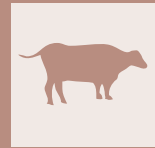


Radical surgical technique for treatment of white line disease in dairy cows



**RICCARDO RINNOVATI[#], ATTILIO L. MORDENTI[#],
MATTIA FUSTINI[#], MICHELANGELO MORSELLI¹, SARA DEL MAGNO[#],
GIULIA FORNI[#], ALESSANDRO SPADARI[#]**

[#] Department of Veterinary Medical Sciences (DIMEVET), Via Tolara di Sopra 50, 40064 Ozzano Emilia (BO), Alma Mater Studiorum, University of Bologna (Italy)

¹ Private Practitioner, 40011 Anzola Emilia (BO), Italy

SUMMARY

Introduction - This clinical research investigates whether rigorous and aggressive surgical debridement of white line disease (WLD) lesions in 236 lame cows, in association with a medicated bandage, would promote clinical healing (as evidenced by coverage of the lesion with new horn) with subsequent improvement in milk production.

Materials and methods - After claw trimming, wall and sole horn were removed and the horn rim trimmed around and inside the lesion using a hoof knife, until abundant bleeding was present. The wound was then rinsed, covered with a topical antibiotic and bandaged.

Results - Out of the initial 236 lame cows, on day two 40 cows were not lame anymore and 196 cows showed a score of 2 out of 5. On day 18, two cows had a grade 4 lameness, with the lesions being smaller but not completely healed. On days 30 and 40, none of the remaining 234 cows developed recurrence of pathology or lameness. At day 60, lesions were completely healed.

Discussion - This aggressive surgical treatment allows milk production not to decrease comparing to the control group and can be easily implemented in practice.

Conclusions - Since bovine claw lesions represent one of the main problems in dairy cattles, this surgical technique could be suggested as a valid option for the treatment of WLD in cows.

KEY WORDS

Bovine claw lesions, sole ulcers, surgical treatment, white line disease, lameness.

INTRODUCTION

Bovine claw lesions represent one of the main problems in dairy cattle. Although lameness has a significant impact on well-being and productivity^{1,2}, the presence of lameness is still high across much of Europe and North America with prevalence of >30%³.

Barker *et al.* in 2010⁴ reported that the prevalence of 'farm level' lameness ranged from 0% to 79.2% (mean 36.8%) demonstrating that some dairy farmers manage lameness more effectively than others do. Whilst the differences could be explained by a wide range of factors, the variation may in part be explained by the different treatment regimens used on farms which would impact on both the promptness and/or effectiveness of the treatment of individual lame animals⁵.

The most common claw lesions observed in cattle are sole ulcers (SU), white line disease (WLD), traumatic injury of the sole caused by excessive wear, thinning of the sole with subsequent ulcer formation, and penetration of the sole by foreign bodies⁶.

Trimming and debridement of claw lesions is the most common approach to therapy, but ideas differ as to how extensive or aggressive this therapy should be. Foot blocks are an im-

portant adjunct to therapy because they prevent continued trauma of injured tissues removing weight bearing on affected claws. Bandages seem to be an obvious part of treatment, but some information suggests that they may actually delay healing in claw lesions. Parenteral therapy is occasionally used, but its value as a routine treatment for claw lesions has not been determined. Topical therapy is commonly applied, but compounds or medications that increase inflammation may be counterproductive. Since lameness is painful, managing the discomfort associated with these conditions is important. Finally, post therapy monitoring and management are often overlooked, but clinical observation and research indicate that these are important considerations in the recovery of animals from lameness⁶.

This study investigates a treatment that consists in a rigorous and aggressive surgical debridement of WLD lesions associated with a medicated bandage, promoting clinical healing as evidenced by coverage of the lesion with new horn, with subsequent improvement in milk production.

MATERIALS AND METHODS

Animals and experimental design

The experiment was conducted between 2009 and 2014, in a Parmigiano-Reggiano dairy farm located in Northern Italy. In this time period, two hundred thirty-six cases (out of 995 cows), affected with acute, purulent and/or necrotic WLD

Corresponding Author:

Riccardo Rinnovati (riccardo.rinnovati2@unibo.it).

Table 1 - Data regarding production of milk (kg) in treated cows and in healthy cows (control group).

Groups	CTR	TRT	SEM	P value
Animals, n.	240	236	–	–
First lactation	8251.5	8523.9	102.7	0.26
Second lactation	8836.7	9252.8	151	0.18
Third lactation	9108.1	9037.3	162	0.83
SEM = Standard Error of the Mean.				

were subjected to treatment (treated group, TRT). Locomotion was scored⁷ when cows were led to the trimming table, WLD were diagnosed by clinical examination after claw trimming. All production data and features of the TRT group were collected and registered and then compared with other two hundred forty healthy cows (control group, CTR), balanced for parity, lactation number, coming from the same farm and in the same time period (Table 1).

Surgical technique

After claw trimming, a regional nerve block of the digital common dorsal nerve and II, III, IV, digital common plantar nerves was done with 2-3 ml of 2% procaine chlorhydrate (Procamidol 20 mg/ml. Richter Pharma AG, Feldgasse 19, 4600 Wels, Austria).

The claw was deterged with a sponge with povidone- iodine 7.5% (LH IODIO 7.5. Lombarda H. S.r.l. Faustina, 20080 Milan, Italy) solution for three to five minutes and after that it was rinsed with saline solution. Wall and sole horn were removed and the horn rim trimmed around and inside the lesion using a hoof knife until abundant bleeding was present. If the lack of horn was excessive, a block was attached to the healthy claw before corrective trimming.

The wound was then rinsed with saline solution and a topical application of antibiotic powder was done (sulfanilamide 10g, chlortetracycline 2g. Named Izoaspersorio. IZO s.r.l. Via San Zeno 99/A 25124 Brescia, Italy). After that, a sterile gauze was applied over the wound that was protected from infection by a bandage consisting of two layers of cotton rolls covered by a jute bandage held in situ with packaging tape (Figure 1). The cow was then brought back into the group and the bandage was lost spontaneously within 15 days.

The locomotion score for each treated animal was repeated two days after surgery; treated cows were then reevaluated at 18, 30, 40 and 60 days.

Statistical analysis

All data regarding milk production of the two experimental groups were subjected to one-way repeated-measures ANOVA statistical analysis, through the use of the “t” Student’s test, with the surgical treatment as main effect. Statistical analysis was performed using SigmaStat® release 2.0 (SPSS Inc. Chicago, USA) with a significance level of $p \leq 0.05$.

RESULTS

White Line Disease was the 26% of cause of lameness in the study population; the median age of treated cows was four years and four months old. Hind limbs were the most affected, with a total of 127 cows (53.8%). Out of the 236 lame

**Figure 1** - Foot with coverage bandage.

cows, 198 had a grade 3 lameness, 35 had a grade 4 and three had a grade 5⁷.

In 42 cows, lesions affected the lateral claws of both hind limbs (17.7%). A significant decrease ($p \leq 0.05$) in lameness from day zero (total of 236 lame cows) was observed on day two with 40 cows found not lame anymore (16.9%) and 196 cows showing a score of 2 (83%). On day 18, only two cows had lameness (grade 4); the lesions were smaller but not completely covered by new horn. The two cows that presented lameness developed a septic arthritis. On days 30 and 40, none of the remaining 234 cows developed recurrence of pathology or lameness due to WLD or other causes. At day 60, lesions were completely healed (Fig. 2).

Data about milk productivity (kg of milk) in the first, second and third lactation comparing a CTR group (240) with the TRT cows (236) are summarized in Table 1. No statistical differences in terms of production between healthy and sick animals were observed.

DISCUSSION

Sole ulcers and WLD are two of the most common claw horn lesions in confined dairy cattle. Predisposing causes include unbalanced weight bearing between claws and metabolic, enzymatic, and hormonal changes that result in a weakened third phalanx (P3) suspensory apparatus and downward displacement of P3 within the claw horn capsule⁸.

The white line is a 3-part structure that serves as junction between the sole and the axial and abaxial wall. Because of its heterogeneous composition, this structure is vulnerable to trauma and separation that permits organic matter to be entrapped within the white line horn tissue⁸.

The suggested treatment of WLD today consists in application of an orthopedic foot block to the healthy claw and corrective trimming of the lesion. A recent paper⁹ proposed in non-healing WLD an extensive debridement of loose horn and infected corium under regional anesthesia with good results comparing to classical treatment. The treatment consists in functional claw trimming, application of a block on the sound partner claw, and with retrograde intravenous anesthesia removing



Figure 2 - The photos show the surgical wound on days 0; 18; 30; 40; and 60.

loose horn and sole and trimming the horn rim around the lesion using a hoof knife. All infected corium was removed with a scalpel blade⁹. Differently, the treatment described in this paper consists in an aggressive and deep surgical debridement of the lesion until causing a copious blood dripping as described for other pathologies of the foot¹²; this allows a thorough cleaning of the lesion and a rapid resolution of the pathology. In fact, 18 days after surgery, only two cows of the 236 treated presented lameness. In these two subjects the lameness was probably caused by a post-operative contamination.

The use of bandages for the treatment of sole ulcers or WLD is controversial unless used for a specific purpose such for the control of hemorrhage, treatment of digital dermatitis or prevention of granulation tissue formation. Two studies de-

scribed any improvement in the rate of healing using bandages except for protection in cases where large areas of the corium have been exposed and for control of hemorrhage^{10,11}. In the present study, both lack of a large amount of tissue and hemorrhage were present; for this reason the use of a bandage results important. Normally, bandages are composed of two layers of cotton and self-adherent bandaging tape (Vetrap 10 cm. Equality srl Strada Privata Darwin 5 - 20090 Cusago, Milan)⁹.

In our opinion, this material is not indicated because soaks of sewage and can be easily lost. Indeed, the use of jute and packaging tape gives the bandage greater resistance and allows it to remain *in situ* for at least 15 days, protecting the wound from any insult.

For what concerns the use of topical antimicrobial drugs, the clinical indication suggests an interference with wound healing and the formation of exuberant granulation tissue. Oxy-tetracycline powder in particular should not be used directly on exposed normal corium because it seems to delay healing¹². In our opinion, topical therapy in association with jute bandage is necessary to counteract contamination that is unavoidable during the post treatment period. No problems in granulation tissue were found in this study group.

The use of regional nerves block was easy to perform, allowing a complete and painless removal of the horn; it provides also excellent conditions for a visual inspection and rigorous surgical debridement of the tissue.

This surgical treatment also helps to reintegrate forthwith the animals in lactating cows group; this reason, in association with the absence or reduction of pain, allows the production of milk not to decrease comparing to the CTR group (Table 1). In particular, considering the short period passed from lameness identification and the surgical treatment, the lack of milk production due to the disease can be spread over the remaining days of lactation of each cow.

CONCLUSIONS

Remaining lameness a great problem in dairy cattle management and production, WLD is considered one of the most common problem in confined cattle. We believe that this aggressive surgical management can be implemented easily in practice and could be suggested as a valid option for the treatment of WLD in dairy cows.

References

1. Whay H.R., Waterman A.E., Webster A.J.F. (1997) Associations between locomotion, claw lesions and nociceptive threshold in dairy heifers during the peri-partum period. *Vet J*, 2: 155-161.
2. Green L.E., Hedges V.J., Schukken Y.H., Blowey R.W., Packington A.J. (2002) The impact of clinical lameness on the milk yield of dairy cows. *J Dairy Sci*, 9: 2250-2256.
3. Amory J.R., Barker Z.E., Wright J.L., Mason S.A., Blowey R.W., Green L.E. (2008) Associations between sole ulcer, white line disease and digital dermatitis and the milk yield of 1824 dairy cows on 30 dairy cow farms in England and Wales from February 2003-November 2004. *Prev Vet Med*, 3-4: 381-391.
4. Barker Z.E., Leach K.A., Whay H.R., Bell N.J., Main D.C.J. (2010) Assessment of lameness prevalence and associated risk factors in dairy herds in England and Wales. *J Dairy Sci*, 3: 932-941.
5. Horseman S.V., Whay H.R., Huxley J.N., Bell N.J., Mason C.S. (2013) A survey of the on-farm treatment of sole ulcer and white line disease in dairy cattle. *Vet J*, 2: 461-467.
6. Shearer J.K., Plummer P., Schleining J.A. (2015) Perspectives on the treatment of claw lesions in cattle. *Vet Med-US: Research and Reports*, 6: 273.
7. Sprecher D.J., Hostetler D.E., Kaneene J.B. (1997) A lameness scoring system that uses posture and gait to predict dairy cattle reproductive performance. *Theriogenology*, 6: 1179-1187.
8. Shearer J.K., van Amstel S.R. (2017) Pathogenesis and Treatment of Sole Ulcers and White Line Disease. *Vet Clin Food Anim*, 2: 283-300.
9. Kofler J., Glonegger- Reichert J. (2015) A simple surgical treatment for bovine digital dermatitis-associated white line lesions and sole ulcers. *Vet J*, 2: 229-231.
10. White M.E., Glickman L.T., Embree I.C., Powers P.M., Pearson E.G. (1981) A randomized trial for evaluation of bandaging sole abscesses in cattle. *J Am Vet Med Assoc*, 4: 375-377.
11. Pyman M.F. (1997) Comparison of bandaging and elevation of the claw for the treatment of foot lameness in dairy cows. *Aust Vet J*, 75.2: 132-135.
12. De Vecchis L. (2002) Field procedures for treatment and management of deep digital sepsis. In: *Proceedings of the 12th International Symposium on Lameness in Ruminants*, Orlando, FL, p. 109-116.