

Subclinical Laminitis in Dairy Cattle: 205 Selected Cases*

Ali BELGE Bahtiyar BAKIR

Department of Surgery, Faculty of Veterinary Medicine, Yüzüncü Yıl University, 65080, Van - TURKEY

Ramazan GÖNENCİ

Department of Surgery, Faculty of Veterinary Medicine, Mustafa Kemal University, Hatay - TURKEY

Sedat ORMANCI

Department of Surgery, Faculty of Veterinary Medicine, Yüzüncü Yıl University, 65080, Van - TURKEY

Received: 19.06.2002

Abstract: The economic importance of lameness in dairy cattle has newly been recognized in Turkey. Lameness incidence in Turkey has been reported to be between 13% and 58%, which is similar to that of other countries where 4% and 55% incidence rates have been reported. The objective of this study was to determine the prevalence of sole lesions associated with subclinical laminitis in the hooves of dairy cattle in Van, Turkey. The risk factors for subclinical laminitis are proposed and discussed. The soles 205 selected dairy cattle were examined. The lesions were determined as solar hemorrhage (61.4%), yellow waxy discoloration (58.5%), heel erosion (23.9%) and white line separation (19%). The sole lesions in cattle were widespread both before and after calving; causative factors must always have been operative. In conclusion, it is thought that husbandry and management are more influential than nutrition in the prevalence of subclinical laminitis in Turkey.

Key Words: Subclinic laminitis, lameness, dairy cattle

Sütçü Sığırlarda Subklinik Laminitis: Seçilmiş 205 Olgu

Özet: Türkiye'de sütçü sığırlarda topallığın önemi yenice anlaşılmaktadır. Türkiye'de % 13 – 58 arasında bildirilen topallık oranları diğer ülkeler için rapor edilen % 4 – 55 rakamlarına yakındır. Bu çalışmada, Van yöresinde subklinik laminitis ile ilişkili taban lezyonları prevalansının belirlenmesi amaçlandı. Subklinik laminitis için risk faktörleri incelendi ve tartışıldı. Toplam 205 sığır taban lezyonları açısından muayene edildi. Lezyonlar taban hemorajisi % 61,4, tabanda sarımtırak renk değişikliği % 58,5, ökçe erozyonu % 23,9 ve beyaz çizgi ayrılması % 19 olarak saptandı. Taban lezyonları buzağılama öncesi ve sonrası yaygın olarak gözlemlendi. Sonuç olarak, subklinik laminitisin gelişiminde beslenmeden daha çok bakım ve barındırma faktörlerinin etkili olduğu kanısına varıldı.

Anahtar Sözcükler: Subklinik laminitis, topallık, sütçü sığır

Introduction

Laminitis is defined as a diffuse aseptic inflammation of the lamina in the hooves of cattle, horses and sheep. Subclinical laminitis is the most common form of laminitis in dairy cows (1–6).

Subclinical laminitis is considered the most important cause of hoof lameness since it produces physical changes in the hoof (1,2,7-11). Changes in posture or locomotion are not usually observed. Therefore, diagnosis and determination are difficult. It is possible to assess the prevalence of the disease in a herd by the changes in the

hoof that are best seen at the time of trimming (2,10-12).

Laminitis is a multifactorial event and can be brought on by growth rate, age, parturition, parity, stage of lactation, milk production, feeding and nutrition, behavior, housing, season, hoof trimming practices and reproductive disorders (2,4,11,13-19).

Yellow waxy discoloration of the sole, hemorrhage of the sole, separation of the white line and erosion of the heel have been regarded as symptomatic signs of subclinical laminitis (1,3-5,8). Furthermore, lesions

* This work was funded by the Yüzüncü Yıl University Research Foundation, project number 99 VF 052.

considered by researchers to be associated with subclinical laminitis include an inflamed coronary band, a sunken and rotated distal phalanx (20), abnormal horn formation with reduced hardness and strength (20,21), flaky or chalky white powder on the sole, deformed claws, horizontal grooves in the hoof horn (15,22), overgrown claws, abscessed soles and double soles (14).

Subclinical laminitis was considered a major predisposing factor for the development of ulceration of the sole (pododermatitis circumscripta), separation of the white line (avulsio zona alba), and erosion of the heel (erosio ungulae) (2,7-11).

Despite an extensive literature search, no reports were found regarding the prevalence of subclinical laminitis in dairy cattle in Turkey. Therefore, the objective of the present study was to determine the prevalence of sole lesions associated with subclinical laminitis in the hooves of dairy cattle in Turkey. The risk factors for subclinical laminitis are also proposed and discussed.

Materials and methods

Two hundred five dairy cows were examined. Most of the animals examined were between close to calving and within 3 months after calving. No attempt was made to investigate stables according to perceived problems with laminitis. The herdsmen were interviewed to obtain information about nutrition, housing and trimming intervals of the herd.

Each cow was examined while it was restrained in lateral recumbency or in a standing position. The lateral and medial claws of the fore and hind limbs of each animal were examined after thorough cleaning. In order to observe the anatomy of the sole, a hoof trimmer grinder was used to remove a thin layer (approximately 1 to 3 mm) of the weight-bearing surface of each sole and the solar surface of the bulb of the heel.

In this study, yellow discoloration and hemorrhage of the sole, separation of the white line and erosion of the heel were considered lesions associated with subclinical laminitis. Yellow discoloration of the sole was recorded as ranging from slight yellow discoloration to severe yellow waxy discoloration. Likewise, hemorrhage of the sole was recorded as varying from slight red discoloration to severe hemorrhage with ulceration of the sole. Separation of the white line was determined when there

was disintegration along the white line of sufficient magnitude to cause fissures that were impacted with the material. Erosion of the heel was recorded where there was loss of integrity of the normally smooth bulbar horn, resulting in the formation of shallow oblique grooves. In its severe form, erosion of the heel resulted in a complete loss of the normal structure of the heel with the final formation of deep, oblique V-shaped grooves. Multiple, irregular, pitted depressions of the surface of the bulbar horn were considered lesions that would precede more severe erosion of the heel (11,15).

Prevalence and each of the 4 categories of lesions associated with subclinical laminitis were determined using 205 selected cattle.

Results

Among the cattle, hemorrhage of the sole was the most frequently observed lesion. Hemorrhage of the sole was observed in at least 1 cow in all herds. Yellow discoloration of the sole was observed almost as frequently as hemorrhage of the sole, but separation of the white line and erosion of the heel were recorded less frequently than hemorrhage of the sole and yellow discoloration of the sole in cattle.

Hemorrhage of the sole was the most frequently observed lesion. It was observed in 126 out of 205 cattle (61.4%) (Figures 1,2). Yellow discoloration of the sole was observed in 120 out of 205 cattle (58.5%) (Figure 3). Erosion of the heel was observed in 49 out of 205 cattle (23.9%) (Figure 4). Separation of the white line was observed in 40 out of 205 cattle (19%) (Figure 5).

In all herds, dairy cattle were housed in stalls and maintained in confinement on concrete floors, and in general shallow litter bedding material was used. Cows were often observed to stand for long periods, and were sometimes found lying down on the concrete floors of the stalls. During the summer, the cows were confined to grass. During the winter, when weather permitted, the cows were allowed to use an exercise area around the barn.

In general, a total mixed ration was given to cows. All dairy cows were fed with concentrated food (range 20% to 50% of diet) and forage (range 50% to 80% of diet). Total ration crude protein content ranged between 12% and 17% and total ration energy content ranged between

4 NEL and 6 NEL (2000-2500 Mj/DM). The milk production of the cattle averaged 5000 kg annually.

Discussion

The economic importance of lameness in dairy cattle has been newly recognized in Turkey. Lameness incidence in Turkey has been reported between 13% and 58% (23-28), which is similar to that of other countries, where 4% and 55% incidence rates have been reported (29).

Subclinical laminitis is thought to be a major predisposing cause of lesions such as sole ulcers and white zone lesions, which can cause lameness (2,7-11). Therefore, the possible predisposing factors and the prevalence of subclinical laminitis in Van, Turkey were examined.

Four categories of lesions were found to be associated with subclinical laminitis. The most important findings in the present study were hemorrhage and yellow discoloration of the sole. The prevalence of hemorrhage of the sole was 61.4%, and the prevalence of yellow discoloration of the sole was 58.5%. The other findings

recorded were 23.9% for erosion of the heel and 19% for separation of the white line.

Smilie et al. (11) reported 62.1% for hemorrhage of the sole, 27.1% for erosion of the heel and 15.8% for separation of the white line. In another study (10), 26.7% sole hemorrhages, 36.2% yellow waxy discoloration, 9.3% separation of the white line and 13.3% erosion of the heel were reported. Bargai and Levin (16) observed 28.6% solar hemorrhages, 26.7% white line separation and 14.5% sandy soles.

The findings reported in the present study are in agreement with the above descriptions of prevalence of solar hemorrhages, yellow discolored soles, white line separation and heel erosion (10,11,15,16).

The most common cause of laminitis is known to be a high-energy ration. Feeding high-energy rations to dairy cows is essential to maintain high production. However, the practice of giving large amounts of concentrated food in the absence of roughage could cause a reduction in rumen pH, which is thought to predispose animals to laminitis (15,21).



Figure 1. Solar hemorrhage (large black arrow) in zone 4 on the medial claw and chalky or flaky powder sole (small black arrow) in both digits.



Figure 2. Note the hemorrhage of the sole along the white line in zone 2 on the medial and lateral claws of the hind limb.



Figure 3. Yellow discoloration and hemorrhage of the sole can be seen in zones 1,2,4, and 5 on the medial claw.

In the present study, indirect measurements of effective fiber indicated that diets (concentrated food 20%–50% and forage 50%–80%) fed to cattle should

be adequate. Total ration crude protein content was between 12% and 17%. Milk production of cows was low (average 5000 kg per annum), and concentrated



Figure 4. There are deep and irregular heel erosions in zone 6 on both digits.



Figure 5. Diffuse white line separation can be seen in both digits.

food consumption by dairy cows exceeded their metabolic needs, especially for milk production. Therefore, lesions associated with subclinical laminitis appeared in the hooves several weeks both before and after parturition.

Therefore, it was thought that no significant relationship between the prevalence of subclinical laminitis and nutrition according to the chemical composition of the ration and milk production of cows was possible.

Yellow discoloration and hemorrhage of the sole may be the results of serum leaking from damaged blood vessels due to mechanical trauma in the weight-bearing surfaces that correspond to areas of the dermis (1,3,7,8,10,16,21).

The major predisposing factors in the etiology of white zone lesions and erosion of the heel are excessive walking and standing on hard surfaces, and wet and dirty foot conditions, which soften the horn (10,11,16).

Environmental management factors, such as bedding material, surfaces of floors in yards, and the use of footbaths were also considered. Dairy cattle used in this study were housed indoors and maintained on concrete floors. As bedding material a small amount of litter was usually used. Especially during winter, animals stayed indoors. When the weather permitted, the cows were allowed to walk around the barns. The incidence of solar hemorrhages and yellow discolored soles were high and were apparently caused by trauma to the sole caused by flooring. In addition, the survey showed that traumatic

subclinical laminitis was quite prevalent in dairy cattle and we found that the major contributor to solar trauma was irregular, rough and pointed concrete floors. Dairy cattle were kept under intensive and unhygienic conditions in indoor stables. In addition, hoof trimming was not seriously performed.

In this study, the herdsmen were volunteers and were randomly selected. Management, housing and feeding practices were representative for dairy cows in Turkey.

The present results indicate that, because the sole lesions in cattle were widespread both before and after calving, causative factors must have always been operative. In addition, both nutrition and management may play a role in the occurrence of sole lesions in dairy cows.

In conclusion, subclinical laminitis developed at high levels in dairy cattle and there is thought to be a complex interaction between husbandry and management, rather than being based on nutrition.

References

1. Nilsson, S.A.: Clinical, morphological and experimental studies of laminitis in cattle. *Acta Vet. Scand.* (suppl), 1963; 4: 124-139.
2. Greenough, P.R.: The subclinical laminitis syndrome. *Bov. Pract.*, 1985; 20: 144-149.
3. Boosman, R., Nemeth, F., Gruys, E.: Bovine laminitis: clinical aspects, pathology and pathogenesis with reference to acute equine laminitis. *Vet. Quart.*, 1991; 13: 163-171.
4. Bargai, U., Shamir, I., Lublin, A., Bogin, E.: Winter outbreaks of laminitis in dairy calves: aetiology and laboratory and pathological findings. *Vet. Rec.*, 1992; 131: 411-414.
5. Lischer, C., Ossent, P.: Laminitis in cattle: a literature review. *Tierarztl. Prax.*, 1994; 22: 424-432.
6. Midla, L.T., Hoblet, K.H., Weiss, W.P., Moeschberger, M.L.: Supplemental dietary biotin for prevention of lesions associated with aseptic subclinical laminitis (pododermatitis aseptica diffusa) in primiparous cows. *Am. J. Vet. Res.*, 1998; 59: 733-738.
7. Bradley, H.K., Shannon, D., Neilson, D.R.: Subclinical laminitis in dairy heifers. *Vet. Rec.*, 1989; 125: 177-179.
8. Vermunt, J.J.: Subclinical laminitis in dairy cattle. *New Zeal. Vet. J.* 1992; 40: 133-138.
9. Logue, D.: Lameness, lesions of the claw of the dairy cow and subclinical laminitis. *Br. Vet. J.*, 1995; 151: 343-346.
10. Smilie, R.H., Hoblet, K.H., Eastridge, M.L., Weiss, W.P., Schnitkey, G.L., Moeschberger, M.L.: Subclinical laminitis in dairy cows: use of severity of hoof lesions to rank and evaluate herds. *Vet. Rec.*, 1999; 144: 17-21.
11. Smilie, R.H., Hoblet, K.H., Weiss, W.P., Eastridge, M.L., Rings, D.M., Schnitkey, G.L.: Prevalence of lesions associated with subclinical laminitis in first lactation cows from herds with high milk production. *J. Am. Vet. Med. Assoc.*, 1996; 208: 1445-1451.
12. Frankena, K., Vankeulen, K.A.S., Noordhuizen, J.P., Noordhuizenstassen, E.N., Gundelach, J., De Jong, D.J., Saedt, I.: A cross-sectional study into prevalence and risk indicators of digital haemorrhages in female dairy calves. *Prev. Vet. Med.*, 1992; 14: 1-12.
13. Peterse, D.J.: Nutrition as a possible factor in the pathogenesis of ulcers of the sole in cattle. *Tijdschr. Diergeneesk.*, 1979; 104: 966-970.
14. Peterse, D.J.: Laminitis and interdigital dermatitis and heel horn erosion. *Vet. Clinics of North Am.: Food Anim. Pract.*, 1985; 1: 83-90.
15. Greenough, P.R., Vermunt, J.J.: Evaluation of subclinical laminitis in a dairy herd and observations on associated nutritional and management factors. *Vet. Rec.*, 1991; 128: 11-17.
16. Bargai, U., Levin, D.: Subclinical laminitis in dairy cattle in Israel. *Isr. J. Vet. Med.*, 1993; 48: 168-172.
17. Vermunt, J.J., Greenough, P.R.: Lesions associated with subclinical laminitis of the claws of dairy calves in two management systems. *Br. Vet. J.*, 1995; 151: 391-399.
18. Nocek, J.E.: Bovine acidosis: implications on laminitis. *J. Dairy Sci.*, 1997; 80: 1005-1028.

19. Svensson, C., Bergsten, C.: Laminitis in young dairy calves fed a high starch diet and with a history of bovine viral diarrhoea virus infection. *Vet. Rec.*, 1997; 140: 574-577.
20. Livesey, C.T., Fleming, F.L.: Nutritional influences on laminitis sole ulcer, and bruised sole in Friesian cows. *Vet. Rec.*, 1984; 114: 510-512.
21. Brandejsky, F., Stanek, C., Schuh, M.: The pathogenesis of subclinical laminitis in dairy cattle: studies of the hoof status, rumen status and blood coagulation factors. *Deuts. Tierarzt. Wochens.*, 1994; 101: 68-71.
22. Enevoldsen, C., Grohn, Y.T.: Sole ulcers in dairy cattle: association with season, cow characteristics, disease and production. *J. Dairy Sci.*, 1991; 74: 1284-1298.
23. Alkan, İ., Boynukara, B., Gençcelep, M.: Van ve yöresinde siğir ayak hastalıklarının yayılışı, nedenleri ve sağaltımı üzerine bir araştırma. *Yüzüncü Yıl Üniv. Vet. Fak. Derg.* 1993; 4: 87-95.
24. Yücel, R.: İstanbul ve Tekirdağ bölgesindeki siğirlerde görülen ayak hastalıklarının toplu bir değerlendirmesi. *İstanbul Üniv. Vet. Fak. Derg.* 1982; 8: 47-61.
25. Anteplioğlu, H., Samsar, E., Akın, F., Güzel, N.: Siğirlerin Ayak Hastalıkları, *Ankara Üniv. Vet. Fak. Yay. No: 407: 3-11.*
26. Güzel, N., Erden, H.: Aydın yöresi siğircilik işletmelerinde ayak hastalıklarının dağılımı. *Vet. Cer. Derg.*, 2000; 6: 8-11.
27. Yavru, N., Elma, E., Koç, Y., Erer, H., Özkan, K., İzci, C., Kaya, Z.: Konya bölgesi siğir topalıklarına neden olan ayak hastalıkları üzerine radyolojik ve histopatolojik incelemeler., *Selçuk Üniv. Vet. Fak. Derg.*, 1992; 8: 3-8.
28. Görgül, O.S.: Siğirlerde tırnak bakımı ve ayak hastalıkları sebep ve sonuç ilişkileri. *Uludağ Üniv. Vet. Fak. Derg.*, 1998; 7: 37-44.
29. Singh, S.S., Ward, W.R., Murray, R.D.: Aetiology and pathogenesis of sole lesions causing lameness in cattle: a review. *Vet. Bull.*, 1993; 63: 303-315.