

Racing Performance in Standardbred Trotters with Chronic Synovitis after Partial Arthroscopic Synovectomy in the Metacarpophalangeal, Metatarsophalangeal and Intercarpal (Midcarpal) Joints

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Roneus B., A.-M. Andersson and S. Ekman: Racing performance in standardbred trotters with chronic synovitis after partial arthroscopic synovectomy in the metacarpophalangeal, metatarsophalangeal, and intercarpal (midcarpal) joints. Acta vet. scand. 1997, 38, 87-95. – Chronic synovitis may cause recurring lameness in competing race horses. Forty-five standardbred horses with recurring lameness secondary to chronic synovitis were studied. Arthroscopic synovectomy was performed in 32 metacarpophalangeal/metatarsophalangeal joints and in 28 intercarpal joints of horses that had previously been treated unsuccessfully with commonly used intraarticular medication. The outcome of the synovectomy was evaluated by comparing racing performance before and after surgery. The synovial membrane was microscopically characterized as chronic synovitis of varying severity. Racing performance was expressed by racing results including average earnings/race, place 1-3, best time and racing index. Fourteen of 19 horses with chronic synovitis of the intercarpal joint performed at an equal or higher racing level after synovectomy. Twenty-one of 26 horses with lameness secondary to chronic synovitis in the fetlock joint had an equal or higher racing capacity after synovectomy. The results of this study indicates that arthroscopic synovectomy in combination with rest is an effective method in the treatment of chronic synovitis when conventional intraarticular medication has failed.

horses; degenerative; joint disease; lameness; histopathology.

Introduction

Inflammatory reactions in the joints of race horses may occur as a result of repeated overload trauma during training and racing. The joint reactions range from mild synovitis to severe degenerative joint disease (McIlwraith 1982). Villonodular synovitis, in which soft-tissue masses are found in the dorsal aspect of the metacarpophalangeal joint and chronic proliferative synovitis represent severe lesions in the

joints (Nickels *et al.* 1976, Barclay *et al.* 1980, van Veenendaal & Moffat 1980). Kannegieter (1990), however, has suggested that more subtle forms of chronic synovitis can occur.

Clinically apparent synovitis is commonly treated with intraarticular injections of sodium hyaluronate, corticosteroids or polysulfated glucosaminoglycans in combination with rest (Palmer & Bertone 1994). This treatment is of-

ten successful; the lameness disappears and the horse returns to training and racing after a few weeks of convalescence. If treatment is not successful, the lameness persists or recurs after a short period. In these horses, diagnostic arthroscopic examination can be useful to evaluate the lesions in the synovial membrane or/and the articular cartilage (Moore & Schneider 1995). During the last 10 to 15 years arthroscopy has greatly improved the diagnosis of equine joint disease, especially in the evaluation of soft tissue injuries, including macroscopic evaluation of changes in the synovial membrane. Synovectomy has been used in both humans and horses to remove inflamed or infected synovial membrane (Leitch 1979, Jann et al. 1986, McEwen 1988). Different surgical methods have been used to remove the diseased synovial membrane; including arthrotomy (Rose 1988), electro-surgery (Jann et al. 1986) and arthroscopic surgery (McIlwraith 1990, Jones et al. 1994).

The purpose of this study was to evaluate the outcome and racing performance after arthroscopic partial synovectomy of chronic synovitis in the metacarpo- and metatarsophalangeal and intercarpal joints in standardbred trotters. A microscopic classification of the chronic synovitis was also performed in biopsy specimens obtained during surgery.

Materials and methods

Arthroscopic partial synovectomy was performed in 45 standardbred trotters (24 stallions, 13 mares and 8 geldings). The horses were in training and all had a history of previous intra-articular medication and adequate periods of rest with unsuccessful results. Previous intra-articular treatments had included hyaluronic acid (Hylartil vet, Pharmacia and Hyonate vet, Bayer), polysulfated glucosaminoglycans, (Adequan, Luitpold Pharma), orogtein (Palo-

sein, Coopers), betamethasone (Celeston bifas, Schering-Plough), flumethasone (Fluвет vet, Lövens) and joint lavage. In most cases each joint had been injected on several occasions.

The horses were admitted to the Large Animal Surgical Clinic at the University of Agricultural Sciences during 1989 to 1994 because of recurring lameness. Routine lameness examination was performed including diagnostic intra-articular anesthesia. All affected joints were radiographed to rule out major skeletal injuries such as severe arthrosis with large osteophytes. Horses with superficial fibrillation, erosions, and wear lines in the articular cartilage were included in the study. However, joints that showed severe full thickness erosions with subchondral bone damage were excluded. All joints included in the study showed macroscopic evidence of chronic synovitis, i. e. villous hypertrophy at diagnostic arthroscopy. Thirty-two metacarpo-/metatarso-phalangeal joints were operated in 26 horses and in 19 horses, 28 intercarpal joints were operated.

Surgical procedure

Surgery was performed with the horses under general anaesthesia. The horses were positioned in dorsal recumbency and the joints were aseptically prepared for surgery. In fetlock joints, the arthroscope (Storz, 4 mm. Wide Angle Telescope, Forward-Oblique 30° in a 5.5 mm Arthroscope Sheath) was inserted dorsally in the proximal portion of the joint lateral to the common digital extensor tendon. The instrument portal was made medial to the extensor tendon (McIlwraith 1990). In some cases, the arthroscopic and instrumental portals were reversed during surgery to obtain better access to the inflamed synovial membrane intended to be removed. The joint was held in an extended position in order to relax the dorsal joint capsule during surgery. In intercarpal joints, the arthroscope was inserted lateral to the extensor carpi

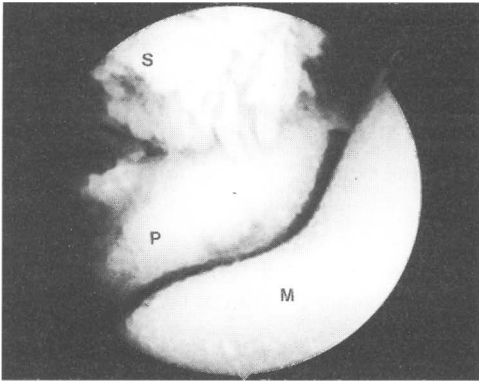


Figure 1. Arthroscopic view of the dorsal part of the metacarpophalangeal joint showing chronic synovitis with hypertrophy and thickening of the synovial villi. M = third metacarpal bone; P = first phalanx; S = synovial membrane.

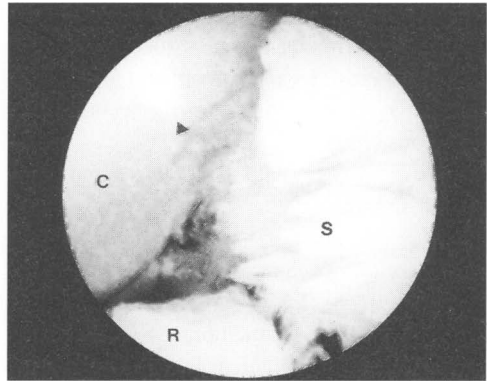


Figure 2. Arthroscopic view of the dorsomedial aspect of the intercarpal joint with chronic synovitis and hypertrophy and thickening of the synovial villi. Coexisting articular cartilage erosions are present dorsomedially on the third carpal bone (arrow). C = third carpal bone; R = radial carpal bone; S = synovial membrane.

radialis tendon and the instrument portal was made medial to the extensor tendon. The carpus was positioned in a 90° flexed angle during surgery. Lactated Ringers solution was infused with an infusion pump to maintain adequate joint distention and to thoroughly lavage the joint at the end of the surgery. Synovectomy was performed manually with a Ferris-Smith Arthroscopic Rongeur (4×10 mm bite), Arthroscopic Cutting Rongeur (Sontec) or a motorized synovial membrane resector (Storz, Arthro-Ease 28200VX). Hypertrophied synovial villi were removed from the dorsal aspect of the joints. In the dorsal region, proximal to the articular cartilage of the distal metacarpus/metatarsus in the fetlock joints, the synovium forms a plica or pad that varies in size. Chronic synovitis may manifest as an enlargement of this plica. The normal plica should be less than 4 mm thick. The presence of discrete nodules or areas of the plica with a thickness of 8 mm or greater is characteristic of chronic proliferative synovitis (Madison 1995). When enlarged, this synovial plica was excised. Full thickness artic-

ular cartilage erosions in the intercarpal joints, most often on the medial aspect of the third carpal bone or on the radial carpal bone, were debrided.

Convalescence

Eight weeks of stall rest with daily handwalking were recommended after surgery.

Classification

In chronic synovitis, different abnormalities of the villi were observed, including thickening of villi, clubbing, plaque like flattening and formation of new types of villi, atrophy of villi and adhesion formations (Figs. 1 and 2).

To correlate the prognosis for racing performance by the degree of cartilage and bone lesions observed arthroscopically in combination with the chronic synovitis, all horses were divided into 4 groups:

Group 1: Horses without or with minor superficial changes of the articular cartilage such as mild superficial fibrillation or a few superficial wear lines or dimples.

Group 2: Horses with moderate or severe lesions of the articular cartilage such as multiple wearlines, erosions and osteophytes.

Group 3: Horses with synovitis secondary to infectious arthritis.

Group 4: Horses with synovitis secondary to chip or slab fractures.

Microscopic examination of synovial membrane biopsies

Biopsies of synovial membranes from 15 fetlock joints and 12 intercarpal joints were obtained during surgery. The biopsies were immediately immersed in a 4% aqueous solution of buffered formaldehyde, embedded in paraffin, cut into approximately 3 μm sections, stained with hematoxylin & eosin (HE), coded and examined with a light microscope. The degree of inflammatory reaction was evaluated by a modification of methods described by Rooney *et al.* (1988) and Asari *et al.* (1994).

Fibrosis of the subintima of the synovial membrane was graded as none, mild, moderate or severe. Infiltration of inflammatory cells was graded as none, mild, moderate or severe according to the number of vessels involved, the diameter of the perivascular infiltrates and the percentage of lymphocyte infiltration involved: none (1-5/low power field (LPF, $\times 20$)), mild (6-10/LPF), moderate (11-20/LPF) and severe (>20 /LPF). Vascular proliferation was determined by the number of vessels and was estimated to be: none (1-3/LPF), mild (4-10/LPF), moderate (11-20/LPF) and severe (> 20 /LPF). The synovial membranes were then categorized according to the severity of the inflammatory reactions as: mild chronic synovitis when villi formation with mild fibrosis and mild vascular proliferation but no lymphocytes were found; chronic synovitis with villi formation, moderate fibrosis, moderate vascular proliferation, and mild inflammatory cell infiltration; chronic perivascular synovitis

with villi formation with moderate fibrosis, moderate vascular proliferation, and moderate – severe perivascular inflammatory cell infiltrates including granulocytes. The joint cavity contained fibrin (fibrinous synovitis) or fibrinopurulent exudate (exudative) in a few cases.

Follow up

Racing results for all horses before and after surgery were obtained from the Swedish Trotting Association.

Results

Metacarpo- and metatarsophalangeal joints

The age of the 26 horses ranged from 2 to 9 years (mean 4.6 years).

The duration of lameness ranged from one month to more than one year before surgery with a “mean lameness history” of 6 months. Lameness at a slow trot at presentation ranged from grades 1 to 3 (on a scale 1-5, where 1 is mild and 5 is non weight-bearing). The lameness increased by an average of 2 grades after one minute flexion test of the joint and all horses showed discomfort and pain at maximal flexion. In all horses, the lameness and flexion reaction disappeared after intraarticular anaesthesia. Fourteen of the 26 horses had joint abnormalities detected on radiological examination composed of mild degenerative joint disease or soft tissue swelling. Twelve horses were radiologically normal.

Six horses were operated bilaterally and the remaining 20 horses were operated in one fetlock joint (Table 1).

Racing results before and after synovectomy of the fetlock joints

Prior to surgery, 18 of 26 horses had raced, and 23 horses had raced by 12 months after surgery of the last horse to be operated in the study.

Comparison of post surgery versus pre surgery racing performance revealed that 21 horses raced

Table 1. Synovectomy of 32 fetlock joints (26 horses) and 28 intercarpal joints (19 horses).

| | Intercarpal | Metacarpophalangeal | Metatarsophalangeal |
|-------|-------------|---------------------|---------------------|
| Left | 15 | 17 | 2 |
| Right | 13 | 10 | 3 |

at an equal or increased level, 2 horses on a lower level, and 3 horses had not raced. The racing performance was measured according to earnings/race, places 1-3, best time and racing index. The mean convalescence period (months) before the first race after surgery (>12 months follow up) was 7.7 months (Table 2).

Racing performance was equal to or had improved compared to before surgery in all the 12 horses of group 1, where there was minimal or no articular cartilage lesions present, and equal or had improved in 7 of 10 horses in group 2. Because there were only 2 horses in groups 3 and 4 respectively, no conclusions can be made regarding racing performance (Table 3).

Intercarpal joints

The age of the 19 horses ranged from 2 to 5 years (mean 4.2 years) with a "mean lameness history" of 5 months (2 to 12 months). All horses showed lameness at slow trot and the lameness ranged from grades 1 to 5 and all horses showed increased lameness after flexion of the joint. The lameness increased an average of 2 grades in most horses after flexion test and all horses showed discomfort and pain at maxi-

Table 2. Convalescence period (months), after synovectomy of fetlock and intercarpal joints, before first race post surgery (>12 months follow up). Mean convalescence period (from surgery to first race) was for fetlock joints 7.7 months ± 3.5 (range 3-17) and for intercarpal joints 7.5 months ± 3.5 (range 4-14).

| | Fetlock | Intercarpal joints |
|-------------|----------|--------------------|
| 3-5 months: | 6 horses | 3 horses |
| 6-8 | 11 | 7 |
| 9-12 | 4 | 3 |
| >12 | 2 | 1 |
| Not raced | 3 | 5 |

mal flexion of the joint. The lameness disappeared after intraarticular anaesthesia in all horses. Radiological changes were observed in 15 horses, with sclerosis of the medial aspect of the third carpal bone in 9 horses, radiolucency and small cystic changes of the third carpal bone in 2 horses, small periarticular osteophytes in one horse, chip fracture with osteophytes of the third carpal bone in one horse, an old slab fracture and sclerosis of the third carpal bone in one horse, osteomyelitis in one horse, and no radiographic changes in 4 horses.

Table 3. Racing results in different groups operated in the fetlock joint (>12 months follow up).

| Group | Total number of horses | Racing performance | | |
|-------|------------------------|--------------------|-------|-----------|
| | | Equal or higher | Lower | Not raced |
| 1 | 12 | 12 | 0 | 0 |
| 2 | 10 | 7 | 2 | 1 |
| 3 | 2 | 1 | 0 | 1 |
| 4 | 2 | 1 | 0 | 1 |

Table 4. Racing results in different groups operated in the intercarpal joint (>12 months follow up).

| Group | Total number of horses | Racing performance | | |
|-------|------------------------|--------------------|-------|-----------|
| | | Equal or higher | Lower | Not raced |
| 1 | 9 | 7 | 0 | 2 |
| 2 | 7 | 6 | 0 | 1 |
| 3 | 1 | 0 | 0 | 1 |
| 4 | 2 | 1 | 0 | 1 |

Nine horses were operated bilaterally in both left and right intercarpal joints, 6 horses in the left joint only and 4 horses in the right joint only (Table 1).

Racing results before and after synovectomy of intercarpal joints

Fifteen of the horses had raced prior to surgery and 4 were in training, but had not raced yet. The racing performance after surgery compared with preoperative performance was equal or higher in 14 horses, and 5 had not raced.

The mean convalescence period before the first race after surgery (>12 months follow up) was 7.5 months (Table 2).

The racing level was equal or had improved in 7 of 9 horses in group 1, and in 6 of 7 horses in group 2. Because there were only 1 and 2 horses in groups 3 and 4 respectively, the conclusions could not be made for these groups (Table 4).

Results of the microscopic examination

The biopsies of the synovial membranes from 15 fetlock joints (Table 5) and 12 intercarpal joints (Table 6) were all classified as chronic synovitis of differing severity.

In several cases, a hypertrophy of the dorso-proximal synovial plica was observed macroscopically in the fetlock joints at arthroscopic examination. However, excessive villinodular masses, compatible with villonodular synovitis were not present.

Discussion

All horses in this study had a history of recurring lameness despite repeated administration of intraarticular medication. Diagnostic arthroscopy is an excellent technique to evaluate lesions in the synovial membrane and the articular cartilage not detectable on radiographs. Synovectomy is frequently used in humans to treat rheumatoid arthritis and haemophilic arthropathy (Montane et al. 1986). Synovial regeneration after synovectomy has been evaluated in humans and animals, including the horse (Jones et al. 1994). Healing after synovectomy has been observed as regeneration of the synovial lining by metaplasia of connective tissue in about 35 days (Mitchell & Cruess 1967, Martini 1986). Morphological studies on healthy equine carpal joints have shown that the formation of a normal synovial lining after synovectomy requires more than 30 days (Jones et al. 1994), and even after 120 days the synovium was grossly devoid of villi. Histologic examination revealed abnormal synovial architecture including absence of villi and changes of the fibrous intima and synoviocytes (Theoret et al. 1996). Based on the observation that there were no lameness and no changes of the articular cartilages postoperatively, the regenerated synovial membrane seems to have a normal function despite morphological alterations (Jones et al. 1994, Theoret et al. 1996). These observations are supported by the clinical results from

Table 5. Microscopic classification of 15 fetlock joints.

| | |
|--|----|
| Mild chronic synovitis | 1 |
| Chronic synovitis | 10 |
| Chronic perivascular synovitis | 2 |
| Fibrinous chronic perivascular synovitis | 2 |

Table 6. Microscopic classification of 12 intercarpal joints.

| | |
|--------------------------------|---|
| Mild chronic synovitis | 4 |
| Chronic synovitis | 3 |
| Chronic perivascular synovitis | 4 |
| Exudative synovitis | 1 |

Table 7. Racing results in groups with different microscopic classification of the synovitis of fetlock and intercarpal joints (>12 months follow up).

| Microscopic classification | Total number of horses | Racing performance | | |
|--|------------------------|--------------------|-------|-----------|
| | | Equal or higher | Lower | Not raced |
| Mild chronic synovitis | 5 | 2 | 0 | 3 |
| Chronic synovitis | 13 | 11 | 0 | 2 |
| Chronic perivascular synovitis | 6 | 3 | 1 | 2 |
| Fibrinous chronic perivascular synovitis | 2 | 2 | 0 | 0 |
| Exudative synovitis | 1 | 1 | 0 | 0 |

the present study and indicates that they also are valid for diseased joints.

The aim of the present study was to evaluate the outcome of synovectomy in standardbred trotters by comparing racing performance before and after surgical treatment. The results of the present study indicate that arthroscopic synovectomy in combination with rest may be an effective method in the treatment of chronic synovitis when conventional intraarticular medication and rest has failed. Fourteen of the 19 horses with chronic synovitis of the intercarpal joint performed at an equal or higher racing level after synovectomy. Twenty-one of 26 horses with lameness due to chronic synovitis of the fetlock joint had an equal or higher racing capacity after synovectomy. Even horses with severe chronic changes of the synovial membrane and the articular cartilage returned to racing and performed successfully. The heterogeneity of the material makes other factors and injuries, not reported to the clinic, impos-

sible to consider in the evaluation of the racing performance of these horses. Unfortunately, no control group, where only a diagnostic arthroscopy was done, was available. The lack of a control group is a clinical reality, yet a scientific nightmare.

The value of microscopic examination in determining an accurate prognosis is not clear cut according to the present study (Table 7). However, the severity of the chronic synovitis was often in accordance with the severity of the lesions in the articular cartilage.

Degenerative joint disease or osteoarthritis is a complex disease which includes changes of synovial fluid, synovial membrane, joint capsule, articular cartilage and subchondral bone (McIlwraith 1987). If the inflamed hypertrophic synovial membrane is removed, the production and stimulation of cartilage destructive enzymes may decrease, but the entire synovial membrane is impossible to remove.

The present study indicates that partial removal

of inflamed synovial membrane in combination with rest appears to be valuable in the treatment of horses with chronic lameness secondary to chronic synovitis in the intercarpal and fetlock joints.

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Sammanfattning

Effekten av synovektomi som behandling vid kronisk synovit hos varmblodiga travhästar.

Kronisk synovit orsakad av cyklisk överbelastning av lederna kan resultera i återkommande hältproblem hos tvärlingshästar. Synovit med kroniska förändringar av synovialmembranen är svårbehandlad med konventionell terapi med intraartikulära injektioner och vila.

Kirurgisk synovektomi utfördes med artroskopitek-

nik på 45 varmblodiga travhästar med kronisk synovit i 32 kotleder och 28 mellersta carpalleder. Resultaten av operationsmetoden utvärderades genom att jämföra tävlingsprestationer före respektive efter utförd synovektomi.

14 av 19 hästar med kronisk synovit i carpus startade och tävlade på samma eller högre nivå efter synovektomi jämfört med innan de blev halta. 21 av 26 hästar med kronisk synovit i kotlederna kom tillbaka och startade och tävlade på samma eller högre nivå. His-

topatologi av biopsier från synovialmembranen tagna under operationerna visade kroniska inflammatoriska reaktioner av varierande grad. Konvalescens-tiden var i genomsnitt 7,7 (kotleder) respektive 7,5 (carpus) månader från operation till första start efter operation. Denna studie indikerar att synovektomi med artroskopiteknik i kombination med adekvat vila kan vara ett effektivt sätt att behandla tävlingshästar med kronisk synovit.

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