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Session 5 - Treatment and Control of Claw Diseases

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To be asked to present a state-of-the-art lecture on treatment and control of claw diseases is indeed an honour and a challenge. The past decade has seen many advances in the understanding of pathogenic processes leading to diseases of the digit of cattle and the resulting information has suggested new avenues for treatment and control which may be used to supplement our existing methodologies. I believe we have come a long way from the time when our only option in the handling of bovine digital diseases was to treat “Footrot” with systemic antibiotics or by amputation although these two methods still have a place in the armamentarium of the bovine practitioner today. Armed with a better understanding of anatomy and physiology of the hoof, a better appreciation of the role of factors leading to sub clinical laminitis (SC) and the role SC plays in the development of non-infectious claw diseases, we are better able to effectively treat and control (perhaps even prevent?) this very expensive and painful spectrum of diseases leading to lameness and loss of production. Infectious claw diseases are a leading source of lameness in intensive production facilities and the increasing international spread of such problems remains a major concern within the industry and our profession. Intensive efforts are underway to develop effective methods of diagnosis, control and treatment, the last of which is made even more difficult by the ever increasing constraints of national and international institutions to restrict the use of effective treatment regimens in the interest of consumer protection and long-term health considerations for both human and animal populations. To present an overview of current methodologies to treat and control claw diseases within this framework is therefore both a motivating and intimidating task.

The documentation of developments in treatment and control of claw disease is largely found, not surprisingly in the well-documented proceedings of this meeting published bi-annually. In particular the last ten years of proceedings have contained the majority of new and relative information available for those of use interested and involved in claw diseases. The other major source of contemporary information is the proceedings of the world cattle association which meets around the world each year. The “fraternity” of claw trimmers, animal scientists and veterinarians who regularly attend these meetings and frequently publish in other journals tend to present their information first in “our” proceedings. Textbooks continue to serve as reliable sources of basic information, provide a broad based overview and perspective valuable for the first step into the realm of digital diseases but lag behind in transferring the most up to date information in our rapidly developing specialty. The advent of Internet access to digital textbooks which can be updated almost instantaneously on a chapter-by-chapter basis should provide up to date information to practitioners worldwide - I’m looking forward to seeing such a book dedicated to digital diseases in cattle.

I will present my overview with a preliminary look at recent advances in anatomical information, which has provided a solid basis for understanding newer concepts in biomechanics, physiology and pathophysiology. This will be followed by a section on state of the art comments on treatment of infectious and non-infectious diseases of the claw. The final section will review control of claw diseases from the perspective of recent developments in monitoring incidence of claw diseases for the purposes of diagnosis and evaluating treatment methodologies.

Anatomy:

While the anatomy of the bovine digit has not changed (to my knowledge) for a significant period of time, our understanding of the anatomy and functional anatomy has made significant strides within the last few years, which affects our therapeutic opportunities. The group from the Department of Veterinary Anatomy from the Free University of Berlin (Budras, Mülling, Westerfeld) has expanded our understanding of the anatomy of the claw lamina/lamellae, which is so crucial to the health, and functionality of the digit. Not only have they continued to examine the claw but also in combination with interdisciplinary support from other colleagues have integrated their findings with patho-etiological factors to further shed light on the role of disease processes leading to alterations to the integrity of the suspensory apparatus of the claw which for many of us is an additional approach to the evaluation of claw disorders. Observations of gross anatomical relationships and normal histological findings combined with scanning electron microscopy have lead to a better understanding of the three dimensional aspects of the supporting structures within the claw and clearly define the uniqueness of the bovine claw in comparison with the anatomy of the equine hoof. In doing so they have added a new understanding of biomechanics and pathological processes of so called laminitis which has increasingly been considered as a multifactorial disease and is coming under
increasing scrutiny as to its exact role in specific diseases such as claw ulceration.

The group from the University of Zürich (Lischer, Ossent) have combined clinical and pathological experiences to produce a new perspective on the functional aspects of biomechanics of the sole and heel of the claw in our cattle populations. The presence of fatty digital cushions as supportive structures in the heel and sole region as additional weight bearing factors supplementing the reduced carrying capacity of the bovine suspensory apparatus of the claw is an example of this. Biochemical analysis of fat cushion quality relative to age and susceptibility to sole ulceration has provided an insight into factors which might be managed during periods of high risk for development of claw disease and opened a new perspective into areas to further evaluate factors influencing the development of disease in different age groups. The metabolic changes occurring during the beginning of lactation in heifers may be affecting the cushioning capability of the fat within the claw and be reflected in a predisposition to development of sole ulcers. The work of Paulus and Nuss (2002) relating to sole thickness measurements provides further information relative to physical factors to this critical area.

The ability to measure claw physical properties using such techniques as Rahman Spectrometry (Petrie et al, 2002) if further expanded could produce a new insight into physical aspects of claw wall properties and their role in health and disease. The role of genetic factors related to horn quality and predisposition could in the future add another dimension to the ongoing battle with both infectious and non-infectious diseases of the digit.

Ultrasonographic examination in the evaluation of normal and abnormal structures affected in lameness has progressed at a rapid rate. To date most applications in orthopaedics have been applied to proximal regions but distal limb problems in joints and tendons are readily examined for diagnostic and prognostic purposes. The group from Vienna (Köfler, Stanek,) have examined and documented almost every conceivable orthogonal structure available to the application of ultrasound probes both transcutaneously and internally. In many clinical examinations of individual animal (occasionally herd outbreaks) the ultrasound findings further add to diagnostic and prognostic decisions.

The search for a better understanding of disease processes is the attempt to find markers of degenerative and septic processes and indicators of success or failure in the monitoring of treatment regimens. Matrix metalloproteinases (MMP's) are proteolytic enzymes secreted by macrophages, epithelial cells, endothelial cells and fibroblasts within the extra cellular matrix. They are involved in the metabolic turnover of proteoglycans in normal healthy joints as well as in disease processes and are identified and quantitated by the use of enzyme immunoassay techniques performed on synovial fluid aspirates. As such they can be considered to be markers of processes occurring within a specific joint (Sumner-Smith, 2002). Matrix metalloproteinases have been examined relative to their role in degenerative joint diseases by a number of researchers. Arcan et al., in 2002 demonstrated the presence of MMP's in cattle with ongoing septic joint disease. Proteolytic enzyme analysis relative to degenerative, septic and other aetiologies continues to develop as another aid in evaluation of joint disease and lameness evaluation. We can expect further progress in the understanding and treatment of lameness in conjunction with continued research in the area of applied pathobiology in the near future. It thus behoves us to keep abreast of the new information relating to mediators of inflammation and disease and the application thereof in our field.

Treatment of claw diseases

Infectious diseases

The use of topical medications with or without bandages to treat infectious conditions of the limb and digit will probably always be controversial and remain in the realm of personal preference of the claw trimmer or veterinarian involved. Likewise is the controversial topic of which medications are allowed to be used in infectious (and infected) conditions, the difference however is that this decision will not remain solely within the domain of the veterinarian but will continue to be at the discretion of governing bodies (such as national or international agencies) with far-reaching powers. In Europe today, one must always be aware of the ever-changing regulations regarding the distribution and use of a vast number of medical products, which were previously not so strictly controlled. What was allowed last month or last year may have been disallowed last week. One example of this is the products available for the topical treatment of digital dermatitis and for application in footbaths. The access to current electronic data "on the net" relative to the latest status on medication is becoming increasingly important for all practitioners.

The use of footbaths to treat and control infectious conditions of the claws has become an environmental issue particularly when products containing trace minerals are used.

Non-infectious diseases

Nutritional aspects pertaining to quality of claw and sole integrity and ability to withstand physical, and septic challenges continues to play a role in the preventive measures to maximise performance and optimise well-being. Nutritional supplementation appears to improve claw horn strength (Meyer et al. 2002, Guguchi et al. 2002,) and optimise health and resistance to disease, I am certain more information will continue to be presented on this topic in the future

Functional claw trimming as effectively described by Shearer and van Amstel (2002) remains the backbone of maintaining good health status and improving the wel-
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fare of the cow as well as providing the opportunity for regular assessment of claw health within a herd. The question is not should we do it but rather how can we more effectively promote its universal application by qualified health professionals. This theme should continue to be presented and promoted within this group on an ongoing basis.

Surgical procedures

There have not been a large number of new surgical procedures developed for the treatment of lameness during the past few years. Refined surgical techniques are not always cost effective for standard production animals but are readily justified for the valuable breeding and high production animals. The standard therapies for septic joints continue to be flushing with various cannulae or in the best case scenario with concurrent arthroscopic methods including tenoscopy.

The procedure of joint arthrodesis to salvage joints severely damaged by infection or trauma has been practiced for many years and reflects human intervention to supplement the normal, natural process of ankylosis. The term "joint resection" which suggests surgical removal of all or part of a joint should to my mind be differentiated from "joint arthrodesis" which is defined as surgical fusion and is "de facto" the complete obliteration of all the joint space with subsequent bone fusion and precludes any form of joint movement.

Evidence based evaluations of techniques such as claw amputation versus distal interphalangeal (DIP) joint resection such as used by Heppelmann et al, 2002 to compare the success rates of the two surgical techniques, joint resection versus claw amputation, is an important approach to continuous evaluation of surgical as well as non-surgical procedures at our disposal. The simple documentation of new or modified surgical techniques without appropriate evaluation may be interesting but does little to inform the practitioner as to the relative merits of established versus "new" procedures. It is important to evaluate the results of such testing critically and limit conclusions to the strict results of the study to ensure the readership remains clearly informed. It is all too tempting for someone scanning the literature to equate joint resection with surgical arthrodesis and therefore imply conclusions which may not have been intended by the authors.

Pseudoarthrosis is defined as a “false joint” and in most cases is considered an orthopaedic failure or at least a troublesome complication in fracture healing. It is significant to note that various forms of pseudoarthrosis exist and may be defined according to stage of development and/or desired function.

Simple pseudoarthrosis is a fibrous union between the bone fragments, which allows mobility. This form of arthrodesis may persist or may develop further to a fibrous form.

Fibrous pseudoarthrosis is a form of false joint formation in which fibrous or even hyaline cartilage may form in the intervening space between fragments.

Neoarthrosis (new joint) is the category reflecting the highest form of development of a pseudoarthrosis in which clefts form in the fibrocartilagenous union and become lined with a membrane with many features of a synovial membrane surrounding hyaline cartilaginous tissue covering the opposing boney ends (Jubb and Kennedy 1963, Sumner-Smith 2002).

The intentional creation of a pseudo or neoarthrosis such as in the case of the "paired joints" of the fetlock remains an interesting application of the above concepts.

Control of claw diseases

Claw disease monitoring programs to identify and monitor the significance and status of lameness and claw disease within herds are considered to be important to most people who are concerned with "herd health management". Closer scrutiny frequently reveals a lack of practice of this principle when compared to efforts and systems used to monitor udder health and milk quality, reproduction, metabolic status of the herd and infectious disease within an integrated herd health program. De Kruif's article on an integrated approach to health management while complete in scope is typical of many who appear to place little emphasis on lameness and tend to focus on milk production, reproduction, housing, infectious diseases etc. when planning such programs. Greenough (2003) in his article, which focuses on subclinical laminitis, suggests the importance of such integration in the evaluation of claw diseases. The question of why such programs do not adequately emphasize and implement lameness evaluation protocols for the control and treatment of claws diseases should be addressed.

There remains the question of the treatment and control of claw diseases on an individual or herd basis. In this case "state of the art" when it refers to the use of medical products must be considered on a very fluid basis and when considering application within the various countries comprising the European union it is anything but united. While there is a Veterinary Formulary for Europe which is published every few years, the guidelines for medications which are allowed for use, for example in the treatment of claw diseases seem to change on a much more frequent basis. In addition, the regulations pertaining to the use of veterinary medication frequently differs between each country and may not be covered by information found in the European Veterinary Formulary. The situation is further complicated by the classification of whether a product or active ingredient is a considered as a pharmaceutical drug or a product for herd prophylaxis (the same active ingredient may have one or both classifications). The veterinarian is frequently asked to treat an individual, small group or large herd problem and must then decide on how to apply the many aspects of the ever changing regulations. The current status of the various drugs for use in the treatment of claw diseases is available via direct consultation from informed pharmacologists and through the Internet.

The role of environmental and management effects on
the development of claw and leg diseases is covered in a review type article published in 2002 by Webster and focuses on identification of risk factors, aetiology and pathogenesis of infectious and non-infectious disorders and pain relative to their significance in control and treatment of claw diseases. There is a myriad of publications on effects of housing, feeding and other management factors on development and incidence of lameness and claw diseases in producing dairy cattle. Stanek and co-workers have recently extended this concept and looked different housing arrangements on claw diseases of fattening bulls and role of robotic milking on lameness, which will be presented during this meeting.

Pain control continues to gain an increasing profile in all aspects of veterinary medicine including digital pain Webster (2002). In a review of pain control in food animals, George (2003) considerable effort is expended to describe drug treatments for painful livestock including the use of opioids and non-steroidal anti-inflammatory drugs and specific indications and dosages. Very little information was presented regarding the control of digital or distal limb pain and suggests that much work needs to be done to address this problem. Evaluation of treatment regimens, stage of development of infectious disease and evaluation of degree of pain as a measure of efficacy of treatment was presented by Bathina and co-workers (2002). Currently funding has been made available within the European union for studies on animal welfare, which logically includes work on factors influencing bovine lameness problems viewed from the perspective of optimising welfare in order to prevent situations leading to manifestation of pain. Hopefully this will provide practical guidance to a long neglected aspect of the treatment of claw diseases.

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Introduction

Inflammations of the pododerm in the sole and wall area tend to perforate without appropriate treatment. Subsequently, deeper structures are involved in the purulent inflammatory processes, such as deep flexor tendon, deep flexor tendon sheath, bursa podotrochlearis, navicular bone, and the distal- and middle phalanx. Commonly the septic process proceeds into the nearby distal interphalangeal joint (DIP-joint). Treatment of such cases requires a resolute surgical approach.

Digital amputation (DAmp) is a relatively uncomplicated procedure with a broad spectrum of indications (Kofler 1988). However, the affected claw is lost; thus, the remaining claw has to carry the whole load. Since this may be disadvantageous in present housing systems, other radical but claw conserving methods for treatment of septic arthritis of the DIP-joint are suggested alternatively. Distal interphalangeal joint resection (DJR) is supposed to have a similar spectrum of indication as DAmp. In contrast to the simple resection of the deep flexor tendon and the navicular bone (Assmus 1964) the expectedankylosis of the coffin joint after DJR should bring about sufficient stability to prevent hyperextension (tipping) in the treated claw (Köstlin und Nuss 1988). However, DJR needs considerable more surgical skills than DAmp.

Thus, the objectives of this controlled prospective and randomized clinical study were to investi-gate, (a) whether DJR covers the same spectrum of indications as DAmp and (b) to compare the therapeutic success rate of these methods. Therefore, the healing process, development of lame-ness and the survival rate were compared between animals with similar clinical initial situations either treated by DAmp or DJR, respectively.

Material and methods

Fifty-two dairy cows with septic arthritis of the coffin joint due to a perforating pododermatitis and without other concurrent diseases, admitted to the Clinic for Cattle, were included in the study (German Holstein Friesian: [mean ± s] milk yield 8140 ± 960 kg, age 5.5 ± 2.3 years). Animals were submitted from 45 farms; 36 cows were housed on the farm in free stalls with cu-bicles (33 slatted flooring, 2 asphalt flooring, 1 straw mattress) and 16 animals originated from tie stalls (6 straw bedding, 10 rubber mats with grids). The average farm size was 58.4 cows. Twelve animals were pregnant at the time of surgery.

The musculoskeletal system of the animals was examined clinically in standing position, during movement and more in detail in lateral recumbency (examination table; including arthrocentesis of the coffin joint). X-rays and sonography were performed on the defect claw. The septic arthritis of the coffin joint was caused by a perforating pododermatitis either of the sole in 40 animals (77%), of the abaxial wall in 9 cows (17%) or interdigital phlegmona in 3 cows (6%). After diagnosis of septic arthritis of the coffin joint, cows were accepted for the study and thereafter they were randomly assigned to the DAmp-group (N = 26) or the DJR-group (N = 26) regardless of the origin, pregnancy, and diagnosis.

All surgeries were carried out in lateral recumbency after retrograde intravenous anaesthesia (15 ml Procainhydrochlorid 2%; V. digitals dorsalis communis III) in combination with a local retrograde intravenous antibiosis (3 Mio IE Penicillin-G). Surgical procedures: DAmp: the af-fected claw was amputated 0.5 cm distally to the coronary band using a Liess wire saw, tendons were removed as far as possible and the middle phalanx was excised in the second interpha-langeal joint. DJR: the distal part of the deep tendon and the navicular bone were removed from plantar. Thereafter a canal with a diameter of 10 mm was drilled through the coffin joint parallel to the coronary band using a surgical drill (6.3 bar, 21,000 rpm, 6 mm). Axially and ab-axially, about 5 mm broad bone bridges at the distal and middle phalanx were left. The counter-lateral healthy claw was raised by a wooden block (12.5 x 6 x 3 cm). In all cows, benzyl penicillin was administered into the opened tendon sheath and chlortetracycline ointment was applied to the wound. After DJR, for prevention of a tipping claw, the treated claw was fixed in a bended posi-tion for period of 90 days p.o. by wrapping elastic bandages over the dorsal wall of the treated claw and through a dent (1 cm deep) carved into the undersurface of the wooden block. All cows received systemically antibiotics (ampicillin-trihydrate 10 mg/kg BW, sc, q 12 h) for 5 subse-quent days post operationem (p.o.).

Follow up examinations were performed 7, 14, 28, 90 and 200 days and finally two years post surgery.

Results

Six months p.o. 8 cows of the DAmp-group and 9 cows of the DJR-group had been culled; two years after surgery, 21 animals of each group had left the farm. Persistent lameness was beside mastitis and infertility one of the main reasons for slaughtering (6 DAmp-cows, 5
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DJR-cows).

None of the DJR cows required subsequent DAmp. On average, the lameness score decreased significantly faster in cows of the DAmp-group as compared to cows of the DJR-group (Figure 1). It took about 4 weeks until cows of both groups showed a comparable mild degree of lameness (L I-II).

In general, three bandage renewals (BR) carried out on day 7, 14 and 28 d p.op. were sufficient to achieve a wound occlusion in 24 DAmp-cows and in 23 DJR-cows. After DAmp one cow developed an osteomyelitis of the proximal phalanx (2 additional BR); one cow suffered from a skin lesion at the coronary band (2 additional BR). After DJR two cows developed a subcutaneous abscess at the coronary band (2 additional BR); one exhibited a tenovaginitis of the common flexor tendon sheath (3 additional BR).

In 7 cows after DJR and in 3 cows after DAmp the lateral claw of the contra-lateral limb developed sole defects within 120 days p.op. requiring additional treatment. Two cows of the DAmp group were culled after detection of a deep sole ulcer in the remaining claw. Following DJR, one cow showed a sole ulcer affecting the formerly blocked claw. A tipping claw was observed in spite of prophylactic measures in 8 of 17 cows within 200 days p.op. At this time an ankylosis in the coffin joint was diagnosed by x-ray in two of the 17 investigated animals after DJR.

Discussion and conclusion

Perforating pododermatitis and septic arthritis of the distal interphalangeal joint in cows include regularly various inner structures of the claw in the destructive purulent inflammatory processes. Since altered tissue is removed bounteously almost all of such cases can be treated by digital amputation. According to the study design in this investigation cows which underwent DJR had a comparable initial situation in the affected claw as cows of the DAmp-group. Thus, results re-vealed a nearly comparable variety of indications for DJR.

Following DAmp, the remaining claw at the treated limb bears early substantial weight, as indicated by a rapid decrease in the degree of lameness in these cows (fig.1), while animals after DJR remained severely lame leading to an overload of the contra-lateral limb. Accordingly, more sole defects in the contra-lateral limb developed in DJR-cows. I contrast, after DAmp the remaining claw of the treated side had to carry more load which went ahead with a higher number of pro-found sole ulcers at this claw. Treatment of these defects is always complex and prognosis never-theless poor. Contrary to the results of Köstlin und Nuss (1988) after DJR only rarely defects affecting the remaining claw were found.

In agreement with other studies (Köstlin und Nuss 1988, Jeong 1993), the majority of the ani-mals (81%; 21 ani-mals DAmp vs. 21 animals DJR) had been culled after two years irrespectively of the surgical interference. In both groups in about 25% of the cases culling was attributable to persistent lameness. Thus, in this regard results revealed no advantage of DJR over DAmp.

The obligate resection of the deep flexor tendon in DJR leads in the further healing course to hyperextension and therefore does not allow a physiological load bearing of the treated claw. For that reason prevention measures are recommended for at least six weeks after surgery to avoid the development of a tipping claw. Although this was executed consequently even over a period of 90 days p.op., in this study in about 50% of the DJR-cows only a tipping claw was success-fully averted. However, there was on the other hand no indication that successful prevention of a tipping claw had any effect on the survival rate of the DJR cows.

In conclusion, since the degree of lameness decreased rapidly after surgery and the surgical tech-nique is easy and quick, digital amputation appears advantageous over the resection of the distal interphalangeal joint in dairy cows with septic arthritis of the coffin joint. However, the substantial risk of claw disorders at the remaining claw after DAmp, which are usually irreparable, has to be considered.


Abstract

Pain experienced by lame cows is a serious welfare concern. This study investigates the effectiveness of NSAID therapy or application of foot blocks to lame dairy cows as part of their lameness treatment on pain alleviation and milk production. Pain was assessed using daily activity level monitors and a 5-point locomotion scoring system. Daily milk yields were recorded to investigate the economic aspect of each treatment. A total of 270 lameness treatments were carried out over a 7-month period. Foot lesions were classified as either acute digital skin lesions or chronic claw horn lesions. Acute lesions were randomly assigned to NSAID/no NSAID, while chronic lesions were randomly assigned to NSAID/block/no further treatment. The effect of treatments on activity levels, locomotion scores and milk yields were investigated. The results indicated complex interactions between the foot lesions presented, and the treatments administered.

Introduction

The pain experienced by lame cattle can be relieved or controlled by treatment. Toussaint Raven (1985) suggested that unloading a diseased claw could reduce pain and aid healing. This can be achieved by trimming or attaching a block to the healthy claw of an affected digit. A veterinary surgeon could prescribe analgesic agents to alleviate digital pain and potentially reduce the degree of hyperalgesia experienced by the animal post-treatment (Whay et al., 1998). The effectiveness of treatments currently available to the farmer, cattle foot trimmer or veterinary surgeon has not been assessed quantitatively and their cost effectiveness is unknown. Therefore, this study investigates the effect of three lameness treatments on pain control, welfare and milk production in dairy cattle.

Costs associated with lameness include increased labour, reduced milk yield, cost of treatment, reduced fertility and increased culling with subsequent herd replacement costs (Kossaibati and Esslemont 1997). In this study, the basic cost of each treatment was compared only with the associated effect on milk production.

Materials and Methods

Data were collected from a single commercial herd over a 7-month period, while all cattle were housed in a single cubicle building. All cattle were locomotion scored twice weekly using a 5-point numerical rating scale (O’Callaghan et al., 2002). Lame cattle were identified as those assigned locomotion scores 3 to 5 on the scale. The pain experienced by cattle as a result of lameness was assessed using the subjective locomotion scoring system and daily activity monitoring. Pedometers were fitted to a lower hind limb of each cow to allow daily activity monitoring, (Afimilk 9.00, Fullwood Fusion Electronics 1999). As each cow entered the milking parlour a stationary antenna recorded both her identity and the pedometer counter value. The time of milking was also recorded. The steps taken between records were the differences between successive counter values. Differences divided by the appropriate time interval yielded the activity level in steps per hour (steps/hr). Milk yields by individual cows were automatically recorded at each milking (Afimilk 9.00). For consistency, milk yields were divided by the time difference between successive milkings to provide the variable yield/hr. All lame cattle had their feet trimmed according to the Toussaint Raven (1985) method. All foot lesions were classified as either acute (digital dermatitis/foul) or chronic (sole ulcer/white line disease). Lesion severity was scored as mild, moderate or severe. All infectious skin lesions were treated with topical antibiotic. Cows presenting with acute lesions were randomly assigned one of two possible treatments; NSAID therapy/no NSAID. Cows presenting with chronic lesions were randomly assigned one of three possible treatments; NSAID therapy/no NSAID. NSAID therapy/application of a foot block (Demotec 95, Siegfried Demel, Germany)/no further treatment.

Data handling and statistical analysis

All data were collated in Microsoft Excel 2000 (Microsoft Corporation. 1985-1999). Minitab 13.1 (Minitab Inc. 2000) and SAS software package (SAS Institute, Inc. 1990) were used for the analyses. The relationship between locomotion scores and the variables steps/hr and yield/hr were investigated using the ‘Means’ procedure in SAS. The steps/hr and yield/hr associated with different types and severity of foot lesion were similarly investigated. The effect of treatment on locomotion was examined by comparing scores attributed to cows within 7 days before treatment against the frequency of all subsequent locomotion scores associated with each pre-treatment score, recorded up to 30 days post treatment. The effect of treatment on steps/hr and yield/hr was quantified and tested with least squares regression analysis, using the generalised linear modelling (GLM) procedure in SAS. The dependent variables steps/hr and yield/hr were fitted to three classification variables: ‘treatment’, ‘before/after’ and ‘lesion severity’. Critical significance level was set at P = 0.01.
Results

Over the duration of the study, 270 lameness treatments were carried out. Table 1 presents the number of each treatment carried out. The median steps/hr and yield/hr associated with each locomotion score are shown in Table 2. Higher locomotion scores were associated with lower activity levels. The relationship between locomotion scores and milk yield was less clearly defined.

Table 1. Distribution of treatments allocated to cows presenting acute and chronic lesions

<table>
<thead>
<tr>
<th>Lesion type</th>
<th>Treatment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>NSAID therapy</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>No NSAID</td>
<td>76</td>
</tr>
<tr>
<td>Chronic</td>
<td>NSAID therapy</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Application of foot</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>No further treatment</td>
<td>46</td>
</tr>
</tbody>
</table>

The median steps/hr and yield/hr values associated with different types and severity of foot lesion are presented in Table 3. All moderate and severe lesions were associated with lower activity levels than mild lesions.

Table 2. Median steps/hr and yield/hr associated with locomotion scores attributed to cows

<table>
<thead>
<tr>
<th>Locomotion score</th>
<th>Steps/hr</th>
<th>Yield/hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>82.5</td>
<td>0.91</td>
</tr>
<tr>
<td>2</td>
<td>78.9</td>
<td>0.91</td>
</tr>
<tr>
<td>3</td>
<td>69.6</td>
<td>0.92</td>
</tr>
<tr>
<td>4</td>
<td>59.9</td>
<td>0.96</td>
</tr>
<tr>
<td>5</td>
<td>56.9</td>
<td>0.84</td>
</tr>
</tbody>
</table>

The results of this study emphasise the difficulty of assessing pain in large groups of animals and applying generalised results to individual cases. They also reflect the individuality and variability of recovery and emphasise the importance of incorporating the nature and severity of foot lesions into decisions on treatment. Preliminary results suggested that milk yields were relatively independent of the type and severity of foot lesions. Since the cows in this study were all treated after peak lactation, they naturally produced less milk as the study progressed. However, when treatments were analysed according to lesion severity, the yield/hr values of all cows presenting moderate or severe foot lesions, irrespective of type, who received NSAID were higher than those cows that received only basic foot trimming. Foot blocks produced a similar result in cows with moderate and severe chronic lesions. Therefore, the cost of treatments may potentially be recovered through improved milk production.

Discussion

Generally, the frequency of non-lame locomotion scores increased after treatment. However, the continued presence of locomotion scores of 3 and 4 post treatment indicated that many cows continued to display lameness up to 30 days after treatment.

Analysis of the data using least squares regression revealed variable results. Treatment of mild acute lesions with a NSAID resulted in significant increases of up to 18 steps/hr (p<0.001, S.E. 3.63) compared with treatment without NSAID. NSAID treatment of moderate acute type lesions made no difference to activity levels and reduced activity associated with severe acute lesions by up to 5 steps/hr (p<0.01, S.E. 1.90). In comparison, NSAID treatment of moderate and severe acute lesions, increased yield/hr by 0.3kg/hr and 0.1kg/hr (p<0.001, S.E. 0.02) respectively, compared with treatment without NSAID.

Basic foot trimming of mild chronic type lesions resulted in the highest activity levels after treatment. NSAID therapy of these lesions was associated with reduced activity by up to 49 steps/hr (p<0.0001, S.E. 4.71), while foot blocks were associated with similarly reduced activity levels after treatment of up to 54 steps/hr (p<0.0001, S.E. 5.13), compared to basic treatment of foot trimming only. In comparison, treatment of moderate severity chronic lesions with NSAID therapy was associated with increased activity by up to 11 steps/hr (p<0.0001, S.E. 2.77), while application of foot blocks was associated with reduced activity levels by up to 21 steps/hr (p<0.0001, S.E. 3.85), compared with basic treatment. Basic foot trimming with or without the application of foot blocks to cows presenting severe chronic lesions resulted in similar daytime activity levels post treatment. However, NSAID therapy resulted in reduced daytime activity by 9 steps/hr (p<0.001, S.E. 2.35). Milk yields associated with mild chronic type lesions were not affected by treatment type. However, NSAID therapy of moderate chronic lesions was associated with increased yield/hr values of up to 0.55kg/hr, while application of foot blocks were associated with increased values of up to 0.33kg/hr. In each case these differences were significant at the p<0.0001 level, (S.E. 0.03-0.04). Application of foot blocks to cows with severe chronic lesions resulted in increased yield/hr by 0.29kg/hr (p<0.0001, S.E. 0.03), while NSAID therapy increased yield/hr by up to 0.08kg/hr (p<0.01, S.E. 0.03), compared with basic treatment.

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5. Session: Treatment and control of claw diseases

References


Introduction

Septic inflammations of synovial cavities of distal limbs are a frequent cause of lameness in cattle: the distal interphalangeal joint and the digital flexor tendon sheath are most frequently affected (1-12). Especially in cases where penetrating puncture wounds proximal or distal to the dew claws have been responsible for septic inflammation of the digital flexor tendon sheath, also with involvement of the directly dorsal adjacent fetlock joint or the proximal interphalangeal joint recess assessment includes a thorough clinical, ultrasonographic and radiographic examination of the swollen region (5-8).

This report describes 2 cases of septic tenosynovitis of the hind limb digital flexor tendon sheath. One was a fibrinous-purulent tenosynovitis in the right lateral digit of a 4.7 years old Simmental cow, the other a sero-fibrinous tenosynovitis in the right lateral digit of a 2.5 years old Charolais bull - and a concurrent sero-fibrinous arthritis of the adjoining fetlock joint, caused in both patients by sharp puncture and laceration wounds over the digital flexor tendon sheath area, which were treated using a novel surgical approach to the affected fetlock joint.

Material and Methods

Case 1: The cow, showed grade 3 (out of 4) lameness on the right hindlimb, a distinct and painful swelling of the whole lateral digital flexor tendon sheath area from the pastern to mid-metatarsus and moderate swelling around the fetlock joint. A small puncture wound was found on the axial aspect of the lateral dew claw. Ultrasonographic examination confirmed the clinical diagnosis and arthrocentesis revealed the nature of the effusion. A fibrinopurulent tenosynovitis of the right lateral digit and a concurrent sero-fibrinous arthritis of the adjoining fetlock joint was diagnosed.

Case 2: The bull, showed grade 4 (out of 4) lameness on the right hindlimb, extreme swelling over the bulbs of the heel reaching proximally over the whole tendon sheath area to mid-metatarsus, distinct swelling of the coronet, moderate swelling dorsal and plantar to the fetlock joint and an older, infected lacerated wound on the lateral bulbs of the heel covered with granulation tissue. Radiographic and ultrasonographic examination and aspiration of synovial fluid from the digital flexor tendon sheath and fetlock led to the final diagnosis: sero-fibrinous tenosynovitis in the right lateral digit, a concurrent sero-fibrinous arthritis of the adjoining fetlock joint, infection of the deep digital flexor tendon over the distal sesamoid bone and septic serous arthritis of the distal interphalangeal joint.

Surgical approach:

After preparation of the digital and metatarsal region for surgery, in both cattle a wooden block was attached to the sound medial claw. Both patients were given an intravenous regional anaesthesia using 40 ml of procaine-hydrochloride (Minocain 2%, Atarost, Germany) with a rubber tourniquet proximal to the tarsus.

In the Charolais bull, starting from the laceration wound all the infected tissues were resected: the deep digital flexor tendon at its insertion and the distal sesamoid bone. After preparation of the digital and metatarsal region for surgery, in both cattle a wooden block was attached to the sound medial claw. Both patients were given an intravenous regional anaesthesia using 40 ml of procaine-hydrochloride (Minocain 2%, Atarost, Germany) with a rubber tourniquet proximal to the tarsus.

In the Charolais bull, starting from the laceration wound all the infected tissues were resected: the deep digital flexor tendon at its insertion and the distal sesamoid bone. After preparation of the digital and metatarsal region for surgery, in both cattle a wooden block was attached to the sound medial claw. Both patients were given an intravenous regional anaesthesia using 40 ml of procaine-hydrochloride (Minocain 2%, Atarost, Germany) with a rubber tourniquet proximal to the tarsus.

IN 2 CATTLE - NEW SURGICAL APPROACH FROM PLANTAR VIA THE DIGITAL FLEXOR TENDON SHEATH WALL

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In the Charolais bull just at the same site a fibrin clot was strongly attached and a canal into the plantar fetlock joint pouch was discovered robbe filled with clotted fibrin.

In both patients this small canal was enlarged using a scalpel with a 11 blade and in addition a second approach to the plantar fetlock joint pouch was carried out, making a 2-3 cm long and about 5 mm wide incision between the two abaxial branches of the suspensory ligament. In this way a large access to the joint pouch was created allowing removal of fibrin clots of about 1-2 cm size using a curette and permitting effective joint lavage. In addition, a hypodermic needle (2.1 mm diameter) was inserted into the dorsal pouch and a teat catheter into the small distal joint capsule canal. 3-5 liters of 0.9% isotonic saline solution with dilute 0.1% polyvidon-iodine-solution were used for irrigation. Both incisions of the fetlock joint capsule were drained with small pieces of Ligasano-polyurethane-soft foam dressing material (Ligamed medical products, Cadolzburg-Wachendorf, Germany) to avoid premature closure, and the wound of the digital flexor tendon sheath was also covered with Ligasano. The tendon sheath wound was not sutured. A support bandage using sterile dressing material was applied. The operated digit was fixed in its correct position on the wooden block using a metal wire which was inserted through a 3 mm drill hole on the tip of the claw to avoid a possible overextension of this digit due to the removal of the deep digital flexor tendon.

A systemic antiinflammatory therapy using 3 mg ketoprofen per kg body mass (Rometen 10%, Merial) was given for 4 days and 20,000 IU benzyl-penicillin and 20 mg streptomycin per kg body weight (Peni-strepto, Virbac Laboratoires) was administered for 10 days.

In both patients the digital flexor tendon sheath and the opened fetlock joint were lavaged daily for 3 consecutive days using the same solution and same amounts. After this time the original swelling was clearly reduced and the synovial fluid of the fetlock joint appeared nearly normal. After the last joint lavage the joint capsule insertions were no longer drained, and only the digital flexor tendon sheath wound was covered with Ligasano-polyurethane-soft foam dressing material and a firm bandage until day 10-14 postoperatively.

**Results**

In these two patients, the lameness improved rapidly within the next 10-14 days, the surgical wounds closed rapidly with granulation tissue and the patients were discharged home 16 and 17 days respectively after surgical intervention showing grade 1 lameness.

When the progress of these patients was checked by phone 6 weeks later, complete healing of the wounds was reported and the animals were no longer lame. Telephone follow-up 12 months later revealed that the animals were without lameness, showing no weightbearing problems and normal digits conformation.

**Discussion**

This new surgical approach to an infected fetlock joint through the plantar wall via the surgically opened digital flexor tendon sheath showed no detrimental effects on healing of the infected joint: after removing the Ligasano-polyurethane-soft foam drainage this incision between the two lateral branches of the suspensory ligament was closed by fibrin adhesions and later by secondary wound closure. Using this technique in bovine patients showing a purulent digital flexor tenosynovitis and a concurrent septic arthritis of the fetlock joint as described, a second skin incision for arthrotomy of the plantar pouch from lateral which would be necessary otherwise, could be avoided. It is a very easy and effective approach in cases when severe septic inflammation of the digital flexor tendon sheath invades the fetlock joint pouch.

**References**