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Research

Behavioral observations and comparisons of nonlame horses and lame horses before and after resolution of lameness by diagnostic analgesia

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ABSTRACT

Differentiation between alteration in behavior which is the result of pain and that reflecting other behavior is potentially challenging in ridden horses. A ridden horse ethogram has been developed, tested, and combined with a pain score. Nonlame horses generally had lower pain scores than lame horses, although there was a small overlap. To determine if the ethogram could be used to differentiate lame horses before and after diagnostic analgesia had substantially improved lameness, and to verify its use in comparison of nonlame and lame horses, a retrospective study was done. Video recordings of 10 lame horses were reviewed by a trained assessor before and after diagnostic analgesia resolved the baseline lameness and improved any gait abnormalities seen in canter. The ridden horse ethogram was applied to each horse under each circumstance that it was ridden. Occurrence (yes/no) for each of 24 behaviors was recorded. Data were combined with that of an additional 13 nonlame horses and 24 lame horses. After abolition of lameness, the total sum score of behaviors ($P < 0.01$), sum of facial ($P < 0.05$), sum of body ($P < 0.05$), and sum of gait ($P < 0.05$) scores were all significantly reduced. Fifteen behavioral markers occurred significantly more often in lame horses (P values 0.00–0.05), and an additional 4 markers were only seen in lame horses. For pooled data, all sum markers were significantly higher in lame horses compared with nonlame horses or after resolution of lameness ($P < 0.05$). The length of the video recordings was not standardized among horses, nor before and after diagnostic analgesia. It was not possible to hide the presence of lameness which could have biased the assessor. Application of the ridden horse ethogram was able to differentiate between lame horses before and after diagnostic analgesia and nonlame and lame horses, although there was some overlap.

Introduction

Differentiation between alteration in behavior which is directly the result of pain (Girodroux et al., 2009; Meehan et al., 2009; Zimmerman et al., 2011; Dyson and Murray, 2012; Dyson, 2012; Parkes et al., 2013; Dyson, 2014, 2016, 2017; Plowright and Dyson, 2015; Barstow and Dyson, 2015; Dyson and Rasotto, 2016) and because of other behavior (Warren-Smith et al., 2007; McGreevy, 2007; Christoffersen et al., 2007; Visser et al., 2009; McLean and McGreevy, 2010; Hall et al., 2013; Górecka-Bruzda et al., 2015) in ridden horses can be challenging. Lack of recognition of pain may result in stronger or punitive training cues (aids) being applied, potentially to the detriment of equine welfare.

A facial expression ethogram for ridden horses has recently been developed (Mullard et al., 2017). This was combined with a pain score and used to differentiate between still images of the heads of lame and nonlame horses (Dyson et al. 2017). Reductions in pain scores were observed after abolition of lameness by diagnostic analgesia. This demonstrated that a combination of several features of facial expression (e.g., both ears back, an intense stare, tension in the muscles caudal to the eye, and the mouth open) may occur when horses experience pain. A ridden horse ethogram for whole horse behavior has also been developed (Dyson et al., 2018). When

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combined with a pain score, it was possible to differentiate nonlame and lame horses based on video recordings. To differentiate between pain, conflict behavior (Górecka-Bruzda et al., 2015), and other behaviors, comparison of horses with musculoskeletal pain before and after pain relief would be helpful. Evaluation of behavior before and after diagnostic analgesia has abolished lameness is potentially more robust than assessing the response to systemically administered analgesics because some pain causing lameness responds poorly to nonsteroidal anti-inflammatory drugs (Dyson, 2016). Moreover, systemic analgesics may mask non-musculoskeletal pain.

The purpose of the present study was to apply a ridden horse ethogram (Dyson et al., 2018) to video recordings of the same horses before and after lameness was abolished by diagnostic analgesia. It was hypothesized that the baseline pain score in lame horses would decrease after lameness had been improved by diagnostic analgesia. In addition, by the amalgamation of this new data set with the previously published data from lame and nonlame horses (Dyson et al., 2018), derived with exactly the same methodology, the validity of the ethogram for differentiation between lame and nonlame horses was further tested.

Materials and methods

Lame horses before and after diagnostic analgesia

Experimental design

This was a longitudinal repeated measures study, evaluating ridden behavior in 10 lame horses from video recordings before and after application of diagnostic analgesia. The horses were otherwise ridden under identical conditions.

Horse selection

Video recordings of 10 randomly selected horses undergoing lameness investigation at the Animal Heath Trust between March 2013 and February 2016 which had been acquired for reasons unrelated to the present study were reviewed. Videos were acquired with a high-definition video camera (Panasonic HC-X900) (Panasonic HC-X900, Panasonic Corporation, Hamburg, Germany). Footage was acquired from the front and the back and both sides of each horse. Horses were included if there was footage of the horse ridden in working trot and working canter following the boundaries of a 20 × 60m arena and in working trot in 10-meter diameter circles and/or circular figures of 8 based on 10-meter circles. The footing was waxed sand and fiber, which was leveled daily. Video recordings were available both before diagnostic analgesia and after both abolition of lameness and improvement in gait abnormalities observed in canter.

The horses comprised 4 mares and 6 geldings; ages ranged from 5 to 13 years (mean 8.5 years; median 9 years). There were 7 warmbloods and 3 Irish sports horses used for dressage (n = 6), show jumping (n = 2), and general purposes (including unaffiliated competition, n = 2). All horses were presented for investigation of poor performance (reduced quality of performance). No horse had evidence of oral pain, and saddle fit was adequate. The pain causing lameness was associated with bilateral hind limb proximal suspensory desmopathy and sacroiliac joint region pain in all horses; one horse also had unilateral forelimb proximal suspensory desmitis.

Data acquisition

The video recordings were assessed blindly by JMB, an equine veterinarian who had undergone 1-year post graduate equine training and additional training in equine behavior. The ridden horse pain behavior ethogram (Table 1) was applied to trot and canter, each on the left and the right reins, trot circles to the left and to the right, and transitions between gaits. For each category, a pain score had been predetermined by consensus between SD (a Royal College of Veterinary Surgeons Specialist in Equine Orthopedics and British Horse Society Instructor) and JMB (a Diplomate of the American College of Veterinary Behavior and Diplomate of the American College of Veterinary Welfare), as previously described (Dyson et al., 2018). The duration of each video recording was documented. Occurrence (yes/no) of each behavior marker was recorded and a total marker occurrence score for each horse was determined; trot and canter were scored independently. The videos were viewed in real time; the videos could be stopped and replayed; slow motion was not available. The grade of lameness (on a scale of 0-8) (Dyson, 2011) ascribed prospectively to the lamest hind limb before diagnostic analgesia by SD was recorded. A symmetrical lack of hind limb impulsion and engagement was graded as 2.

Table 1
The ridden horse pain ethogram which was applied to all horses

Area	Behavior descriptor
Body-head	Repeated changes of head position (up/down) Head tilted or tilting repeatedly Head in front of vertical (>30°) for >10s Head behind vertical for >10s Head position changes regularly, tossed or twisted from side to side, corrected constantly
Facial-ears	Ears rotated back or flat (both or one only) >5s; repeatedly lay flat
Facial-eyes	Eye lids closed or half closed for 2-5 s Sclera exposed Intense stare for 5s
Facial-mouth	Mouth opening and shutting repeatedly for >10 s Tongue exposed and/or moving in and out Bit pulled through the mouth on one side (left or right)
Body-tail	Tail clamped tightly to middle or held to one side Tail swishing large movements: repeatedly up and down/ side to side/circular; during transitions
Gait	A rushed gait (frequency of trot steps > 40/15s); irregular rhythm; repeated changes of speed Gait too slow (frequency of trot steps <35/15s); passage-like trot Hind limbs do not follow tracks of forelimbs but deviates to left or right, on 3 tracks Canter repeated leg changes: repeated strike off wrong leg, change of leg in front and/or behind, crooked on 3 tracks, disunited Spontaneous changes of gait (e.g., breaks from canter to trot) Stumbles or trips/catches toe repeatedly
Gait obedience	Sudden change of direction against rider direction Reluctant to move forward, stops spontaneously Rearing (both forelimbs off the ground) Bucking or kicking backward (one or both hind limbs)

Assessments were made in trot and canter and on left and right reins independently. Differences between trot going around the periphery of the arena and in 10-meter diameter circles were noted. From Dyson et al. 2017.

Data analysis

The average time of video recordings was 3.2 ± 0.3 minutes. Individual behaviors were compared and the sum score for all behaviors; behaviors were subdivided into clusters for facial behaviors (e.g., eyes, nostrils), gait-related behaviors (e.g., canter lead, rushing), and body expression (e.g., tail movement, head carriage). Differences between mean lame (before) and mean nonlame (after) markers were analyzed through pairwise comparison (Wilcoxon sign test), and differences between mean occurrence of markers (yes/no) were analyzed using a Cross tab Chi square test (SPSS. 23.0, 2015 [SPSS Inc, Chicago, Illinois, USA]). Significance level was set at $P < 0.05$.

Amalgamated data

Occurrence data (yes or no) from this study (n = 10) and from a previous study using the same ethogram applied by the same