EQUINE VETERINARY JOURNAL
Equine vet. J. (2009) **41** (2) 130-138
doi: 10.2746/042516408X345099

Osteoarthritis of the thoracolumbar synovial intervertebral articulations: Clinical and radiographic features in 77 horses with poor performance and back pain

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Keywords: horse; facet joints; back pain; impinging dorsal spinous processes
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Summary

Reasons for performing study: **Back pain is well recognised as a cause of poor performance in horses, but the role of lesions of the thoracolumbar synovial intervertebral articulations (facet joints) has not been well documented.**

Objectives: **To describe the clinical features, radiographic appearance and location of facet joint lesions and determine if there was any breed, gender, age, bodyweight or work discipline predilection.**

Methods: **Data from 77 horses examined at the Animal Health Trust January 1997–September 2007 with evidence of thoracolumbar pain and radiographic changes of the facet joints were reviewed. The presence of either other osseous abnormalities of the thoracolumbar region or other problems potentially contributing to poor performance were recorded. Facet joint lesions were graded radiographically and their location determined. Influence of breed, gender and discipline on the presence of lesions, effect of location on the type of lesion and the influence of impinging dorsal spinous processes on the clinical features were assessed using Chi-squared tests.**

Results: **There was no effect of breed, gender, age or bodyweight on occurrence of facet joint lesions. Showjumpers were significantly less affected than horses from other disciplines. There were commonly 2–5 affected facet joints, usually in the caudal thoracic and cranial lumbar spine (T15–LI). Sclerosis, periarticular new bone and narrowing of the joint space were the most frequent radiographic lesion types. Clinical features were significantly different between horses with and without impinging dorsal spinous processes. Severity of clinical signs was related to the presence of other osseous abnormalities, not the number of facet joints involved or the lesion grade.**

Conclusions: **Osteoarthritis of the facet joints of the thoracolumbar spine can occur alone, in horses with back pain, or in association with other osseous abnormalities.**

Potential clinical relevance: **Osteoarthritis of the thoracolumbar facet joints probably contributes to back pain, but further investigation of the prevalence of osteoarthritis in horses without clinical signs of back pain is merited.**

Introduction

Back pain is a common contributor to poor performance (Jeffcott 1975, 1980, 1985), but definitive diagnosis of the underlying cause is challenging. Back pain is a frequently perceived problem in sports horses, especially dressage horses. Impinging or over-riding dorsal spinous processes, so-called kissing spines, are well recognised as a cause of thoracolumbar pain (Jeffcott 1980; Ranner and Gerhards 2002; Walmsley *et al*. 2002). Other lesions include spondylosis (Townsend *et al*. 1986; Marks 1999), osteoarthritis of the synovial intervertebral articulations (hereafter referred to as facet joints) (Stecher 1962; Haussler 1999; Hendrickson 2002; Denoix and Dyson 2003), stress fractures of the lumbar facet joints (Haussler and Stover 1998), lumbosacral intervertebral disc lesions (Haussler *et al*. 1997; Denoix 1999a), supraspinous ligament (Denoix 1996) and muscle injuries.

The contribution of osteoarthritis of the thoracolumbar facet joints to back pain and poor performance has not been well documented. Radiography (Butler *et al*. 2000; Denoix and Dyson 2003; Coudry *et al*. 2007), ultrasonography (Denoix 1999a; Reisinger and Stanek 2005) and nuclear scintigraphy (Nowak 1988; Weaver *et al*. 1999; Dyson *et al*. 2003) can be used to assess the thoracolumbar facet joints, but acquisition of high quality images and their interpretation is potentially challenging. This is compounded by the variation in shape of the facet joints within the thoracic region and differences between the thoracic and lumbar areas. Denoix (1999a) proposed a grading system for radiographic assessment of the thoracic facet joints. It has been suggested that the caudal thoracic region is at risk of facet joint pathology associated with biomechanical function (Denoix and Dyson 2003). However, to our knowledge, there has been no large scale study of osteoarthritis of the thoracolumbar facet joints in sports horses.

The aims of this study were to investigate the prevalence of radiographic evidence of osteoarthritis of the thoracolumbar facet joints in a group of sports horses, with clinical evidence of thoracolumbar pain, and to determine if there was any difference in breed, gender, age, bodyweight and work discipline of affected horses compared with the clinic population. We also set out to document the types of radiographic changes present and their

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[Paper received for publication 23.01.08; Accepted 01.07.08]

relationship with other osseous abnormalities of the thoracolumbar region and to determine if a combination of other osseous lesions and osteoarthritis of the facet joints influenced clinical signs. It was hypothesised that dressage horses age >8 years would be most commonly affected, and that lesions would be identified most frequently between the 16th thoracic and 1st lumbar vertebrae and involve more than one articulation.

Materials and methods

Inclusion criteria

Horses in the study were examined at the Animal Health Trust (AHT) between January 1997 and September 2007. They were presented for evaluation of poor performance and were selected if they had clinical evidence of thoracolumbar (back, B) pain, with or without concurrent lameness, and abnormalities of one or more articular facet joints detected radiographically (*Group B*, n = 77). Horses with back pain were subdivided into those with facet (F) joint lesions without impinging dorsal spinous processes (*Group BF*), and those with facet joint lesions and impinging dorsal spinous processes (I) (*Group BI*). For inclusion, the clinical signs of thoracolumbar pain persisted despite abolition of lameness by local analgesia of the affected limb(s). All horses underwent comprehensive radiographic examination of the thoracolumbar region.

Horses were selected prospectively from 1997 for inclusion in the study by an experienced clinician (S.J.D.). The case records were reviewed and data concerning breed (Thoroughbred, Thoroughbred cross, Warmblood), gender, age, bodyweight, discipline (racing, dressage, showjumping, eventing, endurance, general purpose), history and duration of clinical signs recorded. Horses used for unaffiliated level competition were classified as general purpose. These data were compared with those for all horses (A) examined at the AHT between January 1998 and October 2003 (Murray *et al*. 2006) (*Group A*, n = 1075), excluding those with primary thoracolumbar region pain.

For comparative purposes, the results of radiographic examination of horses that showed no clinical evidence of back pain at the time of clinical examination (Control horses, C), but which underwent radiographic examination of the thoracolumbar spine at the request of the owner or referring veterinary surgeon (*Group C*, n = 154) were reviewed. To determine the prevalence of osteoarthritis of the thoracolumbar facet joints in horses with back pain, data from all other (O) horses with thoracolumbar pain examined radiographically during the study period (*Group BO*, n = 567) were assessed.

Clinical examination

Comprehensive clinical examination was performed at rest, in hand, on the lunge and ridden, if the horse was safe to ride. Examination at rest included appraisal of the thoracolumbar and pelvic conformation, development and symmetry of the epaxial musculature of the thoracolumbar region and the muscles of the hindquarters. Systematic, careful palpation of the thoracolumbar region was performed to assess alignment of the dorsal spinous processes, presence of muscle spasm, focal pain on palpation, and induction of muscle fasciculation or spasm by palpation. Firm pressure was applied to the dorsal midline of the thoracolumbar and pelvic regions and ventral thorax in order to induce flexion and extension in the sagittal plane. Lateral bending was induced by firm stroking to the left and to the right of the midline in the lumbar region and over the hindquarters. This was performed to assess freedom of movement, repeatability of movement, whether mobilisation induced muscle tension or evidence of pain, characterised by grunting, biting, laying the ears back, kicking, swishing the tail, or moving about excessively in the stable. The responses were assessed in light of the horse's temperament and its responses to palpation and manipulation of the neck and limbs. If the results were equivocal, examination was repeated on several occasions.

Horses were examined moving in straight lines in hand on a hard surface and turned in small circles, and on the lunge, on both soft and hard surfaces to assess the presence of lameness and freedom of movement of the back, impulsion and willingness to go forwards. Fore- and hindlimb flexion tests were performed. Examinations were repeated after local analgesia to abolish any lameness. Horses were assessed being tacked up, using when possible the owner's tack. The horse's behaviour while being tacked up and mounted was assessed. The fit of the tack was evaluated and, if inappropriate, on a separate occasion the tack was changed and the horse re-evaluated. Horses were included in the study only if clinical signs persisted after change in tack (e.g. bit, saddle, pads or numnahs, girth). When possible, horses were assessed ridden by the usual rider and one of the AHT's experienced riders. Horses were worked at the level to which they were trained at walk, trot and canter, including lateral work where applicable and were sometimes assessed jumping. Freedom of movement of the back, ease of turning, rhythm, impulsion, head and neck carriage, quality of contact with the bit, transitions, quality of paces, ease of performing lateral work to the left and to the right and flying changes were assessed. Clinical features were categorised according to Table 1.

TABLE 1: Categorisation of clinical features in 77 horses with poor performance, back pain and radiological evidence of osteoarthritis of thoracolumbar synovial intervertebral articulations

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Radiographic examination

Lateral radiographic views of the dorsal spinous processes, articular facet joints and vertebral bodies of the thoracolumbar region (T6 – L6) were obtained prior to 2004 (Butler *et al*. 2000). Thereafter, lateral oblique (horizontal 20° ventral-dorsal oblique) views from the left to the right and from the right to the left of the mid to caudal thoracic facet joints were obtained in addition to lateral views of the lumbar facet joints. The x-ray beam was centred on the thoracic facet joints, approximately 15–25 cm ventral to the dorsal midline, depending on the size of the horse. The cassette or imaging plate was supported in a custom designed holder, so that it was positioned perpendicular to the x-ray beam. Radiographs were obtained at the end of expiration in order to avoid the diaphragm being superimposed over the caudal thoracic facet joints. Lateral views of the facet joints were obtained in 24 horses and oblique views in 53 horses; both lateral and oblique views were obtained in 10 horses. Images obtained prior to January 2005 were acquired using a conventional radiography system; from January 2005 a computed radiography system (Kodak Direct View CR 500) was used. In *Groups BF* and *B* 34 horses were examined using conventional radiography and 43 using computed radiography. Exposure factors varied depending on the size of the horse.

Diagnostic analgesia

Horses with impinging dorsal spinous processes were reassessed ridden 15 min after infiltration of local anaesthetic solution around the processes (Denoix and Dyson 2003). Horses with clinical suggestions of sacroiliac joint region pain were reassessed after infiltration of local anaesthetic solution around the sacroiliac joint region (Dyson and Murray 2003). In a small proportion of horses (n = 12) that only had lesions of the facet joints, mepivacaine was injected around the osteoarthritic facet joints on the left and right sides under ultrasound guidance, using a total of 10 ml mepivacaine per side. The affected joint(s), on each of the left and right sides, were identified ultrasonographically using a 5 MHz convex array transducer (Denoix and Dyson 2003). A 9 cm spinal needle was inserted 1–2 cm abaxial to the midline and directed ventrally until it contacted the bone. This was visualised ultrasonographically. Up to 5 ml mepivacaine was injected at each site. Horses were walked for 15 min after injection and then reassessed ridden. From 2004 most horses in *Groups BF* and *BI* (n = 57) were examined *per rectum* to include ultrasonographic evaluation of the lumbosacral and sacroiliac joint regions.

Image analysis

All images were assessed prospectively by an experienced clinician (S.J.D.) and retrospectively by a trained analyst (M.G.). For image interpretation all images were orientated with cranial to the left. The presence of closeness of, impinging or overriding of the dorsal spinous processes was recorded, together with any mineralised opacities dorsal to a dorsal spinous process, altered shape or size of the dorsal spinous processes, spondylosis of the vertebral bodies and abnormalities of the thoracolumbar facet joints.

Development of the grading system

For the purposes of this study, the previously documented categorisation of abnormalities of the thoracolumbar synovial intervertebral articulations (Denoix 1999a) was used to grade the thoracolumbar synovial intervertebral articulations from the 9th thoracic (T9) to 1st lumbar (L1) vertebrae of 12 horses. Two independent assessors (MG and SJD) reviewed the images blindly. Following comparison of the results and, after recognition of some difficulties of application of the grading system, the system was modified (Table 2).

TABLE 2: Grades of lesions of thoracolumbar facet joints observed radiographically (modified from Denoix 1999a)

Grades	General criteria	Radiographic signs
1	Sclerosis	Increased opacity of the subchondral bone, deeper in the articular processes or further dorsally from the joint.
2	Osteolysis	Radiolucent areas in the subchondral bone, deeper in the articular processes or further dorsally from the joint.
3	Intra and periarticular remodelling	Enlargement of the facet joint, irregularity of the bone margins intra and/or periarticularly.
4	Dorsal extension of the joint	Continuous extension of the facet joint. dorsally along the dorsal spinous processes.
5	Modification of the joint space, asymmetry	Narrowing of joint space, no clear joint. space, double joint space, enlarged joint space.
6	Ankylosis	Complete loss of joint space.

Image analysis

The modified grading system was used to assess the radiographs of 10 other horses, 10 times in a random order by M.G. to determine that there was acceptable repeatability of interpretation of the results. The modified system was used finally to grade the images of all horses. Each set of images was graded 3 times in random order by M.G. For statistical comparisons between horses, in which oblique views of the left and right sides were available and in which only lateral views were available, the data from left and right sides were pooled, based on the presumption that lesions detected separately on the left and right sides would have been detected on a lateral image. A total facet joint score for each joint was obtained by summing the grade (Table 2) for each lesion.

Statistical analysis

A Chi-square test was used to determine if there was a significant effect of breed, sex or discipline on the presence of thoracolumbar facet joint lesions by comparison with the general clinic population (*Group A*), excluding horses with thoracolumbar region pain. Age and bodyweight were compared between horses with thoracolumbar facet joint lesions and the general clinic population using a Mann-Whitney U test. Descriptive statistics were used to describe data distribution for number of affected thoracolumbar facet joints per horse, left right symmetry, grade of thoracolumbar facet joint lesions and clinical signs of horses with lesions of thoracolumbar facet joints. A Chi-square test was used to determine if there was an influence of location on grade of lesion, and to test whether there was a difference in the distribution of clinical signs between horses with and without lesions of dorsal spinous processes. Significance level was set at $P<0.05$.

Results

During the study period, osteoarthritis of the thoracolumbar facet joints was identified in 77 of 644 horses (12%) with clinical evidence of thoracolumbar region pain (Table 3). The remaining horses (*Group BO*) had impinging dorsal spinous processes (n = 529), spondylosis (n = 11), impinging dorsal spinous processes and spondylosis (n = 12), fracture of a lumbar dorsal spinous

TABLE 3: Summary of the horses which underwent radiographic examination of the thoracolumbar spine

Group		No.	Percentage
B	All horses with back pain.	644	
	Osteoarthritis of thoracolumbar facet joints.	77	12
BF	Osteoarthritis of facet joints alone.	30	
BI	Osteoarthritis of facet joints and impinging or over-riding dorsal spinous processes.	47	
BO	Back pain without osteoarthritis.	567	88
	Impinging or over-riding dorsal spinous processes.	524	
	Spondylosis	11	
	Spondylosis and impinging or over-riding dorsal spinous processes.	12	
	Fracture of lumbar dorsal spinous process.	1	
	Subluxation of thoracolumbar vertebrae.	2	
	Supraspinous ligament injury.	2	
	Lumbosacral disc disease alone.	2	
	Tack and/or rider induced pain.	5	
C	Horses with no clinical evidence of back pain, which underwent radiographic examination of the thoracolumbar spine.	154	

process (n = 1), subluxation of a thoracolumbar vertebra (n = 2), supraspinous ligament injury (n = 2), *longissimus dorsi* muscle pain with no detectable osseous abnormality (n = 8), tack and/or rider induced pain (n = 5), lumbosacral disc pathology (n = 2). No horse in *Group C* had evidence of osteoarthritis of the thoracolumbar facet joints. Osteoarthritis of the thoracolumbar facet joints was identified in 24 of 450 horses (5.3%) with back pain in which lateral radiographic views were obtained and in 53 of 194 horses (27.3%) with back pain in which lateral oblique projections were acquired.

Breed, gender, discipline, age and bodyweight

There was a similar breed distribution in *Groups B* (*I* and *F*) and *A*. Most horses were Thoroughbreds (*Group B* [*I* and *F*] 27.3%, *Group A* 25.7%), Warmbloods (*Group B* [*I* and *F*] 23.4%, *Group A* 23.8%) or Thoroughbred cross horses (*Group B* [*I* and *F*] 24.7%, *Group A* 27.3%). There was a similar gender distribution in *Groups B* [*I* and *F*] and *A*, with geldings predominating (*Group B* [*I* and *F*] 67.5%, *Group A* 63.2%). However, the discipline distribution was significantly different in *Groups B* [*I* and *F*] and *A*. There were significantly fewer showjumpers in *Group B* [*I* and *F*] compared with *Group A* (9.1 vs. 17.4%). General purpose riding horses were the largest single discipline in both groups (*Group B* [*I* and *F*] 36.4%, *Group A* 38.8%), followed by dressage (19.5%) and eventing (18.2%) in *Group B* [*I* and *F*], and showjumping (17.4%), dressage (15.4%) and eventing (14.7%) in *Group A*. There was no significant difference in age or bodyweight distribution between the 2 groups (*Group B* [*I* and *F*] mean age 8.6 ± 3.1 years, *Group A* 8.8 ± 3.5 years; *Group B* [*I* and *F*] 564 ± 68 kg, *Group A* 557 ± 80 kg).

Location of facet joint lesions

Lateral radiographic views of the thoracic facet joints were obtained in 24 horses and oblique projections in 53 horses. In these 53 horses, only 17 (15%) lesions were unilateral from a total of 115 abnormal sites. Unilateral lesions were usually located in the more cranially affected facet joints (T9–T11). There was no significant difference in the distribution of lesions between left and right sides. Lateral and oblique projections were available for 10 horses, in 8 of which lesions were identified in one or more facet joints in both projections.

TABLE 4: Percentage of each lesion grade (1–6, see Table 2) at synovial intervertebral articulations from the ninth thoracic (T) to first lumbar (L) vertebra for 77 horses with poor performance. Some horses had more than one grade of lesion at a single joint. Lesions were significantly more prevalent at the articulations between T16 and T17, and T17 and T18 than at other locations (P = 0.0361)

Location of lesion	Grade of lesion						No. of affected facet joints
	1	2	3	4	5	6	
T9–T10	33.3	0.0	66.7	33.3	0.0	0.0	3
T10–T11	33.3	33.3	66.7	33.3	0.0	0.0	3
T11–T12	50.0	50.0	50.0	50.0	50.0	0.0	2
T12–T13	66.7	0.0	33.3	16.7	83.3	0.0	6
T13–T14	58.3	0.0	41.7	33.3	75.0	0.0	12
T14–T15	40.0	0.0	20.0	56.0	68.0	8.0	25
T15–T16	50.8	7.9	50.8	44.4	71.4	6.4	63
T16–T17	90.1	31.0	91.6	45.1	70.4	25.4	71
T17–T18	67.5	25.0	87.5	47.5	57.5	35.0	40
T18–L1	45.5	21.2	87.9	27.3	54.6	36.4	33
All locations	62.8	17.8	69.0	42.6	65.1	16.3	258

Lesions were present in the majority of horses in T16–T17 facet joints (71 horses, 92%) and frequently in T15–T16 facet joints (63 horses, 82%) (Table 4). T17–T18 and T18–L1 were less frequently affected (40 [52%] and 33 [43%] horses, respectively). However these facet joints could not be assessed in some horses due to superimposition of the diaphragm and/ribs (T17–T18: 31 horses, T18–L1: 15 horses). Facet joints located more cranially had fewer lesions (T14–T15: 25 horses [32%]; T13–T14: 12 horses [16%]; T9–T10 to T12–T13: 14 horses [18%]).

Number of affected joints per horse

Between 1 and 8 facet joints in the thoracolumbar region had lesions unilaterally or bilaterally, mean ± s.d. 3.7 ± 1.6 and a median of 3 affected joints per horse (Fig 1). Facet joints that could not be assessed were excluded from this analysis. Fifteen horses had 2 abnormal facet joints, 21 horses had lesions in 3 facet joints, 13 horses in 4 facet joints and 14 in 5 facet joints.

Grades of lesions

Lesions varied in severity within each category. Typical lesions are illustrated in Figs 2–4 and o1–o7; (online figures can be found at www.evj.co.uk/suppinfo). Intra- or periarticular bone remodelling, sclerosis of the subchondral bone or deeper into the articular processes, and alteration (most commonly narrowing) of the joint space were the most frequent types of lesions observed. Dorsal extension of the joint was common. Osteolysis in the articular processes or dorsal to the facet joint, or complete ankylosis of a facet joint were observed rarely (Table 4).

Grades of lesions were significantly different depending on facet joint location (P = 0.0361). Sclerosis was most common in T16–T17 facet joints. Ankylosis occurred most frequently in the caudal thoracic facet joints (T14–L1). Presence of dorsal extension of the joint and incomplete loss of the joint space was not significantly affected by location (Table 4). Some grades of lesions were not observed at some locations. Osteolysis was not detected in any T9–T10, T12–T13, T13–T14 or T14–T15 facet joints, and was rarely observed at T15–T16. Modification of the joint space was not detected in T9–T10 and T10–T11 facet joints. Ankylosis was not detected in any facet joint from T9–T10 to T13–T14 inclusive.

Other osseous abnormalities of the thoracolumbar spine included impingement of the dorsal spinous processes in 47 horses

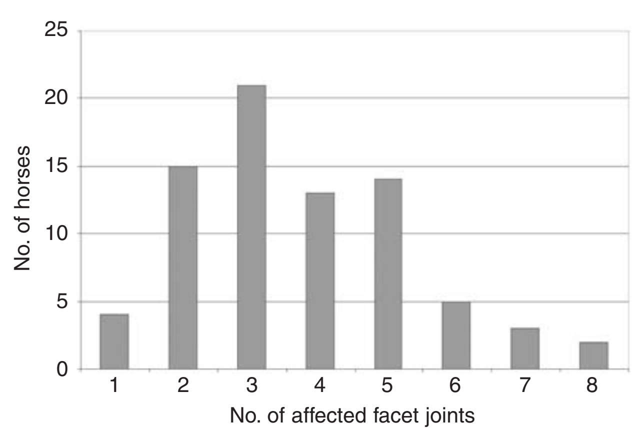


Fig 1: Illustration of the number of thoracolumbar facet joints with radiological lesions per horse for 77 horses with poor performance. ■ *= Total of horses.*

(61%), involving between 2 and 10 dorsal spinous processes. Of these 47 horses, 91.5% had lesions involving the dorsal spinous processes at the same sites as facet joint lesions with (51.1%), or without (40.4%), concurrent lesions involving the dorsal spinous processes at other sites. Two horses had spondylosis of thoracic

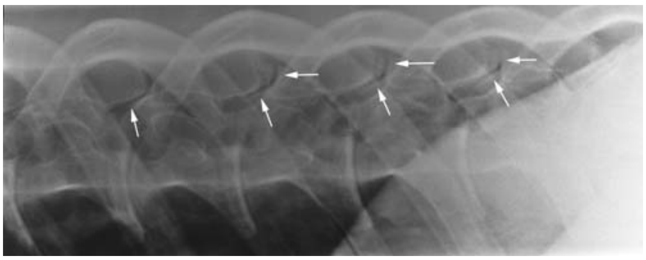


Fig 2a: Horizontal 20° ventral oblique view of the right caudal thoracic facet joints of an asymptomatic 8-year-old Thoroughbred event horse. Cranial is to the left. There is no detectable radiographic abnormality of the synovial intervertebral articulations (arrows).

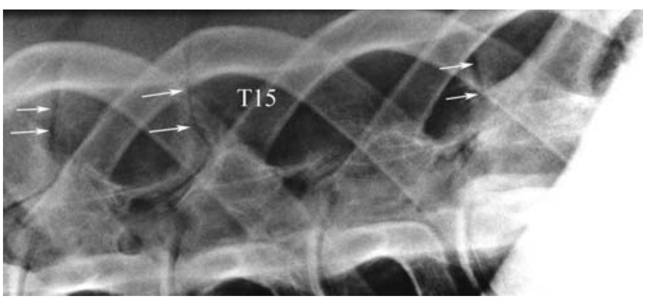


Fig 2b: Horizontal 20° ventral oblique view of the right caudal thoracic facet joints (T13–T18) of a 16-year-old Cob general purpose mare. Cranial is to the left. There is proximal extension of all facet joints between T13 and T18 along the dorsal spinous processes (arrows), with sclerosis of the cortical bone. The joint spaces of the synovial intervertebral articulations between T15 and 16 and T16 and 17 are narrowed.

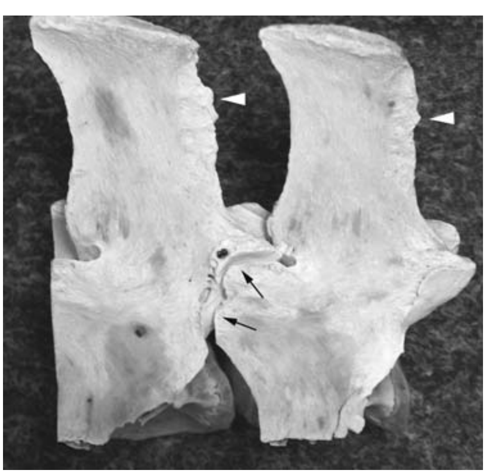


Fig 2c: Photograph of boiled osseous specimens of the 14th and 15th thoracic vertebrae of a 4-year-old Thoroughbred hurdler with chronic back pain, subjected to euthanasia for other reasons. Cranial is to the left. There was radiographic evidence of biaxial osteoarthritis of the thoracic facet joints from the 14th–18th thoracic vertebrae. There is periarticular new bone formation on both sides of the synovial intervertebral articulation between T14 and T15 (black arrows) and osteolytic lesions in the caudal articular process of T14. Note also the new bone formation on the caudal aspect of each dorsal spinous process (white arrowheads) representing entheseous new bone at the attachment of the interspinous ligament.

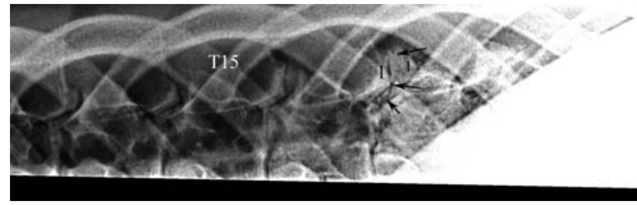


Fig 3a: Horizontal 20° ventral oblique view of the left caudal thoracic facet joints (T13–T18) of a 7-year-old Thoroughbred cross general purpose gelding. Cranial is to the left. There is thickening of the subchondral bone of the caudal articular process of T15. The synovial intervertebral articulation between T16 and T17 is enlarged proximally. The joint space width is irregular (arrows). There is generalised sclerosis of the caudal articular process of T16 and the cranial articular process of T17 (1).

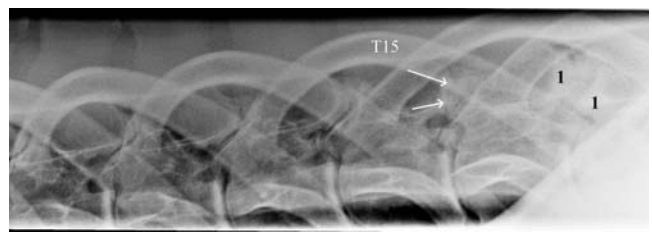
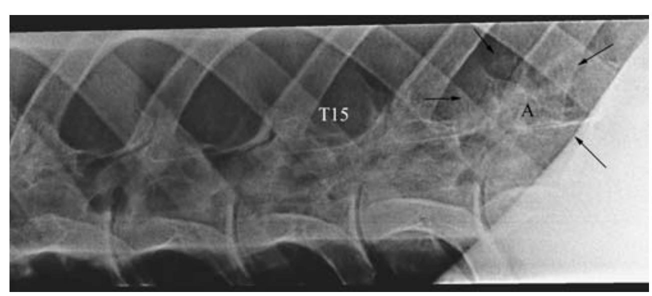


Fig 3b: Horizontal 20° ventral oblique view of the right caudal thoracic facet joints (T12–T17) of a 9-year-old Danish Warmblood dressage gelding. Cranial is to the left. The synovial intervertebral articulations between T13 and 14, T14 and 15, T15 and 16, and T16 and 17 are all abnormal. The joint space between T13 and 14 is narrowed dorsally. There is periarticular new bone dorsally involving the articulation between T14 and 15. The joint space between T15 and T16 is narrowed. There is generalised marked sclerosis of the caudal articular process of T16 and the cranial articular process of T17 (1).

a)



b)

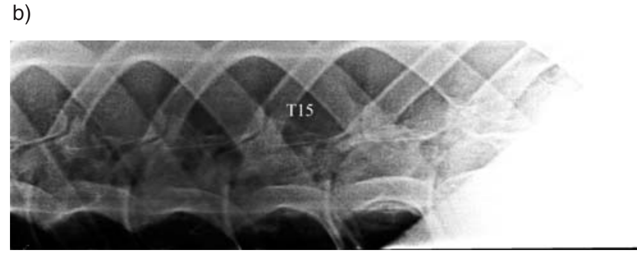


Fig 4: Horizontal 20° ventral oblique views of the right (a) and left (b) caudal thoracic facet joints (T13–T17) of an 8-year-old Irish Sport Horse general purpose gelding. Cranial is to the left. There is considerable periarticular new bone around the synovial intervertebral articulation between T15 and 16 and marked narrowing of the joint space, especially on the right side. On the right side there is considerable periarticular new bone (arrows) and ankylosis of T16–T17 facet joint (A). A similar lesion is seen on the left side. The diaphragm prohibits evaluation of the T17–T18 facet joints.

vertebral bodies, one of which had spondylosis of one intervertebral articulation at which level no lesion of the facet joints or dorsal spinous processes was detected. The other horse had 2 adjacent sites of spondylosis, at which the facet joints and dorsal spinous processes were fused. Thirteen horses (17%) also had sacroiliac joint region abnormalities (positive response to periarticular analgesia and/or abnormal radiopharmaceutical uptake detected by scintigraphy, with or without changes of the bone margins detected by transrectal ultrasonography). Two horses in *Group BF* had degenerative lesions of the lumbosacral joint detected by transrectal ultrasonography, one of which also had sacroiliac joint region abnormalities.

Clinical features and influence of lesions involving the dorsal spinous processes

The most common clinical signs detected at rest included tension, swelling, pain or spasms in the thoracolumbar muscles, and limited flexibility of the thoracolumbar spine. When evaluated moving, stiffness and poor hindlimb impulsion were the most frequent clinical signs, affecting more than 50% of horses (Fig 5). Atrophy of the muscles of the thoracolumbar or pelvic regions, failure to work on the bit, being on the forehand, abnormal limb flight (usually toe-drag), poor quality canter, reluctance to work willingly, and bucking were also common (20–50% of horses). When the total facet joint score, obtained by summing the grades for each lesion, was compared with the number of clinical signs there was no correlation.

Clinical signs were compared between horses with radiographic abnormalities of the facet joints alone (*Group BF*, n = 30) and those with concurrent impinging dorsal spinous processes (*Group BI*, n = 47). A larger range of the clinical signs (Table 1) were seen in *Group BI* than in *Group BF*. Clinical signs that were significantly over-represented in *Group BI*, included epaxial muscle atrophy and abnormal function of the thoracolumbar muscles, reduced thoracolumbar mobility, difficulties in picking up the hindlimbs, or exaggerated lifting of the hindlimbs, and abnormal limb flight.

Concurrent lameness

Twelve horses had concurrent forelimb lameness, 27 had concurrent hindlimb lameness and a further 14 horses had both forelimb and hindlimb lameness. However, the clinical signs described above were not altered after abolition of the lameness using local analgesic techniques of the affected limb(s).

Response to periarticular analgesia

In all horses (n = 12) in which mepivacaine was infiltrated around the osteoarthritic facet joints, improvement in performance was seen when the horses were ridden 15 min later. All horses in *Group BI* (n = 47) showed clinical improvement after local infiltration of mepivacaine around the impinging dorsal spinous processes. A further 8 horses with 2 or more close dorsal spinous processes showed no change after local infiltration with mepivacaine and were, therefore, not included in *Group BI*. All horses (n = 13) in *Group BF* defined as having concurrent sacroiliac joint region pain showed improvement after local infiltration of mepivacaine around the sacroiliac joint regions. A further 10 horses in *Groups BF* and *BI* showed no response to infiltration of mepivacaine around the sacroiliac joint regions.

Discussion

The results of the study supported the hypotheses that facet joint lesions are most frequently identified in the caudal thoracic spine and involve more than one joint per horse. Impinging dorsal spinous processes were often associated with facet joint lesions and influenced clinical signs. However, contrary to our hypothesis, dressage horses were not over-represented relative to the clinic population. The study provides unique results for a large number of horses with thoracolumbar region pain all examined by the same experienced clinician using a standardised clinical protocol.

In a previous study of thoracolumbar pain, showjumping horses were over-represented (Jeffcott 1980), however in the current study there was a significantly smaller proportion of show jumpers in the horses with back pain compared with the normal clinical population. It had been anticipated that dressage horses might be more likely to have clinical manifestation of osteoarthritis of the facet joints because of the large amount of work done in sitting trot, the degree of collection required and the need to flex and extend the thoracolumbar spine in both sagittal and frontal planes. Moreover, because the quality of movement and contact with the bit is judged, it had been considered likely that more subtle clinical signs would be perceived by riders as a significant problem in horses with osteoarthritis of the facet joints.

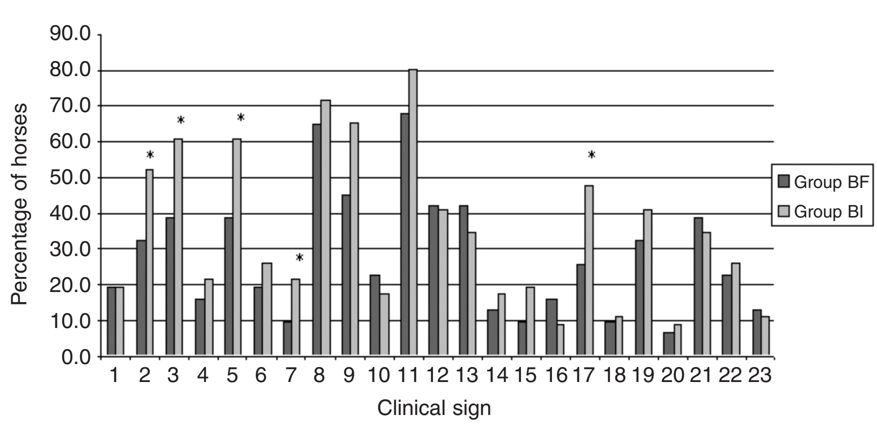


*Fig 5: Percentage of horses with each clinical sign (see Table 1) in horses with osteoarthritis of the facet joints without (*Group BF*), or with impinging of the dorsal spinous processes (*Group BI*). * indicates significant over-representation in* Group BI.

In a previous study of sacroiliac joint region pain, dressage and showjumping horses were over-represented (Dyson and Murray 2003). The over-representation of male horses (stallions and geldings) in the current study was typical of the clinic population. Osteoarthritis of the facet joint lesions had the highest prevalence in the caudal thoracic region (between T15 and L1), a site where there is high dorsoventral and lateral mobility (Denoix 1999b). It is, therefore, probable that the articular processes experience more load (potentially torsional) and the articular capsule more tension in this region. In contrast it was reported that the mobility of the spine caudal to T13 was low (Jeffcott and Dalin 1980; Townsend and Leach 1984), especially due to the L-shape and deep interlocking of the articular processes (Townsend 1985). However, this would not preclude higher torsional forces (previously described as pressure) and tension of the compartments of the facet joints, which may be responsible for the development of lesions. The thoracolumbar junction is characterised as a transitional area with many changes in the articular, transverse and spinous process shape, size and orientation, which may all contribute to localisation or gradations of biomechanical forces. Furthermore, this area is located under the caudal aspect of the saddle. The weight of the rider increases strain in this region. The prevalence of back pain in Standardbred trotters and pacers, which are never ridden, is reported to be low (Mitchell *et al.* 2003). However, to our knowledge, there has been no radiographic study comparing the incidence of osseous abnormalities of the thoracolumbar region in horses which have and have not undergone ridden exercise.

Thoracic facet joint lesions at a single site were rare and lesions occurred most frequently at 2–5 locations, with the majority being bilateral in horses in which oblique radiographic views were obtained (Fig 4). Impingement of 2–10 dorsal spinous processes, located at the same sites of facet joint lesions, with or without involvement of more cranial or more caudal sites, was observed frequently. It was suggested that the greater range of mobility in the caudal thoracic region could account for the frequency of impingement of the dorsal spinous processes at this location (Jeffcott 1980; Denoix 1999b). Impinging or over-riding of the dorsal spinous processes may limit mobility of the thoracolumbar region and alter biomechanical forces on the facet joints, which might predispose to osteoarthritis. Impingement of the dorsal spinous processes may result in the thoracolumbar spine being held in slight extension, a position in which the articular processes of the facet joints undergo more tension (Townsend 1985; Denoix 1999b).

a)

b)

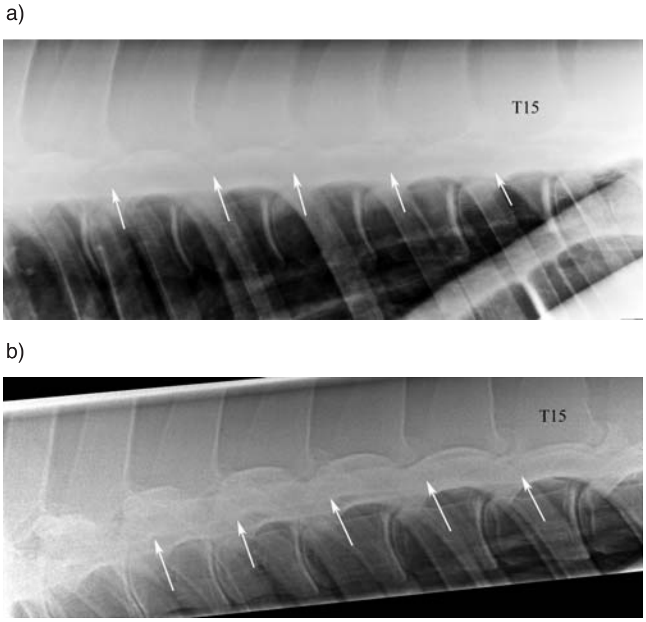


Fig 6: Lateral views of normal mid-thoracic facet joints of a 14-year-old Thoroughbred gelding (a) and of a 4-year-old gelding (b). Cranial is to the left. The facet joints are almost completely obscured by the ribs in (a) and in (b) the ventral aspect of the facet joints (mainly the cranial articular processes) cannot be assessed due to the superimposition of the ribs (arrows).

In the current study, impingement of the dorsal spinous processes was frequently associated with dorsal extension of the facet joints at the same site (Fig 2). The joint often looked continuous between the articular processes and the dorsal spinous processes. This association has been reported previously (Butler *et al.* 2000; Denoix and Dyson 2003). Facet joint lesions have also been reported in association with vertebral laminar stress fractures in the caudal thoracic and lumbar spine in horses subjected to gross *post mortem* examination (Haussler and Stover 1998).

In the current study, horses with osteoarthritis of the thoracolumbar facet joints frequently had other lesions potentially contributing to pain or back stiffness, including not only impinging dorsal spinous processes, but also spondylosis, sacroiliac joint region pain and lumbosacral intervertebral disc degeneration. Recognition of these lesions is potentially important, both for determining a treatment plan and for assessing prognosis.

Sclerosis of the subchondral bone, periarticular bone remodelling and narrowing of the joint space were the most frequent types of radiological lesions, similar to other sites of osteoarthritis (Butler *et al.* 2000). Ankylosis was most commonly observed in the most caudal thoracic facet joints. This probably represents advanced osteoarthritis, perhaps induced by the greater movement and strains in this area.

The clinical signs observed in the current study were similar to those previously described for other back lesions, with reduced quality of performance, poor hindlimb impulsion, short striding, reluctance to work on the bit, loss of balance, unwillingness to work, stiffness and reduction of mobility of the back (Jeffcott 1975, 1979; Hendrickson 2002; Boswell *et al.* 2003; Denoix and Dyson 2003; Dyson 2003, 2004; Kold and Dyson 2003; Wennerstrand *et al.* 2004). Sixty-eight percent of horses, in the current study, had concurrent fore- or hindlimb lameness. Back muscle pain may develop secondary to lameness (Bathe 2003; Bennett 2003; Dyson *et al.* 2003; Kold and Dyson 2003; Rick 2003; Landman *et al.* 2004), which potentially confounds interpretation of the significance of the osseous abnormalities identified; however, the clinical signs of back pain were generally more severe than expected for secondary pain (Dyson 2004). The authors do not believe that any of the clinical signs described were specific for osteoarthritis of the facet joints, rather than a manifestation of generalised back pain. However, horses with impingement of the dorsal spinous processes and osteoarthritis had more clinical signs and were generally clinically worse than horses with facet joint osteoarthritis alone.

The current study covered a period of 10 years using 2 different radiographic techniques to evaluate the thoracic facet joints. Both techniques require a high output x-ray generator (Weaver *et al.* 1999; Butler *et al.* 2000; Hendrickson 2002; Denoix and Dyson 2003). Lateral views were obtained until September 2004, although in horses with high sprung ribs the facet joints often could not be evaluated (Fig 6) and the prevalence of osteoarthritis is likely to have been significantly underestimated. Furthermore, the left and right facet joints were superimposed, therefore it was not possible to determine if a lesion was unilateral or bilateral. Using an oblique view the x-ray beam is tangential to the joint space, permitting better assessment of its width and regularity. However, especially in the caudal thoracic region superimposition of either a rib or the diaphragm can prohibit complete or accurate assessment of the joints.

The ventrodorsal angulation of the x-ray beam in oblique views results in superimposition of more of the diaphragm than using a horizontal x-ray beam. Therefore the T17–T18 facet joints could not be assessed in 31 of 53 horses in which oblique views were obtained (Fig 4). Acquisition of both lateral and oblique views might provide the most comprehensive information. Currently, the authors routinely acquire oblique views of the thoracic facet joints and if the T17–T18 facet joints are obscured, an additional well-collimated lateral image is also obtained.

In the current study period, 12% of horses presenting with thoracolumbar region pain had radiographic evidence of osteoarthritis of thoracolumbar facet joints. This is probably an underestimate, because 23.7% of 194 horses in which oblique views of the facet joints were available had osteoarthritis. In a *post mortem* study, 97% of 36 Thoroughbreds of unknown history had evidence of osteoarthritis (Haussler 1999). It has been suggested that osteoarthritis of the thoracolumbar facet joints is more consistently associated with back pain than impinging or overriding of the dorsal spinous processes (Denoix 1999a), although the prevalence of radiographic evidence of osteoarthritis in clinically normal horses is unknown. During the study period, 154 horses with no clinical evidence of thoracolumbar pain at the time of clinical examination underwent radiographic examination of the thoracolumbar region, including oblique views in 70%. None of these horse had radiographic evidence of osteoarthritis of the thoracolumbar facet joints. Lesions may have been missed in those horses in which only lateral radiographic views were obtained. In the study period impinging dorsal spinous processes, with or without spondylosis, was seen more commonly in association with back pain than osteoarthritis of the facet joints.

This study focused on radiography to assess the thoracolumbar facet joints. Many of the horses underwent nuclear scintigraphic examination, but the results are not reported here, and are the subject of a separate study. Ultrasonography can also be used to assess the articular and periarticular bone surfaces of the facet joints and permits evaluation of the left and right sides independently (Denoix 1999a; Denoix and Dyson 2003). However, accurate evaluation of joint space width and subchondral bone pathology and dorsal extension of lesions is difficult. Ultrasonography was not used routinely to assess the facet joints in the current study, but in the horses in which it was performed (18/77, 23.4%) did not yield additional information. However, ultrasonography of any facet joints obscured radiographically by ribs or the diaphragm might be useful and is now routinely employed.

It has been suggested previously that local anaesthesia is of little value for the assessment of osteoarthritis of the synovial intervertebral articulations because the anaesthetic solution may readily diffuse to sites on the dorsal and ventral rami of the spinal nerves (Denoix and Dyson 2003). However, in this study, local anaesthetic solution was injected periarticularly in 12 horses, all of which had radiographic evidence of osteoarthritis but no other detectable osseous abnormalities. All showed improvement suggesting that it was probable that the joints were the cause of pain resulting in poor performance.

This study had limitations. Horses were selected prospectively, but image analysis was performed retrospectively, and 2 different x-ray techniques were employed. Technical limitations of both techniques prohibited assessment of all the thoracic facet joints. Only lateral views of the lumbar facet joints were obtained, because oblique views result in superimposition of abdominal viscera. Many of the horses had several abnormalities including other osseous abnormalities of the thoracolumbar region, with or without lameness, contributing to poor performance. Local analgesia of the facet joints was performed in only 12 horses. This local analgesic technique is technically demanding and not particularly well tolerated by unsedated horses. Therefore, it is difficult to assess the significance of osteoarthritis of the facet joints alone. To determine the relative significance of impinging dorsal spinous processes and osteoarthritis of the facet joints, larger studies of horses, with and without thoracolumbar region pain, would be required. It is possible that concurrent lameness, by altering the way in which the horses moved, predisposed to pre-existing osseous abnormalities of the back becoming symptomatic. A longitudinal study to monitor the development of lesions would be useful.

The study lacked a control group of asymptomatic horses in full athletic function. Ideally, to determine the prevalence of osteoarthritis in a normal population it is necessary to compare horses presenting with poor performance, back pain or lameness.

This study demonstrated that osteoarthritis of the facet joints of the thoracolumbar spine can occur alone in horses with back pain or in association with other osseous abnormalities, especially impingement of the dorsal spinous processes. The caudal thoracic spine was the most frequent location of lesions detected radiographically. In the authors' experience, oblique radiographic views of this region potentially give more information than lateral images of the facet joints. Severity of clinical signs was related to the presence of other osseous abnormalities, not the number of facet joints involved, nor the severity of lesion grade. To assess the clinical significance of facet joint lesions, further investigation of the prevalence of osteoarthritis in asymptomatic horses in full work is merited.

Acknowledgements

We thank the many referring veterinary surgeons, without whom this study would not have been possible.

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Author contributions All authors contributed to the initiation, conception, planning and writing for this study. Its execution was by M.G. and S.D., with statistics by R.M.