Arthroscopic surgery of the middle carpal joint in trotting Standardbreds: Findings and outcome

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Introduction

Lameness arising from middle carpal joint disorders is common in training and racing Standardbred horses, with 28% of young horses affected, and carpal lameness was the most common cause for rest periods longer than one month (1). The causes of lameness from the middle carpal joint can be fragmentation of the carpal bones, tearing of the palmar intercarpal ligaments, cartilage lesions, crush fractures and synovitis (2, 3). Fractures of the carpal bones involving the middle carpal joint can be diagnosed radiographically, but in certain cases the fragments are only seen during arthroscopy (4). Additionally, lesions of cartilage and soft tissue have been described, and although the radiographic findings may suggest the presence of lesions, arthroscopic examination is required to provide a definitive diagnosis (3, 5, 6). The aims of this study were to characterize the surgical findings of middle carpal joints in trotting Standardbred racehorses, and examine if these findings could be used to predict the future racing ability of the horse. It has recently been reported that horses with severe injuries to the articular cartilage in the stifles still can perform as athletes, and in this study we examined the effects of lesions in the middle carpal joint on future performance (7). An additional aim of our study was to evaluate the results of motorized synovectomy of the middle carpal joint.

Materials and methods

We reviewed medical records from trotting Standardbred horses in which arthroscopic surgery of one or both of the middle carpal joints was performed between 1997 and 2007. The horses included in our study had undergone lameness examination and had positive responses to intra-articular anaesthesia of the middle carpal joints. A number of horses needed additional intra-articular anaesthesia in other locations to abolish lameness completely. For horses to be considered candidates for surgery, it was necessary that a significant part of the lameness originated from the middle carpal joint, as judged by the referring clinician. The decision for surgery was based on failure of previous medical treatment, such as the administration of non-steroidal anti-inflammatory drugs or intra-articular corticosteroids and hyaluronic alone, or in combination with focal areas of decreased bone density on the third and radial carpal bones on sky-line radiographs, or fragmentation of the carpal bones evident on radiographs. All horses were in active racing or training at the time of surgery. Horses which underwent additional simultaneous surgical procedures were excluded from the study; this did not include nine stallions that were castrated, and three other horses in which the antebrachio-carpal joints were inspected and no lesions identified. A total of 178 horses were included in our study. The horses in which the antebrachio-carpal joint was inspected arthroscopically had been referred for surgery after non-specific anaesthesia of both carpal joints. Horses with slab fractures were excluded as these injuries by definition also include another joint. A number of the horses that were included in our study were medicated in additional joints at the time of surgery, as a result of additional anaesthesia required to abolish lameness, and this information was included in the analysis. The number of starts and prize money before surgery were also included in the analysis. The time to start (TS), prize money (PM) and number of starts (NS) were used as outcome endpoints in the analysis. A simple perform-
Surgery was performed as previously described with horses positioned in dorsal recumbency and the carpal joints in approximately 90 degrees of flexion and the joint was distended with isotonic solution (8). Two portals were used for the arthroscope and instruments; the portals were sutured after completion of the procedure. A 30 degree Hopkins arthroscope was used. Cartilage lesions were graded on a scale of 0–3 as follows: 0 represented no cartilage lesions, 1 represented a lesion leaving a defect 1–10 mm in length across its widest dimension, 2 represented a lesion of 10–20 mm width, and 3 represented a lesion larger than 20 mm. The size of the lesion was estimated by comparing it with the size of the 4 x 10 mm Ferris-Smith rongeur. Cartilage lesions were also graded 0–3 with respect to depth, where 1 represented superficial fibrillation, 2 represented partial thickness erosion and 3 represented full thickness lesions involving the subchondral bone. Synovitis was subjectively graded from 0–5 with 0 being no abnormalities (pale, thin villi) and 5 corresponding to severe synovitis (thickened, red or brown villi with thickened tufts extending into the joint space). The palmar intercarpal ligament lesions were graded on a scale of 0–3: 0 represented normal ligaments, 1 represented the subjective assessment that ligaments were slightly loose, 2 represented partial tearing, and 3 represented complete tearing. In addition, the location of the largest cartilage lesion was noted and the presence of osteophytes, wear lines, or chip fragments and the location of the latter were noted. When both forelimbs underwent surgery at the same time this was noted, but only the gravis finding of each parameter was noted. Full thickness cartilage lesions were debrided to healthy bone with curettes, torn ligamentous tissue and hypertrophic synovial membrane were removed with rongeurs and a 5.5 mm soft tissue resector. Hypertrophic synovial membrane was removed flush with the dorsal joint capsule without disrupting the fibrous joint capsule itself. Chip fragments were removed and the fracture sites were debrided to healthy subchondral bone by curettage. The same surgeon (BR) performed the surgeries. This surgeon made all assessments and recorded the findings. Flunixin meglumine 1.1 mg/kg (50 mg/ml solution) and intravenous sodium benzylpenicillin b at a dose of 12 mg/kg were administered to all horses before induction of anaesthesia.

Postoperative care

The horses were discharged from the clinic on the day after surgery or on the same day of surgery if surgery had been performed in the morning. Box stall rest for two weeks followed by four weeks of turn-out in a small paddock before gradual return to exercise over the following six weeks was prescribed for all horses. Bandages with sterile pads over the dorsal aspect of the carpus were changed as needed and the horses were prescribed non-steroidal anti-inflammatory drugs, which were administered by the owner.

Statistical analysis

The impact of the different surgical findings on whether horses started at all after surgery was analyzed with Fischer’s exact test or Pearsons Chi-square test. Kruskall-Wallis rank sum test was used to test if there were differences if surgery involved the left, the right or both front legs, if the medial palmar intercarpal ligament was injured, or if cartilage erosions were present with respect to TS, NS, PM and PI after surgery. This was also tested after separating the lesions into one group of more severe lesions and comparing those to all the others. Mann-Whitney rank sum test was used to test if there were differences in horses with chip fractures compared to those without, on the same outcome variables. Finally, a sum score was created where every recorded finding was assigned one if the lesion was found, and zero if not. The sum score was tested with Spearman’s rank correlation test.

Results

The mean age of horses at the time of surgery was 4.2 years (range 2–9 years), the mean number of starts before surgery was 13 and the median number of starts before surgery was six. Sixty percent of the horses had started before surgery and 66% started after surgery. Of horses that had started before surgery 75% started after surgery. Of the 178 horses, 56 horses underwent surgery of the left middle carpal joint, 30 horses underwent surgery in the right middle carpal joint, and 92 horses had surgery of both joints. Twenty-three horses were medicated in one or more joints at the time of surgery. Neither surgery in one or both legs, nor simultaneous medication with betamethasone of a different joint did influence any of the parameters of PM, PI, NS or TS for starting horses, or whether the horse started at all after surgery. For horses starting after surgery, the mean time to start after surgery was 226 days (range 70–708), with 50% of horses starting within 200 days and 75% of starting horses starting within 243 days. The mean number of starts after surgery was 16, with a median of 6.5. Mean PI before surgery was 1.02 and mean PI after surgery was 1.27. Number of starts before surgery, age, PM before surgery, and PI before surgery did not significantly affect whether the horse started after surgery, or the parameters PM, PI, NS or TS after surgery. In total 270 joints underwent surgery and the findings are summarized in Table 1. Furthermore, the medial palmar intercarpal ligament was injured in 88 joints; most of these were mild injuries. There were chip fragments on the radial carpal bone in 12 joints, and there were chip fragments on the third carpal bone in 35 joints. Most fragments were smaller than 10 mm in length. In addition to the findings men-

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a Karl Storz Endoskop, Skärholmen, Sweden
b Geepenil: Orion Pharma Animal Health, Sollentuna, Sweden
c Celeston bifas, (6mg/ml): Merck Sharp & Dohme, Sollentuna, Sweden
Table 1  Arthroscopic findings in the middle carpal joint. The numbers denote the number of joints showing a specific lesion, and in the case of the cartilage erosion, also the widest measure across the injury without reference to depth. It should be noted that the total number of injuries exceeds the number of joints due to many joints showing more than one lesion.

<table>
<thead>
<tr>
<th>Lesion Description</th>
<th>Number of joints</th>
<th>Total joints</th>
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<tbody>
<tr>
<td><strong>Synovitis:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>171</td>
<td>206</td>
</tr>
<tr>
<td>Severe</td>
<td>7</td>
<td></td>
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<tr>
<td><strong>Eroded cartilage on radial carpal bone:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10 mm</td>
<td>39</td>
<td>84</td>
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<tr>
<td>10-20 mm</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>&gt;20 mm</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td><strong>Eroded cartilage on third carpal bone:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;10 mm</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>10-20 mm</td>
<td>71</td>
<td>154</td>
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<tr>
<td>&gt;20 mm</td>
<td>19</td>
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Discussion

In this description of a series of trotting Standardbred horses, no single characteristic of the joint status of the middle carpal joint predicted the racing career postoperatively. Moreover the total amount of different lesions was not predictive of the future racing career. Review of the horses in this study indicated that certain individuals had long racing careers after surgery despite the presence of more severe damage to the middle carpal joint and damage to bone, cartilage and ligaments. This may explain the lack of significant association between the severity of lesion and future racing soundness in this material. The lack of association between severe joint cartilage damage and future soundness has also been described in studies of the equine stifle (7). In order to rule out possible confounding influence from the presurgical racing career, these data were included in the analysis and were found not to affect the postsurgical racing career. It has not been possible to identify any factor which can discriminate between horses with severe joint lesions that do respond to surgery, or the convalescence training regime, and those which do not respond. Therefore, it is the authors’ opinion that although a joint may have a general appearance that precludes future racing, this cannot be accurately predicted at the time of surgery.

In this material, 75% of the horses that had raced before surgery started again after surgery, and of these, 75% started within eight months postoperatively. Although this study does not include a control group which has not undergone surgery, these data indicate that a large proportion of horses with lameness originating from the middle carpal joints that did not respond to medical therapy will be able to return to racing after arthroscopic debridement of lesions and resection of hypertrophic synovial membrane. In addition, it would have been difficult to include a group of horses which had not undergone surgery as arthroscopy was necessary to diagnose and describe the lesions. Our results indicate that horses with lameness localized to the middle carpal joint in which anti-inflammatory treatment does not prove effective can still be able return to racing after surgery and a period of rest and convalescence. Furthermore, chip fracture of the radial carpal bone seems to reduce the number of starts after surgery, compared to chip fracture of the third carpal bone. It is also noteworthy that in this material, there were no chip fractures of the intermediate carpal bone, which contrasts the findings in a previous report (2). However, there were only very few trotting Standardbred horses in the study by McIlwraith et al.; this may indicate that chip fractures of the intermediate carpal bone is a problem in horses used for sports other than trotting.

The vast majority of horses included in our study were subjected to partial synovectomy, and the presence of synovitis or resection of the synovial membrane did not affect the outcome. This is further substantiated by the fact that of the 12 horses without any lesion besides synovitis, 10 raced and earned money after surgery suggesting that synovectomy may be a safe procedure. This finding has previously been reported in clinical cases after synovectomy of the carpal and metacarpal/metatarsal joints, and in an experimental study of radiocarpal joints (9, 10). However, this finding contrasts data from experimental studies that suggest that synovectomy can adversely affect the articular cartilage in the middle carpal joint and cause fibrosis of the synovial membrane (11, 12). The authors of this study would like to hypothesize that hypertrophic synovitis is important in the aetiology of lameness originating from the middle carpal joint, as the enlarged tufts of cauliflower-like villi may become impinged when the forelimb is under load.
Limitations of this study were the lack of control horses and the retrospective design. Regarding the lack of control horses, the horses included in this paper had been treated medically and rested before surgery was performed, and without being able to train or race as intended. Furthermore, it would have been very difficult to actually control what happened to horses intended as non-operated controls, as they could have undergone surgery at another veterinary practice. The retrospective design of the paper makes it very difficult to track treatments during these horses’ careers, besides the surgery and the lameness examination preceding it. This means that the exact treatment before, and after, surgery is impossible to determine at an individual level. Additionally, the number of horses with more severe lesions may have been too small to see a real effect of increasing size of osteochondral defects in the carpal bones.

In conclusion, the findings of our study indicate that the localization of osteochondral lesions in the middle carpal joints of standardbred trotters differs from that in other breeds, that primary synovitis carries a good prognosis after synovectomy and joint lavage in horses that do not respond to medical therapy. In contrast, it was not possible to identify factors which can accurately predict outcome in terms of racing performance or chance of return to racing after surgery. This highlights a need for well designed prospective multicentric investigations of surgical findings and surgical interventions in relation to future racing performance.

Conflict of interest
There are no grants, financial support or conflict of interests to declare.

References