streptococci (7%),

*Pseudomonas* spp. (5%) and *Proteus* spp. (5%). The resistance profile of *Staph. aureus* for a period of 5 years was studied by Amine-Khodja *et al.* (1984) and they found that resistance to tetracycline, lincomycin and spiramycin, but resistance to kanamycin remained low.

Okin (1983) reported *Staphylococcus aureus* (8 cases) and *Proteus mirabilis* (4 cases) as the most common bacterial agents out of 13 cases of canine pyoderma. The most effective antibiotics for Gram-positive bacteria were found to be lincomycin, erythromycin and cephalexin, and for gram-negative bacteria were cephalexin and gentamicin.

Berg *et al.* (1984) identified major coagulase positive staphylococci of dogs as *Staphylococcus intermedius*. Out of 72 samples taken from healthy canine skin as well as from various surgical and pyogenic lesions, 70 were identified as *Staph. intermedius* while two as *Staph. aureus*. Both species were found to be coagulase positive.

Cerri *et al.* (1984) reported maximum sensitivity to cefotaxime (63%), netilmicin (60%) and piperacillin (60%) on strains of *Staph. aureus* isolated from cases of canine pyoderma.

Wisselink *et al.* (1985) depicted coagulase positive staphylococci to be the most common isolate in 23 German Shepherd dogs suffering from deep pyoderma. Isolates were highly sensitive to lincomycin and trimethoprim-sulfadiazine combination.

Kunkle (1987) in a study on 87 dogs with skin infections isolated 96 staphylococci strains, of these, 88 were *Staph. intermedius*, 4 *Staph. epidermidis*, 3. *Staph. xylosus*, and one *Staph. simulans*.

Awad-Masalmeh and Jurinka (1988) in a study on canine pyoderma isolated staphylococci (94.1%) as major isolate, out of which 72 percent were in pure form and 22 percent were mixed with streptococci. *Staph. intermedius* (58.5%) was most common staphylococcal strain. The remaining 5.9 percent included various Gram negative organisms viz. *Pseudomonas* spp., *Proteus* spp., *E.coli, Klebsiella* spp. and *Pasteurella multocida* in pure and mixed cultures. Staphylococcal isolates showed 4.8, 11.0, 19.0, 28.0, 39.5 and 61.9 percent resistance to gentamicin, neomycin, erythromycin, chloramphenicol, tetracycline and ampicillin, respectively.

Medleau and Blue (1988) recovered 32 staphylococcal isolates from 30 cats, out of swab specimens obtained from skin lesions of 45 cats cultured bacteriologically for staphylococci. Out of 23 coagulase positive staphylococci, 16 were identified as *Staphylococcus aureus*, 5 as *Staph. intermedius*, and 2 as *Staph. hyicus*. Out of 9 coagulase negative staphylococci, 6 were identified as *Staph. simulans*, 2 as *Staph. epidermidis*, and 1 as *Staph. xylosus* Staphylococcal isolates were susceptible to clavulanic acid-amoxycillin, cloxacillin, cephalothin, chloramphenicol, gentamicin, erythromycin, and trimethoprim-sulfamethoxazole. Resistance to penicillin-G, ampicillin and tetracycline was frequent.

Love (1989) isolated 190 strains of staphylococci from different canine samples. Thirty percent were isolated from skin conditions (19.5% superficial dermatitis, 10.5% pyoderma) and rest from different conditions. Of the total strains 97.4% were coagulase positive staphylococci (85.8% *Staphylococcus intermedius*, 11.6% *Staph. aureus*) while the other were coagulase negative. Of the *Staph. intermedius* isolates, all were sensitive to cloxacillin, 98.4% to gentamicin while 27.9% to penicillin-G and ampicillin. Resistance pattern among bacteriostatic antibiotics were 21.6% to tetracycline, 7.4% to lincomycin, 5.3% to chlormphenicol and 3.1% to erythromycin.

Woldehiwet and Jones (1990) differentiated the *Staphylococcus* spp. of canine origin into *Staph. intermedius* and *Staph. aureus*. They observed no significant difference between the sensitivity pattern of *Staph. aureus* and *Staph. intermedius* to gentamicin, chloramphenicol, erythromycin, framycetin, neomycin, lincomycin and ampicillin. While resistance towards penicillin were different in *Staph. aureus* (80%) and *Staph. intermedius* (69.8%).

Khosla *et al.* (1991) isolated pure form of *Staphylococcus aureus* (26), *Staph. epidermidis* (20), coagulase-negative staphylococci (6) and *Micrococcus* spp. (5) out of 60 cases of canine pyoderma, while 3 plates were sterile. All these isolates were quite sensitive to gentamicin, chloramphenicol, kanamycin and co-trimaxozole while streptomycin was least sensitive.

Pal *et al.* (1993b) reported single infection of coagulase positive *Staphylococcus aureus* in 101cases (44.10%) out of a total of 229 cases of canine pyoderma. Rest cases were due to mixed infection of *Staph.aureus* with one or 2 other bacteria such as *Streptococcus pyogenes*, *Corynebacterium pyogenes* and *Pseudomonas aeruginosa*.

Kamboj *et al.* (1995) isolated 229 bacterial strains either single or in mixed infections out of 210 bacterial dermatitis cases. *Staphylococcus intermedius* (82.96%) was the major isolates followed by *Staph. aureus* (5%) *Staph. epidermidis*, *Streptococcus* spp. (3.49 % each), *Proteus* spp., *E. coli, Bacillus* spp. (2.18% each) and *Pseudomonas* spp. (1.31%) were also isolated. In-vitro drug sensitivity indicated that all staphylococci isolates were sensitive to cephalexin and amikacin. The sensitivity to other drugs were cloxacillin (93.59%), amoxycillin (91.13%), gentamicin, kanamycin, lincomycin and chloramphenicol (89.65% each).

Aujla *et al.* (1997) incriminated staphylococci (80%) in most of the cases, with *Staph. intermedius*, *Staph. aureus*, and *Staph. epidermidis* being found in 45, 22.5, and 12.5 percent cases, respectively. In-vitro drug sensitivity revealed gentamicin and doxycycline to be most effective drug against all strains of staphylococci and streptococci. Erythromycin, chloramphenicol, co-trimoxazole and nalidixic acid were cent percent effective against streptococci but not staphylococci. Staphylococci were found to be resistant to ampicillin, penicillin, bacitracin and polymixin-B in majority of cases.

Bettenay *et al.* (1998) isolated *Staphylococcus intermedius* from 77 percent cases, while 8 dogs showed no growth out of 65 dogs with bacterial skin infection. Other bacterias isolated were beta-haemolytic streptococci, *Proteus* spp. *Streptococcus faecalis*, *Pseudomonas aeruginosa*, *Pasteurella* spp. and *Escherichia coli*.

Mueller *et al.* (1998) in a study on 65 dogs suffering with bacterial skin infection reported *Staphylococcus intermedius* form 50 cases (77%). Other bacterias isolated included *Escherichia coli*, *Proteus* spp., *Pseudomonas aeruginosa* and *Streptococcus faecalis*. Strains were sensitive to clavulanic acid/amoxicillin (100%), cephalexin (98%), cloxacillin (96%), doxycycline (92%), erythromycin (90%) lincomycin (84%), trimethoprim-sulfonamide (58%), and penicillin (22%).

Pellerin *et al.* (1998) in a retrospective study compared the antimicrobial susceptibility of 131 *Staphylococcus intermedius* strains isolated from apparently healthy dogs, and 187 strains isolated from canine pyodermas, during 3 successive periods. Strains were moderately susceptible to chloramphenicol, doxycycline, macrolides and trimethoprim sulfonamide combination. Strains were highly susceptible (>95%) to oxacillin, amoxycillin clavulanic acid, cephalexin, gentamicin, fucidic acid, enrofloxacin and marbofloxacin.

The proportion of multiresistant strains increased from 10.8% in the first period, to 28% in the third period suggesting increase in the prevalence of resistant strains due to use of antibiotics.

*Batta et al.* (1999) observed that out of 45 cases of canine dermatitis 36 were positive for bacterial and/or fungal etiology. They reported 27 cases to be positive for bacterial isolates alone or along with fungal isolation while 22 were found positive for fungal isolation. Bacterias isolated were *Staph. aureus* (18), *Streptococcus pyogenes* (4), *Actinomyces pyogenes* (2), *Bacillus* spp. (2) and *Pseudomonas aeruginosa* (1).

Patil *et al.* (1999b) carried out antimicrobial sensitivity tests on 50 samples of canine pyoderma and revealed highest sensitivity to gentamicin (42 cases) followed by chloramphenicol (35), cephalexim (28), erythromycin (20), kanamycin (8), lincomycin (8), co-trimaxazole (5), cloxacillin (5), ampicillin (3) and penicillin-G (1).

## HAEMATOLOGY AND BIOCHEMICAL STUDIES

Misquita and Jagadish (1989) carried out haematological studies on 12 clinical cases of canine pyoderma and revealed not much difference in total erythrocyte count, (TEC), packed cell volume (PCV), differential leucocyte count (DLC) and haemoglobin (Hb)values, however a decrease in total leucocyte count (TLC) post treatment was reported.

Kamboj (1991) depicted a slight increase in TLC in dogs with bacterial dermatitis. Haemoglobin and TEC were found in normal range. The DLC revealed a slight neutrophilia.

Pal *et al.* (1995a) reported significantly higher values of serum phosphorus, cholesterol and blood glucose levels in dogs with experimentally produced pyoderma, while serum Ca, Cu, Zn and Fe were significantly lower. Significantly lower levels of Fe, Zn and Cu contentsof hair were found in pyoderma affected dogs as compared to control animals.

Aujla *et al.* (1997) observed marked leucocytosis and absolute neutrophilia with predominance of band cells in cases of canine pyoderma. Biochemical studies revealed no significant change in total proteins, albumin and total immunoglobulins, whereas, circulating immune complex analysis revealed significant increase as compared to normal controls.

## HISTOPATHOLOGICAL STUDIES

Muller and Krick (1969) revealed the pathological changes in superficial pyoderma in dogs which includes acanthosis and superficial dermal infiltration of polymorphonuclear leukocytes, histiocytes, plasma cells, and mast cells concentrated around pilosebaceous units. These were accompanied by ulceration of the epidermis, epidermal oedema, spongiosis and vascular dilation. Deep pyoderma involves a deeper penetration producing a massive

inflammatory response, more destruction and draining fistulas. These were accomplished by penetration through hair follicles (folliculitis) and sebaceous glands and perifolliculitis with infiltration of neutrophils and a few macrophages in cases with acute superficial pyoderma. Superficial peri-vascular dermatitis with infiltration of neutrophils, lymphocytes and plasma cell around the blood vessels and in dermo-epidermal junction were also present in superficial pyoderma. Deep pyoderma were marked by either diffuse purulent inflammation of deeper dermis or frank abscessation. Neutrophils also infiltrated around sebaceous glands and surrounding adipose tissue. Chronic suppurative dermatitis were characterized by hyperplasia, hypertrophy, hyperkeratosis, spongiosis, acantholysis, superficial erosions to complete exfoliation and subepidermal oedema. In addition to neutrophils there was also abundance of lymphocytes, lymphoblasts, plasma cells, macrophages and fibroblasts.

Rojko *et al.* (1978) carried out histopathological studies on 30 dogs having clinical lesions of pyoderma. Acanthosis was usually present followed by parakeratosis and hyperkeratosis. Epidermal degeneration associated with neutrophil infiltration and intradermal pustule formation were present in 22 dogs (73%). Lymphoplasmocytic infiltration (93% cases) and dermal reticuloendothelial cell (53% cases) were also featured. Purulent or purulogranulomatous perifolliculitis (53% cases) and hidradentis

(27% cases) were also characteristics of pyoderma. Moderate degree of superficial dermal oedema was seen in 8 dogs (27%). Bacteria were rarely found.

Reinke *et al.* (1987) observed superficial ulcerative reaction and suppurative folliculitis in dogs suffering from pyotraumatic dermatitis.

The histopathological findings of bacterial dermatitis revealed lesions of acute nature characterized by infiltration of neutrophils in the epidermis as well as in the dermis and abscesses usually involving the hair follicle (Kamboj, 1991).

Pal *et al.* (1993a) in a study on histopathological changes of skin in experimentally produced pyoderma on 5 dogs, reported hyperkeratinization, acanthosis, papillamatosis, thinning and erossion of epidermis. Dermal layer showed collagenous oedema along with necrosis of the collagen fibre and microabscesses. Macrophages were found surrounding sweat glands, sebaceous glands and hair follicles. Sweat glands showed evidence of hyperplasia, atrophic changes and infiltration of lymphocytes, monocytes and few plasma cells. Vascular necrosis were also noted.

Aujla *et al.*(1997) studied histopathological changes in dogs suffering with canine pyoderma and reported superficial abscessation, purulent folliculitis and perifolliculitis with infiltration of neutrophils and a few macrophages, and superficial peri-vascular dermatitis in cases with acute superficial pyoderma. Deep pyoderma was marked by either diffuse purulent inflammation of deeper

dermis or frank abscessation. Neutrophils also infiltrated around sebaceous glands and surrounding adipose tissue. Chronic suppurative dermatitis were characterized by hyperplasia, hypertrophy, hyperkeratosis, spongiosis, acantholysis, erosion of epidermis and subepidermal oedema. In addition to neutrophils there was also abundance of lymphocytes, lymphoblasts, plasma cells, macrophages and fibroblasts.

## TREATMENT

Craig (1972) obtained complete cure in 70 percent cases of bacterial dermatitis with oral or systemic preparation of trimethoprim and sulphadiazine combination.

Done (1974) carried out a 14 days course of systemic and topical gentamicin to treat a case of dry eczema caused by *Pseudomonas aeruginosa*. Afterward treatment was continued at a reduced level.

Northway (1975) tried a commercially available preparation of aloe vera extract for the treatment of mixed bacterial infection in 70 dogs with various skin diseases and achieved good response.

Thompson and Mandy (1976) treated different conditions of canine pyoderma viz. acute moist dermatitis, folliculitis, generalized pyoderma and canine impetigo with 2.5 percent benzoyl peroxide (lathering base shampoo) followed by daily application of 5

percent benzoyl peroxide (alcohol gel vehicle). This resulted in complete resolution of lesions within 5-7 days with minimal crusting.

Cardini *et al.* (1977) treated 67 cases of pyodermatitis caused by staphylococci based on antibiotic sensitivity test. Complete cure was achieved in all dogs, but relapse was found in 11 dogs.

Ciric *et al.* (1977) treated a 4 year old male German Shepherd having severe, deep, generalized pyoderma with gentamicin. The case was already treated with chloramphenicol and prepared vaccine without much improvement. Gentamicin (3 mg/kg, I/m in half doses at 12 hour intervals) along with local cure of antibiotics and sulfonamide powder showed marked improvement only 5 days after the start of treatment, which was continued for 15 days. Later the same treatment was successfully applied in 11 other cases, which were treated for 7-15 days according to the severity of disease.

Papp and Vetesi (1978) effectively treated 35 cases of impetigo in dogs by local application of streptomycin in combination with cortisone.

Chakrabarti *et al.* (1983) treated 20 clinical cases of pyoderma in dogs with Teeburb capsule at the dose levels of 1 to 2 capsules thrice daily for 7 to 12 days. He reported clearance of cutaneous lesions within 10 days of consecutive therapy. The lesions became dry as the weeping condition disappeared within 5 days of therapy.

Bogaard *et al.* (1984) treated 4 dogs having deep seated pyoderma with *Staph. aureus* alpha toxoid emulsified in Freund's adjuvant and later 10 similar cases with commercially available preparation of alpha and beta toxoids (Isopyol). Treatment was effective but showed either adverse reactions or relapse in few cases.

Bywater *et al.* (1985) compared the efficacy of clavulanate-potentiated amoxycillin with amoxycillin alone in experimental staphylococcal infection in dogs and in a controlled trial in clinical cases of skin infection in dogs and cats and concluded that clavulanate - potentiated amoxycillin was more effective than amoxycillin alone.

Reinke *et al.* (1987) carried out the microscopic examination of skin of dogs suffering with pyotraumatic dermatitis and conducted a treatment trial with corticosteroids or antibiotics. The cases with superficial, ulcerative, inflammatory process of undetermined cause and pathogenesis responded well to corticosteroids therapy. Dogs with severe folliculitis (pyoderma) gave poor response to corticosteroids and were corrected by antibiotic therapy. It was concluded that antibiotics should be used for treating pyotraumatic dermatitis with suppurative folliculitis.

Angarano and Mac Donald (1989) found cefadroxil to be an effective antibiotic for the treatment of canine bacterial pyoderma. Out of 30 dogs treated with cefadroxil administered orally

at 22 mg/kg of body weight, 12 hourly, for 21 to 30 days, 29 were found to have good to excellent response. Thus, they suggested cefadroxil as a good choice in the treatment of canine pyoderma in cephalosporins sensitive cases.

Becker *et al.* (1989) treated cases of chronic recurrent pyoderma with antibiotics combined with either intravenous injection of propionibacterium acne or placebo. Complete recovery was found in 12 out of 15 dogs treated with antibiotics and propionibacterium acne after 12 weeks of treatment, whereas recovery was seen only in 5 out of 13 dogs treated with antibiotics and placebo.

Krick and Scott (1989) isolated staphylococci from 17 cases of bacterial folliculitis, furunculosis and cellutitis in German Shepherd dogs. All cases responded initially to appropriate systemic antibiotics therapy, however eight dogs (47.1%) showed relapse when the treatment was discontinued. Ultimately 14 (82.4%) were in remission for 2-18 months after 1-3 course of antibiotic therapy.

Misquita and Jagadish (1989) studied the influence of topical Himax ointment and oral administration of Teeburb capsule on canine pyoderma. They found these two indigenous herbal medicines to be effective in superficial, surface and deep pyoderma bringing about its cure by an average of 14, 14 and 32 days respectively.

Price (1989) reported a case of 6 year old English Setter dog with a complex of dermatologic conditions throughout its life time, that did not respond to prescribed treatment, revealed pyoderma, seborrhoea and an allergy on detailed examination. Culture of an active lesion revealed *Staphylococcus intermedius* that was sensitive only to gentamicin and cephalosporins and resistant to several antibiotics. The condition was cured by treatment with prednisone, cefadroxil and vitamin supplements and benzoyl peroxidase baths.

Paradis *et al.* (1990) reported enrofloxacin as an excellent antibiotic for the treatment of canine bacterial pyoderma. After proper diagnosis 30 dogs with bacterial pyoderma were treated with enrofloxacin administered orally at 2.5 mg/kg. every 12 hourly, for 2 to 14 weeks. At the end of antibiotic treatment 28 (93.3%) dogs were found to have an excellent response. Relapses were seen in 25% of these dogs after follow up periods of 1 to 4 months.

Wustenberg and Rodenback (1990) in a clinical trial treated 54 canine pyoderma cases with cephalexin-monohydrate (Cefaseptin/Chassot) and observed complete healing in 31 patients and further 7 cases healed completely after second treatment of relapse. Thirteen patients showed permanent relapses after each treatment with only incomplete healing while the treatment was unsuccessful in one case.

Khosla *et al.* (1991) found parentral administration of benzathine penicillin (twice weekly) along with local application of 1% povidone-iodine (twice daily) to be quite effective for complete recovery of pyodermatitis (*Staphylococcus aureus* infection) in dogs within 10 days. Cases having mixed infection of *Sarcoptes scabiei* and *Staph. aureus* showed an excellent response to Ivermectin alongwith antibacterial therapy giving completed recovery within 15 days.

Messinger and Beale (1993) conducted a blind trial to determine the efficacy of potentiated sulfa drugs in the treatment of canine superficial pyoderma. Trimethoprim-sulfadiazine once daily provided 38.5% recovery by 3 weeks and 75.9% by 6 weeks while with twice daily combination, 57.1% and 78.6% of dogs were cured by 3 and 6 weeks, respectively. With once daily sultadimethoxine-ormetoprim, 75.0% and 100.0% of dogs were cured by 3 and 6 weeks, respectively. They found the difference to be statistically non-significant possibly due to the low sample size.

Pal *et al.* (1995b) treated 15 cases of experimentally induced canine pyoderma with Teeburb capsules and Himax D ointment and reported clearing of lesions in 12 dogs after 3 weeks of treatment while rest dogs showed marked (2 cases) to moderate (1 cases) improvement.

Scott *et al.* (1993) carried out as study on 20 canine pyoderma cases associated with *Staphylococcus intermedius*, and concluded that ormethoprim-sulfadimethoxine is very active in vitro against *Staph. intermedius*, very efficacious for the treatment of superficial or deep staphylococcal pyoderma, rarely associated with side effects, convenient to use (oral, once daily), and reasonably priced.

Carlotti and Leroy (1995) concluded that the following systemic antibiotics can be used for the treatment of canine pyoderma :- lincomycin, clindamycin, tylosin and diaminopyrimidine-sulfamides (bacteriostatic); amoxycillin-clavulanic acid, cefalexin, cefadroxil and third-generation quinolones such as enrofloxacin and marbofloxacin (bactericidal).

Harvey (1996) treated 30 cases of canine superficial pyoderma with tylosin at a dose rate of 20 mg/kg twice daily orally for three weeks. Twenty-Two dogs recovered after three weeks of treatment while two dogs required further two weeks of treatment giving a total response rate of 80 percent. Five cases (16.6 percent) failed to respond and three of these subsequently responded to other antibacterial treatment. One dog suffering with transient gastro-enteritis due to tylosin treatment also subsequently responded to a different antibacterial agent.

Lloyd *et al.* (1997) in a blind study compared the efficacy of two dose rate of oral co-amoxyclav (12.5 mg/kg or 25.0 mg/kg, twice daily for up to 12 weeks) in curing the lesions of canine folliculitis, furunculosis and cellulitis. The lesions of folliculitis were cured in 91.5% of cases, in a mean period of 2.3 days. Furunculosis and cellulitis were cured respectively in 87.5% and 60.0% of the dogs, in mean periods of 37.6 and 44.7 days. Thus they concluded that the standard dose rate was very effective in folliculitis and furunculosis and there was no benefit in doubling the dose.

Bettenay *et al.* (1998) treated 65 dogs with bacterial skin infection with doxycycline hydrochloride and recommended it as choice of therapy for superficial pyoderma but not for deep pyoderma. Complete remission after 3 weeks of therapy was achieved in 53% cases of superficial infection and 14% cases of deep pyoderma. A partial response was observed in 40% of superficial and 50% of deep pyoderma.

Guaguere *et al.* (1998) suggested that the clinical efficacy of cephalexin is greater in vitro than in vivo. Both controlled and randomized studies were carried out on 165 dogs to demonstrate the clinical efficacy of cephalexin compared with Amoxicillin-clavulanic acid (ACA). Cephalexin (30 mg/kg/day) treatment of superficial pyoderma resulted in 93 percent of clinical recoveries compared with 76 percent following ACA treatment (25 mg/kg/day). In deep pyodermas there was no significant difference between groups receiving 30 mg/kg/day cephalexin (71% recovery), 60 mg/dg/day cephalexin (83%) or 50 mg/kg/day ACA (74%).

Scott *et al.* (1998) tried clindamycin hydrochloride capsules (11 mg/kg, q, 24 h) administered orally to 20 dogs with deep staphylococcal pyoderma. They reported clindamycin as an effective, safe and convenient antibiotic for the treatment of deep staphylococcal pyoderma in dogs.

Carlotti *et al.* (1999) reported marbofloxacin to be very effective antibacterial for treatment of difficult cases of canine pyoderma particularly in deep pyoderma, for severe or recurrent skin infections or in severe mixed bacterial infections. Marbofloxacin used at 2 mg/kg body weight, once daily, proved to be clinically safe thus may be used for long term treatment which is commonly required in cases of deep pyoderma.

Chakrabarti *et al.* (1999) tried two herbal drugs (Newcharm gel and charmid capsule) against experimental pyoderma in dogs and found the combined therapy charmid capsule orally and New Charm gel topically) to be superior to topical therapy (New charm gel) alone. No untowards effects of these herbal drugs on dogs were reported.

Little wood *et al.* (1999) conducted a randomised clinical trial for the treatment of canine superficial pyoderma and found clindamycin hydrochloride (59% recovery) to be significantly more effective than clavulanate-amoxycillin (30% recovery) after 3 weeks of treatment.

Patil *et al.* (1999a) reported excellent results by using erythromycin and gentamicin for the treatment of different types of pyoderma alongwith supportive therapy. Complete recovery was observed in both erythromycin (@ 15mg/kg. b.wt. orally thrice daily) and gentamicin (@ 2mg/kg b.wt. S/c every 24 hours) treated dogs, 15 days after treatment.

# Chapter-3

# Materials & Methods

# MATERIALS AND METHODS

The present study was carried out on clinical cases of dermatological disorders in dogs brought for treatment at Bihar Veterinary College Hospital, Patna and from other hospitals/private clinics/ Govt. police dog squad and local residential colonies in and around Patna, between the period from August'1999 to July'2000. The detailed study was carried out on 78 dogs suffering with pyoderma out of 244 dogs with different types of dermatological disorders examined during the present study.

## HISTORY AND CLINICAL EXAMINATION

A detail history including age, sex, breed, hair length, location and type of skin lesion and owner's complaint were recorded in a specially designed proforma. Inquiry was also made regarding the intensity and frequency of pruritus and development of skin lesions such as papules, pustules and scabs. Any previous treatment given and clinical response elicited were also noted. Clinical examination of the entire skin surface of all the dogs included in the present study were done.

## SAMPLE COLLECTION

### *Collection of skin scrapings :*

Skin scrapings were taken from all the cases from periphery of the active lesions. Hairs around the lesion were clipped

and the affected areas were moistened with 10 percent potassium hydroxide (KOH) solution. The skin was deeply scraped with the help of a sterilized scalpel blade till the blood oozed out and were taken on a clean dried sterilized piece of paper. The skin scrapings were also preserved in sterilized vials containing 10 percent KOH solution for further processing.

***Collection of swabs :***

The exudate was collected from the skin lesions of dogs tentatively diagnosed as pyoderma on the basis of their gross lesions with sterile cotton swabs. Before collecting the specimen, hairs around the lesion were clipped and trauma to the pustule was avoided. In case of intact pustule, the area was gently cleaned with 70 per cent alcohol, air dried and pustule was opened with a sterile scalpel blade. A sterile cotton swab was touched to the exudate avoiding any contact with surroundings. Similarly, exudate was taken on sterile cotton swabs from animals showing suppurative lesions. In case of crusty lesion, hairs around the lesion were removed, leaving the crust intact. Surface of the crust was wiped with alcohol and air dried. Crust was removed aseptically with forceps. A sterile swab was rubbed over the moist surface beneath the removed crust, avoiding contact with surroundings. All swabs

were placed individually in sterile test tubes under complete aseptic conditions near a flame.

**PROCESSING OF SKIN SCRAPINGS**

Samples of skin scrapings were pooled in 10 per cent KOH solution in a petridish, gently heated and kept at room temperature for 20 - 30 minutes. Fluid was taken on a clean glass slide and covered with a cover slip. Sample which was preserved in 10 per cent KOH solution for overnight was taken in a centrifuge tube and centrifuged at 1500 rpm for 15 minutes. The supernatant fluid was discarded and a drop of sediment fluid was placed on a clean glass slide and covered with a cover slip.

***Identification of parasitic dermatitis cases :***

The above prepared slides were examined for any mite or mite's egg first under low power and then in high power of the microscope for confirmation.

The identification of *Sarcoptes scabiei* and *Demodex canis* was done as per description given by Sloss and Kemp (1978).

Skin samples showing mites were classified as parasitic dermatitis or mange and identified as either sarcoptic mange (having *Sarcoptes scabiei* ) or demodectic mange (having *Demodex canis* ).

***Identification of mycotic dermatitis cases :***

To identify fungal infection 10 percent KOH treated skin scrapings were directly examined under microscope for presence of

fungus or fungal spores. Whenever needed lactophenol cotton blue preparation was prepared and used for examination.

Samples showing fungus or fungal spores were described as mycotic dermatitis.

## BACTERIOLOGICAL STUDIES

### *1. Collection of swabs :*

Described earlier under the heading sample collection.

### *2. Isolation of the organism :*

Skin swabs were streaked on sterile nutrient agar, Mac Conkey's agar and 10 per cent sheep blood agar plates and incubated at 37°C for 24 - 48 hours. Representative colony was noted for colonial characters, pattern of haemolysis and lactose fermentation capacity. All the types of colonies were obtained in pure form by conventional method on nutrient agar slants and were used for identification of bacteria.

### *3. Identification of isolates :*

The identification of the bacteria was done on the basis of cultural, staining, morphological and biochemical characteristics as per standard techniques (Cruickshank, 1968).

**i) Morphology :**

Smears from lactose fermenter, non-lactose fermenter and other representative colonies were made on clean, dry,

microscopic glass slides and stained with Gram's stain. These stained smears were examined under oil immersion lens of microscope for Gram's reaction, shape and arrangement.

**ii) Motility :**

The motility of the organisms in 12-18 hours broth culture was examined by means of hanging drop method as described by Cruickshank (loc. cit.).

**iii) Biochemical reactions :**

All the colonies obtained in pure form on nutrient agar slants were put to different biochemical and sugar fermentation tests for identification of all isolates, as described by Cruickshank (loc. cit.).

Lactose fermenter, non-lactose fermenter and other gram-negative bacteria were identified on the basis of biochemical tests such as IMVIC (Indole Methyl Red Voges- Prosekaur Citrate Utilization) reaction, hydrogen-sulphide production test, nitrate reduction test, urease production test, and phenyl - alanine deaminase (PPA) test and sugar fermentation test of glucose, lactose, sucrose, mannitol and maltose.

Cocci were identified on the basis of catalase test and sugar fermentation test of glucose, lactose sucrose, mannitol and maltose. Haemolysis, if any was also observed on blood agar plate.

Characterization of *Staphylococcus* spp. was done on the basis of pigmentation, coagulase test, mannitol fermentation and acetoin production.

Finally, organisms were identified according to Edwards and Ewing (1962).

***4. In-vitro drug sensitivity test :***

Antibiotic sensitivity test was done by disc diffusion technique as modified by Kirby - Bauer (Carter, 1973).

First of all, nutrient agar plates were dried in the incubator. The overnight broth culture was poured and a lawn was prepared by spreading uniformly over the whole plate with the help of a sterile bent glass rod. The selected antibiotic discs (Table 1) were gently placed at an adequate spacing (2 cm. or more) on the moist surface of the agar plates with sterile fine pointed forceps to ensure full contact with the medium and moistening of the disc. The plate was then incubated at $37^0$ C for 24 hours. The zone of inhibition was measured with the help of measuring scale and interpretation of result was done as per specifications mentioned in the zone size interpretation chart supplied by the disc manufacturer[1].

**CLASSIFICATION OF PYODERMA :**

After confirmed diagnosis, classification of pyoderma cases were done. Canine pyoderma were classified as surface, superficial and deep, based on the depth of the skin involvement (Ihrke, 1987 ; Codner, 1988a ; Mason, 1991) as presented in Table 2.

[1] HIEDIA LABORATORIES LIMITED, MUMBAI - 400 086, INDIA.

**Table 1.:** ***Different antimicrobial discs used for in-vitro sensitivity test***

| Sl. No. | Antimicrobial agent | Symbol | Disc content |
|---|---|---|---|
| 1. | Amikacin | Ak | 30 mcg |
| 2. | Amoxycillin | Am | 10 mcg |
| 3. | Amoxyclav (Amoxycillin/Clavulanic acid) | Ac | 30 mcg (20/10 mcg) |
| 4. | Ampicillin | A | 10 mcg |
| 5. | Cephalexin | Cp | 30 mcg |
| 6. | Cephotaxime | Ce | 30 mcg |
| 7. | Chloramphenicol | C | 30 mcg |
| 8. | Ciprofloxacin | Cf | 5 mcg |
| 9. | Cloxacillin | Cx | 10 mcg |
| 10. | Enrofloxacin | Ex | 10 mcg |
| 11. | Erythromycin | E | 15 mcg |
| 12. | Gentamicin | G | 10 mcg |
| 13. | Penicillin - G | P | 10 units |

**Table 2. :** ***Classification of Pyoderma.***

| Type | Depth of Skin involvement | Conditions |
|---|---|---|
| 1.Surface pyoderma. | Stratum corneum (outermost layer) | i) Acute moist dermatitis<br>ii)Intertrigo(Skin-foldfold pyoderma) |
| 2.Superficial pyoderma | Layers of epidermis below stratum corneum and peripheral area of hair follicle. | i) Impetigo<br>ii) Superficial folliculitis<br>iii) Acne |
| 3.Deep pyoderma | Tissues deeper than hair follicles, including dermis and sometimes sub-cutaneous layer. | i) Generalised pyoderma<br>ii) Pododermatitis (inter digital pyoderma)<br>iii) Nasal pyoderma<br>iv) Callus or pressure point pyoderma.<br>v) Anal furunculosis<br>vi) Muzzle/chin pyoderma. |

## HAEMATOLOGICAL STUDIES

The haematological studies viz. total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC) and haemoglobin (Hb) estimation were carried out before treatment and also after complete recovery in dogs suffering with pyoderma (Coles, 1974 and Schalm *et al.*, 1975). Different haematological values ascertained by conducting the examination and taking the blood from 6 normal healthy dogs of different age groups and breed has been taken as the base value.

***Collection of blood :***

Two milliliter (ml) of blood was aseptically collected either from cephalic vein or recurrent tarsal vein in a sterile vial containing 0.2 ml of 3.85 percent sodium citrate. Simultaneously, a fresh drop of blood was taken on a clean dry glass slide and a thin smear was prepared for differential leucocyte count.

***Estimation of Haematological Parameters :***

Haemoglobin concentration was estimated by using Sahli's haemoglobinometer with double prism standard as described by *Schalm et al.* (loc. cit.), and expressed in gram per decilitre (g/dl).

For differential leucocyte count (DLC), blood smear was stained with Leishman's stain (*Schalm et al., loc. cit*). Counting was done under the oil immersion lens as per methods of Coles (1974) and expressed in percentage. Total erythrocyte count (TEC) and total

leucocyte count (TLC) were done by conventional methods as described by *Schalm et al.* (loc . cit.), and were expressed in millions per cubic milliliter ($10^6$/cu. mm) of blood and thousands per cubic ($10^3$/Cu.mm) of blood, respectively.

## HISTOPATHOLOGICAL STUDIES

The histopathological studies were carried out on some specific cases of pyoderma.

### *1. Collection of Biopsy Material :*

Biopsy specimens were taken with the helps of 6 mm. skin biopsy punch after desensitizing the affected part of the skin with local anaesthetic agent (2 % lignocaine hydrochloride[1]). The tissue was preserved in 10 per cent buffered formal saline solution for at least 48 hours.

### *2. Processing of tissue :*

After fixation, the tissues were thoroughly washed in running water, dehydrated in ascending grades of alcohol and acetone, cleared in xylene, infiltrated in paraffin at 58-60$^0$C and finally embedded in paraffin blocks. The paraffin sections were cut at 5-6 μ thickness (Luna, 1968).

### *3. Histological examination :*

For histological studies the sections were stained with Harri's haematoxylin and eosin (Luna, loc.cit.). The stained sections were examined under light microscope and changes were recorded.

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[1] Xylocaine 2%, ASTRA-IDL LIMITED, BANGALORE - 560063, INDIA.

## TREATMENT

The cases diagnosed as pyoderma were divided into four treatment groups, viz. Group- A, B, C and D. Animals of group A, B, and C were treated with different selected antimicrobial drugs based on in-vitro sensitivity test, while Group-D animals were treated with a herbal preparation. (Table 3). Before treatment cleaning of the lesions were done with Savlon[1] solution and owners were advised to clean the lesions regularly.

Each dog was treated for a minimum period of four days and evaluation of animals for recovery were done at 4 days interval for a maximum period of 24 days. Complete recovery was judged by disappearance of gross lesion. Animals were again evaluated after one week of recovery to rule out any possibility of reoccurence.

Details of the drugs used has been presented in Table 3 and detail of the schedule for the treatment has been depicted in Table 4.

## STATISTICAL ANALYSIS

Statistical analysis of data was done according to Snedecor and Cochran (1967). Values measured in percentage were transformed to angle corresponding to percentage (Angle = Arcsin $\sqrt{\text{Percentage}}$) as given by C.I. Bliss before further statistical analysis of data.

[1] ICI India Limited, Chennai - 600 09, India.

**Table 3. : *Details of the drugs used for the treatment of Pyoderma***

| Group | Classification | Generic Name | Trade Name | Presentation & Composition | Firm |
|---|---|---|---|---|---|
| A. | Cephalosporins (First Generation) | Cephalexin | SPORIDEX | **Tablet & Capsule**<br>125 mg, 250 mg & 500 mg Cephalexin. | RANBAXY Laboratories Limited, Devika Towers, 11th floor, 6 Nehru Place, New Delhi-110 019. |
| B. | Semisynthetic Penicillin (+ Beta lactamase inhibitor) | Clavulanated Amoxycillin | CLAVAM | **Tablet**<br>Amoxycillin 250 mg + Clavulanate Pot. 125 mg | ALKEM Laboratories Limited. Phoenic Millcompound, 3rd Floor, 462, Senapati Bapat Marg, Mumbai - 400 013. |
| C. | Aminoglycoside | Gentamicin | MARCOGENTA | **Injectable**<br>Gentamicin sulphate 40 mg/ml. | MARC Laboratories Pvt.,Ltd. "Avanbi Mansions' 3 Vidhan Sabha Marg, Lucknow - 226 001. |
| D. | Herbal | Herbal | ANBIOFLAM<br>+<br>DERMANOL | **Capsule**<br>200 mg capsule<br>**Ointment.**<br>30 gm tube | PET VEDICA<br>Petcare Divison of<br>Indian Herbs<br>Research & Supply Co. Ltd.<br>Darra Shivpuri,<br>Saharanpur - 247 001.<br>(U.P.) |

**Table 4 :** ***Details of schedule of drugs for the treatment of canine pyoderma.***

| Group | Generic Name | Dose rate | Schedule | Route of Admn. | No. of animals treated | Period of Treatment (days) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Minimum | Maximum |
| A. | Cephalexin | 30 mg/kg | bid | Orally | 22 | 4 | 24 |
| B. | Clavulanated Amoxycillin | 20 mg/kg | bid | Orally | 20 | 4 | 24 |
| C. | Gentamicin | 3 mg/kg | bid | Parental S/C | 19 | 4 | 24 |
| D. | Anbioflam capsule + Dermanol ointment | 1-2 Caplules | bid. bid. | Orally locally | 17 | 4 | 24 |

*Abbreviations used*

Admn. - Administration

bid. - Twice daily or twice a day.

# Chapter-4

# *Results*

# RESULTS

The present investigation was carried out on clinical cases of pyoderma (bacterial dermatitis) with much emphasis on its epidemiology, diagnosis and treatment, on dogs in and around Patna. During the period from August 1999 to July 2000 a total of 244 dog were screened for different types of dermatological disorders, out of which 78 were found positive for pyoderma.

## INCIDENCE

Incidence pattern of pyoderma were studied in domesticated dogs, which suggested how the disease is distributed in environmental condition prevailing in Patna (Bihar)

### *Different types of dermatological disorders*

On the basis of skin scraping examination and cultural examination of swab, different types of dermatitis were ascertained. Out of a total of 244 dermatological cases of dogs, 78 (31.97%) were positive for bacterial infection (pyoderma). Number of cases identified as sarcoptic mange, demodectic mange and fungal dermatitis were 56 (22.95%), 39 (15.98%) and 43 (17.62%), respectively. Nineteen (7.79%) cases were identified as non-specific dermatitis in which no etiology was ascertained. Nine cases (3.69%) of mixed type was found in which bacterial dermatitis was either associated with sarcoptic mange (6 cases) or with demodectic mange (3 cases).

The chi-square test of significance showed significant difference ($P<0.01$) for the incidence of different types of dermatitis in dogs. (Table 5 Fig. 1)

***Incidence of different types of pyoderma***

Seventy eight cases identified as pyoderma were classified into surface, superficial or deep pyoderma based on depth of the skin involvement and the condition associated with it. Maximum cases of superficial pyoderma (43.59%) and minimum of deep pyoderma (25.64%) were recorded. Rest 30.77 per cent cases were diagnosed as surface pyoderma. The chi-square test of significance did not show any significant difference for the incidence of different types of pyoderma in dogs (Table 6, Fig.2).

***Sex wise Incidence :***

The sex wise incidence of pyoderma in dogs is presented in Table 7 (Fig. 3). Female has slightly higher (57.69 %) predispostion for pyoderma than male (42.31 %), however, the chi-square test of significance did not reveal any significant effect of sex on the incidence of pyoderma in dog.

***Age wise Incidence :***

Age wise incidence of bacterial dermatitis in dog along with the chi- square test of significance for the effect of age on the

incidence of canine pyoderma has been presented in Table 8. The highest incidence (42.31%) of pyoderma was recorded in 0-6 months age group and it was found gradually decreasing with the advancement of age. The lowest incidence (6.41% each) was recorded in both age-group of 6-8 years and of 8 years and above. The pattern of incidence as presented in other age groups were 19.23 percent in 6 months to 2 years, 15.38 percent in 2-4 years, and 10.26 percent in 4-6 years (Fig. 4).

The chi-square test of significance for the effect of age on the incidence of pyoderma in dogs revealed significant ($P < 0.01$) difference between the age groups, i.e. age had a significant effect on the occurrence of pyoderma.

***Breed wise Incidence :***

For calculating the breed wise incidence of canine pyoderma, non-descript dogs and cross bred dogs were included under the heading mixed breed whereas pure breed dogs were tabulated according to their breed name. The breed wise incidence of canine pyoderma has been shown in Table 9 (Fig. 5). Breed related incidence showed maximum incidence of pyoderma in Spitz (38.46%) followed by German Shepherd (28.21%). Minimum incidence was observed in Pomeranian, Dachshund and Cocker Spaniel (1.28% each). Incidence in other breeds were in the range of 2.56 percent to 8.97 percent.

The chi-square test of significance for the effect of breed on the incidence of canine pyoderma has been shown in Table 9. It revealed significant ($P< 0.01$) effect of breed on the incidence of pyoderma in dogs. Spitz showed highest incidence followed by German Shepherd, while breeds such as Pomeranian, Dachshund and Cocker Spaniel showed least incidence.

***Hair-length wise incidence :***

All the dogs were categorized into long, medium or short hair types depending upon the length of their hair. Incidence of canine pyoderma in relation to hair length (Table 10, Fig. 6) revealed maximum incidence in dogs with long hair coat (51.28%), followed by dogs with medium hair coat (34.62%) and minimum in dogs with short hair coat (14.10%).

The chi-square test of significance for the effect of hair length on the incidence of bacterial dermatitis in dogs (Table 10) showed significant ($P<0.01$) difference between different hair types. Thus, dogs with long hair are most affected by pyoderma, while dogs with short hair are least affected.

***Month wise Incidence :***

The month wise incidence of bacterial dermatitis in dogs has been presented in Table 11 (Fig. 7). The maximum percentage of cases were found in the month of September (15.38%) followed by August (12.82%). The minimum incidence was recorded in March

and April (3.85% each). The incidence in other months were found to be with little variation ranging from 5.13 percent to 10.26 per cent. The chi-square test of significance did not show any significant effect of month on the occurrence of pyoderma.

***Seasonal Incidence :***

All the 78 positive cases of pyoderma were distributed among four season of 3 months each as presented in Table 12 (Fig. 8) to study the seasonal incidence of this disease in dogs. Maximum incidence was found in rainy season (38.46%), while it was minimum in summer season (16.67%). Spring and winter season showed 19.23 percent and 25.64 percent incidence, respectively. The chi-square test of significance revealed significant ($P<0.05$) effect of seasons on the occurrence of pyoderma.

***Distribution of lesions :***

The pattern of distribution of lesions on various body parts of dogs in cases with pyoderma has been presented in Table 13 (Fig.9). The lesions present on eye and nose (nasal pyoderma) has been included in the face region, while callus pyoderma (lesions on elbow, hock and tarsal joints) and interdigital pyoderma has been included in the regions of fore legs or hind legs. During the present study it was found that in most of the cases lesions were present on the abdominal region (30.77%) followed by dorsal side of back

(23.08%). Head (3.85%), neck (2.56%) and tail (2.56%) were affected in least number of cases. Lesion of pyoderma in face region was present in 14.10 per cent cases. Hind legs (14.10%) were slightly more affected then fore legs (8.97%).

The chi-square test of significance for the pattern of lesion distribution on different parts of body in canine pyoderma (Table 13) revealed significant ($P<0.01$) difference between the various body parts.

***Clinical Symptomatology :***

No change in the temperature, pulse rate and respiration rate was observed in the dogs suffering with pyoderma. These values were found near normal level in almost all the cases. Gross lesions in most of the cases included presence of papules, pustules and cysts. There was exudation of pus and serum from the lesion in case of suppurative lesion. Sometimes, these exudates were found dried forming yellow crust. Vesicular and pustular lesions were present in more number of cases. Folliculitis and furunculosis were also observed. In some cases of deep pyoderma ulceration and formation of fistulous tracts and sinus were observed. Cases of impetigo showed crusty lesions on the abdominal region of puppies. Pruritus and alopecia were also sometimes reported (Fig. 11 to 14).

**Table 5.** *Incidence of different types of dermatological disorder in canines.*

| Type | Frequency | Percentage | $\chi^2_{5df}$ |
|---|---|---|---|
| 1. Bacterial dermatitis (Pyoderma) | 78 | 31.97 | 76.459** |
| 2. Sarcoptic mange | 56 | 22.95 | |
| 3. Demodectic mange | 39 | 15.98 | |
| 4. Fungal dermatitis | 43 | 17.62 | |
| 5. Non-specific dermatitis | 19 | 7.79 | |
| 6. Mixed type | 09 | 3.69 | |

** Significant at P<0.01.

**Fig. 1.** ***Histogram showing incidence of different types of dermatological disorder in canines***

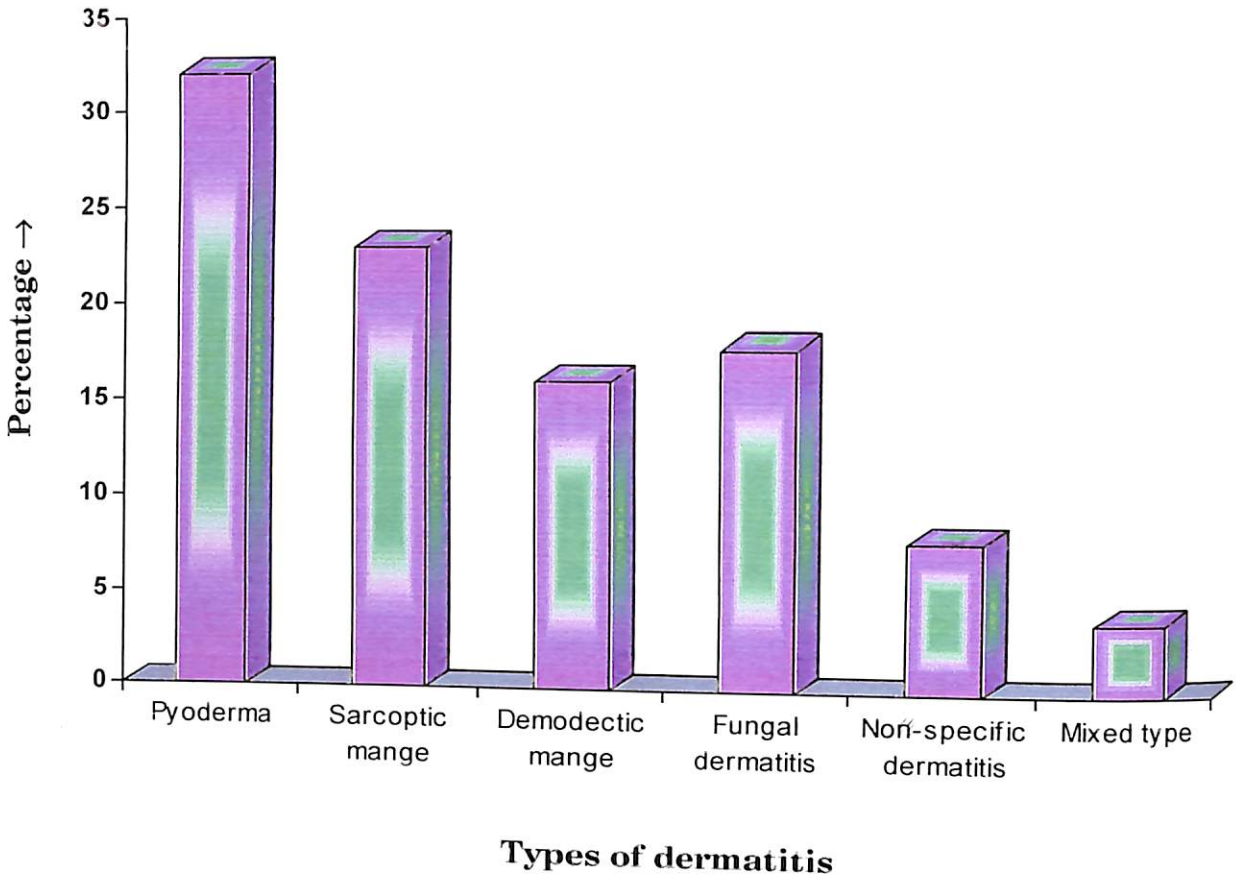


**Fig. 2.** ***Histogram showing incidence of different types of canine pyoderma.***

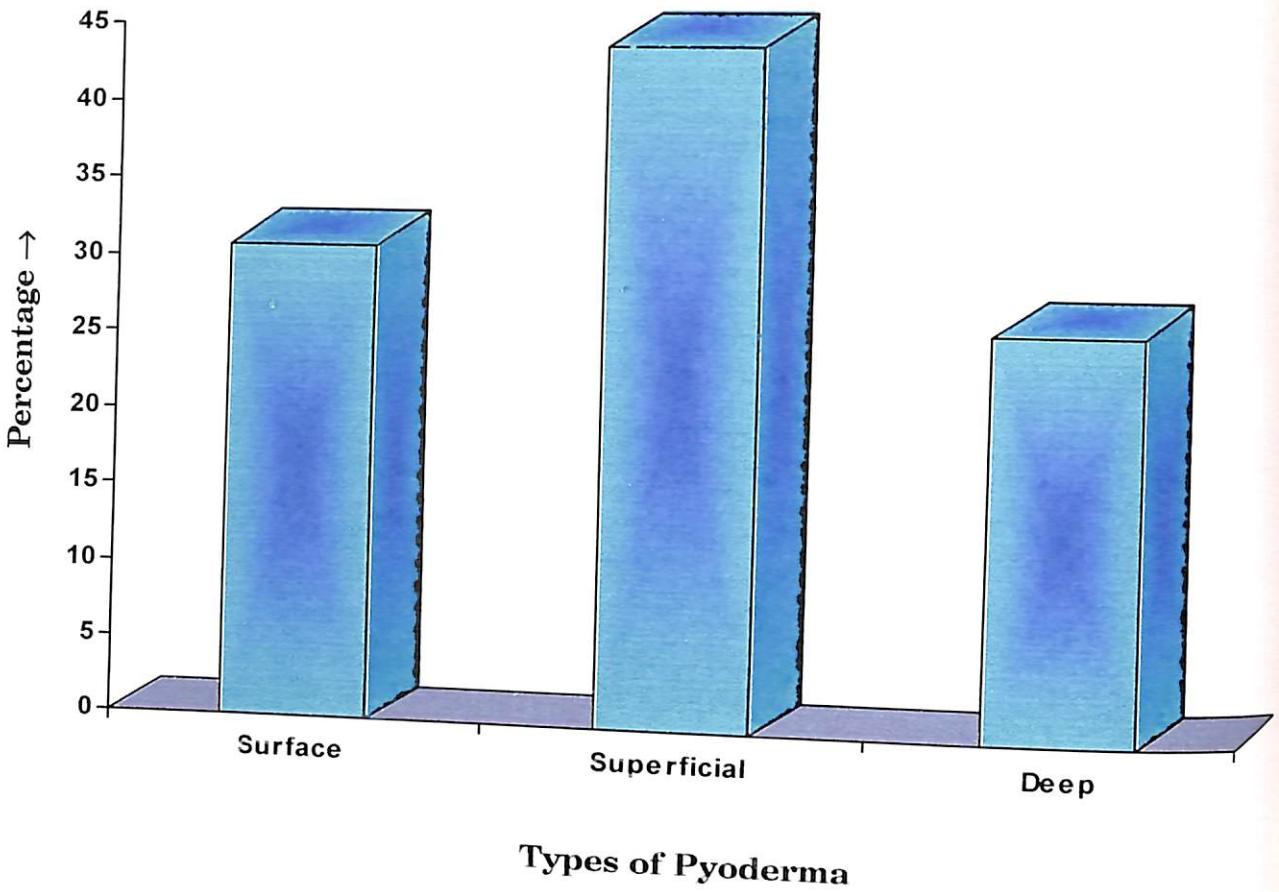


**Table 6.** *Incidence of different types of pyoderma in dogs.*

| Type | Frequency | Percentage | $\chi^2_{2df}$ |
|---|---|---|---|
| 1. Surface Pyoderma | 24 | 30.77 | $4.00^{NS}$ |
| 2. Superficial Pyoderma. | 34 | 43.59 | |
| 3. Deep Pyoderma. | 20 | 25.64 | |

NS = Non-significant.

**Fig. 3.** ***Histogram showing sex wise incidence of canine pyoderma.***

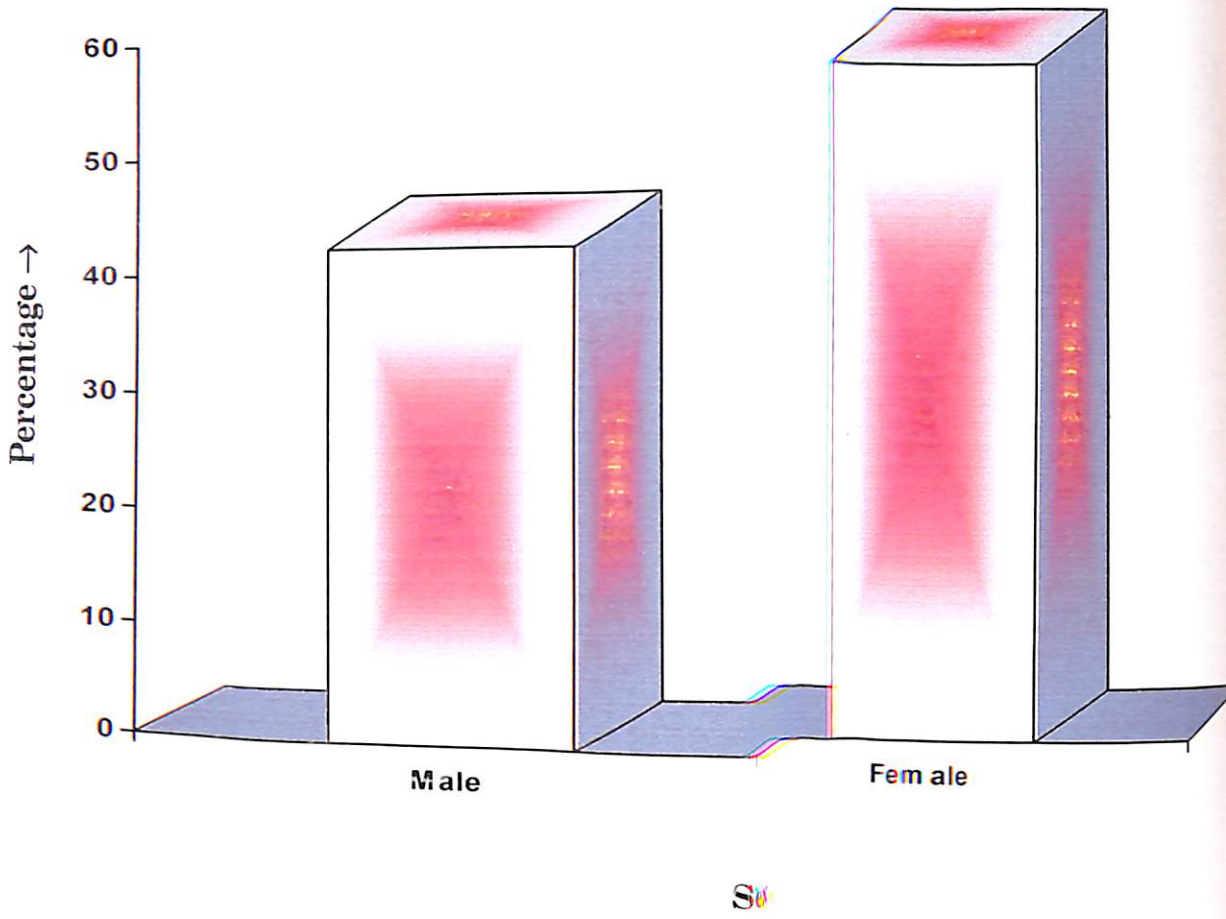


**Fig. 3.** ***Histogram showing sex wise incidence of canine pyoderma.***

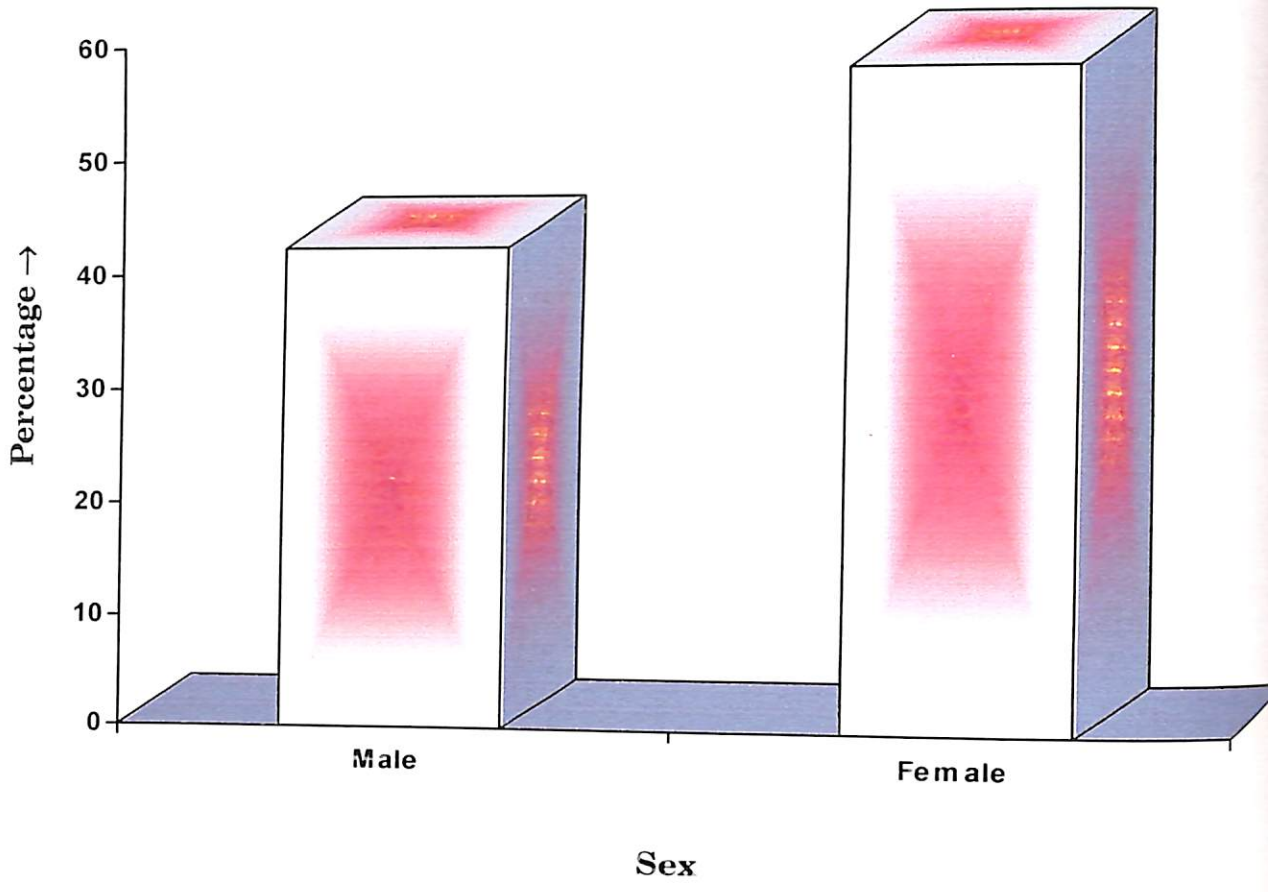


**Table 7.** *Incidence of canine pyoderma in different sexes.*

| Group | Frequency | Percentage | $\chi^2_{1df}$ |
|---|---|---|---|
| 1. Male | 33 | 42.31 | 1.846 NS |
| 2. Female | 45 | 57.69 | |

NS = Non-significant.

Fig. 4. *Histogram showing age group wise incidence of canine pyoderma.*

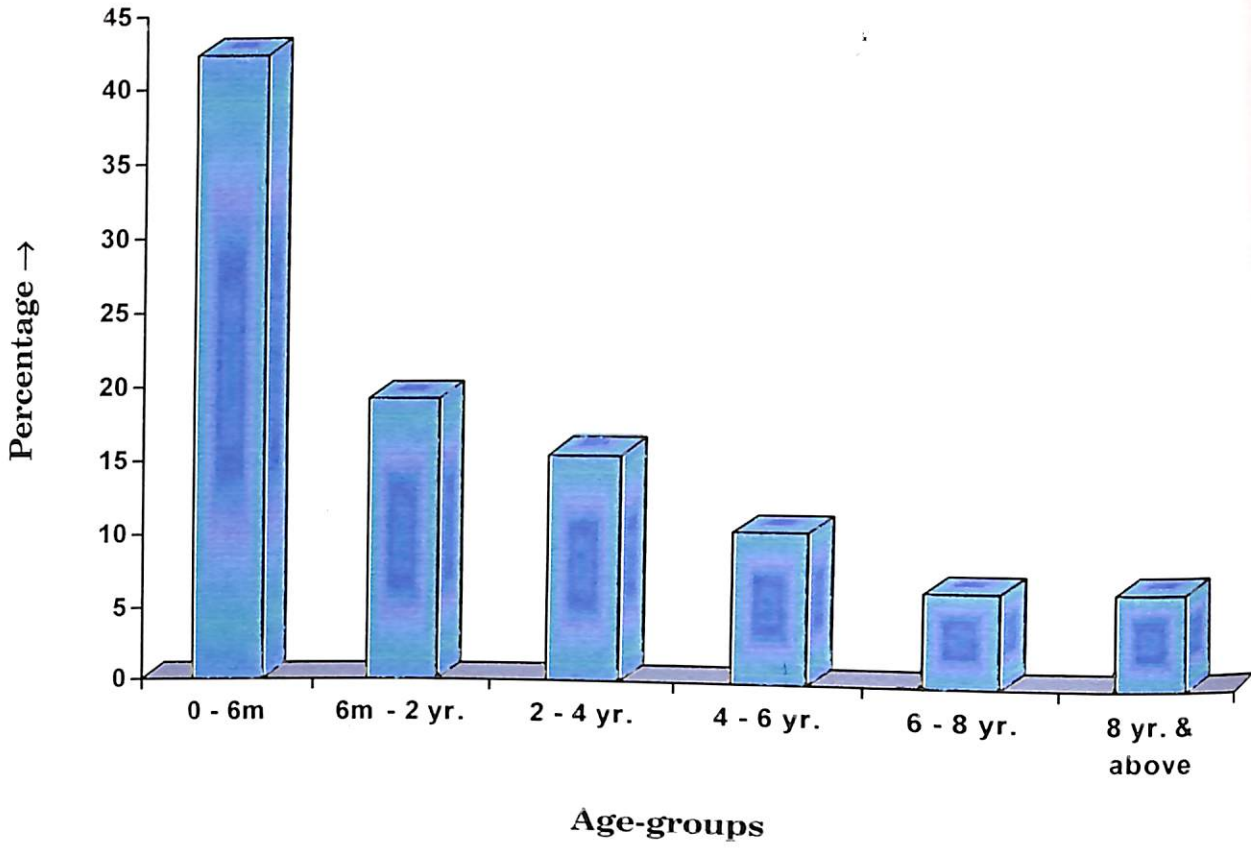


**Table 8.** *Incidence of pyoderma in different age- groups in dogs.*

| Age-group | Frequency | Percentage | $\chi^2_{5df}$ |
|---|---|---|---|
| 1. 0-6 months | 33 | 42.31 | 42.923** |
| 2. 6 months-2 years | 15 | 19.23 | |
| 3. 2 - 4 years | 12 | 15.38 | |
| 4. 4 - 6 years | 8 | 10.26 | |
| 5. 6 - 8 years | 5 | 6.41 | |
| 6. 8 years & above | 5 | 6.41 | |

** Significant at $P < 0.01$.

Fig. 5. *Histogram showing breed wise incidence of canine pyoderma.*

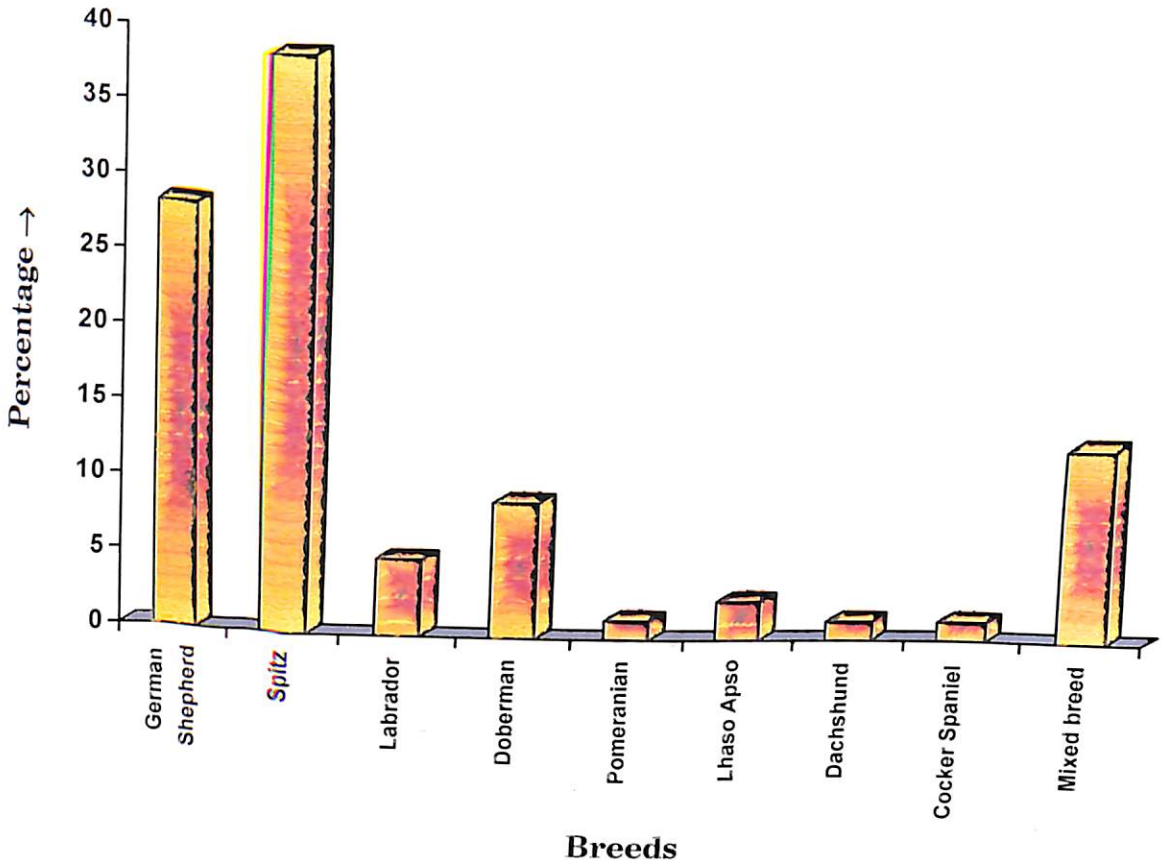


**Table 9.** *Breed wise incidence of canine pyoderma*

| Breed | Frequency | Percentage | $\chi^2_{8df}$ |
|---|---|---|---|
| 1. German Shepherd | 22 | 28.21 | 101.538** |
| 2. Spitz | 30 | 38.46 | |
| 3. Labrador | 4 | 5.13 | |
| 4. Doberman | 7 | 8.97 | |
| 5. Pomeranian | 1 | 1.28 | |
| 6. Lhaso Apso | 2 | 2.56 | |
| 7. Dachshund | 1 | 1.28 | |
| 8. Cocker Spaniel | 1 | 1.28 | |
| 9. Mixed breed | 10 | 12.82 | |

** Significant at $P < 0.01$.

**Table 10.** *Effect of hair length on the incidence of canine pyoderma.*

| Group | Frequency | Percentage | $\chi^2_{2df}$ |
|---|---|---|---|
| 1. Long hair | 40 | 51.28 | 16.231** |
| 2. Medium hair | 27 | 34.62 | |
| 3. Short hair | 11 | 14.10 | |

** Significant at $P < 0.01$

**Fig. 6.** ***Histogram showing hair-length wise incidence of canine pyoderma***

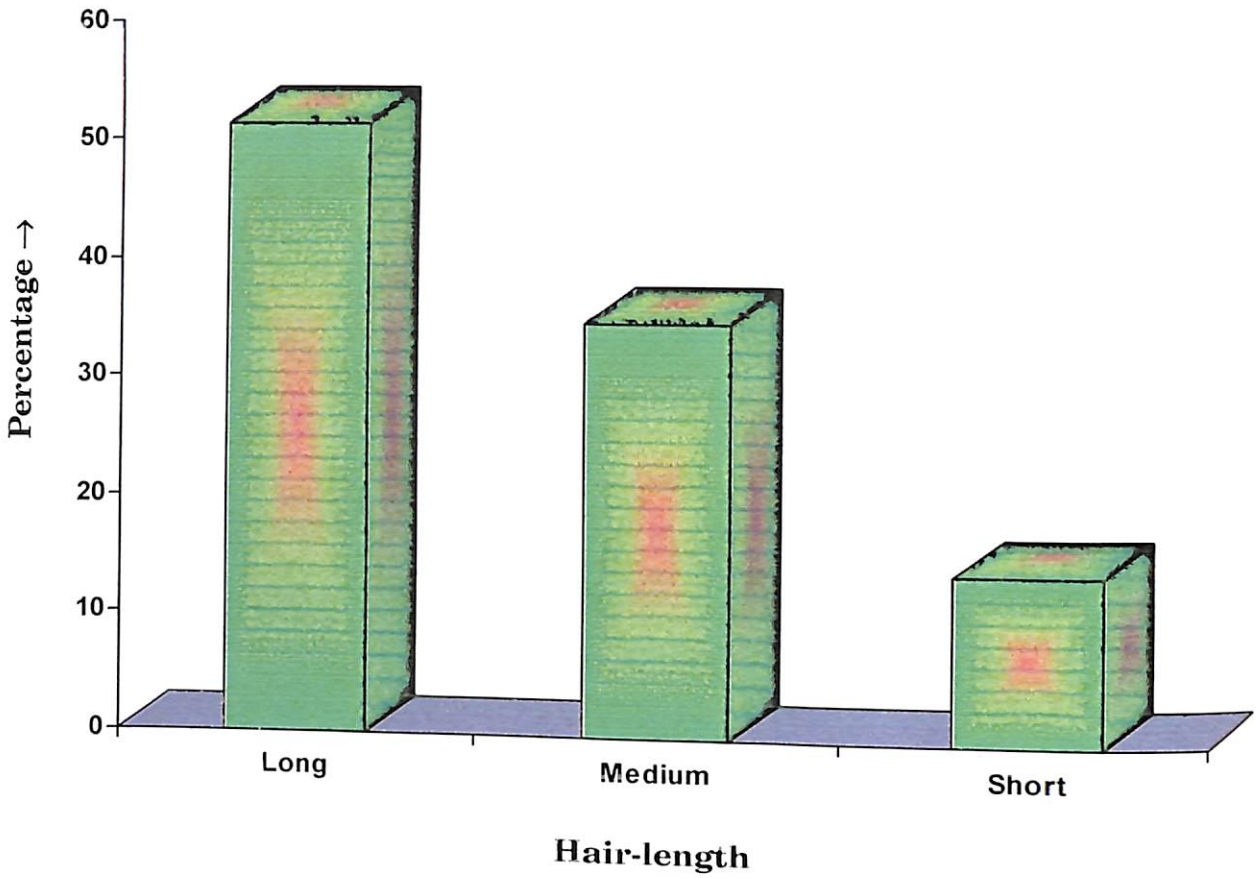


**Fig. 7.** ***Graph showing month wise incidence pattern of canine pyoderma***

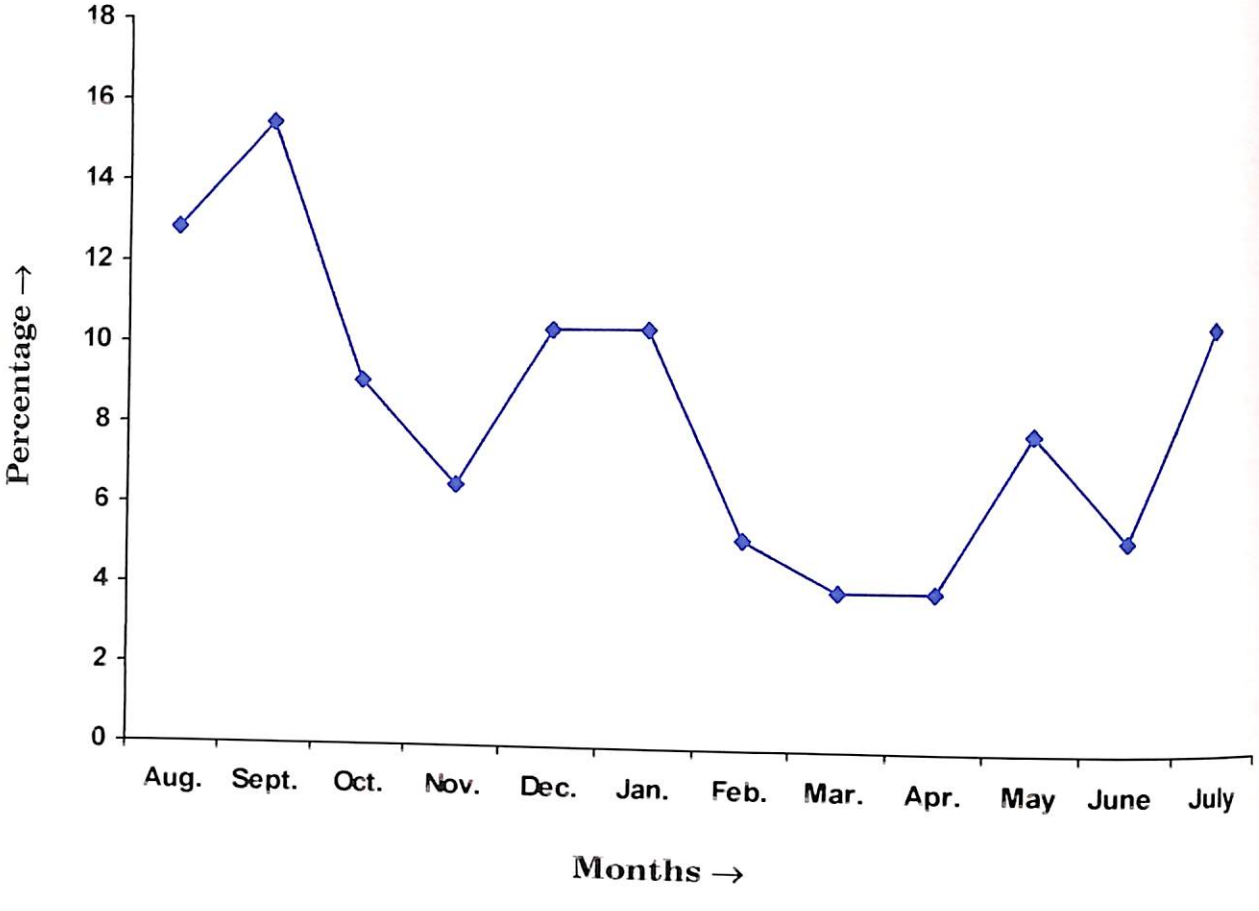


**Table 11.** *Incidence of canine pyoderma in different months.*

| Month | Frequency | Percentage | $\chi^2_{1\,df}$ |
|---|---|---|---|
| August | 10 | 12.82 | $13.692^{NS}$ |
| September | 12 | 15.38 | |
| October | 7 | 8.97 | |
| November | 5 | 6.41 | |
| December | 8 | 10.26 | |
| January | 8 | 10.26 | |
| February | 4 | 5.13 | |
| March | 3 | 3.85 | |
| April | 3 | 3.85 | |
| May | 6 | 7.69 | |
| June | 4 | 5.13 | |
| July | 8 | 10.26 | |

NS = Non-significant.

Fig.8. *Histogram showing seasonal incidence of canine pyoderma*

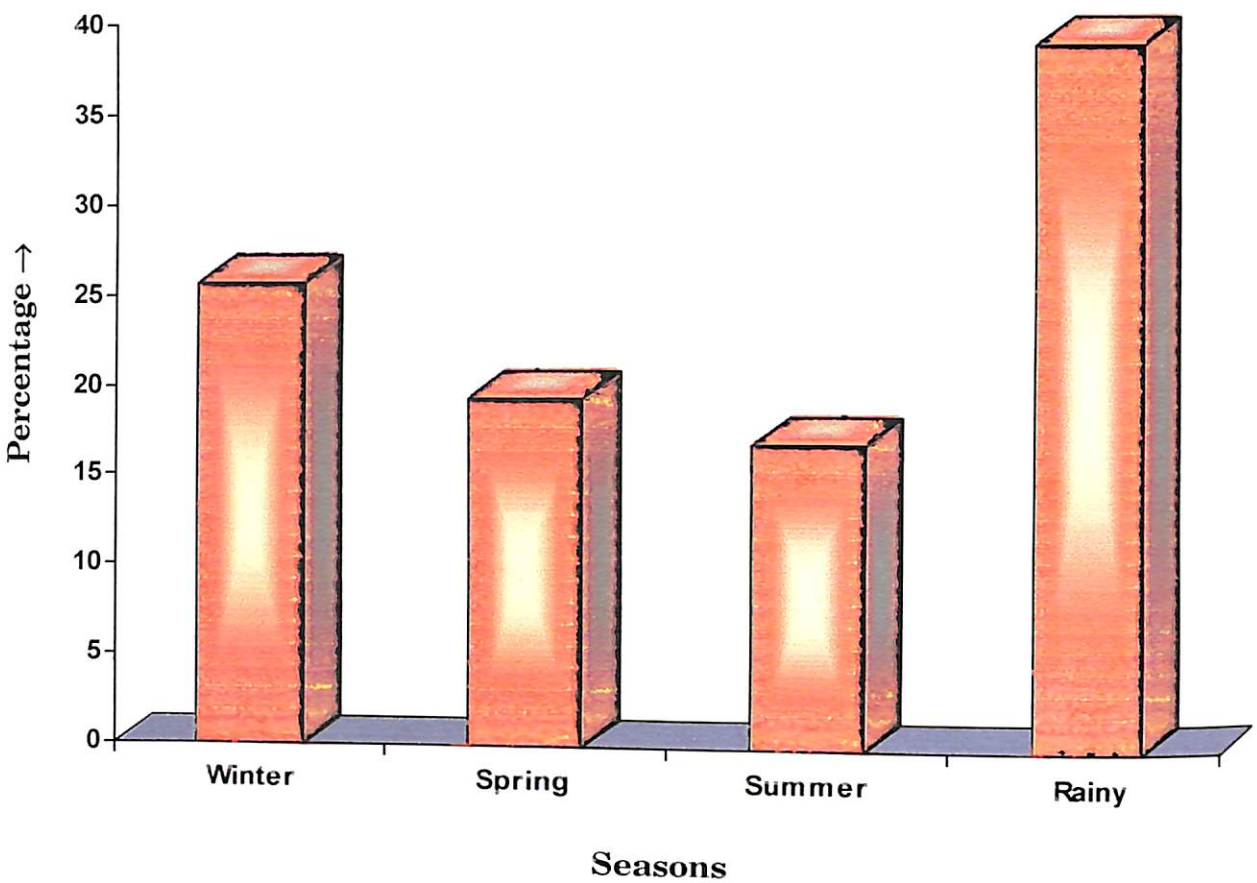


Table 12. ***Incidence of canine pyoderma in different seasons.***

| Season | Frequency | Percentage | $\chi^2_{3df}$ |
|---|---|---|---|
| 1. Winter (Oct,Nov,Dec) | 20 | 25.64 | 8.872* |
| 2. Spring (Jan, Feb, Mar.) | 15 | 19.23 | |
| 3. Summer (April, May, June) | 13 | 16.67 | |
| 4. Rainy (July, Aug, Sept.) | 30 | 38.46 | |

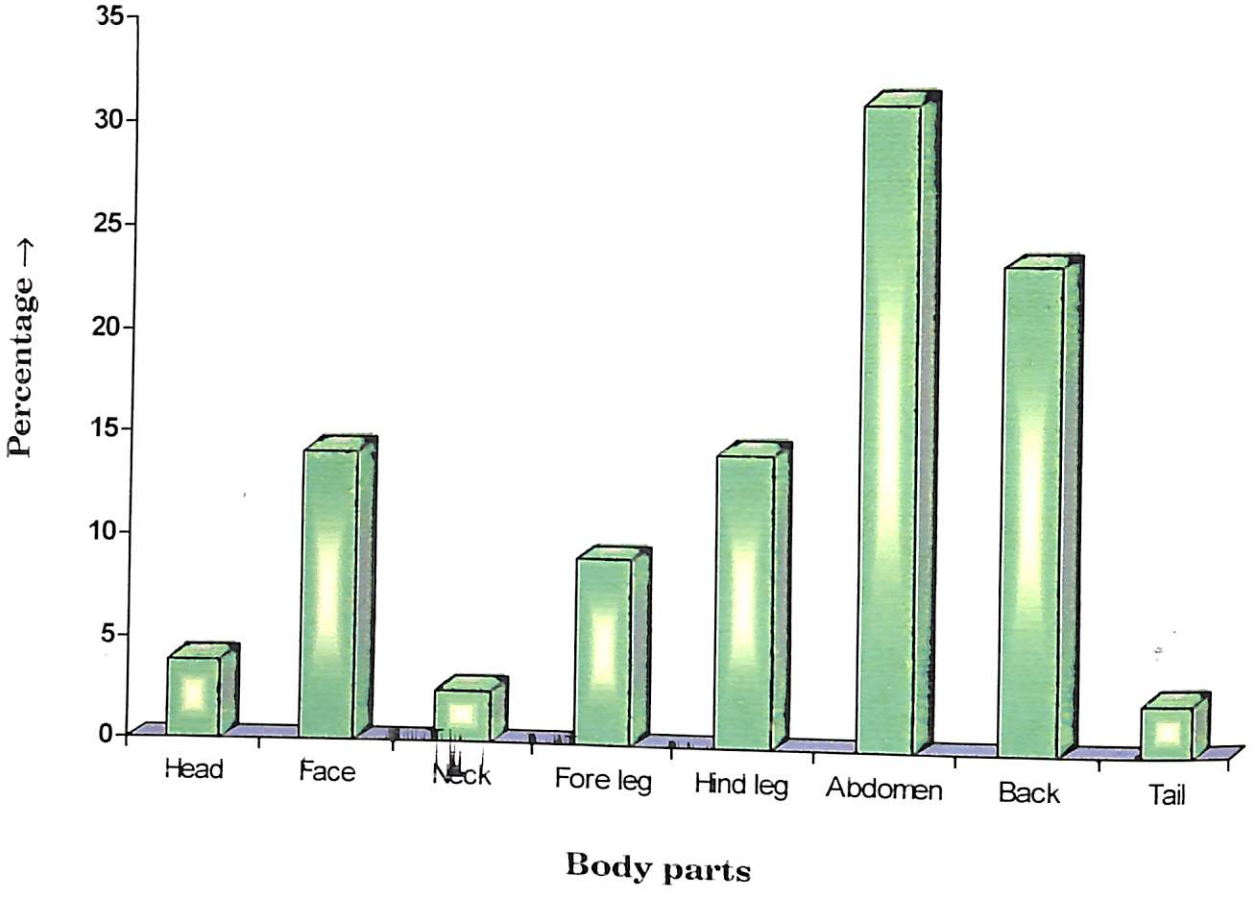
* Significant at $P < 0.05$.

**Table 13.** ***Pattern of lesion distribution in canine pyoderma.***

| Part affected | Bacterial dermatis cases | | $\chi^2_{7df}$ |
|---|---|---|---|
| | Frequency | Percentage | |
| 1. Head | 3 | 3.85 | 45.897** |
| 2. Face | 11 | 14.10 | |
| 3. Neck | 2 | 2.56 | |
| 4. Fore leg | 7 | 8.97 | |
| 5. Hind leg | 11 | 14.10 | |
| 6. Abdomen | 24 | 30.77 | |
| 7. Back | 18 | 23.08 | |
| 8. Tail | 2 | 2.56 | |

** Significant at $P < 0.01$.

**Fig.9.** ***Histogram showing lesion distribution in different body regions of canine pyoderma***



## BACTERIOLOGICAL STUDIES

### *Frequency of Different Isolates In Canine Pyoderma :*

Of the total 78 cases of bacterial dermatitis in dogs, 97 bacterial strains were isolated. They were either present in pure form (61 cases) or in mixed form (17 cases) as depicted in Table 15. The details of the isolates alongwith their numbers and percentage has been given in Table 14 (Fig.10). Distribution of different bacteria responsible for canine pyoderma revealed predominance of *Staphylococcus* spp. (80.41%), of which coagulase-positive *Staph. Inermedius* (69.07%) was the major isolate. Coagulase-positive *Staph. aureus* (7.22%) and coagulase-negative *Staph. epidermidis* (4.12%) were rare among staphylococcal isolates. Other bacteria isolated were *Streptococcus pyogenes* (8.25%), *Bacillus subtilis* (4.12%), *Proteus vulgaris* (4.12%), *Pseudomonas aeruginosa* (2.06%) and *Escherichia Coli* (1.03%). The chi-square test showed significant variation among the various bacterial isolates (Table 14).

The frequency of isolation of bacteria in pure or mixed form has been presented in Table 15 and association of bacteria in mixed infection has been shown in Table 16. A total of 61 bacterial strains were isolated in pure form and all were identified as *Staph. intermedius*.

Mixed infection by two bacterial isolates were present in 15 cases (30 isolates). *Staphylococcus* spp. (4 *Staph intermedius*, 7 *Staph. aureus* and 4 *Staph. epidermidis* ) was isolated in all the 15 cases alongwith either of *Streptococcus pyogenes* (6), *Proteus* spp. (4), *Pseudomonas aeruginosa* (2), *Bacillus subtilis* (2) or *E. Coli* (1).

Two cases revealed the association of three bacterial isolates, viz. *Staph. intermedius, Streptococcus pyogenes* and *Bacillus subtilis*.

Thus, *Staphylococcus* spp. was isolated from all the 78 cases of pyoderma. All the other bacteria present were in mixed infection with *Staph.* spp.

***In-Vitro Drug Sensitivity Test :***

Antibiogram of isolates has been presented in Table 17. All the 97 isolates were subjected to drug sensitivity tests. Pattern of sensitivity of different drugs in descending order were, enrofloxacin (96.91%), ciprofloxacin (94.85%), cefotaxime (90.72%), cephalexin (89.69%), gentamicin (83.51%), amikacin (82.47%), clavulanated amoxycillin or amoxyclav (81.44%), amoxycillin (77.32%), erythromycin (76.29%), chloramphenicol (73.20%), cloxacillin (61.86%), ampicillin (44.33%) and penicillin-G (31.96%).

Out of 78 isolates of *Staphylococcus* spp. subjected to in-vitro drug sensitivity test, 76 (97.44%) were sensitive to enrofloxacin, 75 (96.15%) to ciprofloxacin, 71 (91.03%) to cefotaxime, 70 (89.74%) to cephalexin, 68 (87.18%) to erythromycin, 66 (84.62%) to gentamicin, 64 (82.05%) to amikacin, 63 (80.77%) to amoxyclav, 61 (78.21%) to amoxycillin, 52 (66.67%) to cloxacillin, 36 (46.15%) to ampicillin, and 25 (32.05%) to penicillin- G.

Among the 8 streptococcal isolates, majority of them were sensitive to amoxycillin, amoxyclav, cefotaxine (100% each), cephalexin, amikacin, ciprofloxacin and enrofloxacin (87.50% each).

However these isolates were moderately sensitive to cloxacillin (75.00%) penicillin- G and gentamicin (50% each). They were least sensitive to ampicillin (37.50%) and almost resistant to erythromycin and chloramphenical (12.50% each).

Among the 4 isolates of *Proteus* spp., all of them were sensitive to cephalexin, gentamicin and enrofloxacin (100% each). They were 75 percent (moderately) sensitive to amoxyclav, cefotaxime and ciprofloxacin and 50 percent sensitive to amoxycillin, amikacin and chloramphenicol. These isolates were least sensitive (25%) to ampicillin and erythromycin. These organisms were resistant to penicillin - G and cloxacillin.

All the 4 isolates of *Bacillus* spp. were sensitive to enrofloxacin, ciprofloxacin, amoxyclav, amoxycillin, cephalexin, cefotaxime, gentamicin, amikacin, erythromycin, and chloramphericol (100% each ). Organisms were moderately sensitive to ampicillin (75%) and least sensitive to penicillin- G and cloxacillin (50% each).

Two isolates of *Pseudomonas* spp. were sensitive to enrofloxacin, ciprofloxacin, cephalexin, cefotaxime, gentamicin, amikacin, and chloramphenicol (100 % each). These were found resistant to amoxyclav, amoxycillin, ampicillin, penicillin-G, cloxacillin and erythromycin.

The lone isolate of *E. coli* was found sensitive to enrofloxacin, ciprofloxacin, gentamicin, amikacin, chloramphenicol, and amoxyclav, but was resistant to all other antibiotics.

Table 14. ***Incidence of different bacteria responsible for canine pyoderma.***

| Organism isolated | Frequency | Percentage | $\chi^2_{7df}$ |
|---|---|---|---|
| 1. *Staphylococcus intermedius* | 67 | 69.07 | 286.918** |
| 2. *Staphylococcus aureus* | 7 | 7.22 | |
| 3. *Staphylococcus epidermidis* | 4 | 4.12 | |
| 4. *Streptococcus pyogenes* | 8 | 8.25 | |
| 5. *Bacillus subtilis* | 4 | 4.12 | |
| 6. *Proteus vulgaris* | 4 | 4.12 | |
| 7. *Pseudomonas aeruginosa* | 2 | 2.06 | |
| 8. *Escherichia coli* | 1 | 1.03 | |

** Significant at P<0.01.

**Table 15. :** ***Frequency of isolation of bacteria in pure or mixed form***

| Bacteria isolated | Pure form | Mixed form | | Total |
|---|---|---|---|---|
| | | Association with 1 bacteria | Association with 2 bacteria | |
| 1. *Staphylococcus intermedius* | 61 | 4 | 2 | 67 |
| 2. *Staphylococcus aureus* | 0 | 7 | 0 | 7 |
| 3. *Staphylococcus epidermidis* | 0 | 4 | 0 | 4 |
| 4. *Streptococcus pyogenes* | 0 | 6 | 2 | 8 |
| 5. *Proteus vulgaris* | 0 | 4 | 0 | 4 |
| 6. *Pseudomonas aeruginosa* | 0 | 2 | 0 | 2 |
| 7. *Bacillus subtilis* | 0 | 2 | 2 | 4 |
| 8. *Escherichia coli* | 0 | 1 | 0 | 1 |
| Total bacteria isolated | 61 | 30 | 6 | 97 |
| Total no. of positive cases | 61 | 15 | 2 | 78 |

**Table 16. :** ***Association of different bacteria in mixed infections of canine pyoderma.***

| | *Streptococcus pyogenes* | *Bacillus subtilis* | *Proteus vulgaris* | *Pseudomonas aeruginosa* | *Escherichia Coli* | *Streptococcus aureus + Bacillus subtitis* |
|---|---|---|---|---|---|---|
| *Staphylococcus intermedius* | 1 | 1 | 1 | 0 | 1 | 2 |
| *Staphylococcus aureus* | 3 | 0 | 2 | 2 | 0 | 0 |
| *Staphylococcus epidermidis* | 2 | 1 | 1 | 0 | 0 | 0 |

**Table 17. :** ***Sensitivity pattern of different antimicrobials on organisms isolated from canine pyoderma.***

| | Staphylococci **78** | Streptococci **8** | *Proteus* spp. **4** | *Bacillus* spp. **4** | *Pseudomonas* spp. **2** | *E. coli* **1** | Total **97** |
|---|---|---|---|---|---|---|---|
| Amoxyclav | 63 (80.77) | 8 (100.00) | 3 (75.00) | 4 (100.00) | R | 1 (100.00) | 79 (81.44) |
| Amoxycillin | 61 (78.21) | 8 (100.00) | 2 (50.00) | 4 (100.00) | R | R | 75 (77.32) |
| Ampicillin | 36 (46.15) | 3 (37.50) | 1 (25.00) | 3 (75.00) | R | R | 43 (44.33) |
| Penicillin-G | 25 (32.05) | 4 (50.00) | R | 2 (50.00) | R | R | 31(31.96) |
| Cloxacillin | 52 (66.67) | 6 (75.00) | R | 2 (50.00) | R | R | 60 (61.86) |
| Cephalexin | 70 (89.74) | 7 (87.50) | 4 (100.00) | 4 (100.00) | 2 (100.00) | R | 87 (89.69) |
| Cefotaxime | 71. (91.03) | 8 (100.00) | 3 (75.00) | 4 (100.00) | 2 (100.00) | R | 88 (90.72) |
| Gentamicin | 66 (84.62) | 4 (50.00) | 4 (100.00) | 4 (100.00) | 2 (100.00) | 1 (100.00) | 81 (83.57) |
| Amikacin | 64 (82.05) | 7 (87.50) | 2 (50.00) | 4 (100.00) | 2 (100.00) | 1 (100.00) | 80 (82.47) |
| Erythromycin. | 68 (87.18) | 1 (12.50) | 1 (25.00) | 4 (100.00) | R | R | 74 (76.29) |
| Chloramphenicol | 61 (78.21) | 1 (12.50) | 2 (50.00) | 4 (100.00) | 2 (100.00) | 1 (100.00) | 71 (73.20) |
| Ciprofloxacin | 75 (96.15) | 7 (87.50) | 3 (75.00) | 4 (100.00) | 2 (100.00) | 1 (100.00) | 92 (94.85) |
| Enrofloxacin | 76 (97.44) | 7 (87.50) | 4 (100.00) | 4 (100.00) | 2 (100.00) | 1 (100.00) | 94 (96.91) |

- Figures in parentheses indicate incidence percentage.
- Figures in bold indicate total number of isolates.

## HAEMATOLOGICAL STUDIES

The haematological parameters such as total erythrocyte count (TEC), total leucocyte count (TLC), differential leucocyte count (DLC) and haemoglobin (Hb) concentration of dogs suffering with pyoderma were estimated before treatment (pretreated group) and after recovery (post recovered group). Estimation of these parameters in 6 normal healthy dogs (control group) provided the base value for the comparison.

***Total Erythrocyte Count :***

Mean, Standard Error (S.E.) and coefficient of variation percentage (C.V. %) of total erythrocyte count ($10^6$/cu.mm of blood) of different groups are presented in Table 19. The mean total erythrocyte count in normal control, pretreated and post recovered groups were recorded as 6.79 ± 0.13, 6.53 ± 0.07 and 6.66 ± 0.05, respectively. There was slight decrease in TEC value in dogs suffering with pyoderma as compared to animal of control group, which reached to nearly normal value after complete recovery. Analysis of variance showing the effect of these groups on the TEC in dogs has been depicted in Table 18, which showed non-significant variations in TEC values in different conditions.

***Total Leucocyte Count :***

Mean ± S.E. alongwith C.V. % of total leucocyte count ($10^3$/cu. mm of blood) of different groups has been recorded in Table 21. The mean total leucocyte count in control, pretreated and post recovered groups were 12.45 ± 0.18, 14.38 ± 0.19, 12.53± 0.08,

respectively. The result showed an increase of 1.93 and 1.85 in the TLC value of pretreated group over base value and post recovered group, respectively. Analysis of variance (Table 20) showed significant ($P<0.01$) increase of TLC value in pretreated animals over both control group and post recovered groups. However, there was non-significant difference between control group and post recovered group.

***Haemoglobin :***

The mean haemoglobin concentration (gram/decilitre) of normal control (13.80 ± 0.13), pretreated (13.52 ± 0.11) and post recovered (13.68 ± 0.11) groups along with their coefficient of variation percentage is shown in Table 23. There was slight decrease in haemoglobin value in pretreated groups as compared to base value, which came to nearly normal value after recovery. However these variations were statistically found to be non-significant (Table 22).

***Differential Leucocyte Count :***

Analysis of variance of differential leucocyte count, viz. neutrophil, lymphocyte, monocyte and eosinophil were conducted by converting the percentage into corresponding angles by the formula,

$$\text{Angle} = \text{Arc}\sin\sqrt{\text{Percentage}}$$

**Neutrophil :**

The average neutrophil percentage in control, pretreated and post recovered groups were recorded to be 69.10, 74.50 and 56.28, respectively (Table 25). Analysis of variance (Table 24) showed

a significant effect of different groups on the neutrophil value in dogs ($P < 0.01$). There was a significant increase in neutrophil count in pretreated group over both post recovered and control groups animals. However, there was non-significant difference in neutrophil value between control group and post recovered group.

**Lymphocyte :**

The mean lymphocyte percentage in normal control (25.00), pre treated (20.04) and post recovered (25.03) groups alongwith their arcsin converted values and coefficient of variation percentage is presented in Table 27. Analysis of variance (Table 26) shows an significant ($P < 0.01$) increase in the lymphocyte value of pretreated group over both control group and post recovered group. The lymphocyte values of control group and post recovered group were almost equal and were statistically non-significant.

**Monocyte :**

The mean monocyte percentage in normal control (3.33), pretreated (3.02) and post recovered (3.18) groups alongwith their arcsin converted values and coefficient of variation percentage may be seen in Table 29. Analysis of variance (Table 28) revealed non-significant effect of different groups on the monocyte value in dogs.

**Eosinophil :**

The mean eosinophil percentage in normal control, pretreated and post recovered groups were recorded to be 2.08, 1.98 and 2.12, respectively (Table 31). Analysis of variance of their arcsin converted values (Table 30) showed non-significant difference between the means of different groups.

**Table 18.** ***Analysis of variance for the effect of different groups on the total erythrocyte count in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 0.424 | $1.542^{NS}$ |
| Error | 159 | 0.275 | |

NS = Non-significant.

**Table 19.** ***Mean ± S.E. and C.V.% of total erythrocyte count ($10^6$/cu.mm. of blood) in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | 6.79 ± 0.13 (6) | 4.601 |
| 2. Pre-treated | 6.53 ± 0.07 (78) | 8.916 |
| 3. Post recovered | 6.66 ± 0.05 (78) | 7.081 |

Figures in parentheses indicate the number of animals.

**Table 20.** ***Analysis of variance for the effect of different groups on the total leucocyte count in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 67.573 | 42.075** |
| Error | 159 | 1.606 | |

** Significant at $P < 0.01$.

**Table 21.** ***Mean ± S.E. and C.V.% of total leucocyte count ($10^3$/cu.mm of blood) in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | $12.45^a$ 0.18 (6) | 3.619 |
| 2. Pre-treated | $14.38^b \pm 0.19$ (78) | 11.688 |
| 3. Post recovered | $12.53^a \pm 0.08$ (78) | 5.524 |

- Figures in parentheses indicate the number of animals .

- Means with different superscripts differ significantly ($P<0.01$).

Table 22. ***Analysis of variance for the effect of different groups on the haemoglobin level in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 0.638 | $0.685^{NS}$ |
| Error | 159 | 0.931 | |

NS = Non-significant

Table 23. ***Mean ± S.E. and C.V.% of haemoglobin (in gm/dl) in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | 13.80 ± 0.13 (6) | 2.292 |
| 2. Pre-treated | 13.52 ± 0.11 (78) | 7.440 |
| 3. Post recovered | 13.68 ± 0.11 (78) | 6.946 |

- Figures in parentheses indicate the number of animals.

Table 22. ***Analysis of variance for the effect of different groups on the haemoglobin level in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 0.638 | $0.685^{NS}$ |
| Error | 159 | 0.931 | |

NS = Non-significant

Table 23. ***Mean ± S.E. and C.V.% of haemoglobin (in gm/dl) in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
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| 2. Pre-treated | 13.52 ± 0.11 (78) | 7.440 |
| 3. Post recovered | 13.68 ± 0.11 (78) | 6.946 |

- Figures in parentheses indicate the number of animals.

**Table 24.** ***Analysis of variance of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) for the effect of different groups on the neutrophil count in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 241.371 | 46.678** |
| Error | 159 | 5.171 | |

** Significant at $P < 0.01$.

**Table 25.** ***Mean ± S.E. and C.V.% of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) of neutrophil in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | $56.23^{a} \pm 0.46$ (69.10) | 2.016 |
| 2. Pre-treated | $59.73^{b} \pm 0.29$ (74.50) | 2.538 |
| 3. Post recovered | $56.28^{a} \pm 0.23$ (69.13) | 3.621 |

- Figures in parentheses indicate the mean percentage of original values.
- Means with different superscripts differ significantly ($P<0.01$).

Table 26. ***Analysis of variance of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) for the effect of different groups on the lymphocyte count in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 239.584 | 65.389** |
| Error | 159 | 3.664 | |

** Significant at P < 0.01.

Table 27. ***Mean ± S.E. and C.V.% of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) of lymphocyte in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | $29.99^{a} \pm 0.39$ (25.00) | 3.203 |
| 2. Pre-treated | $26.54^{b} \pm 0.23$ (20.04) | 7.544 |
| 3. Post recovered | $29.98^{a} \pm 0.21$ (25.03) | 6.237 |

- Figures in parentheses indicate mean percentage of original values

- Means with different superscripts differ significantly (P < 0.01).

Table 28. ***Analysis of variance of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) for the effect of different groups on the monocyte count in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 1.974 | $0.692^{NS}$ |
| Error | 159 | 2.851 | |

NS= Non-significant

Table 29. ***Mean ± S.E. and C.V.% of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) of monocyte in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | 10.51 ± 0.26 (3.33) | 6.093 |
| 2. Pre-treated | 9.87 ± 0.19 (3.02) | 17.132 |
| 3. Post recovered | 10.12 ± 0.20 (3.18) | 17.109 |

- Figures in parentheses indicate mean percentage of original values.

**Table 30.** ***Analysis of variance of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) for the effect of different groups on the eosinophil count in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 2 | 2.893 | $0.562^{NS}$ |
| Error | 159 | 5.149 | |

NS= Non-significant

**Table 31.** ***Mean ± S.E. and C.V.% of angles corresponding to percentage (Angle = Arcsin $\sqrt{Percentage}$) of eosinophil in canine pyoderma.***

| Treatment | Mean ± S.E. | C.V.% |
|---|---|---|
| 1. Normal Control | 8.18 ± 0.64 (2.08) | 19.083 |
| 2. Pre-treated | 7.73 ± 0.27 (1.98) | 31.245 |
| 3. Post recovered | 8.11 ± 0.24 (2.12) | 26.556 |

- Figures in parentheses indicate mean percentage of original values

## HISTOPATHOLOGICAL STUDIES

Skin biopsy materials were collected from 10 dogs suffering from different types of pyoderma. They were studied for histopathological changes after preparing the sections and staining with Harri's haematoxylin and eosin stain.

Histopathological studies of 5 cases of superficial pyoderma were carried out, of which 3 were of superficial folliculitis and 2 of impetigo cases. In most cases of the superficial pyoderma, infiltration of leucocytes were noticed in the stratum germinativum which penetrated to the hair follicles. Mostly infiltration of neutrophil were noted and a few mononuclear cells were observed (Fig. 15). Sometimes excoriation or superficial loss of epithelium were observed, leading to infiltration of neutrophils, lymphocytes and plasma cells in the deeper layer of stratum corneum (Fig. 16). The skin sections which were showing the change of superficial folliculitis was characterized by presence of inflammatory exudate around the follicles (purulent folliculitis) alongwith superficial abscessation. There were also thickening of the follicular wall (Fig. 17). Usually the upper portion of the follicle was found affected and were dilated by dense accumulation of leucocytes, mainly neutrophils. Somewhere, perifollicular abscess or diffuse perifollicular inflammation in the upper dermis was found due to

destruction of follicle (Fig. 18). Perivascular neutrophilic infiltration were rarely noticed in superficial folliculitis. Skin biopsies from the case of impetigo showed serofibrinous exudate with neutrophilic infiltration which was observed in their epidermis as well as sometimes in upper dermis. Mild reactive changes in the dermal vessels were also observed. Folliculitis were rarely found and somewhere acanthosis was noticed (Fig. 19)

Four cases of deep pyoderma in which histopathological studies were carried out, there were diffuse purulent inflammation found in the deeper dermis. There were heavy infiltration of neutrophils within the dermis (Fig. 20). Lymphocytes, plasma cells and macrophages were rarely observed. Epidermis was found degenerated and neutrophils were infiltrated upto deeper dermal layer and sometime surrounding sebaceous glands. In few instances adipose tissue were also involved. Folliculitis, perifolliculitis and perivascularitis were also observed (Fig. 21). Acanthosis was present in chronic cases. Parakeratosis were seen in few instances.

Histopathological studies of one case of surface pyoderma, identified grossly as acute moist dermatitis showed degeneration of stratum corneum and slight infiltration of neutrophils. (Fig. 22).

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## TREATMENT

For treatment of surface, superficial and deep pyoderma all the animals were divided into 4 groups. Animals of Group-A, B and C were treated with Cephalexin, Clavulanated Amoxycillin and Gentamicin, respectively based on the antibiotic sensitivity test, while Group-D animals were treated with herbal preparation (Anbioflam capsule orally + Dermanol ointment topically) as per schedule described in Table 4.

Table 32 shows number of days required for healing of lesions in pyoderma cases when treated with cephalexin.In case of surface pyoderma and superficial pyoderma all the animals were recovered by 8th day of treatment, while in deep pyoderma all the lesions were found to be healed by 12th day. Average number of days required for treating surface, superficial and deep pyoderma were recorded to be 5.14, 4.80 and 8.80, respectively.

In clavulanated amoxycillin treated group (Table 33), all the animals recovered by 12th day of treatment in surface pyoderma cases, while superficial pyoderma and deep pyoderma required a maximum of 8 days and 16 days respectively for clearing of all the lesions. Average number of days required for treatment were found to be 6.67 in surface pyoderma, 5.78 in superficial pyoderma and 10.40 in deep pyoderma.

Average number of days required for disappearance of lesions in Gentamicin treated animals (Table 34), were recorded to be 6.00, 5.50 and 9.60 in surface, superficial and deep pyoderma, respectively. Gentamicin treated dogs showed 100 percent recovery by 8th day in surface and superficial pyoderma and by 16th day in deep pyoderma.

Clinical recovery in dogs treated with herbal medicines has been presented in Table 35. All the animals showing surface or superficial pyoderma were recovered by 16th day of treatment while deep pyoderma required a maximum of 24 days for complete recovery. Average number of days required for treatment were observed as 11.20, 9.71 and 18.40 in surface, superficial and deep pyoderma, respectively. In deep pyoderma first recovery was registered on 12th day of treatment.

The efficacy of various drugs on different types of canine pyoderma were judged by the average number of days required for treatment. Comparative efficacy of various drugs on surface, superficial and deep pyoderma has been presented in Table- 37, 39 and 41, respectively. Analysis of variance for the effect of various drugs on surface, superficial and deep pyoderma in dogs has been arranged. in Table-36, 38 and 40, respectively.

Analysis of variance (Table 36) showed significant ($P<0.01$) difference in the efficacy of various drugs in treating surface pyoderma. Group-A ($5.14 \pm 0.74$), Group-B ($6.67 \pm 1.33$) and Group-C ($6.00 \pm 1.33$) showed non-significant variation among each other in curing surface pyoderma while Group-D ($11.20 \pm 1.50$) was significantly ($P < 0.05$) different from all the three groups (Table-37).

Animals of Group-A ($4.80 \pm 0.53$) required comparatively less number of days for complete recovery than the animals of Group-B ($5.78 \pm 0.70$) and Group-C ($5.50 \pm 0.73$). Although, these differences were statistically non-significant. Animals of Group-B and Group-C also showed non-significant difference among each other. Animals of Group-D ($9.71 \pm 1.48$) required significantly ($P<0.01$) higher number of days than all other groups for complete recovery (Table-38 and 39).

Analysis of variance (Table 40) showed highly significant ($P<0.01$) difference in the efficacy of various drugs against deep pyoderma in dogs. Animals of Group-D ($18.40 \pm 2.04$) required significantly ($P < 0.01$) higher number of days for recovery from deep pyoderma than the animals of rest of the groups (Table 41). Variations among Group-A ($8.80 \pm 1.50$), Group-B ($10.40 \pm 2.04$) and Group- C ($9.60 \pm 2.04$) were statistically found to be non-significant.

**Table 32. :** ***Efficacy of Cephalexin in canine pyoderma***

| Drug | Type of Pyoderma | No. of animals treated | Number of animals showing clinical lesions on particular day | | | | | | | Avg. No. of days required for treatment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 day | 4th day | 8th day | 12th day | 16th day | 20th day | 24th day | |
| Cephalexin | Surface Pyoderma | 7 | 7 | 2 (71.43) | 0 (100) | — | — | — | — | 5.14 |
| | Superficial pyoderma | 10 | 10 | 2 (80) | 0 (100) | — | — | — | — | 4.80 |
| | Deep pyoderma | 5 | 5 | 4 (20) | 2 (60) | 0 (100) | — | — | — | 8.80 |

Figures in parantheses indicate percentage recovery by that day.

**Table 33. :** ***Efficacy of Clavulanated Amoxycillin in canine pyoderma***

| Drug | Type of Pyoderma | No. of animals treated | Number of animals showing clinical lesions on particular day | | | | | | | Avg. No. of days required for treatment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 day | 4th day | 8th day | 12th day | 16th day | 20th day | 24th day | |
| Clavulanated Amoxycillin | Surface Pyoderma | 6 | 6 | 3 (50) | 1 (83.33) | 0 (100) | — | — | — | 6.67 |
| | Superficial pyoderma | 9 | 9 | 4 (55.56) | 0 (100) | — | — | — | — | 5.78 |
| | Deep pyoderma | 5 | 5 | 4 (20) | 3 (40) | 1 (80) | 0 (100) | — | — | 10.40 |

Figures in parantheses indicate percentage recovery by that day.

**Table 34. :** ***Efficacy of Gentamicin in canine pyoderma***

| Drug | Type of Pyoderma | No. of animals treated | Number of animals showing clinical lesions on particular day | | | | | | | Avg. No. of days required for treatment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 day | 4th day | 8th day | 12th day | 16th day | 20th day | 24th day | |
| Gentamicin | Surface Pyoderma | 6 | 6 | 3 (50) | 0 (100) | — | — | — | — | 6.00 |
| | Superficial pyoderma | 8 | 8 | 3 (62.5) | 0 (100) | — | — | — | — | 5.50 |
| | Deep pyoderma | 5 | 5 | 4 (20) | 2 (60) | 1 (80) | 0 (100) | — | — | 9.60 |

Figures in parantheses indicate percentage recovery by that day.

**Table 35. :** ***Efficacy of Anbioflam capsule + Dermanol ointment in canine pyoderma***

| Drug | Type of Pyoderma | No. of animals treated | Number of animals showing clinical lesions on particular day | | | | | | | Avg. No. of days required for treatment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 day | 4th day | 8th day | 12th day | 16th day | 20th day | 24th day | |
| Anbioflam + Dermanol | Surface Pyoderma | 5 | 5 | 5 | 3 (40) | 1 (80) | 0 (100) | — | — | 11.20 |
| | Superficial pyoderma | 7 | 7 | 6 (14.29) | 3 (57.14) | 1 (85.71) | 0 (100) | — | — | 9.71 |
| | Deep pyoderma | 5 | 5 | 5 | 5 | 4 (20) | 3 (40) | 1 (80) | 0 (100) | 18.40 |

Figures in parantheses indicate percentage recovery by that day.

**Table 36.** ***Analysis of variance for the effect of various drugs on surface pyoderma in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 3 | 39.670 | 5.472** |
| Error | 20 | 7.250 | |

** Significant at $P < 0.01$.

**Table 37.** ***Comparative efficacy of various drugs on surface pyoderma in relation to number of days required for treatment.***

| Group | Drug used | Mean ± S.E. | C.V% |
|---|---|---|---|
| A | Cephalexin | $5.14^{a} \pm 0.74$ (7) | 37.95 |
| B | Clavulanated Amoxycillin | $6.67^{a} \pm 1.33$ (6) | 48.99 |
| C | Gentamicin | $6.00^{a} \pm 0.89$ (6) | 36.51 |
| D | Anbioflam + Dermanol | $11.20^{b} \pm 1.50$ (5) | 29.88 |

- Figures in parentheses indicate number of animals.

- Means with different superscripts differ significantly ($P < 0.05$).

Table 38. ***Analysis of variance for the effect of various drugs on superficial pyoderma in dogs.***

| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 3 | 37.178 | 6.109** |
| Error | 30 | 6.086 | |

** Significant at $P < 0.01$.

Table 39. ***Comparative efficacy of various drugs on superficial pyoderma in relation to number of days required for treatment.***

| Group | Drug used | Mean ± S.E. | C.V% |
|---|---|---|---|
| A | Cephalexin | $4.80^{a} \pm 0.53$ (10) | 35.136 |
| B | Clavulanated Amoxycillin | $5.78^{a} \pm 0.70$ (9) | 36.488 |
| C | Gentamicin | $5.50^{a} \pm 0.73$ (8) | 37.640 |
| D | Anbioflam + Dermanol | $9.71^{b} \pm 1.48$ (7) | 40.184 |

- Figures in the parentheses indicate number of animals.

- Means with different superscripts differ significantly ($P < 0.01$).

Table 40. ***Analysis of variance for the effect of various drugs on deep pyoderma in dogs.***

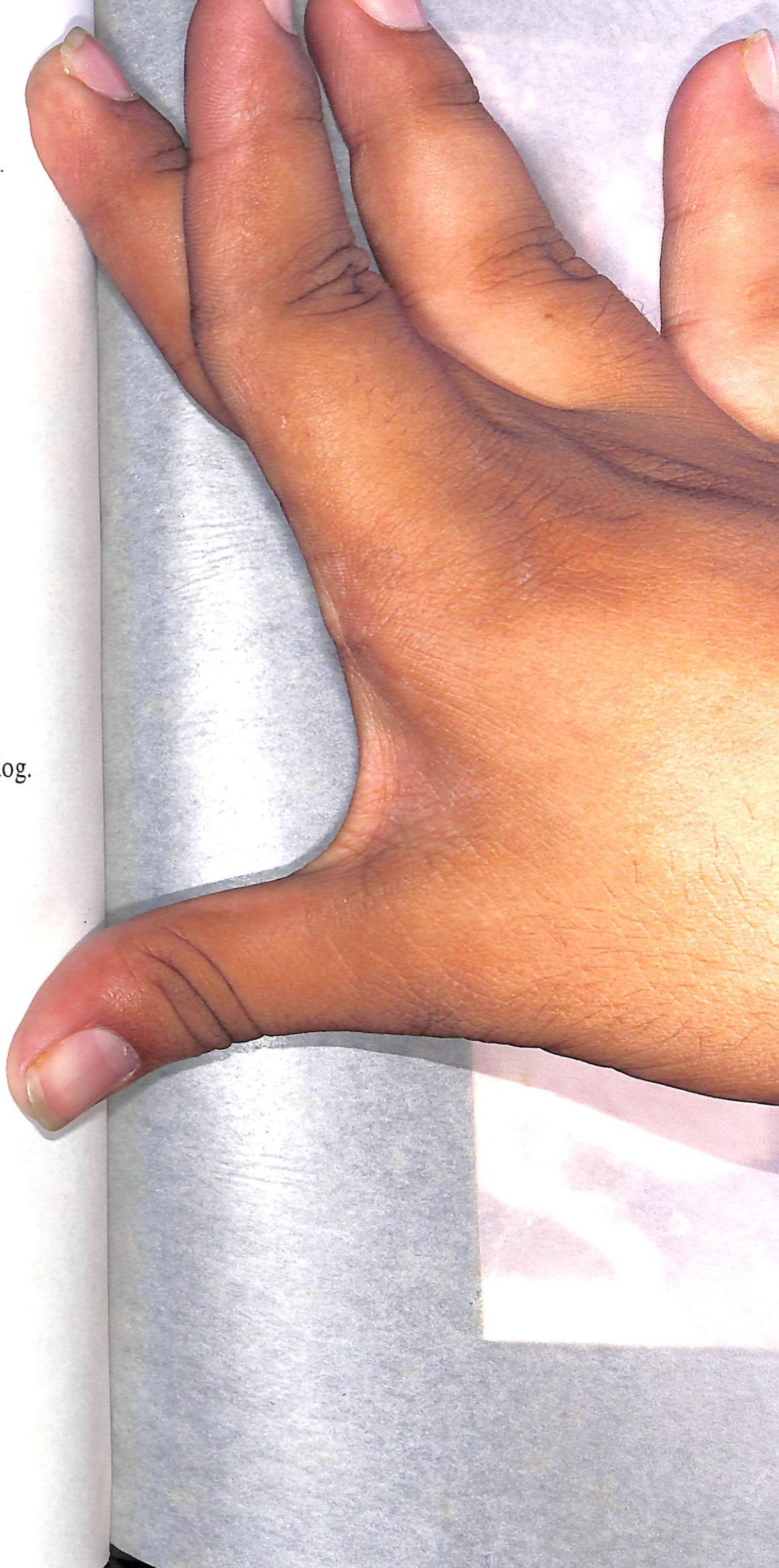
| Source of Variation | df | MS | F |
|---|---|---|---|
| Between treatment | 3 | 98.933 | 5.377** |
| Error | 16 | 18.400 | |

**Significant at $P < 0.01$

Table 41. ***Comparative efficacy of various drugs on deep pyoderma in relation to number of dogs required for treatment.***

| Group | Drug used | Mean ± S.E. | C.V.% |
|---|---|---|---|
| A | Cephalexin | $8.80^{a} \pm 1.50$ (5) | 38.030 |
| B | Clavulanated Amoxycillin | $10.40^{a} \pm 2.04$ (5) | 43.853 |
| C | Gentamicin | $9.60^{a} \pm 2.04$ (5) | 47.507 |
| D | Anbioflam + Dermanol | $18.40^{b} \pm 2.04$ (5) | 24.786 |

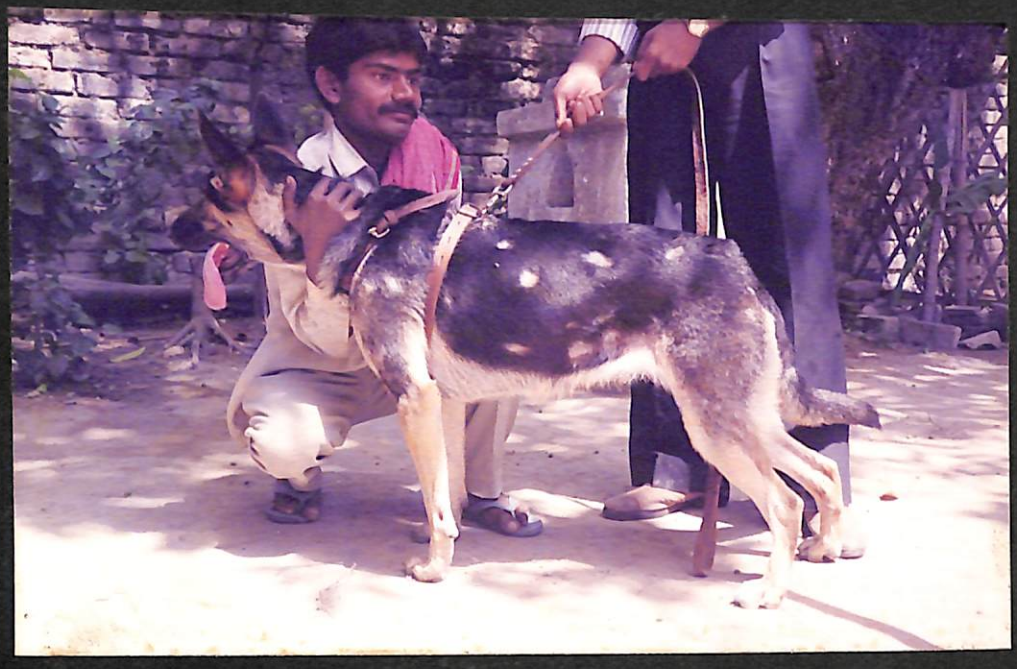
- Figures in the parentheses indicate number of animals.
- Means with different superscripts differ significantly ($P < 0.01$).

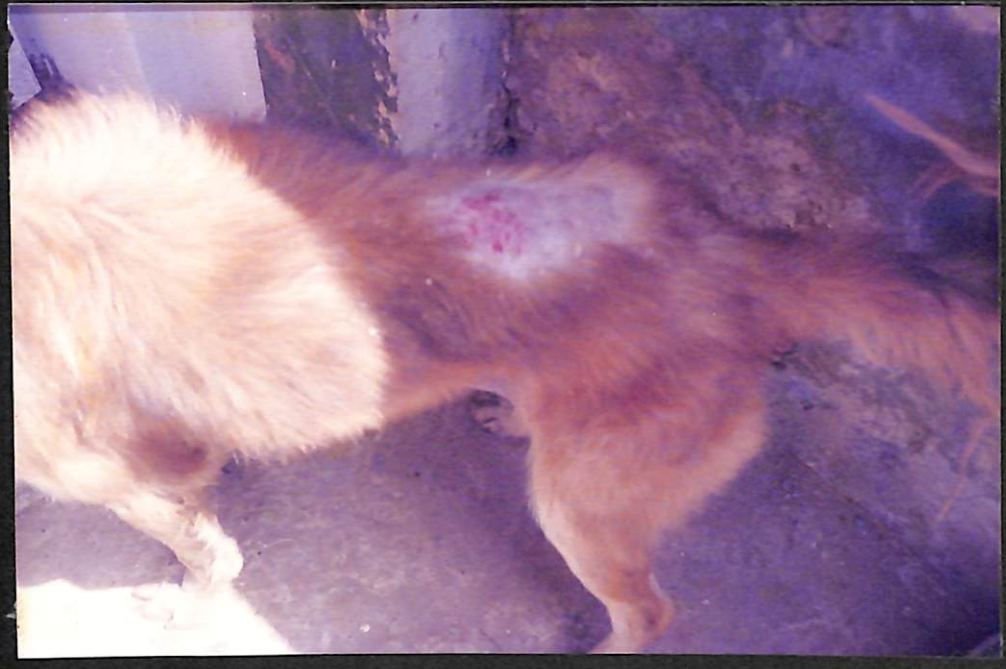


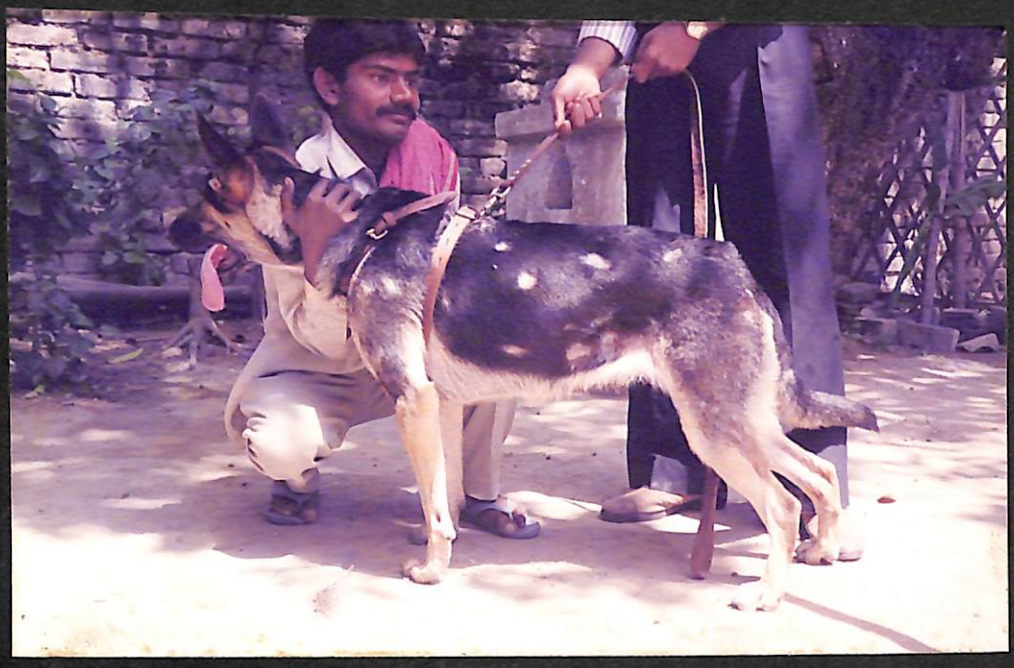
ack region of dog.

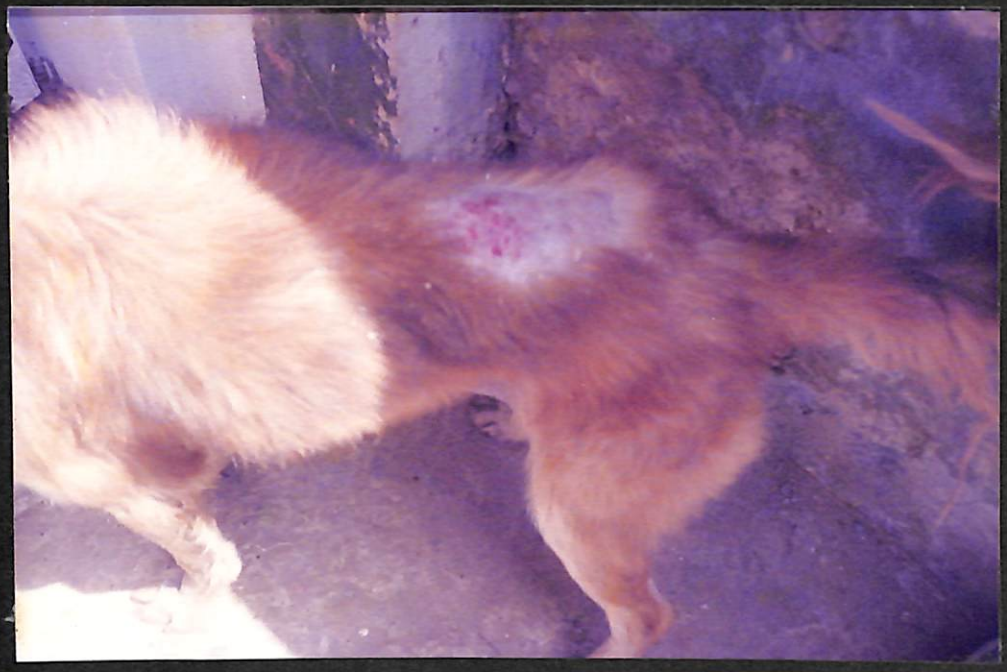
Fig. 11.: Photograph showing generalised pyoderma in dog.

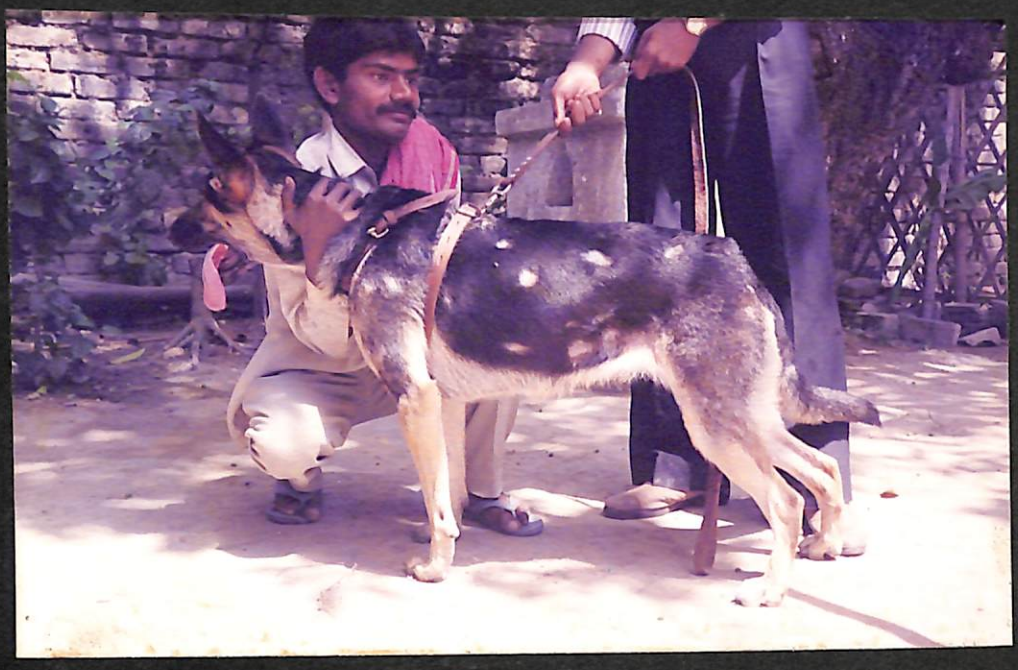
Fig. 12.: Photograph showing lesion of pyoderma on back region of do

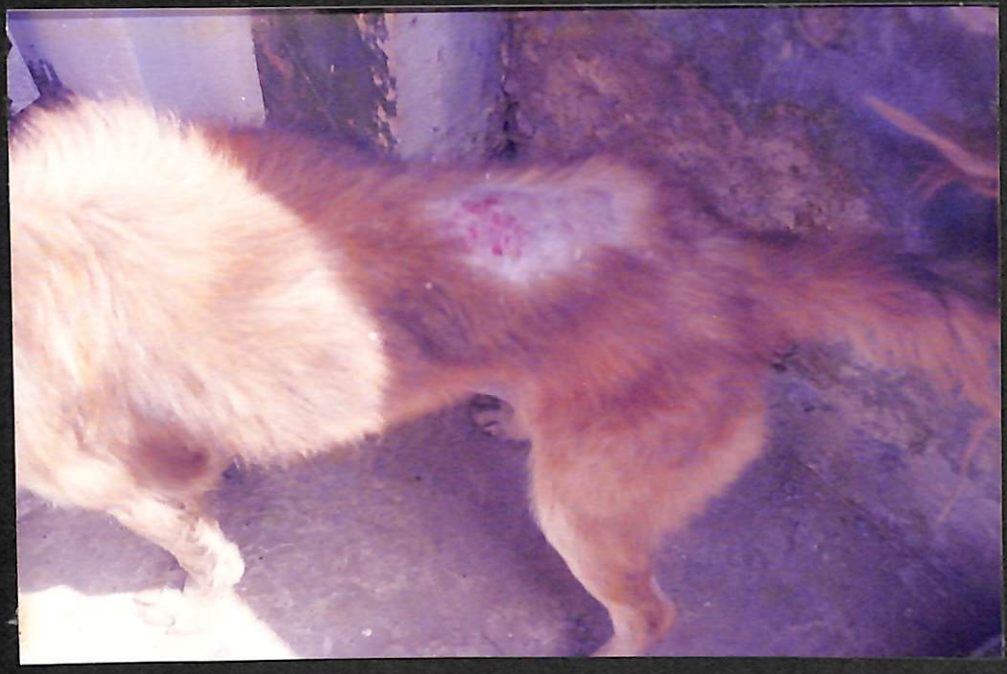












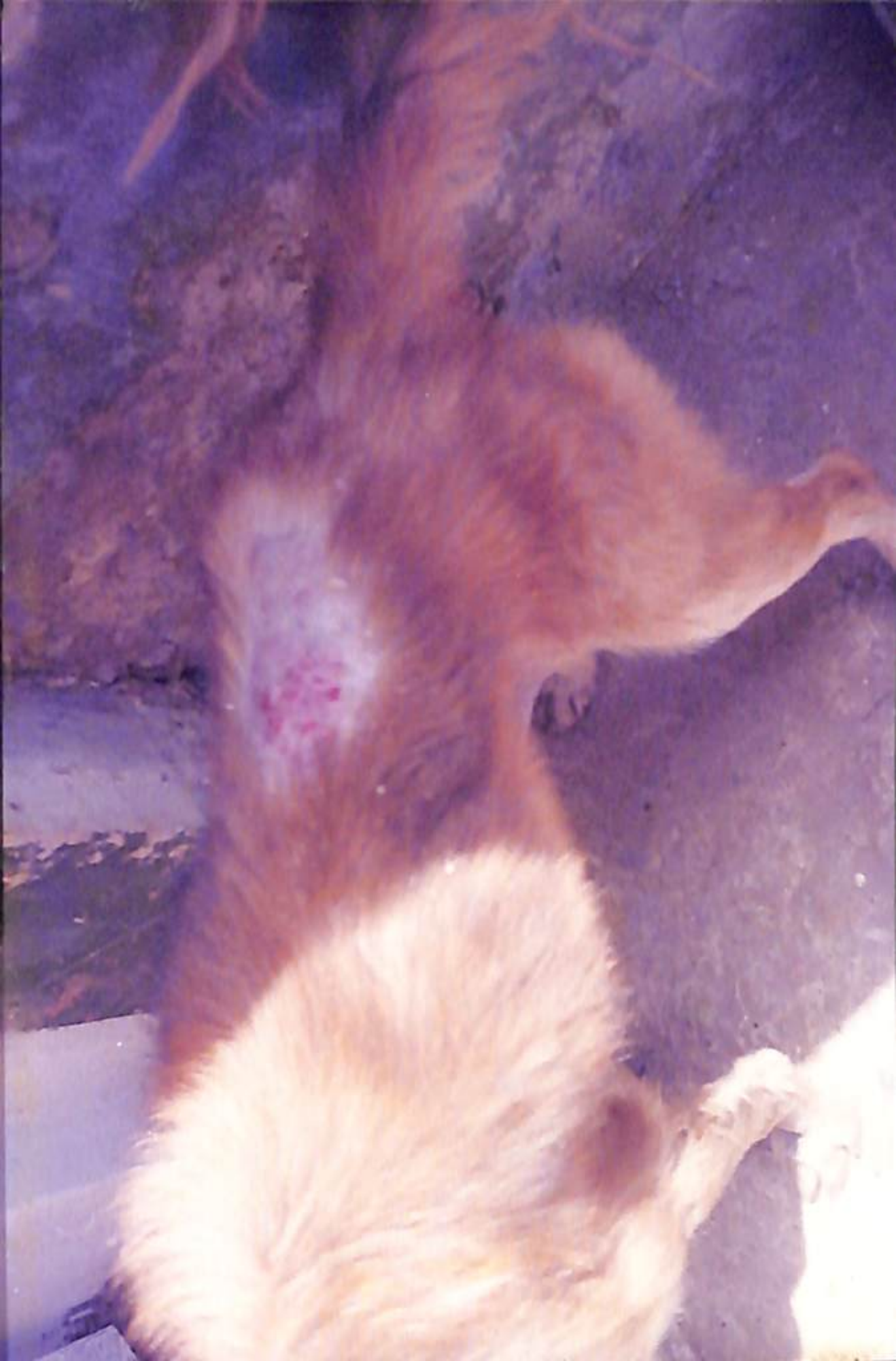
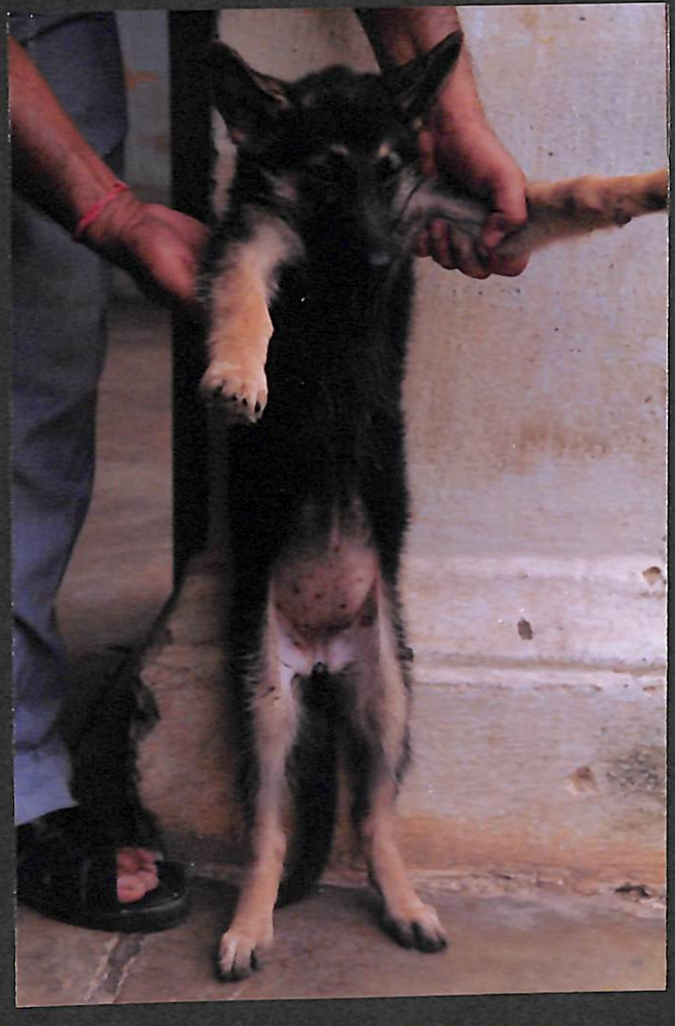
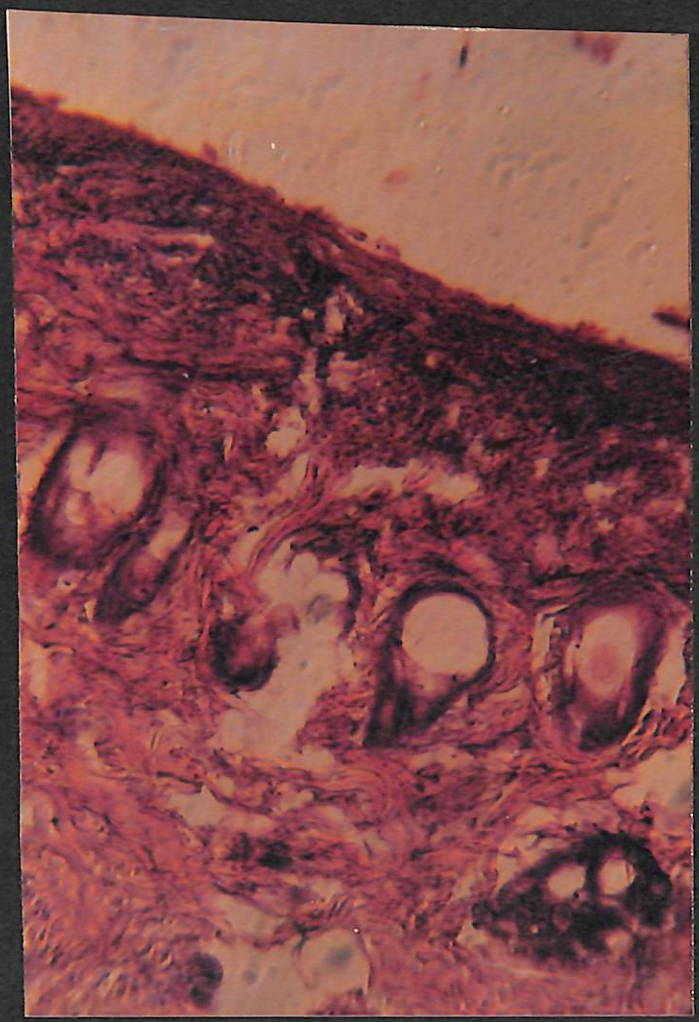
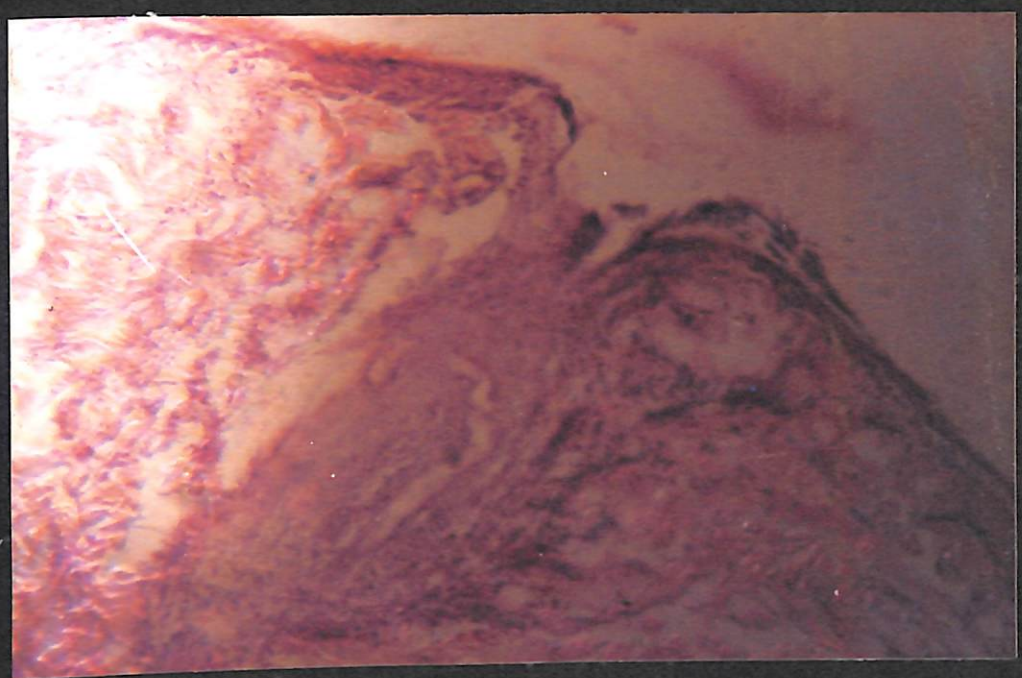


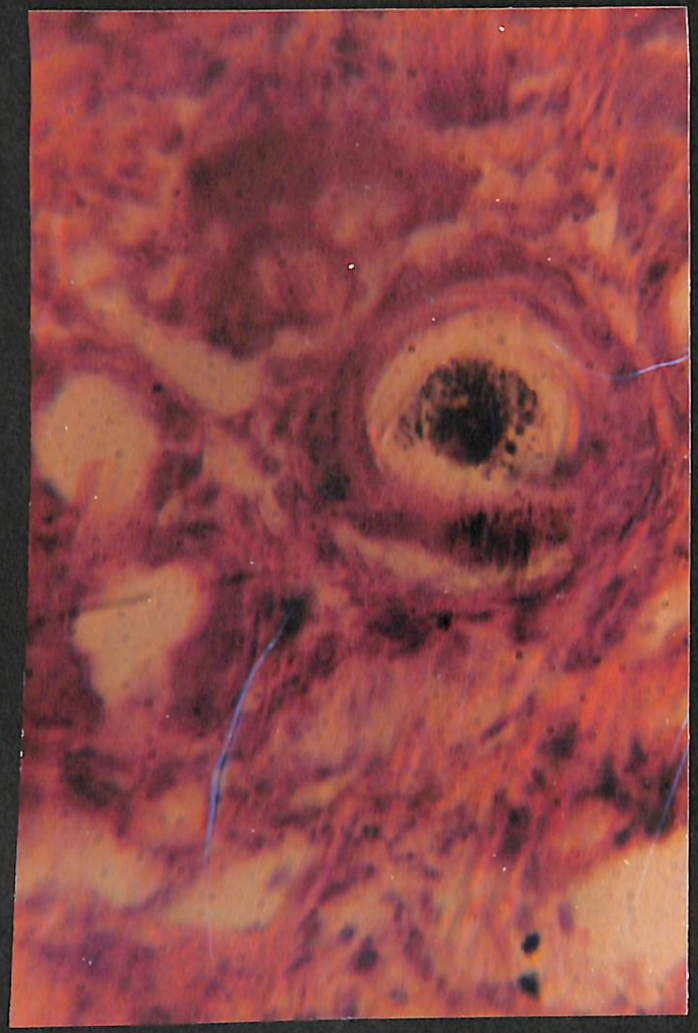
Fig. 13. : Photograph showing pyodermal region on thigh region of dog.

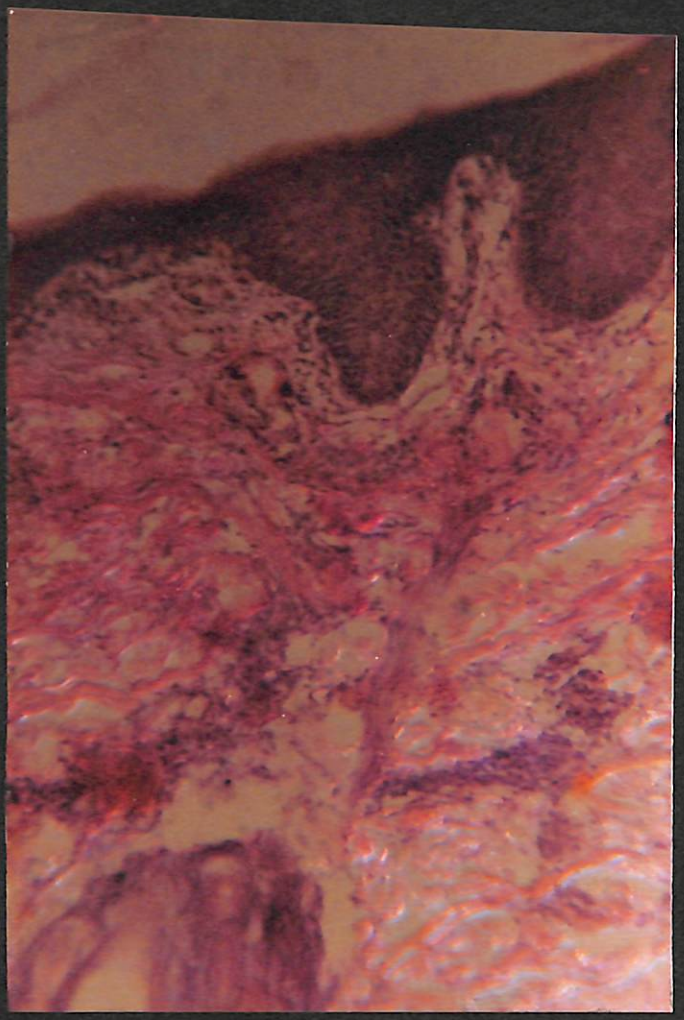
Fig. 14. : Photograph showing lesion of impetigo on abdomen of puppy.

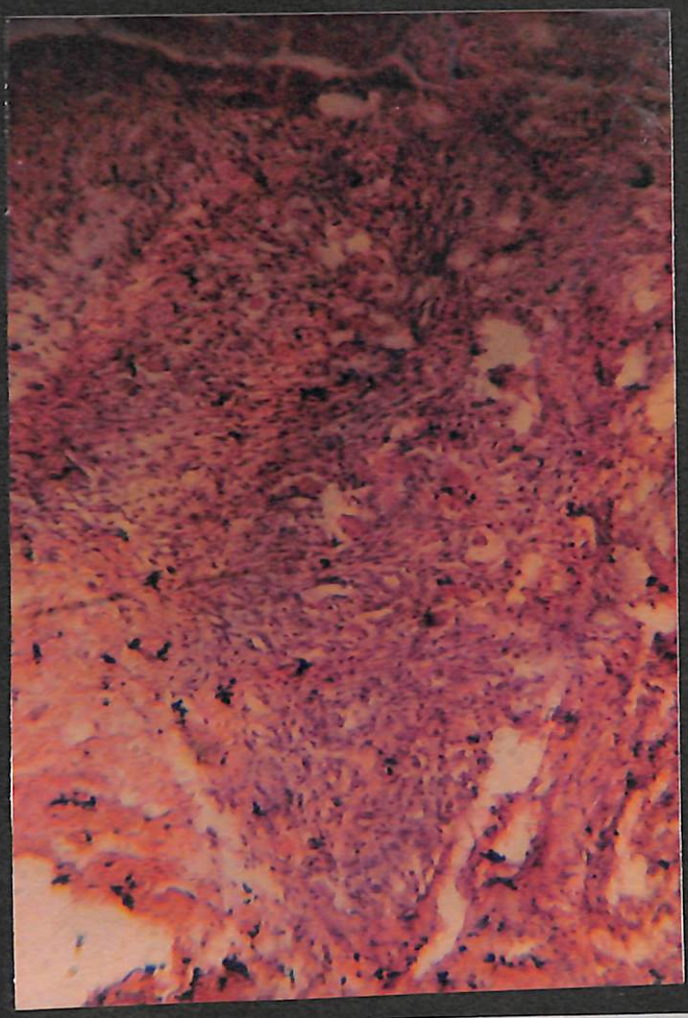


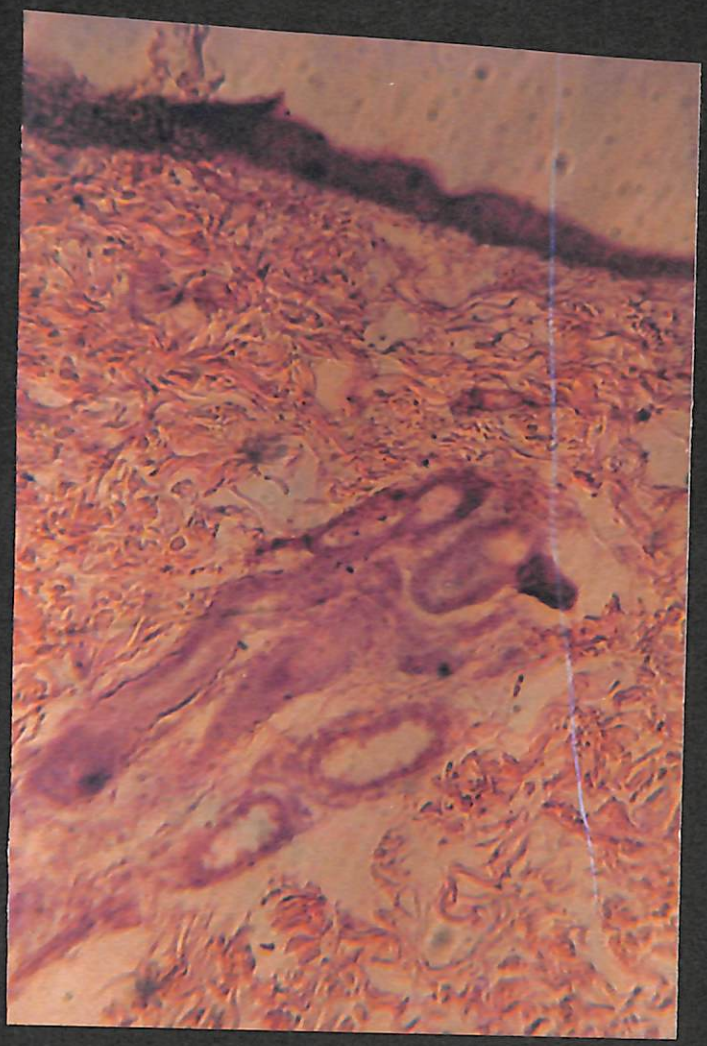


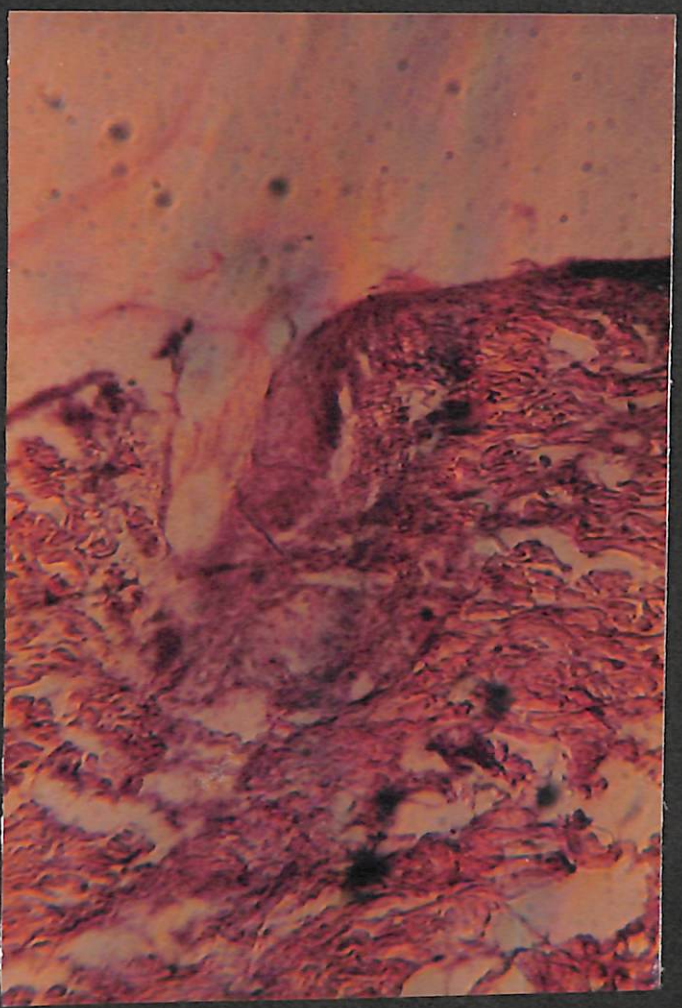












# Chapter-5

# Discussion

# DISCUSSION

The present investigation was planned to study the epidemiology, haematology, histopathology, diagnosis and treatment of pyoderma in domesticated dogs of Patna. The results of the present investigation has been compared with the findings of earlier workers from India and abroad and are discussed here.

## INCIDENCE

There is scarcity of published information both from India and abroad on epidemiological parameters of canine pyoderma. However, attempts have been made to study the pattern of incidence of pyoderma in domesticated or pet dogs of Patna. Relevent information from whichever source available has been compared with the findings of the present study.

### *Different types of dermatological disorders :*

Out of the total dermatological disorders, maximum incidence of pyoderma (31.97%) was observed. This was followed by sarcoptic mange (22.95%), fungal dermatitis (17.62%) and demodectic mange (15.98%) (Table 5). Observation regarding incidence of pyoderma or bacterial dermatitis was in accordance with the findings of Kumar (1988), Kamboj (1991) and Aujla *et al.* (1997). While Gupta *et al.* (1989) reported lesser incidence of pyoderma.

***Different types of pyoderma :***

From the result it was evident that there was significantly higher incidence of superficial pyoderma and lowest of deep pyoderma, while surface pyoderma was reported to occupy the intermediate position between these two (Table 6). The above result was in agreement with Ihrke (1987), Kamboj (1991) and Pal *et al.* (1993b). Contrary to this, Chakrabarti *et al.* (1983) reported higher incidence of deep pyoderma while Misquita and Jagadish (1989) found higher incidence of surface pyoderma. The higher incidence of superficial pyoderma noticed in the present study might be due to predisposing factors such as trauma, ectoparasites and ungroomed coat which helps to produce superficial wound leading to superficial pyoderma.

***Sex wise Incidence :***

Sex related incidence of canine pyoderma revealed that female (57.69%) suffered more as compared to male (42.31%), although the difference was statistically non-significant (Table 7). This finding was in agreement with Kamboj (1991) and Aujla *et al.* (1997). Contrary to this, Misquita and Jagadish (1989), Pal *et al.* (1993b) and Patil *et al.* (1999b) reported higher incidence of pyoderma in male than female. The higher incidence in bitches may be corroborated to the fact that they are more exposed to various

stress factors such as oestrus, whelping, nursing and close confinement with pups. All these factors predispose the bitches for infection.

***Age wise Incidence :***

There was significant effect of age ($P < 0.01$) for the occurrence of pyoderma. Dogs of age group 0-6 months was frequently affected and there was decreasing trend as the age advanced (Table 8). The incidence of canine pyoderma in younger age group was also reported by Kral and Schwartzman (1964), Ohlen and Scott (1986), Kamboj (1991), Khosla *et al.* (1991), Aujla *et al.* (1997) and Patil *et al.* (1999b). However, Pal *et al.* (1993b) reported incidence in both younger as well as older age group, while Krick and Scott (1989) found no relationship between age and occurrence of pyoderma. The increased incidence in younger age group might be due to a possibility that skin and hair of young and healthy animals may serve as a source in the pathogenesis of pyoderma (White *et al.*, 1983). Moreover young dogs are deprived of sunlight since they are mostly kept indoor resulting in poor condition of skin due to lack of vitamins. Overcrowding and frequent soiling with urine and stool (Nesbitt, 1983 and Kamboj, 1991) in this age group add to the occurrence of bacterial infection. Impetigo, the most common type of pyoderma affects young dogs, might be the reason for more occurrence of pyoderma in younger age group.

***Breedwise Incidence :***

In the present study it was observed that pure bred dogs were more susceptible for pyoderma than mixed breeds (Table 9). The above finding corraborate the observation of Aujla *et al.* (1997). Contrary to this, Misquita and Jagadish (1989) and Kamboj (1991) reported higher incidence of pyoderma in non-descript stray dogs. The present study was mainly confined on domesticated dogs, while non-descript (mixed breeds) dogs who are mostly stray in nature and are not brought for treatment. This might be the possible reason for higher incidence pattern in pure bred dogs.

Among pure breeds of dogs, Spitz showed maximum incidence followed by German Shepherd (Table 9). This could be comparable to the observation of Kamboj (1991). However, Pal *et al.* (1993b) found German Shephered and Doberman Pinscher dogs to be most susceptible. Higher incidence in Spitz might be due to overpresentation of this breed since they are mostly domesticated by people due to less space requirement and low keeping cost. They are heavy and thick haired breed and thus any trauma to the skin are not visible and easily detectable from outside, predisposes the dogs for bacterial infection of skin. After the Spitz, next comes German Shepherd which were preferred by peoples as guard dogs and hence the incidence observed in the present studies were second.

***Hair Length wise incidence :***

From the result it was evident that long haired dogs showed significantly higher incidence of pyoderma followed by medium haired and short haired dogs (Table 10), as against the finding of Kamboj (1991). Probable reason of higher incidence in long haired dogs might be due to the fact that any trauma to skin are not easily visible from outside due to long hair, leading to bacterial infection of skin.

***Month wise incidence :***

Although month did not show significant effect on the incidence of cainine pyoderma, however the maximum incidence was recorded in the month of September followed by August, while minimum incidence was seen in March and April (Table 11). This finding was in consonance with Pal *et al.* (1993b). Contrary to this, Kamboj (1991) reported higher incidence in the month of January and May. Higher incidence in the month of September and August might be explained on the basis that hot and humid climate alongwith rainfall during this period provide the most favourable environment for the growth of bacteria on skin surface leading to pyoderma.

***Seasonal incidence :***

From the result it is apparent that the season had significant ($P < 0.05$) effect on the occurrence of pyoderma in dog

(Table 12). Maximum incidence observed in rainy season and minimum in winter season was in accordance with the findings of Pal *et al.* (1993b), while it was against the finding of Kamboj (1991). As explained in the monthwise incidence pattern, higher cases reported during rainy season might be due to high rainfall and increased temperature which leads to hot and humid condition which inturn favours the multiplication of bacteria on the skin surface producing bacterial dermatitis.

***Distribution of lesions :***

In the present investigation, abdomen and back region of dogs were found significantly more prone for the bacterial dermatitis (Table 13). Trauma caused by fighting together and contact with the ground occurs mostly in abdominal and back region, might be the reason for these areas as higher predilection site for occurrence of pyoderma. Almost similar findings were reported earlier by various workers (Chakrabarti *et al.*, 1983; Kamboj, 1991 and Aujla *et al.*, 1997).

**CLINICAL SYMPTOMATOLOGY**

There were no variations in temperature, pulse rate and respiration rate. The lesions such as papules, pustules and vesicles were observed in dogs suffering with pyoderma. There were exudation of pus and serum. Dried yellow crusty lesions were also

found. Sinus and fistulous tracts were observed in deep pyoderma. Pruritus and alopecia were sometime noticed. These observations were in consonance with those of Chakrabarti (1986) and Baker (1987).

## BACTERIOLOGICAL STUDIES

### *Isolation of micro-organisms :*

It is revealed from the result (Table 14) that major bacterial isolates were coagulase positive *Staphylococcus intermedius* (69.07%). Coagulase positive *Staph. aureus* (7.22%) and coagulase negative *Staph. epidermidis* (4.12%) were other staphylococcal isolates. The *Staph. intermedius* was the only isolate obtained in pure culture (Table 15). Other bacteria isolated as mixed infection with *Staphylococcus* spp. were *Streptococcus pyogenes* (8.25%), *Bacillus subtilis* (4.12%), *Proteus vulgaris* (4.12%), *Pseudomonas aeruginosa* (2.06%) and *Escherichia coli* (1.03%) (Table 16). Almost similar isolation pattern were reported by earlier workers from India and abroad (Guilhon *et al.* 1974; Nesbitt and Schmitz, 1977; Ihrke *et al.* 1978, Willemse, 1979; Krogh and Kristensen, 1981; Amine-Khodja *et al.*, 1983; Berg *et al.*, 1984; Wisselink *et al.*, 1985; Kunkle, 1987; Awad-Masalmeh and Jurinka, 1988; Love, 1989; Khosla *et al.*, 1991; Pal *et al.*, 1993b; Kamboj *et al.*, 1995; Aujla *et al.*, 1997; Bettenay *et al.*, 1998; Mueller *et al.*, 1998 and Batta *et al.*, 1999).

Berg *et al.* (1984) and Woldehiwet and Jones (1990) differentiated the *Staphylococcus* spp. of canine origin into *Staph. intermedius* and *Staph. aureus*. Berg *et al.* (loc. cit) identified major coagulase-positive staphylococci of dogs as *Staph. intermedius*. These supports our finding of higher isolation of *Staph. intermedius*.

***In-vitro Drug sensitivity :***

In the present study, in-vitro sensitivity test was carried out on 97 bacterial isolates from canine pyoderma cases (Table 17). It is revealed from the result that drugs of quinolones group viz. enrofloxacin and ciprofloxacin showed almost 95 percent sensitivity towards total isolates, while more than 95 percent effectiveness was observed for strains of staphylococci. Similar was the finding of Pellerin *et al.* (1998). These drugs are bactericidal and are recently introduced in the veterinary practice, thus are less exposed and chances of development or resistance is less. This might be the reason for its higher effectiveness.

Cefotaxime and cephalexin were effective against almost 90 percent of total bacterial strains as well as strains of staphylococci, which might be due to their strong bactericidal action and their activity against beta lactamase producing staphylococci (Sande and Mandell, 1985). These observations are in consonance with those of Okin (1983), Devriese (1988), Kamboj *et al.* (1995), Mueller *et al.* (1998), Pellerin *et al.* (loc. cit.) and Patil *et al.* (1999b).

The sensitivity of staphylococci to aminoglycosides i.e. gentamicin and amikacin was found to be 84.62 and 82.05 percent respectively, while chloramphenicol showed 78.21 percent effectiveness towards these isolates. The result of the present investigation was in accordance with various workers (Nesbitt and Schmitz, 1977; Krogh and Kristensen, 1981; Okin, loc.cit., Wisselink *et al.*, 1985; Awad-Masalmeh and Jurinka, 1988; Devriese, loc.cit.; Love, 1989; Woldehiwet and Jones, 1990; Khosla *et al.*, 1991; Kamboj *et al.*,loc.cit.; Aujla *et al.*, 1997; Pellerin *et al.*, loc. cit. and Patil *et al.*, loc.cit.).

The pattern of sensitivity of natural and synthetic pencillins towards staphylococcal isolates in the present study in descending order were clavulanic acid amoxycillin or amoxyclav (80.77%), amoxycillin (78.21%), cloxacillin (66.67%), ampicillin (46.15%) and penicillin-G (32.05%). Devierse (loc.cit.) and Pellerin *et al.* (loc.cit.) reported similar sensitivity pattern regarding amoxycillin and clavulanic acid. Higher sensitivity of amoxyclav might be due to its beta-lactamase resistant antimicrobial quality. The sensitivity of cloxacillin, ampicillin and penicillin-G were varyingly reported by other workers. Increased resistance noticed against some of the antimicrobial might be due to indiscriminate use of these drugs in lower doses.

Cephalexin, aminoglycosides and chloramphenicol showed maximum sensitivity towards the gram negative bacterias isolated from canine pyoderma cases. These findings corroborate to the findings of Breen (1973), Done (1974), Krogh and Kristensen (loc.cit.), Okin (loc.cit.), Amine-Khodja *et al.* (1984) and Kamboj *et al.* (loc.cit.).

## HAEMATOLOGICAL STUDIES

There was no significant difference in mean total erythrocyte count, haemoglobin, monocyte and eosinophil value in both pre-treated and post-recovered groups as compared to control group (Table - 18, 19, 22, 23, 28, 29, 39, 31). These findings were in agreement with Misquita and Jagadish (1989), Kamboj (1991) and Aujla *et al.* (1997).

From the result it appears that there was significant increase in total leucocyte count in dogs affected with pyoderma and the value returned to normal level after complete recovery (Table - 20 & 21). Stress caused by dermatitis and bacterial toxins might be the possible reason for leucocytosis. The present findings were in accordance with Kamboj (loc. cit.) and Aujla *et al.* (loc.cit.).

There was significant increase in neutrophil count and corresponding decrease in lymphocyte count in pre-treated group as compared to control and post-recovered groups (Table - 24 to 27).

Neutrophilia in pyoderma might have resulted due to acute bacterial infection. The observations were in consonance with those of Kamboj (loc.cit.) and Aujla *et al.* (loc.cit.).

## HISTOPATHOLOGICAL STUDIES

Histopathological studies of cases of superficial pyoderma showed infiltration of neutrophils and few mononuclear cells in the stratum germinativum which penetrated to the hair follicles and sometimes upto the deeper layer of stratum corneum. Excoriation or superficial loss of epithelium were sometime noticed. Purulent folliculitis, perifolliculitis, serofibrinous exudate with neutrophilic infiltration and perivascular changes were also noticed. Cases of deep pyoderma showed diffuse purulent inflammation and heavy infiltration of neutrophils alongwith few lymphocytes, plasma cells and macrophages in the deeper dermis. Degenerated epidermis and infiltrated neutrophils surrounding the sebaceous glands were sometime noticed. Folliculitis, perifolliculitis, perivascularitis, acanthosis and parakeratosis were also observed. Surface pyoderma showed degeneration of stratum corneum and slight infiltration of neutrophils. Almost similar were the finding of the earlier workers Muller and Krick, 1969; Rojko *et al.*, 1978; Reinke *et al.*, 1987; Kamboj, 1991; Pal *et al.*, 1993a and Aujla *et al.*, 1997).

## TREATMENT

Cases of pyoderma were treated with cephalexin (Group-A), clavulanated amoxycillin (Group-B) and gentamicin (Group-C) based on the antibiotic sensitivity test, while few cases (Group-D) were treated with herbal capsule Anbioflam orally along with topical application of Dermanol ointment. Although during invitro drug sensitivity enrofloxacin was found to be most effective, it was not selected for treatment because it might induce abnormalities of growth plate and cartilage in young age group dogs, which showed the highest incidence of pyoderma in present study.

Based on average number of days required for curing of disease i.e. clearing of lesions, on perusal of results (Table - 32 to 35) it could be seen that cephalexin was found to be most effective drug against all types of pyoderma, viz. surface, superficial and deep, followed by gentamicin, clavulanated amoxycillin and herbal combination. Highest cure rate of cephalexin might be due to its more potent action against beta lactamase producing staphylococci (Parry and Pancoast, 1984 and Sande and Mandell, 1985). The cephalosporins having excellent penetration in skin and muscle and long persistence of therapeutic concentration in skin (Choudhary, 1987) might be the reason for its best efficacy. Efficacy of cephalexin has also been reported by earlier workers (Angarano and Mac Donald, 1989; Price, 1989; Wustenberg and Rodenback, 1990; Kamboj, 1991 and Guaguere *et al.*, 1998).

Statistically, non-significant difference was observed in the efficacy of cephalexin, gentamicin and clavulanated amoxycillin. Herbal combination (Anbioflam capsule + Dermanol ointment) required significantly higher average number of days for curing the malady (Table - 36 to 41).

The efficacy of gentamicin might be related to its bactericidal action, broad spectrum activity and parentral administration. Aminoglycosides were quite effective for mixed infections, when therapy was directed against *Staph. intermedius* alone (Ihrke, 1984). Successful use of gentamicin for the treatment of pyoderma was also reported by Done (1974), Ciric *et al.* (1977) and Patil *et al.* (1999a).

Amoxycillin is synthetic bactericidal antibiotic having activity against Gram-positive as well as some Gram-negative bacteria. Amoxycillin plus clavulanate is effective for β-lactamase producing strains of staphylococci, *E. coli* etc. This might be the reason for efficacy of clavulanated amoxycillin in the present study. Similar findings were earlier reported by various workers (Bywater *et al.*, 1985; Lloyd *et al.*, 1997 and Littlewood *et al.*, 1999).

The herbal combination was found to be effective, however the number of days required for treatment was more in comparison to other drugs. Combination was found to be effective for

all types of pyoderma but required relatively greater number of days for curing deep pyoderma. No untoward effect of this drug was observed (Chakrabarti *et al.*, 1999). The finding regarding successful use of herbal preparations carried out by different workers (Chakrabarti *et al.*, 1983; Misquita and Jagadish, 1989; Pal *et al.*, 1995b and Chakrabarti *et al.*, loc.cit.) also support our finding.

From the result it is obvious that cases of superficial pyoderma required least number of days for recovery, followed by superficial and deep in all types of treatment groups. The reason for long duration of therapy in deep pyoderma might be due to involvement of deeper dermal layer of skin in these cases. The layers involved in superficial pyoderma (i.e. epidermal layers and upper dermis) is richly supplied with blood capillaries while stratum corneum layer involved in surface pyoderma is not much supplied with blood which influence the time interval of drug to reach the site. This might be the probable reason for relatively longer recovery time in surface pyoderma as compared to superficial pyoderma. Similar was the finding of Kamboj (1991).

# Chapter-6

# Summary & Conclusions

# SUMMARY AND CONCLUSIONS

Pyoderma, a bacterial infection of the skin, is a common dermatolgical disorder affecting dogs. During the period from August 1999 to July 2000, 244 dogs with dermatological disorders brought for treatment at Bihar Veterinary College Hospital and other hospitals including private clinics in and around Patna, were screened. Seventy eight cases were found positive for pyoderma on which detailed studies were carried out.

Amongst total dermatitis cases, 31.97 percent were of bacterial dermatitis (pyoderma) followed by sarcoptic mange (22.95%), fungal dermatitis (17.62%), demodicosis (15.98%), non-specific dermatitis (7.79%) and mixed type (3.69%).

Maximum cases of superficial pyoderma (43.59%) and minimum of deep pyoderma (25.64%) were recorded while 30.77 percent cases were diagnosed as surface pyoderma.

Bitches (57.69%) were more predisposed for pyoderma than male dogs (42.31%). Statistically the difference was non-significant.

Age wise incidence indicated that pyoderma was most prevalent in the dogs below 6 months of age. Incidence was found to be gradually decreasing with advancement of age.

In the present study pure breed dogs were more affected with pyoderma than the mixed breed. Among the different pure breeds, Spitz (38.46%) were most susceptible followed by German Shepherd (28.21%).

Pyoderma was more common in dogs with long hair (51.28%) followed by medium haired (34.62%) and short haired (14.10%).

Maximum incidence of pyoderma was observed in the month of September (15.38%) followed by August (12.82%) while minimum cases were recorded during March and April (3.85% each). However the variation was statistically non-significant.

Season played a significant role in the occurrence of pyoderma. Maximum incidence was registered in rainy season (30.46%) while minimum was in summer season (16.67%).

Regionwise studies revealed that abdomen (30.77%) was more prone to bacterial dermatitis followed by dorsal side of back (23.08%).

The lesions of pyoderma included papules, pustules and vesicles. There were exudation of pus and serum. Erythema and yellow crusts were also common. Sinus formation and fistulous tracts were observed in few cases.

Bacteriological studies revealed isolation of 97 bacterial strains out of total 78 cases of pyoderma. *Staphylococcus intermedius*

(69.07%) was the major isolate. Other bacteria isolated were *Streptococcus pyogenes* (8.25%), *Staph. aureus* (7.22%), *Staph. epidermidis* (4.12%), *Bacillus subtilis* (4.12%), *Proteus spp.* (4.12%), *Pseudomonas aeruginosa* (2.06%) and *Escherichia coli* (1.03%). *Staph. intermedius* was present as pure culture in 61 cases. Rest 17 cases were mixed infection of staphylococci with one or two strains.

The in-vitro drug sensitivity pattern of bacterial isolates in descending order were : - enrofloxacin (96.21%), ciprofloxacin (94.85%) cefotaxime (90.72%), cephalexin (89.69%), gentamicin (83.51%), amikacin (82.47%), clavulanated amoxycilllin or amoxyclav (81.44%), amoxycillin (77.32%), erythromycin (76.29%), chloramphenicol (73.20%), cloxacillin (61.86%), ampicillin (44.33%) and penicillin - G (31.96%). Almost similar pattern was observed with staphylococcal isolates.

Haematological studies revealed non-significant difference in mean total erythrocyte count, haemoglobin, monocyte and eosinophil value in both pre-treated and post-recovered groups as compared to control group. Significant leucocytosis and neutrophilia were observed in dogs suffering with pyoderma which returned to normal value after complete recovery.

The histopathological findings of superficial pyoderma included infiltration of neutrophils and few mononuclear cells in the stratum germinativum, stratum corneum and upto hair follicles. Excoriation, purulent folliculitis, perifolliculitis and perivascular

ıanges were also observed. Deep pyoderma cases showed diffuse urulent inflammation and heavy infiltrations of neutrophils ongwith few lymphocytes, plasma cells and macrophages in the eeper dermis. Folliculitis, perifolliculitis, perivascularitis, anthosis and parakeratosis were also observed in deep pyoderma. egeneration of stratum corneum and slight infiltration of utrophils were observed in surface pyoderma.

Cephalexin was found to be most effective drug against l types of pyoderma followed by gentamicin, clavulanated noxycillin and herbal combination. However, the efficacy of phalexin, gentamicin and clavulanated amoxycillin statistically owed non-significant difference. Herbal combination (Anbioflam psule orally alongwith Dermanol ointment topically) required gnificantly higher number of days for treating the disease. In all pes of treatment groups, cases of superficial pyoderma required ast number of days for recovery followed by surface and deep oderma.

## ONCLUSIONS

From the above findings of the results it may be ıcluded that : -

History, clinical examination of skin surface, processing and examining skin scrapings might be employed for eliminating the possibility of other types of dermatitis, viz. parasitic and fungal.

Bacteriological examination of exudates taken on cotton swab aids in the proper identification of bacteria involved in the pyoderma. *Staphylococcus intermedius* is the predominant bacteria involved in pyoderma.

In-vitro drug sensitivity of the isolates should form the basis for choosing appropriate antimicrobials for treatment. Quinolones, cephalosporins, aminoglycosides and clavulanated amoxycillin showed higher sensitivity in the present study.

Histopathology and haematology (leucocytosis and neutrophilia) may provide the guidelines for proper diagnosis of pyoderma.

Cephalexin may be used as the choice of drug for the treatment of all types of pyoderma. Gentamicin and clavulanated amoxycillin is equally effective.

Although herbal combination (Anbioflam capsule and Dermanol ointment) requires more numbers of days for treating pyoderma, it may be used because of no untoward effects. It may also be used where there is no facilities for antibiotics sensitivity test particularly under field conditions.

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# Clinical Studies on Canine Pyoderma with Special Reference To its Diagnosis and Treatment

## THESIS
## ABSTRACT

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# ABSTRACT

## CLINICAL STUDIES ON CANINE PYODERMA WITH SPECIAL REFERENCE TO ITS DIAGNOSIS AND TREATMENT

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Pyoderma is cutaneous pyogenic bacterial infection which is a common cause of skin disease in dogs. Main constraints in therapeutic failure are misdiagnosis and improper management of the condition. Keeping in view the above facts present investigation was carried out to ascertain epidemiolgical pattern, proper diagnosis and treatment of the disease. The present study was carried out on domesticated dogs of Patna from August' 1999 to July' 2000.

A detail history and clinical examination of the entire skin surface for all the 244 dogs with dermatological disorders included in the present study ware recorded. Elimination of dogs suffering with mange due to mites and fungal infections were done by processing of skin scrapings by different methods and examining under microscope. Exudates were collected from the skin lesions with

sterile cotton swabs and were innoculated on different media and incubated at 37°C for 24 hours for isolation of microbes. A total of 78 cases were diagnosed as pyoderma, of which 97 bacterias were isolated. The identification of the bacteria was done on the basis of cultural, staining, morphological and biochemical characteristics and the isolates were subjected to *in vitro* drug senstitivity test. The haematological studies (TLC, TEC, DLC and haemoglobin) were carried out on pre-treated, post-recovered and six healthy dogs. The histopathological studies were conducted on some specific cases of pyoderma. The cases diagnosed as pyoderma were divided into four treatment groups. Animals of group A, B and C were treated with Cephalexin, Clavulanated Amoxycillin and Gentamicin, respectively based on *in vitro* sensitivity test, while Group-D animals were treated with herbal combination (Anbioflam capsule + Dermanol ointment).

Amongst total dermatitis cases, 31.97 percent were of bacterial dermatitis (pyoderma) followed by sarcoptic mange (22.95%), fungal dermatitis (17.62%), demodicosis (15.98%), non-specific dermatitis (7.79%) and mixed type (3.69%). Out of 78 cases of pyoderma maximum cases of superficial pyoderma (43.59%) and minimum of deep pyoderma (25.64%) were recorded while 30.77 percent cases were diagnosed as surface pyoderma.

Bitches (57.69%) were more predisposed for pyoderma than male dogs (42.31%) but the difference was statistically non-

significant. Age wise incidence indicated that pyoderma was most prevalent in the dogs below 6 months of age. Incidence was found to be gradually decreasing with advancement of age. In the present study pure breed dogs were more affected with pyoderma than the mixed breed. Among the different pure breeds, Spitz (38.46%) were most susceptible followed by German Shepherd (28.21%). Pyoderma was more common in dogs with long hair (51.28%) followed by medium haired (34.62%) and short haired (14.10%).

Maximum incidence of pyoderma was observed in the month of September (15.38%) followed by August (12.82%) while minimum cases were recorded during March and April (3.85% each). However the variation was statistically non-significant. Season played a significant role in the occurrence of pyoderma. Maximum incidence was registered in rainy season (30.46%) while minimum in summer season (16.67%). Region wise studies revealed that abdomen (30.77%) was more prone to bacterial dermatitis followed by back region (23.08%).

The lesions of pyoderma included papules, pustules and vesicles. There were exudation of pus and serum. Erythema and yellow crusts were also common. Sinus formation and fistulous tracts were observed in few cases.

Bacteriological studies revealed isolation of 97 bacterial strains out of total 78 cases of pyoderma. *Staphylococcus intermedius*

(69.07%) was the major isolate. Other bacteria isolated were *Streptococcus pyogenes* (8.25%), *Staph. aureus* (7.22%), *Staph. epidermidis* (4.12%), *Bacillus subtilis* (4.12%), *Proteus vulgaris* (4.12%), *Pseudomonas aeruginosa* (2.06%) and *Escherichia coli* (1.03%). *Staph. intermedius* was present as pure culture in 61 cases. Rest 17 cases were mixed infection of staphylococci with one or two strains.

The *in vitro* drug sensitivity pattern of bacterial isolates in descending order were : - enrofloxacin (96.21%), ciprofloxacin (94.85%) cefotaxime (90.72%), cephalexin (89.69%), gentamicin (83.51%), amikacin (82.47%), clavulanated amoxycilllin or amoxyclav (81.44%), amoxycillin (77.32%), erythromycin (76.29%), chloramphenicol (73.20%), cloxacillin (61.86%), ampicillin (44.33%) and penicillin - G (31.96%). Almost similar pattern was observed with staphylococcal isolates.

Haematological studies revealed non-significant difference in mean total erythrocyte count, haemoglobin, monocyte and eosinophil value in both pre-treated and post-recovered groups as compared to control group. Significant leucocytosis and neutrophilia were observed in dogs suffering with pyoderma which returned to normal value after complete recovery.

The histopathological findings of superficial pyoderma included infiltration of neutrophils and few mononuclear cells in the stratum germinativum, stratum corneum and upto hair follicles.

Excoriation, purulent folliculitis, perifolliculitis and perivascular changes were also observed. Deep pyoderma cases showed diffuse purulent inflammation and heavy infiltrations of neutrophils alongwith few lymphocytes, plasma cells and macrophages in the deeper dermis. Folliculitis, perifolliculitis, perivascularitis, acanthosis and parakeratosis were also observed in deep pyoderma. Degeneration of stratum corneum and slight infiltration of neutrophils were observed in surface pyoderma.

Cephalexin was found to be most effective drug against all types of pyoderma followed by gentamicin, clavulanated amoxycillin and herbal combination. However, the efficacy of cephalexin, gentamicin and clavulanated amoxycillin statistically showed non-significant difference. Herbal combination required significantly higher number of days for treating the disease, however it may be used where there is no facilities for antibotics sensitivity test particularly under field conditions. In all types of treatment groups, cases of superficial pyoderma required least number of days for recovery followed by surface and deep pyoderma.

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