Vet.Med.J.,Giza. Vol.46, No.4 B (1998): 751-761.

MICROBIOLOGICAL STUDIES ON CLAW DISEASES IN SOME FARM ANIMALS

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SUMMARY

Clinical examination of 1550 adult animals of different breeds (500 cattle, 350 buffaloes, 400 sheep and 300 goats) in Governmental and private populations, showed that a number of 406 animals were suffering from foot disease problems (128 cattle, 35 buffaloes, 163 sheep and 75 goats) . A total of 198 cases of claw diseases exhibiting different lesions in different animals were microbiologically examined. The incidence of aerobic and facultative anaerobic bacteria isolated from different claw diseases were mainly E.coli (21.71%) , *Ps. aeruginosa* (25.75%), Pr. mirabilis (24.74%), *A. Pyogenes* (65.15%), B. anthracoides (46.46%), *S. aureus* (42.92%), *S. epidermidis* (21.71%), *S. saprophyticus* (21.71%) and *Strep. faecalis* (18.68%). Although, the incidence of obligatory anaerobic bacteria isolated were mainly *F. necrophorum* (65.65%) , *Bact. melaninogenicus* (50%), Bact. nodosus (9.59%), Anaerobic streptococci (37.87%) adn *C. perfringens* type A (46.96%). The isolated fungi were mainly Mucor spp. (40.4%), *Candida spp.* (16.16%) , *Penicillium spp.* (6.06%) , Rhizopus spp. (6.56%) and *Aspergillus spp.* (9.09%) . The applied preventive measures, together with specific antibiotic therapy after antibiotic sensitivity test had successfuly solved these foot problems.

INTRODUCTION

Soundness of the claw is necessary to reach the optimal performance in farm animals, regarding milk and meat production as well as fertility. Neglected claw hygiene can be considered as a performance reducing factor on the productivity of animals (Amstutz, 1965). Long standing neglected cases of claw deformities frequently develop secondary complications at the other digital structures such as phalangeal bones, interphalangeal joints and supportive apparatus (Prentice and Neal , 1972) . Clinical lameness is reported to be caused by digital lesions in cattle and sheep were due to different isolated microorganisms such as *F. necrophorum, Bact. melaninogenicus, A. pyogenes* and *E.coli* Egerton (1969, Prentice & Neal 1972, *Russel et al.*, 1978 and Eddy & Scott 1980) . The panaritium (foot rot) disease in cattle and sheep is believed to be

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caused by transdermal invasion of the interdigital subcutaneous tissue by *Bact. melaninogenicus, F.necrophorum, Bact. nodosus* and *A.pygoenes* (Peterson & Nelson 1984, Clark et al., 1985, Cygan et al., 1986 , Greenough 1987 and Nattermann et al., 1991). *Actinomyces pyogenes* is the most common organism isolated from pododermatitis. It enhances the local invasion of the feet with *F. necrophorum* (Roberts and Egerton, 1969) . In Egypt, Soliman et al. (1984), Mahmoud et al. (1987) , Kandeel (1991) and Aid (1993) found different varieties of microorganisms such as *F. necrophorum , Bact. melaninogenicus, Bact. nodosus, A.pyogenes, S.aureus, E.coli* and *Ps. aeruginosa*, in addition to some isolated fungi, which responsible for the most prevalent foot problems among farm animals. In vitro, the antibiotic sensitivity tests against different isolated microorganisms were studied by Samy et al. (1984) and Piriz et al. (1991). The present study is done to throw light on the etiology, incidence, isolation and identification of the most common microbial pathogens responsible for claw diseases (affections) among some farm animals (cattle , buffaloes, sheep and goats) .

MATERIAL AND METHODS

A total number of 850 large ruminants (cattle and buffaloes) and 700 small ruminants (sheep and goats) of both sexes and different ages were examined for different varities of foot diseases (affections). Those animals were collected from different Governmental and private farms in Sharkia province and those cases admitted to the Clinic, Faculty of Vet. Med., Zagazig University.

A total number of 198 smaples were collected as follows; 84 samples from cattle and buffaloe suffered from interdigital necrobacillosis dermatitis, 30 samples from interdigital necrobacillosis in sheep and goats, 35 samples from pododermatitis circumscripta septica in cattle, 20 samples from hell erosions and under running heel in cattle and buffaloes, 4 samples from tenosynovitis in cattle and buffaloes, 10 samples from the septic distal interphalangeal (D.I.P.) arthritis in cattle and sheep , and 15 samples from the inflammation of interdigital sinus in sheep .

Bacteriological samples were collected from the affected claws by sterile swabs under complete strict aseptic measures. Smears from the necrotic septic materials were directly stained by Gram's methods for primary detection of the possible causative microorganisms (Boundy, 1983). The collected swabs were directly cultured on duplicate plates of serum agar, MacConkey agar blood agar and brain heart infusion agar (DIFCO laboratories, Detroit, MI) supplemented with 5% bovine blood . A set of the plates was aerobically incubated at 37°C for 24-48 hours. The remaining set of plates was incubated anaerobically at 37°C for 3-4 days (Roberts and Egerton , 1969; Berg & Loan, 1975 and Samy et al., 1984). Identification of the isolated organisms was carried out by the method described after Willis (1977) and Finegold & martin (1982) . Dermonecrotic test in Guinea pigs was used for typing of C. perfringens as described by Bullen (1952). *Clostridium perfrigens* diagnostic antisera for typing were obtaifned from Burroughs Wellcome, Beckenham, London , England. The results of

dermonecrotic reactions and its neurtralization were interpreted according to Stern and Batty, (1977). Tissue samples for fungal examination were taken and mounted on 10% potassium hydroxide in dimethyl sulphoxide. isloation on Sabouraud dextrose agar, brain heart infusin agar and identification were carried out as described by Zaias and Taplin (1966). In bitro, the antibiotic sensitivity disc diffusion technique for the isolated organisms with using Mueller Hinton agar plates were done as described by Bauer et al. (1966).

RESULTS

The results of the present study showed that the incidence of claw disease in different species was 26.19% from the total examined diseased animals (406) . Sheep showed a higher incidence (42%) followed by cattle (25.6%) , goats (25%) and buffaloes (10%) . the incidence of claw diseases in different animals were recorded in table (1). The results of microbiological examination and incidence of aerobic and anaerobic bacteria isolated from differnt claw diseases are illustrated in (Tables 2, 3) . On the other hand , the incidence of isolated fungi from different claw diseases are recorded in (table 4). Microbiological examination revealed that the prevalent bacterial isolates which were isolated from cases affected with interdigital necrobacillosis dermatitis in cattle and buffaloes (Fig.1 & 2) and interdigital necrobacillosis in sheep (Fig. 3), were: aerobic bacteria such as *E.coli*, *Ps.* aeruginosa, *Pr.mirabilis*, *A. pyogenes*, *B.anthracoides*, *S.aureus*, *S.epidermidis*, *S. samprophyticus*, *Str. faecalis*, and anaerobes such as *F.necrophorum*, *Bact. melaninogenicus*, *Anaerobic Streptococci*, and *C. perfringens* type A as illustrated in (Tables 2 &3) . *Mucor spp.* and Candida spp. was the fungal isolates as in (Table 4). The most isolated microorganisms were *F. necrophorum*, *Bact. melaninogenicus* and *Bact. nodosus*. The microbiological examination of pododermatitis circumscripita septica cases (Fig. 4) revealed that , the most bacterial in descending frequences, were *F.necrophorum*, *Bact. maelaninogenicus*, anaerobic *Streptococci.*, *C. perfringens type* A, A. *pyogenes* and *Staph aureus*, while , *Mucor spp.* and *Candida spp.* were only the two fungal isolates (Table 4). The bacteriological isolates from hell erosions in cattle and buffaloes (Fig.5, 6) and sole under - running and ulceration were similar to cases of pododermatitis circumscripita septica , while the fungal isolates were *Aspergillus spp.*, *Rhizopus and Penicillium spp.* (Table 4) . In cases of , septic tenosynovitis (Fig. 7) , the results revealed that the isolated becteria were mainly *A.pyogenes*, *Ps. aeruginosa*, *S. aureus*, *Str. faecalis and E.coli* (Tables 2,3) . The results obtaifned in case of D.I.P. joint arthritis (Fig. 8) were the same as the previously isolated from cases of interdigital necrobacillosis with predominance of *A.pyogenes*. The inflammation of the interdigital sinus (biflex canal) was common in sheep and microbial examination revealed that the isolated microorganisms were *A.pyogenes*, *Ps. aeruginosa* and *Pr. mirabilis*. In vitro, the results of antibiotics sensitivity test on the isolated bacteria are listed in (Table 5) . According to the culture sensitivity test, *A.pyogenes* was highly sensitive to gentamicin, chloramphenical and erythromycin. E.coli was

Fig. 1: Interdigital necrobacillosis in a cow. note the dark necrotic interdigital skin and swelling above the cornet.

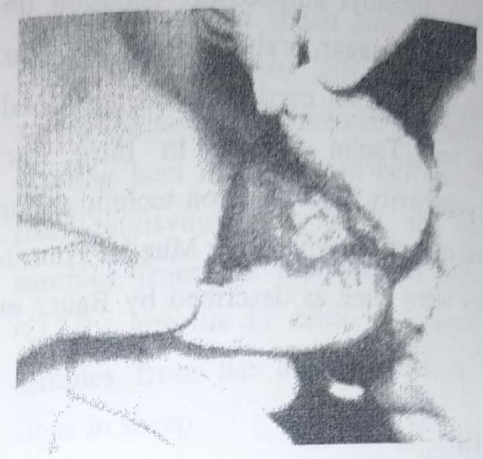

Fig. 2: Interdigital dermatitis in its early stage in a buffaloe.

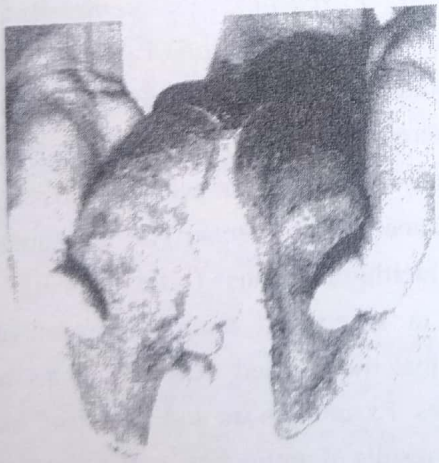

Fig. 3: Interdigital necrobacillosis of the left hind limb of an ewe (Benign foot rot).

Fig. 4: Pododermatitis circumscripita septica (sole ucler) of cow.

Fig. 5: Mild case of heel erosions in beef bull, note small pits in the heel (Arrows).

Fig. 6: Extensive heel erosions with interdigital dermatitis (Arrow) in beef bull.

Fig. 7:Tenosynovitis of flexor tendons at the palmer aspect of the pastern region of a buffaloe (Arrow).

Fig. 8: Advanced case of distal pedal arthritis.

Table 1: Incidence of the different claw diseases among the total number of examined animals.

Species	No. of examined animals	No. of claw diseased snimals	% of claw diseased animals
Cattle	500	128	25.6
Buffaloes	350	35	10
Sheep	400	168	42
Goats	300	75	52
Total	1550	406	26.19

Tabl (2) : Incidence of arobic and facultative anaerobic bacteria isolated form diferent claw diseases:

Claw diseases	Gram negaive baceria						Gram positive baceria											
	E.coli		Ps. aeruginosa		Pr. mirabilis		A.pyogens		B. antracoides		S. aureus		S. epidermidis		S. sapropyticus		Str. faecalis	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Interdigital necrobacilosis drmatitis in cattle and buffaloes (84 samples)	14	16.66	12	14.28	16	19.04	54	64.28	45	53.57	40	47.61	19	22.61	17	20.23	12	14.28
Interdigital necrobacilosis in sheep and goat (30 samples)	14	46.66	16	53.33	14	46.66	20	66.66	13	43.33	10	33.33	12	40	10	33.33	10	33.33
Pododrmatits circumscripta setpica in cattle (35 samples)	11	31.42	4	11.42	12	34.28	21	60	20	57.14	15	42.85	7	20	9	25.71	8	22.85
Heel drosions and under running in cattle and buffaloes (20 samples)	3	15	5	25	4	20	12	60	14	70	12	60	5	25	7	35	5	25
Tenosynovitis in cattle and buffaloes (4 samples)	1	25	3	75	1	25	3	75	-	-	2	50	-	-	-	-	2	50
D.I.P. artritis in cattle and sheep (10 samples)	-	-	3	30	1	10	8	80	-	-	6	60	-	-	-	-	-	-
Inflammation of interdigital sinus in sheep (15 samples)	-	-	8	53.33	1	6.66	11	73.33	-	-	-	-	-	-	-	-	-	-
Total samples = (198	43	21.71	51	25.75	49	24.74	129	65.15	92	46.46	85	42.92	43	21.71	43	21.71	37	18.68

D.I.P. = distal interphalangeal
B. anthracoides = Bacillus anthracoides.
A.Pyogenes = Actinomyces pyogenes
Ps. aeruginosa= Pseudomonas aeruginosa.
S. aureus = Staphylococcus aureus.
C. Perfringens = Clostridium perfringens.
Pr. mirabilis = Proteus mirabilis.
Str. faecalis = Streptococcus faecalis.

Table (3) : Incidence of anaerobic bacteria isolated from different claw disease.

Claw diseases	Gram negative anaerobes						Gram positive anaerobes			
	Fusobacterium necrophorum		Bacteroides melaninogenicus		Bacteroides nodosus		Anaerobic streptococci		Clostridium perfringens type A	
	No.	%	No.	%	No.	%	No.	%	No.	%
Interdigital necrobacillosis dermatitis in cattle and buffaloes (84 samples)	63	75	58	69.04	-	-	25	29.76	40	47.61
Interdigital necrobacillosis in sheep and goat (30 samples)	21	70	-	-	19	63.33	12	40	12	40
Pododermatitis circumscripta septica in cattle (35 sampes)	25	71.4	54	68.57	-	-	17	48.57	25	71.42
Heel erosions and under running in cattle and bufaloes (20 samples)	15	2 75	12	60	-	-	13	65	11	55
Tenosynovitis in cattle and buffaloes (4 samples)	-	-	-	-	-	-	1	25	-	-
D.I.P. arthritis in cattle and sheep (10 samples)	6	60	5	50	-	-	7	70	5	50
Inflammation of interdigital sinus in sheep (15 samples)	-	-	-	-	-	-	-	-	-	-
Total samples = 198.	130	65.6	99	50	19	9.59	75	37.87	93	46.96

Table (4) : The incidence of isolated fungi from different claw diseases.

Claw diseases	Mucor spp.		Candida spp.		Penicillium spp.		Rhizopus spp.		Aspergillus spp.	
	No.	%	No.	%	No	%	No.	%	No.	%
Interdigital necrobacillosis dermatitis in cattle and buffaloes (84 samples)	42	50	-	-	-	-	-	-	-	-
Interdigital necrobacillosis in sheep and goat (30 samples)	18	60	14	46.66	-	-	-	-	-	-
Pododermatitis circumscripta septica in cattle (35 sampes)	20	57.14	18	51.42	-	-	-	-	-	-
Heel erosions and under running in cattle and bufaloes (20 samples)	-	-	-	-	12	60	13	65	18	90
Tenosynovitis in cattle and buffaloes (4 samples)	-	-	-	-	-	-	-	-	-	-
D.I.P. arthritis in cattle and sheep (10 samples)	-	-	-	-	-	-	-	-	-	-
Inflammation of interdigital sinus in sheep (15 samples)	-	-	-	-	-	-	-	-	-	-
Total samples = 198.	80	40.40	32	16.16	12	6.06	13	6.56	18	9.09

Table (5) : Degree of sensititvity of most predominant isolated bacteria to different antibiotics.

Antibiotic discs	Aerobic bactria				Anaerobic bacteria		
	Actinomyces pyognes	E.Coli	S.aureus	psudomona saruginosa	Fusobacterium necrophorum	Baceroides nodosus	Bactroides melaninogenicus
Chloramphenicol (30 µg)	+++	+++	+++	+++	+++	+++	+++
Gentamicin (10 µg)	+++	+++	+++	+++	-	-	-
Tetracycline (30 µg)	++	+++	++	-	++	+++	++
Penicilin-G (10 units)	-	-	++	-	+++	+++	+++
Ampicillin (10 µg)	-	++	++	-	-	-	-
Kanamycin (30 µg)	-	++	-	-	-	-	-
Neomycin (30 µg)	++	+++	+++	-	-	-	-
Streptomycin (10 µg)	-	++	-	++	++	-	++
Erythromycin (15 µg)	+++	++	+++	-	-	++	-
Cephaloridin (30 µg)	++	+	+++	-	-	-	-

highly sensitive to tetracycline, gentamicin, chloramphenicol and neomycin . *S. aureus* was highly sensivtive to gentamicin, erythromycin, chloramphenicol, neomycin and cephaloridine. *Ps. aeruginosa* was highly sensitive to gentamicin and chloramphenicol. *F. necrophorum* was highly sensitive to chloramphenicol and penicillin. *Bact. nodosus* was highly sensitive to chloramphenicol, penicillin and tetracycline. *Bact. melaninogenicus* was highly sensitive to chloramphenicol and penicillin.

DISCUSSION

Foot diseases in farm animals especially cattle cause great economic loss to both dairy and meat industries. Claw diseases constituted the main cause of lameness among livestock in Egypt, ranging between 5.5% (Kandeel, 1991) and 31.18% (Aid, 1993) . In the present study , a nearly similar incidence of claw diseases were obtained (26.19%).

Fusobacterium necrophorum and *B. melaninogenicus* was the prevalent isolated bacteria. Synergy between *F. necrophorum, B. melaninogenicus* and *A.pyogenes* had been denonstrated in the development of ovine foot rot and ovine infective bulbar necrosis (Roberts and Egerton , 1969 and Roberts et al., 1968) and seemingly similar relation might occur in bovine

foot rot. Hite et al. (1948) demonstrated synergy between *F.necrophorum* and *B. melaninogenicus* in the induction of lesions in mice and this was confirmed by Berg (1972) using strians isolated from foot rot in cattle. Also Berg and Loan (1975) induced typical lesions of foot rot in cattle when *(F. necrophorum* and *B. melaninogenicus)* were applied to scarified interdigital skin or inoculated intradermally into the interdigital skin of experimental cattle. This information led to the suggestion that *F.necrophorum* and *B.melaninogenicus,* act synergistically , and are considered as the infective agents causing foot rot in cattle. The obtained results are agree with this suggestion . The high incidence of foot rot (infectious pododermatitis) in the herds cofntaining large numbers of different species of animals (cattle , buffaloes, sheep or goats) , coincided with that reported by Morcos and Zein El-Din (1971) and Boundy (1983) who considered foot rot as the highly disease in Merino sheep which appeared to be particularly susceptible to the disease when exposed to wet contaminated soil bedding . Also , this could be supported by the findings of Egerton et al (1969) who failed to induce experimental specific foot infection through incised interdigital skin of sheep kept on wet conditions free of urine and faecal matters. Concerning the obtained results, there are different varieties of microorganisms either aerobic or anaerobic bacteria, were identified as in Table 2 , 3) . The fungal infections had the least role in the claw diseases (Table 4) as compared with bacterial infections. Egerton et al. (1968) and Roberts and Egerton (1969) found that there were two primary bacterial *(F. necrophorus* and *F. nodosus)* as invadors of the epidermis causing foot rot in sheep. On the other hand , Boundy (1983) and Soliman et al. (1984) stated that the suitable environment of wetness and humidity, favours the invasion of *F. necrophorous* which attacks the soft, iflammed interdigital skin inducing dermatitis. The affected interdigital skin became susceptible to other anaerobes particularly *F. nodosus*. both types cause severe necrosis and disruption of the epidermal matrix, with gradual separation of the hoof. The necrotic changes seen in the deeper epidermal layers and consequent hyperkeratosis of the superficial one indicated the colonization of *F. necrophorous* in the interdigital skin . In addition *F. nodosus* considered one of the main causes of foot rot. Isolation of *A. pyogenes* from most of foot lesions was considered to be the actual causes of those affections, either alone or with other invadors especially in foot rot. This conincides with the results of Arkins (1981) and Rowlands et al . (1983) who found that *A. pyogenes* is considered one of the causes of foot diseases in cases of interdigital necrobacillosis in different animals and it also enhances the local invasion of feet with *F.necrophorous*. In vitro, the application of sensitivity test on some local isolates revealed that *F. necrophorum* was sensitive to chloramphenicol and penicillin and resistant to gentamicin and neomycin, which is in contradiction to Mohamed (1988) who reported that *F. necrophorum* was sensitive to gentamicin. But this result agree with Colllee et al. (1989) who recommended the addition of gentamicin to blood agar for selective isolation of anaerobes. Bacteroides nodosus was sensitive to

chloramphenicol, penicillin, tetracycline, intermediate sensitive to erythromcyin and resistant to other antibioitics. While , *B. melaninogenicus* was sensitive to chloramphenicol, penicillin and resistant to gentamicin and neomycin. These results completely agree with that obtained by Aid (1993) and paritally agreed with Mohamed (1988) who described that the isolated microorganisms from claw affections of cattle and buffaloes including *F. necrophorum* and *B. melaninogenicus* were sensitive to gentamicin and chloramphenicol. The parental administration and localf application of these drugs in diseased cases resulted in a good recovery rate. Similar results were obained by Boundy (1983) and Gradin and Schmitz (1983) . The application of strict hygienic measures were also recommended by the authors.

ACKNOWLEDGMENT

The author is deeply indepted to all staff members of Microbiology Department and to Prof. Dr. A. Kandeel, Surgery Department, Faculty of Vet. Med., Zagazig University for their Kind help and valuable suggestion.

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