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Morphometric Radiographic Findings of the Digital Region in Culling Lame Cows

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ABSTRACT

The aim of the study reported here was to determine the radiographic appearance and morphometry of the digital region in culling lame cows. Present study was carried out on 43 samples of culled lame cows at an abattoir in the vicinity of Tehran. Cases were randomly selected and after recording information for individual cows, affected foot was amputated and carried to Veterinary Teaching Hospital Radiology Department for more routine radiological studies. In every case at least four radiographs were taken of lateral, dorsopalmar/dorsoplantar and two oblique projections. New bone formation, pedal osteitis and gas density were three factors considered for assessing the severity of the disease. Several radiographic landmarks were used to obtain measurements from each of the radiographs. Lameness was assessed by means of a visual locomotion score. For the highest new bone formation length, significant differences were observed between the dorsal and palmar/plantar surface of the proximal part of the P3 bone with other surfaces ($p<0.05$). For the deepest osteitis depth, significant differences were observed between the P3 bone and the other digit bones ($p<0.05$). For the greatest diameter of gas density, significant differences were observed between the P3 bone and the other digit bones ($p<0.05$). In the P3 bone, significant differences were observed between the lateral surface of proximal and distal part with other surfaces for any radiographic determination ($p<0.05$). In conclusion, application of radiography, especially in the cases of chronic and recurrent lameness, can play an effective role in deciding to continue the treatment or cull the animal.

Key words: Lameness, plantar tuberisity, culling, volar process, morphometric, radiology

INTRODUCTION

Lameness in dairy cows is a serious welfare issue. It is a painful condition and causes economic losses (Esslemont and Kossaibati, 1997; Mohamadnia *et al*., 2008) through reduced milk yield (Amory *et al*., 2007) and fertility (Ghasemzadeh-Nava *et al*., 2007; Shams-Esfanabadi and Shirazi, 2006; Yaylak *et al*., 2009; Haghighat-Jahromi and Nahid, 2011) early culling (Booth *et al*., 2004; Nouri, 2007). Effect of lameness on culling is not clear-cut, because several authors have reported little or no increase in culling due to lameness (Booth *et al*., 2004; Cramer *et al.*, 2006; Esslemont and Kossaibati, 1997; Weaver, 1997). Cramer *et al.* (2006) suggested that the presence of any lesion (mainly due to the effect of non-infectious lesions) significantly increased the culling risk of high-producing cows by 20-70%. Cases of bovine lameness are brought to medical attention quite late in the course of the disease process. Due to the nature of the cattle industry, a lame cow or heifer will only be noticed when the clinical condition becomes very obvious to the herdsman (Nouri, 2007; Nouri *et al.*, 2008; Van Meter *et al.*, 2005). Deep sepsis of a digit usually results in asymmetrical swelling of the foot (Nouri, 2007; Nouri *et al.*, 2008; Van Meter *et al.*, 2005) and appreciable widening of the periople part on the affected side (Nouri, 2007; Nouri *et al.*, 2008). At that stage, the process responsible for the lameness is usually quite advanced. Because of this, early and accurate diagnosis is vital in cases of bovine lameness. The chances of restoring the productivity of the animal, its milk yield or weight gain, depend largely on rapid medical or surgical treatment, the course of which relates directly to accurate diagnosis. There is no published report of morphometric radiographic study in the digital region of culling lame cows to the authors' knowledge. The purpose of the study reported here was to determine the radiographic appearance and morphometry of the digital region in culling lame cows.

MATERIALS AND METHODS

Case selection: This cross-sectional and descriptive study was carried out in the winter of the year 2007 at an abattoir in the vicinity of Tehran (Meysam, Robatkarim). According to the data gathered in that place, an average of 35 cows was culled everyday among which around 2 cases were lame. During the three-month period of investigation, 43 culled lame cows of 1135 culled Holstein cows having digit disorders were randomly selected for clinical and morphometric radiographical purpose. The owners were interviewed using a questionnaire to record information about culled lame cow. All cases aged three to eight years; both front legs and hind legs were amputated at the carpus and the tarsus, respectively, immediately after slaughter.

Clinical evaluation: The lower limbs of lame cows were examined after slaughter and tabulated the type and distribution of claw lesions. At the visits, the locomotion scores of all lame cows (n = 43) were recorded. Two observers working together determined the locomotion score. Each animal was observed standing and walking (on a concrete surface whenever possible) using the Sprecher *et al.* (1997) scoring system.

Radiography: The claws and interdigital space cleaned thoroughly with water and a brush before radiography to be able to exactly diagnose the kind of injury in the radiographic images. An X-ray machine was used in this study (Toshiba, model DC-12M) to take radiographic images. In every case at least four radiographs of lateromedial or mediolateral, dorsopalmar/dorsoplantar, dorsolateral-palmaroledial/plantaromedial and dorsomedial-palmarolateral,/plantaromedial were taken using exposure factors of 25 mA, 85-95 kV in 0.04 or 0.02 sec. The mammography cassettes in sizes of 18×24 and 24×30 recorded radiographs.

Morphometric analysis of the radiography: Several radiographic landmarks was used to obtain measurements from each of the radiographs. The P1 and P2 bones were divided into three parts of proximal, middle and distal part and the P3 bone was divided into two parts of the proximal and distal parts and observed from four views and recorded the lesions in each part. New bone formation, osteolysis and gas density were three indices considered for assessing the severity of the disease.

The volar process and plantar tuberisity of the distal phalanx at the caudal and solar border also were evaluated for osteolysis. The lines drawn along the plantar tuberisity were used to determine whether a digit had osteolysis at the plantar tuberisity. If bony material absorbed beyond the line, the digit was classified as having bone osteolysis at the plantar tuberisity. The abaxial wall of the distal phalanx at the caudal and solar border also was evaluated for osteolysis. The lines drawn along the abaxial solar margin were used to determine whether a digit had bone osteolysis at the abaxial solar margin. If bony material absorbed beyond the line, the digit was classified as having bone osteolysis at the abaxial wall. The tip of the distal phalanx at the solar border also was evaluated for bone absorption. The line drawn along the solar surface of P3 bone and another line drawn along the dorsal cortex of the P3 bone were used to determine whether a digit had bone absorption at the tip.

The volar process and plantar tuberisity of the distal phalanx at the caudal and solar border also were evaluated for bone formation. The lines drawn along the volar process and plantar tuberisity were used to determine whether a digit had bone formation at the volar process and plantar tuberisity. If bony material extended beyond the lines, the digit was classified as having bone formation at the tip. The dorsal cortex of the distal phalanx was evaluated to determine the extent of bone formation. A line was drawn between the proximal and distal points on the cortical surface to the junction of the dorsal cortex with the extensor process. The dorsal cortex was classified as having bone formation if an area of mineralization projected dorsal to the line.

The diameter of the largest foci of gas was measured. All radiographic views were used to make accurate morphometric assessments in the study reported here.

Statistical evaluation: Descriptive statistic (standard deviation, average and range) were calculated for each three factors and finally, quantities findings discussed by nested classification and analysis of variance to determine significant differences in the morphometric values between the digit surfaces (Steel and Torrie, 1960).

RESULTS

Case selection: Thirty cases were affected by lesions in different regions of claw capsule (69/7%). Most lesions was mainly due to the effect of non-infectious lesions such as toe ulcer 3 (6/9%), white line disease 5 (11/6%), heel ulcer 6 (13/9%), abaxial groove lesions 7 (16/2%) and sole ulcers 9 (20/9%), respectively. The prevalence rate of claw lesion in the hind limb was higher than fore limb. Lacerations, fracture, penetrating injuries, interdigital lesion such as IDN, ID were other digital lesions in this study.

Clinical findings: All the cases showed signs of disability in weight bearing. Problems with weight bearing, arching of the backbone, lowering of the head and holding abducted of the affected limb were considered as the significant clinical features, in evaluation of locomotion scoring. Locomotion scoring assessment of 43 culled lame cows showed score ranged from grade 4 (20/5%) to 5 (79/5%) on a scale of 1 to 5.

Analysis of the radiographs: Radiographic images taken from the involved digits of the forty three culled lame cows depicted a quite wide range of radiographic signs such as soft tissue swelling, new bone formation, osteolysis and gas density which were observed mostly in the hindlimbs. All signs were relatively the same as forelimbs and the hindlimbs. These signs were distributed in different sizes; they were more significant considering the increased infection and the involvement of other neighboring structures, such as coffin's joint, distal sesamoid bone and even the adjoining digit bones. Most of the lesions were osteoporotic. And lesions were observed in cattle between 3 to 8 year-old. Radiological examinations showed chronic lesions of claw are accompanied by alterations in the structure of phalanxes. In most of cases chronic osteophytes of extensor tendon was seen at insertion on the extensor process as well as calcification of the deep flexor tendon on P3 bone (Fig. 1). Twenty-one out of the total of 43 cases showed periosteal new bone formation on the volar process, extensor process and plantar tuberisity and also these cases had osteolysis on the caudal part of the plantar tuberisity of P3 bone (48.8%). Thirty one out of the total of 43 cases showed periosteal new bone formation on the P2 and P3 bones (72%). Septic arthritis accounted for 8 out of the total of 43 cases found (18.6%). About 75% of arthritis was observed in distal inter-phalangeal joint (Fig. 2).

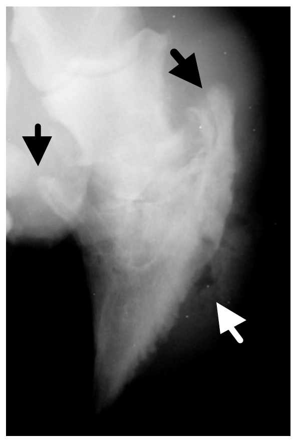

Fig. 1: Dorsomedial-plantolateral oblique view of chronic osteophytes of extensor tendon is seen at insertion on the extensor process (small black arrow) as well as calcification of the deep flexor tendon on P3 (large black arrow). Soft tissue swelling proximal to the coronary band and gas density (white arrow) into the wall are present

Fig. 2: Dorsoplantar view of affected digit showing septic arthritis and osteomyelitis of distal digital joint (White arrow)

Fifteen out of the total of 43 cases showed periosteal new bone formation on the lateral and medial surface and also these cases had osteolysis on the dorsal surface of sesamoid bone (34/8%).

Table 1 summarizes the descriptive statistics for the highest new bone formation length obtained from lateromedial, dorsopalmar/plantar and two oblique projection radiographs of any part of P1, P2, P3 bone and distal sesamoid bone of 43 lame culling cows. Significant differences were not seen between the different surfaces of P1 and P2 bone. Significant

Table 1: The highest new bone formation length (mm) obtained from lateromedial, dorsopalmar/plantar and two oblique projection radiographs of digital bones of 43 lame culling cows

Part	Position	Surface	Ave.	N	SD	Max.	Min.
P1 bone	⅓ Proximal	Lateral	7/21	37	5/75	22	1
		Medial	2/77	22	1/44	5	1
		Dorsal	6/65	32	4/89	20	1
		Ventral	6/28	38	5/23	22	1
	⅓ Middle	Lateral	9/25	43	6/02	24	1
		Medial	4/31	58	2/45	11	1
		Dorsal	5/54	31	3/82	17	1
		Ventral	7/71	49	7/01	35	1
	⅓ Distal	Lateral	7/32	40	5/48	25	1
		Medial	5/61	54	3/32	17	2
		Dorsal	5/45	33	3/96	21	1
		Ventral	6/10	29	4/82	18	1
P2 bone	⅓ Proximal	Lateral	8/04	42	6/08	24	1
		Medial	5	41	3/87	17	1
		Dorsal	5/24	33	4/99	22	1
		Ventral	7/95	42	5/94	22	1
	⅓ Middle	Lateral	8/14	47	5/59	21	1
		Medial	8/27	51	4/6	19	1
		Dorsal	5/6	41	4/44	20	1
		Ventral	6/32	46	5/14	19	1
	⅓ Distal	Lateral	6/72	40	5/12	20	1
		Medial	5/72	37	4/37	24	1
		Dorsal	4/73	34	3/19	15	1
		Ventral	4/5	8	3/29	10	1
P3 bone	½ Proximal	Lateral	5/6	38	4/1	20	1
		Medial	5/1	52	4/2	25	1
		Dorsal	10/4	41	8/6	42	1
		Palmar/Plantar	10/5	40	7/3	30	1
	½ Distal	Lateral	-	4	1/2	4	1
		Medial	-	6	2/1	7	1
		Dorsal	-	5	2/5	7	1
		Palmar/Plantar	-	7	4/5	14	1
Distal sesamoid	Lateral	6/5	20	5/9	21	1	
		Medial	5/8	18	5/9	24	1
		Proximal	8	10	4/8	14	1
		Distal	3/4	5	1/1	5	2
		Palmar/Plantar	2/5	8	0/9	4	1

differences were observed between the dorsal surface and palmar/plantar surface of proximal part of the P3 bone with other surfaces. Significant differences were observed between the lateral surfaces of the distal sesamoid bone with other surfaces for any radiographic determination ($p<0.05$).

Table 2 illustrates the deepest osteitis depth obtained from four projection radiographs of any part of P1, P2, P3 bone and distal sesamoid bone of 43 lame culling cows. Significant differences

Table 2: The deepest osteolysis depth (mm) obtained from lateromedial, dorsopalmar/plantar and two oblique projection radiographs of any part of digital bones of 43 lame culling cows

Part	Position	Surface	Ave.	N	SD	Max.	Min.
P1 bone	⅓ Proximal	Lateral	6	1		6	6
		Medial	7/33	3	4/16	12	4
		Dorsal	12/3	3	5/5	18	7
		Ventral	7	1		7	7
	⅓ Middle	Lateral					
		Medial	2	1		2	2
		Dorsal					
		Ventral					
	⅓ Distal	Lateral	12	1		12	12
		Medial	12	1		12	12
		Dorsal	6/5	2	7/77	12	1
		Ventral	8/5	2	4/94	12	5
P2 bone	⅓ Proximal	Lateral	6	1		6	6
		Medial	6/5	2	7/77	12	1
		Dorsal	12	1		12	12
		Ventral	1/66	3	0/57	2	1
	⅓ Middle	Lateral	7	6	6/29	15	2
		Medial	6/25	8	5/65	15	2
		Dorsal	9/8	5	7/15	15	1
		Ventral	6/16	6	6/88	15	1
	⅓ Distal	Lateral	8/6	10	6/31	17	2
		Medial	8/1	10	5/74	15	2
		Dorsal	8/4	10	5/6	15	2
		Ventral	6/5	6	5/57	15	1
P3 bone	½ Proximal	Lateral	11/05	19	9/1	30	1
		Medial	9/06	15	8/1	25	1
		Dorsal	10/9	11	8/3	32	2
		Palmar/Plantar	12/1	19	7/1	30	1
	½ Distal	Lateral	11/6	13	9/7	30	1
		Medial	11/5	11	10/1	35	1
		Dorsal	5/5	4	5/1	13	2
		Palmar/Plantar	12/1	12	7/6	25	2
Distal Sesamoid		Lateral	10/5	7	6/1	20	4
		Medial	11/8	10	5/4	20	4
		Proximal	10	10	6/8	20	3
		Distal	13/5	9	7/1	20	3
		Palmar/Plantar	16/4	13	8/7	30	3

Table 3: The greatest diameter of gas density obtained from lateromedial, dorsopalmar/plantar and two oblique projection radiographs of digital bones of 43 lame culling cows

Part	Position	Surface	Ave.	N	SD	Max.	Min.
P1 bone	⅓ Proximal	Lateral					
		Medial					
		Dorsal					
		Ventral	2	1		2	2
	⅓ Middle	Lateral	2	2		2	2
		Medial	5	3	2	7	3
		Dorsal					
		Ventral	3/33	3	1/52	5	2
	⅓ Distal	Lateral					
		Medial	6	1		6	6
		Dorsal					
		Ventral	4	2	2/82	6	2
P2 bone	⅓ Proximal	Lateral	8/6	5	3/43	12	3
		Medial					
		Dorsal	7/2	3	4/5	12	3
		Ventral					
	⅓ Middle	Lateral	3/2	5	1/64	5	2
		Medial					
		Dorsal	4/7	3	2/5	7	2
		Ventral	3/5	2	2/12	5	2
	⅓ Distal	Lateral	7	3	5/56	12	1
		Medial	7	1		7	7
		Dorsal	3/7	3	1/52	5	2
		Ventral	6/5	4	4/2	12	2
P3 bone	½ Proximal	Lateral	10/5	4	9/25	23	3
		Medial	3	4	1/41	5	2
		Dorsal	4	3	2/64	7	2
		Palmar/Plantar	8/14	7	8/02	23	2
	½ Distal	Lateral	5/5	2	0/7	6	5
		Medial					
		Dorsal					
		Palmar/Plantar	8/7	3	5/5	15	5
Distal Sesamoid		Lateral	6	1		6	
		Medial					
		Proximal					
		Distal					
		Palmar/Plantar					

were observed between the P3 bone and the other digit bones ($p<0.05$). Significant differences were not observed between different surfaces of the P3 bone and distal sesamoid bone.

Table 3 illustrates the greatest diameter of gas density obtained from four projection radiographs of any part of P3 and distal sesamoid bone of 43 lame culling cows (Fig. 3). Significant differences were observed between the P3 bone and the other digit bones ($p<0.05$). In the P3 bone, significant differences were observed between the lateral surface of proximal and distal parts with other surfaces for any radiographic determination ($p<0.05$).

Fig. 3: Lateral view of affected digit showing a single focal round zone of radiolucency in the plantar surface indicates an abscess pocket containing air (white arrow). Marked soft tissue swelling around the digital region is seen

DISCUSSION

The majority (88-92%) of bovine lameness involves the structures of the digit (Eddy and Scott, 1980; Jubb and Malmo, 1991; Russell *et al*., 1982), if not treated promptly, can progress to create infection of bone, synovial structures, tendons and ligaments of the digit (Anderson and Jean 1996). Effect of lameness on culling is not clear-cut because several authors have reported little or no increase in culling due to lameness (Booth *et al*., 2004; Cramer *et al.,* 2006; Esslemont and Kossaibati, 1997; Weaver, 1997). The decision to cull a cow is complicated, with many factors influencing that decision, notably, age (parity), milk production, fertility and health (Jubb and Malmo, 1991). Improvement in animal welfare, more judicious use of antimicrobials and reduction in treatment costs are additional, potential benefits. Without treatment guidelines, lay personnel may simply attempt therapy with a variety of antimicrobials or topical remedies, often enabling progression of disease through inadequate or inappropriate therapy (Van Meter *et al*., 2005).

In this study radiography has been limited to the digital region of culling lame cows. On radiographic examination, a considerable amount of new bone formation, osteolysis and gas density within the affected digit were observed. The best way of detailed differential diagnosis of these lesions is radiography.

Periosteitis commonly occurs in the extremities such as phalanges and leading to exostosis. In the present study, this condition was seen mostly in the hindlimb. In many reports, as well as in this study, it was found that the calcifications of the deep flexor tendon and osteophyte of the common digital extensor tendon insertion on the third phalanx were the most commonly involved structures (Rusterholz, 1920; Maclean, 1970; Zantinga, 1973; Greenough *et al*., 1981; Bargai and Pharr, 1989; Greenough and Vermunt, 1991; Nuss *et al*., 1996; Moldovan *et al*., 1990; Meimandi-Parizi and Raddanipour, 2005). It has been claimed that exostosis of the deep flexor tendon at its point of insertion, is seen at the point directly dorsal to many cases of ulceration of the sole (Rusterholz, 1920). But in this study, calcifications of the deep flexor tendon on the third phalanx were not related to sole ulcer, specifically. In the present study, bony proliferation at the flexor tuberisity was not evaluated as being important in the pathogenesis of sole lesions. Other studies also have reported that increase in size of the plantar process is a consequence of ageing (Greenough *et al.,* 1981; Bargai and Pharr, 1989). In the lame cows, excessive tension due to abnormal weight bearing and abnormal stance can also influence calcifications of the deep flexor tendon and the common digital extensor tendon on the third phalanx (Nouri, 2007; Nouri *et al.*, 2008). Nuss *et al.* (1996) states that changes in shape of the extensor process, shape of the dorsal surface of P3 were judged as physiologic variations. Zantinga (1973) observed that not all open lesions of the sole are associated with pedal bone change; osteolysis or proliferative changes are secondary to an inflammatory reaction or develop progressively due to either persistence of external lesions or as result of aseptic or septic complications (Moldovan *et al.*, 1990). The findings are in contrast to the findings of Rusterholz (1920) who observed exostosis of the plantar process and at insertion of the flexor tendon in solar ulceration. Maclean (1970) suggested that the presence of this lesion could be used as an aid to diagnose laminitis in barley-fed beef cattle. Therefore, the prevalence of osteopathy in the P3 bone of the culling lame cows is further evidence that laminitis occurred in this group of animal. Greenough and Vermunt (1991) suggested that osteopathy of the apex of the distal phalanx is related to intensive feeding which is consistent with the concept of rumenal acidosis induced laminitis. In this study, post mortem examination revealed that typical changes of chronic laminitis were among the most common pathological features, suggesting that laminitis may have affected virtually all the herd at some previous time.

In one study of 77 cases suffering from lameness in Shiraz dairy farms, the calcified soft tissue was observed only in the cruciate ligaments of the first phalanx but in the present study this lesion commonly occurs in the first and second phalanxes and is higher than that reported by Meimandi-Parizi and Raddanipour (2005).

Pedal osteolysis was second in importance in dairy cows and accounted for 32 out of 43 cases found (74/4%). The most common lesion, osteolysis of plantar tuberisity was found in 22 animals (51/1% of the total). In interpretation of pedal osteolysis, various radiographic changes were found on the toe, plantar tuberisity and abaxial wall of P3 bone; these signs are due to the persistence of the external lesion. When the corium is exposed, infection can invade the deeper structures of the claw and travel proximally to involve the claw structures, resulting in necrosis of the P3 bone. Nuss *et al.* (1996) suggested that the osteolysis and pedal osteitis in the region of the laminae at the dorsal edge of P3 are considered signs of laminitis.

In cases with toe ulcer, two of them showed toe fracture and extensor process entheseophyte (66.6%). Osteolysis of the tip of P3 is common following septic traumatic pododermatitis at the pedal bone tip. Inexperience claw trimmers tend to over trim the horn sole and to grind off the sole wall edge excessively and an infection of the corium at the toe region leads to a direct involvement of the pedal bone rapidly due to the very thin layer of curium and digital cushion in this area (Kofler, 1999). But in this study not all cases with osteolysis of the tip of P3 showed over trim the horn sole. It has been claimed that clinical signs of apical pedal bone necrosis varied widely depending on the severity of the lesions (Kofler, 1999) but the location of exposed lesion on the digital region is more important than severity of lesion. Since contact with ground surface can be an excessive painful condition and explain the severe stilted movements often seen in these animals.

In cases with white line disease, most of them showed solar margin bone absorption, flexor tuberisity entheseophyte, extensor process entheseophyte. One of them showed bone sequestration of P3 bone. Hashemi *et al.* (2005) studied the radiographic appearance of 20 cow digits, with signs of white line disease. The most prominent radiographic abnormalities of the claw artery included perivascular sclerosis (100%) and vascular dilations (90%). Other important findings included extensor process entheseophyte (80%), solar margin irregularities (65%), flexor tuberisity entheseophyte (40%), solar surface bone proliferation (40%), dorsal wall bone proliferation and solar margin bone absorption (45%). In this study, it was also shown that no significant difference was found between the bone changes and duration of lameness. Therefore, the low percentage of solar margin bone absorption is not surprising because all radiographic abnormalities were signs of chronic laminitis. Another possible explanation is that this group of cows which was showed the low percentage of solar margin bone absorption, was monitored early in pathogenesis of white line disease.

In cases with heel ulcer, most of them showed extensor process entheseophyte and osteolysis of the plantar tuberisity on the P3 bone.

In cases with abaxial groove lesions, most of them showed osteolysis of the abaxial wall margin. Flexor tuberisity entheseophyte and extensor process entheseophyte were seen. Two of them showed septic arthritis.

Gas density, however, was rare in this study but accounted for 4 out of 43 cases in both P1 and P2 regions (9/3%) and 9 for P2 region (20/9%). The multiple foci of gas of variable size and shape indicate presence of an abscess in the swollen soft tissue (Bargai and Pharr, 1989). The low percentage of gas density is not surprising because the occurrence of abscess is common in acute case and not chronic case such as most culling lame cows in this study.

On the basis of these radiographic findings some joint disorders such as osteoarthritis were diagnosed. In this study about 13/9% of DJD was observe to occur in the distal interphalangeal joint. While in Shiraz, the percentage of DJD lesions was lower than that reported in the present study (Meimandi-Parizi and Shakeri, 2007). DJD is a sequel of both traumatic injuries and septic arthritis (Bargai and Pharr, 1989; Farrow, 1985). Any septic process in these soft tissue structures may extend into the joint capsule and cause septic arthritis of the joint. Specific physiologic changes that occur intra-articularly as a result of an infection and the reaction of joints to a given infection can vary markedly. There is an increase in the absorptive capacity of the synovial membrane during acute inflammation and a decrease during chronic inflammation. This is of particular importance to antimicrobial penetration. Cartilage destruction may be the result of direct attack by a collagenase and enzymatic attack on cartilage matrix (Orsini, 1984).

Twenty nine out of 43 cases showed the involvement of two digits (67/4%). To evaluate the prognosis, a complete physical claws and limbs is needed. Involvement of one claw and the presence of other orthopaedic disorders or internal disease often a poor prognosis, as does the involvement of two or more claws. In such cases treatment cannot be recommended for economical reasons. We agree with Kofler (1999) that the prognosis is good when only one claw is affected.

In complicated cases, infection travel up the digital region and even reached to the metacarp (tars) bone. Furthermore, traumatize characteristics in these cases increased potentially culminated in penetration of infectious agents from the skin surface into the deep tissues of the digit, horizontally which stimulated the accelerated new bone formation in that region.

CONCLUSION

When infection develops in bone from an external source, it is enhanced by coexisting damage to parosteal tissue, periosteum, bone and bone marrow. Necrotic tissue, such as muscle and fat, in conjunction with clotted blood provides an ideal culture media for bacterial growth. If thrombosis has occurred, the immune defense mechanisms, as well as antimicrobial agents, will be prevented from making contact with the colonized bacteria (Orsini, 1984). In this case and with regards to the farm condition, although herdsman seemingly treats the affected claw and the lameness is decreased but lesions have returned after some while. In cases of deep sepsis of the digit, antimicrobial therapy alone does not usually elicit a cure. Application of radiography, especially in the cases of chronic and recurrent lameness, can play an effective role in deciding to continue the treatment or cull the animal.

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