CLINICAL NAVICULAR DISEASE SYNDROME IN THE HORSE: EFFECT OF CORTICOSTEROID INJECTION INTO THE DISTAL INTERPHALANGEAL JOINT

Klinisch podotrochleosesyndroom bij paarden: effect van intra-articulaire corticosteroïdeninjectie in het hoefgewricht

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ABSTRACT

Clinical navicular disease (CND) is a classification diagnosis defined as a lameness originating in the foot with clinical signs compatible with navicular disease syndrome (ND): the lameness is blocked by distal digital palmar analgesia (DDPA) and no radiographic signs of ND are present. Fifty horses with CND were injected with corticosteroid intra-articularly into the distal interphalangeal (D.I.P.) joint to evaluate the effect of such applications. Follow-up was done by questionnaire, and mean follow-up time was at least one year. Within three to four days after "treatment," 34% of the horses were sound and remained so for two months and longer. In 66% of the horses, no or insufficient (less than two months) effect was recorded. It is suggested that, in horses with CND, 1/3 might have lameness originating from the palmar compartment of the D.I.P. joint, and 2/3 have pain that might be localized in the bursa (results of previous study).

SAMENVATTING

Klinische podotrochleose is een classificatiediagnose waarbij geen andere klinische afwijkingen gevonden worden dan manken, waarbij de lage anesthesie positief is en waarbij op radiografieën geen afwijkingen te zien zijn. Vijftig paarden met klinische podotrochleose werden behandeld met intra-articulaire corticosteroiden injecties in het hoefgewricht, vooral om het effect te bestuderen. Met behulp van een vragenlijst werd nagegaan welk effect er bekomen werd tot tenminste 1 jaar na de inspuiting. Vierendertig procent van de paarden was na 3 tot 4 dagen niet meer mank en bleef gedurende 2 maanden of langer niet meer mank. Bij 66% van de paarden was er geen of een onvolledig effect of hield het effect minder dan 2 maanden aan. Mede gebaseerd op resultaten van een vroegere studie wordt verondersteld dat paarden met klinische podotrocheose in 1/3 van de gevallen pijn hebben in het caudale compartement van het hoefgewricht en in 2/3 van de gevallen pijn hebben in de bursa podotrochlearis.

INTRODUCTION

Radiologists may have different opinions about radiographic signs related to navicular disease syndrome (ND), but large translucent areas, irregular new bone formation along the proximal border, irregular enlargement of the bone, and osteosclerosis of the navicular bone are major and undisputed signs of navicular disease. Minor radiographic findings can be a matter of debate. If no radiographic signs of ND are present – and all other causes of lameness of the foot can be excluded – horses are classified as clinical ND (CND). CND is a classification diagnosis defined as a lameness originating in the foot with clinical signs comparable to navicular disease syndrome (ND).

Warfarin, isoxsuprin, metrenperone, orgotein, and propentophylline are some of the products mentioned in the literature as treatment for ND. Intrabursal corticosteroid injections for ND were described long ago (Bishop, 1960; Wilkins, 1961) and more recently (Verschooten *et al.* 1990) for CND, suspected ND,

and mild ND. To our knowledge, however, intra-articular corticosteroid treatment of the distal interphalangeal (D.I.P.) joint for ND is not reported in the literature. A study was performed by Zaman (1999) at our faculty as a final-year work/thesis; a follow-up was made of 91 horses affected either with CND or mild ND and treated by intra-articular corticosteroid injections.

The intra-articular injection of corticosteroids into the D.I.P. joint, described in this paper, is to be seen as a clinical experiment to evaluate the effect of corticosteroids in horses with CND. The results will be compared to the effect of intrabursal corticosteroid injections reported in a previous study (Verschooten *et al.* 1990). This comparison is possible because the criteria for treating the present horses affected with CND are fully comparable with a number of the horses described in the earlier paper.

MATERIALS AND METHODS

An intra-articular corticosteroid injection into the distal interphalangeal joint was applied to 50 horses affected by CND. These horses were carefully selected from those used in the study by Zaman (1999).

All horses received a full clinical examination and were nerve blocked (distal digital palmar analgesia = DDPA). DDPA was positive in all of these horses: lameness disappeared or switched to the contralateral limb. DDPA was performed in the angle between the proximal border of the cartilage and the palmar side of the pastern region (Fig. 1). Two and a half ml of mepivacaine (Skandicaine, Bofors) were injected subcutaneously close to the palmar nerve on the lateral and medial sides.

Radiographic examination included three views: two dorsopalmar views (the foot on a wooden block angulated 55° and 65° to the horizontal) and one lateromedial (LM) view. For the LM views, the central ray was directed carefully through the horizontal axis of the navicular bone. A grid with ratio 5:1 and 32 lines per cm was used in all views. Radiographic signs of ND have been recently outlined (De Clercq *et al.* 2000), and these criteria were the basis for deciding whether horses affected with foot lameness were radiographically affected or not (see box). Palmaroproximal-palmarodistal views of the navicular bones were not performed, because this view is not decisive for the diagnosis of ND (De Clercq *et al.* 2000). For the intra-articular application of corticosteroids, only horses with clinical signs of ND and no radiographic signs of ND were selected.

Fig. 1. Demonstration of the DDPA: the needle is right in the corner between the upper border of the cartilage and the palmar pastern area. Injection should be strictly subcutaneous and close to the digital palmar nerve. In this particular horse, the solar border has been trimmed but the frog is left untouched. As the frog bulges out, pressure on the frog is more readily transmitted to the painful navicular area. In horses with CND or ND, the stiffness may be transformed into unilateral lameness or the lameness could increase considerably: a positive frog test!

A 24G x 1"" needle was introduced into the distal interphalangeal joint in the midline just above the coronary border, and 40 mg methylprednisolone acetate (Depomedrol, Pharmacia - Upjohn, Puurs) or 40 mg triamcinolone (Albicort-40 , Labaz-Sanofi, Brussels) were injected into the joint. Fifty horses were treated: 37 horses were injected with triamcinolone, and 13 with methylprednisolone. No additional medication was applied

The horses were stable-rested for about three days and thereafter allowed to resume full activity without any restriction, irrespective of the duration of the lameness. Follow-up was done mostly by questionnaire, by telephone inquiry, and (rarely) by re-examining the horses, and follow-up time was 1 year up to 2 years.

Two different drug treatment regimes (Depomedrol versus Albicort) and clinical outcomes (lame versus not lame, two months and more) were evaluated with chi square statistics. Since one cell had an expected count of less than five, Fisher's Exact test was used to evaluate significance.

RESULTS

Age, sex and breed of the horses are outlined in Table 1. Most of the horses were 6 years old and older. Mares and males (only one stallion) were equally affected. The horses had been used primarily for jumping (32), dressage (9), recreation (8), and carriage driving (1). Seventy six percent of the horses had been

RADIOGRAPHIC CHANGES ASSOCIATED WITH NAVICULAR DISEASE (ND) SYNDROME

Dorsopalmar view*

Important signs

- Localized central osteoporotic area or osteoporotic areas or any other area of the distal or proximal border, usually indistinctly delineated and, if sharply delineated, usually indicating a standstill in the evolution of the disease.
- Generalized osteosclerosis (rarely observed: see LM).
- Extensive new bone formation, which has changed the shape of the navicular bone, thus resulting in an enlarged silhouette.
- Several large osteoporotic areas or cysts (5 mm and >) in the distal 3rd of the navicular bone; if well demarcated, their growth has probably been arrested. These cysts may be an expression of increased intra-articular pressure or/and proliferation of synovial tissue.
- Bone chips at the distal border, possibly bilateral, especially important when more than 7mm x 3mm in size and when surrounded by demineralization in the navicular bone.
- Severe syndesmophytosis on the lateral and/or the medial side of the NB.
- Severe new bone formation in the middle or along the proximal border of the NB, without affecting the general shape of the NB.

Irrelevant signs

- One to several canales sesamoidales (= synovial fossae) at the distal border of the navicular bone ending in cysts (5 mm and <); the number, length, and location of synovial fossae are unimportant.*
- Asymmetrical bilateral navicular bones without any other sign.

Lateromedial or mediolateral view

Important radiographic signs

- Osteosclerosis of the medullar cavity.
- Localized translucent area in the subchondral bone plate and/or in spongiosa, hazily delineated.
- Enlarged silhouette of the navicular bone in the proximodistal and/or the dorsopalmar direction.
- Calcifications in the soft tissues close to the navicular bone in or around the deep flexor tendon.
- Irregular new bone formation at the margo liber.
- Extension of the margo ligamenti.
- Indistinct outline of the area between the distal border of the NB and the caudal intra-articular border of PHIII, with or without bone fragments.
- Osteoporosis of the subchondral bone plate (normal thickness or thinner than normal).
- Disappearance of the sharp demarcation between the subchondral bone plate and spongiosa.

Irrelevant signs

- Thinning of the subchondral bone plate, but normal radio-opacity, often as a result of inactivity, whether or not associated with lameness.
- Well-defined exotosis at the proximal border.
- Well-defined small spur at the proximal border of the facies articularis of the navicular bone opposite the 2nd phalanx.
- Central depression in the ridge of the navicular bone (synovial fossa), sharply delineated.

*** Important remark: although the synovial fossae may be large or deeply extending into the navicular bone on DP views, they never show up on LM radiographs, even of excellent technical quality.**

Table 1. Age and sex of the 50 horses in the trial.

Age		Sex	
3 - 5 years old:	4	Mare:	26
6 - 10 years old:	30	Gelding:	23
11 - 15 years old:	14	Stallion:	1
16 years and >:	2		

owned for one year or more by the same owner; only 2 had been with the present owner for less than 5 months. Therefore, most histories of the horses were quite reliable.

Fifty-two percent of the horses were lame for the first time, 36% had been lame before, and for 12% no information was available about previous lameness. Lameness had existed less than 2 weeks in only 18% of the horses, between 1 and 2 months in 28%, between 3 months and 1 year in 32%, and longer than 1 year in 22%.

Lameness occurred suddenly in 50% of the horses (slight lameness in 26% and quite severe lameness in 24%), progressively in 34%, and no data had been recorded for 16% of the horses. Work had been stopped before the examination at the faculty clinic for 6 to 10 days in 20%, 2 to 6 weeks in 24%, and 2 to 4 months in 20%. Thirty-one percent of the horses had been working right up to the time of the examination. According to the owners, work increased lameness in 46% of the horses, but in 54% it decreased the lameness (*a frigore*). Fifty-two percent of the horses had been rested without any beneficial effect, either in the stable or in pasture, or both. For 17% no specific data about rest or work could be obtained.

Eighty percent of the horses had been treated unsuccessfully in many different ways before being presented at the faculty: NSAIDs (sometimes for a long time), general corticosteroids, isoxsuprin, biotin, selenium and vitamin E, clay, homeopathy, osteopathy, egg-bar-shoe or several other orthopaedic shoes, and variable resting periods. Some of the horses had been treated for joint diseases unrelated to the foot or for several other affections not related to the foot.

Lameness was reported in the history to be either unilateral or bilateral. Upon examination, however, the incidence of bilateral lameness turned out to be double the reported incidence, and that of unilateral lameness was cut in half (Table 2). Seventy percent of the horses were not lame, or were only stiff, when walking on a hard surface in a straight line and without shoes; when trotting in a straight line, 84% were lame and 16% were stiff. Details are outlined in Table 3. Almost 100% of the horses were lame when trotting in

Table 2. Lameness reported by the owner and lameness established upon clinical examination (n = 50 horses).

Lameness reported by owner		Lameness established upon examination	
Left front leg	20	Left front leg	12
Right front leg	15	Right front leg	7
Bilateral	15	Bilateral	31

Table 3. Details of lameness in 50 CND horses on hard surface.

No lameness when walking in a straight line – stiff on trotting: 4
No lameness when walking in a straight line – slightly lame on trotting: 24
Stiffness on walking and trotting: 4
Stiffness on walking and lameness on trotting: 3
Slight lameness on walking in a straight line and one leg slightly lame on trotting: 7
Slight lameness on walking in a straight line and one leg distinctly lame on trotting: 8

a circle to the right or the left on a hard surface, and lameness increased when trotting with the lame foot on the inside of the circle. Wedge tests were performed primarily on horses that were stiff when trotting on a hard surface and were positive in 83% of the tests (n=18) and negative in 17%. Unilateral DDPA was positive in 38% of the horses, and lameness switched to the other foot in 62% of the horses. The results of the intra-articular corticosteroid injection are outlined in Table 4. An effect was considered positive if the owners could work with the horse in the same way as they could when the horse was not lame. If owners reported that lameness was merely less than before, the result was categorized as negative. No effect was observed in 40% of the horses. Twelve percent of the horses were sound for less than 4 weeks; 14% for 5 to 7 weeks; and 34% of the horses were sound for 2 months or more.

A positive effect of less than 1 or 2 months is interesting clinical information regarding the probable localization of pain in CND horses, but the therapeutic effect was considered to be negative. Results were considered to be positive only if horses could be worked without apparent lameness for at least 2 months. Only 16% of all treated horses were still working after 6 months, and only 8% after 1 year.

The effect of unilateral and bilateral intra-articular application of corticosteroids was as follows:

- 26% of the horses showed no effect after unilateral application;
- 40% showed no effect after bilateral application;
- 10% showed an effect of 2 months and more after unilateral application; and
- 24% showed an effect of 2 months and more after bilateral application.

Table 4. Effect of intra-articular corticosteroid application of CND in 50 horses.

Effect	Percent of horses
None	40 %
Less than 4 weeks	12 %
5-7 weeks	14 %
2 months and more	34 %

Horses affected with CND for less than 4 months before intra-articular treatment were 3 times more sound for 2 months or more than horses that had been lame one year and longer before treatment. Fisher's Exact test did not reveal any significant difference between the two drug treatment regimes concerning clinical outcome (F.E.= 0.93; p = 0.50). Complications due to the injection of the corticosteroids into the distal interphalangeal joint were never observed. Not one horse showed increased lameness immediately after the injection, and infections never occurred.

DISCUSSION

Most horses had been owned by the same owner for a long time, and therefore the history was trustworthy as far as the general problem of the lameness was concerned; not one horse presented was sound. However, the owners were not aware that bilateral lameness was present at a rate of two times more than they thought. Although no radiographic signs of ND were present, the age distribution of the present group corresponds quite well with that of ND horses. Radiographic signs of ND are a matter of debate, especially when minor changes are concerned. The present radiographic selection was very strongly based on absolute normality. Palmaroproximal-palmarodistal views are not decisive for a diagnosis of ND (De Clercq *et al.*, 2000). The current criteria may always be questioned, but it is absolutely impossible that the CND horses in this study would be diagnosed as CND horses on the basis of other criteria.

Jumping horses were much more severely affected than horses used for other purposes. In Belgium, many horses are worked an average of only 3.4 hours per week and usually not more than 1 hour at a time (Verschooten, unpublished data: evaluation of workload in 1002 horses). In jumping, untrained feet might suffer much more from the sudden, heavy loads than in dressage.

Lameness was present for one month or more in 82% of the horses, and even much longer in 54%; more than 1/3 had been lame even before the present lameness. Compared to ND, CND is likewise most often a longstanding problem.

The sudden appearance of the lameness in all gradations in 50% of the horses and its progressive appearance in 34% is also comparable to ND. In our opinion, progressive lameness is often an incorrect observation, because lameness, whatever the cause, usually appears suddenly. According to the owner, progressive lame-

ness often means that bilateral stiffness was almost unnoticeable at first, but the owner's attention is triggered when the stiffness becomes unilateral. These observations fit perfectly with the history of ND as well.

Lameness could be *a frigore*, but an increased workload could induce more lameness as well. Only 28% of the horses were slightly lame when walking. Very often, stiffness or lameness increased when the horses were trotted without shoes on a hard surface, and especially when lunging in tight circles to the left or the right side. Wedge tests were useful with stiff horses, because stiffness was easily converted to unilateral lameness. Only 1/3 of the horses were still "working" when presented for examination; all others were being rested for shorter or longer periods, either in the stable or in pasture, though without success. Eighty percent of the horses had been treated in many different ways without success. In other words, regardless of what was done, nothing could stop the lameness. It is quite likely that CND and ND are untreatable.

It should be stressed that heel bruises, contracted or sheared heels, broken bars, corns or under-run heels were found in none of the horses. These affections are thought to be responsible for painful heels unrelated to the navicular area and the lameness is blocked by DDPA as well.

The reliability of a questionnaire is open to debate, and if "treated" horses had been examined while being considered sound by the owner, some lameness might possibly have been found to be present. However, the change in walking and trotting is often very spectacular after intra-articular corticosteroid application, even after a few days, and when the effect lasts for two months, owners' reports are credible. Response to whatever new treatment is often very positive, but if the "good result" does not last very long, then the owners realize that the problem has not been solved. Negative results are even more likely to be correctly reported by owners. Therefore we assume that a positive effect reported to last 2 months and longer is correct, as was the case in 34% of the CND horses receiving an intra-articular injection of corticosteroids into the joint. Overall, this is a poor result, but each horse was almost perfectly sound for 2 months or longer! The injection itself is not expected to be effective longer than 2 or 3 months, but it was possible to work the horses again and, if work was continued on a daily basis, they were able to work much longer than the effective period of the medication.

A comparison of the results of the intra-articular injections of corticosteroids with the results of intrabursal corticosteroid injections in 49 CND horses (Verschooten *et al.*, 1990) found the intra-articular treatment to be far less effective. Intra-articular and intrabursal corticosteroid injections have very different effects in CND horses. These effects can be summarized as follows:

- no (or less than 2 months) effect is observed in 66% of the horses treated intra-articularly, versus 40% in the intrabursal group;
- an effect of 2 months and more is observed in only 34% of the horses in the intra-articular group, versus 60% positive results in the intrabursal group.

When intrabursal injection was effective immediately, the pain was apparently localized in the structures lining the bursa. When intra-articular application of corticosteroids in the joint was effective, it was logical to assume that the pain was localized in the joint and, more specifically, in the palmar aspect of the D.I.P. joint (the small joint between the navicular bone and the 3rd phalanx). This is a hypothesis, however, because analgesia of the caudal compartment of the distal interphalangeal joint alone is not possible. Nevertheless, our hypothesis may be correct, since general DJD of the distal interphalangeal joint is not a very common problem.

Distal digital palmar analgesia is effective if the pain is localized in the navicular region, the caudal compartment of the distal interphalangeal joint included. This was observed in an unusually severe DJD of this joint, confirmed by post-mortem examination (Verschooten, unpublished data), with a positive digital palmar analgesia. In DDPA, the structures within the hoof capsule, including the extensor process, are completely anesthetized (Fig. 2). Severe ND is effectively, but not completely, blocked. In severe distal syndesmopathy of the deep digital flexor tendon or in infectious pododermatitis, DDPA is only partially effective in alleviating the pain. If the D.I.P. joint is affected, DDPA will be effective only partially or not at all.

No medical treatment other than intra-articular or intrabursal corticosteroids can change a lame CND horse into a sound one so quickly. The horses are able to work immediately, and even laymen can easily assess the effect of treatment because the difference before and after treatment is indisputable. The effect, if any, of the corticosteroids is usually evident within

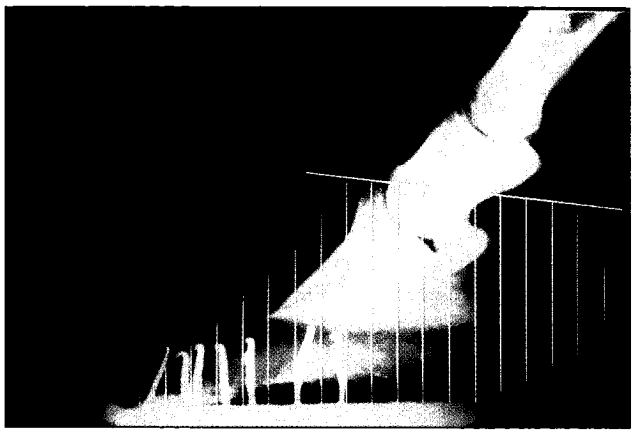

Fig.2. The drawing on the LM photograph of the foot outlines the area of the anesthetic effect of DDPA as became evident from observations by the senior author (F.V.) during 35 years of lameness examination. The extensor process should be included in sound horses and in horses with pathological changes of the extensor process itself. However, with extensive pathological changes around the extensor process anesthesia of this area might be incomplete. The D.I.P. joint is incompletely anaesthetized, but the caudal compartment of the distal interphalangeal is effectively blocked.

2 to 3 days after injection, and rarely later than 5 days after injection.

Results of nuclear scintigraphic examination of the front feet of sound jumping horses have been compared with the examinations of horses with primary foot pain (Dyson, 2002). There was a good correlation between a positive response to intra-articular analgesia of the distal interphalangeal joint and intrathecal analgesia of the navicular bursa and increased uptake of radiopharmaceutical in the region of the navicular bone in the horses with primary foot pain. Therefore, it was concluded that quantitative scintigraphic assessment of bone phase images of the foot, in combination with local analgesic techniques, can be helpful in identifying the potential source of pain causing lameness related to the foot. In our opinion, the present results of intra-articular corticosteroid application and the earlier results of intrabursal application confirm the scintigraphic findings, because the immediate effect of corticosteroid application is completely comparable to intrathecal and intra-articular analgesia.

Furthermore, almost the same results were found when a much larger number (n=148) of horses affected with CND and suspected or minor ND were treated with corticosteroids intra-bursally (Verschooten *et al.*, 1990). When intra-articular corticosteroid treatment was applied in a larger number (n=91) of horses with CND and low-grade ND, nearly the same results were obtained as well (Zaman, 1999). In other words, in pure CND and in low-grade ND, the effects of intra-articular and intrabursal corticosteroid infiltration are totally comparable, and pain is therefore apparently present in the same areas. CND is therefore a part of one and the same ND syndrome. At this time, it is unknown how many cases of CND finally develop into ND.

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REFERENCES

Bishop H.W. (1960). A clinical review – navicular disease. *The Journal of the Royal Army Veterinary Corps 31*, 61-64.

De Clercq T., Verschooten F., Ysenbaert Y. (2000). A comparison of the palmaroproximal-palmarodistal view of the isolated navicular bone to other views. *Veterinary Radiology & Ultrasound 41*, 525-533.

Dyson SJ. (2002). Subjective and quantitative scintigraphic assessment of the equine foot and its relationship with foot pain. *Equine Veterinary Journal 34*,164-70

Verschooten F., Desmet P., Peremans K. and Picavet T. (1990). Navicular disease in the horse: The effect of controlled intrabursal corticosteroid injection. *Equine Veterinary Science 10*, 316-320.

Wilkins J..H. (1961). A review of the therapeutic use of corticosteroids in equine lameness. *The Veterinary Record 73*, 1383-1389.

Zaman, K. (1999) De behandeling van podotrochleose met intra-articulaire toediening van corticosteroïden. *Dissertation, Faculty of Veterinary Medicine, Ghent University.*