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Analyzing Pain in Equine with Eye Syndrome: Advancements in Recognition and Assessment Systems

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Abstract

Equine eye syndrome, or EES, is a serious health concern for horses that results in pain and suffering. The goal of this research is to improve the early detection and treatment of equine ocular discomfort by exploring novel methods for identifying and evaluating pain in horses suffering from EES. We performed a retrospective observational analysis on each horse treated for ophthalmologic disorders from October 2020 to October 2022. The clinical improvements of horses in the present investigation are divided into different categories: excision, ophthalmic operation and discharge with medical care. The Horse Grimace Measure (HGM) and the Pain Index for Behavior (PIB) are used to evaluate temporal patterns using linear regression. The relationships between slope, capture and development are found using the Kruskal-Wallis test. Out of the 114 horses that fulfilled the requirements for entry, 46 were released following solely medical treatment, 33 had eye surgery and 16 had excision. Two ophthalmology operations were conducted on five horses. When the horses were admitted, the PIB readings were greater in the medically managed horses than in the enucleated horses. Compared to horses under medicinal management, excision-requiring horses experienced a greater increase in HGM and PIB throughout their hospital stay. Additionally, PIB increased more in these cases than in cases of ocular eye surgery. When it comes to tracking the course and reaction to treatment, pain scoring could be a helpful tool for horses with eye conditions.

Keywords: Equine eye syndrome (EES), horses, health concern, pain, HGM, PIB

INTRODUCTION

Equine health and welfare are critical to many industries, including sports, pleasure and agriculture. Eye syndrome presents a distinct set of difficulties among the many health issues that afflict horses. An in-depth knowledge of the physiological and behavioral markers linked to ocular discomfort is necessary to identify and evaluate pain in horses suffering from eye syndrome. Recent years have seen notable developments in recognition and evaluation methods that provide new perspectives on the early identification and treatment of pain in horse eye diseases (1, 2).

Equine eye syndrome is a broad term for several problems that can affect the eyes, including inflammation, injuries and infections. It can be difficult for caregivers and doctors to recognize discomfort in horses since they are predatory animals and have an innate tendency to conceal symptoms, particularly in the early stages. Because the eyes are a fundamental sensory organ, they play an important part in a horse's overall well-being, making early identification and therapy of eye-related discomfort imperative (3).

Modern technology has been used by recognition system advancements to improve horse practitioners' diagnostic skills. High-resolution imaging methods such as optical coherence tomography (OCT) and infrared thermography

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have allowed for precise observation of ocular structures as well as the detection of minor abnormalities. These non-surgical methods can identify possible pain origins early by providing useful information on variations in the shape and warmth of the eyes (4, 5).

Methods of evaluation have improved to offer a more complete image of horse ocular discomfort. Traditional pain rating methods that depend on subjective assessments are supplemented with objective metrics. For example, ocular surface pressure mapping quantifies pain by detecting pressure locations on the eye. This method allows for a more consistent and accurate assessment of pain, which leads to more successful treatment plans (6, 7).

Due to the unusual structure and physiology of equine eyes, ocular pain in horses can be difficult to diagnose. Understanding the pain levels of uveitis, corneal ulcers and glaucoma is crucial for correct diagnosis. Ocular imaging and tonometry can diagnose discomfort and suggest therapy (8).

Telemedicine developments have broadened the scope of equestrian therapy, enabling remote observation of equine patients suffering from eye syndrome. Caretakers and veterinarians can monitor changes in crucial indicators using wearable and smart technologies, which allow them to take action promptly and reduce the strain on the horse. This proactive strategy increases the effectiveness of veterinary therapy while improving the general health of the impacted horses (9, 10).

The author (11) examined minute changes in facial expression to gauge acute discomfort. Using geometric morphometrics, they examined changes in face form before and after laparoscopic eye surgery. It demonstrated the significance of identifying unique pain expressions in the treatment of captive macaques by identifying firmly closed or compressed eyelids and lip tension as prevalent facial alterations on the first postoperative day.

The study (12) aimed to create a facial image-based automated method for assessing horse discomfort. They identified pain-related indicators in horses by using approaches for facial image analysis. It provided prospective improvements in equestrian well-being by demonstrating the viability of an automated evaluation method for equine discomfort based on face images.

The research (13) sought to create and evaluate a model for automatic video monitoring of horses kept in stables. It involved developing and testing an automated system, perhaps using video analysis techniques, to track horse behavior in stable settings. By creating and validating an automated video tracking model, they have improved welfare and management practices by offering a dependable way to monitor horses kept in stables.

The Article (14) examined recent developments in the medical recognition of pain in dogs, with an emphasis on the assessment of emotions and facial expressions. It explores the newest techniques and technology for interpreting canine emotions, especially facial expressions, to improve pain diagnosis in dogs. It described how evaluations of emotions and facial expressions have advanced as useful instruments for diagnosing pain in therapeutic settings.

The research (15) has studied the use of recumbency in elderly and chronically orthopedic horses as a measure of equine well-being. It evaluated the relationship between horses' well-being and recumbency. Using 83 horses and wearable sensor equipment, it found that recumbency was essential for Rapid Eye Movement (REM) sleep. While age and lameness do not affect recumbency, REM deficiency negatively affects well-being, highlighting the importance of technology in evaluating the welfare of horses.

The author (16) focused on bio-sensing technology for early sickness detection and precision livestock farming was examined in farm management. Farmers made better judgments using smart agricultural equipment data, enhancing production, sustainability and animal care. Automation, robotics and wearable sensors increased product quality, cost and environmental management. The technology could revolutionize early sickness detection, management as well as animal operations, enabling sustainable and efficient farming.

The article (17) examined the multifactorial causes of body temperature rises, distinguishing hyperthermia from fever. As an acute response to infections, fever was controlled and reduced pathogens. It highlighted the need for standardized infrared thermography (IRT) protocols to detect animal health issues that gave insights into farm animal pathology pathophysiological mechanisms and recent scientific findings.

The author (18) developed deep learning-based smartphone software for offline equine eye image analysis to detect uveitis. They trained four neural networks on 2346 augmented equine eye images to classify images. Cross-validation showed 99.82% training and 96.66% validation accuracy in identifying uveitis, other eye diseases and healthy cases. Equine uveitis was uniquely identified and demonstrated image-based ophthalmic disease detection.

The author (19) created the Feline Grimace Scale (FGS) to measure ear location, muzzle tension, whiskers alteration, orbital tightness and head posture to diagnose acute cat suffering. Painful cats scored higher on FGS, which had great correlations with validated measures, outstanding inter and intra-rater reliability along with internal consistency. It established a cut-off score, proving its acute pain assessment validity and reliability.

The study (20) aimed horse postural sway analysis using an IMU on the withers to monitor the center of mass variations. Seven induced lame horses were observed with withers-fixed IMUs. Significant displacement alterations and compensating actions were identified. It demonstrated how useful IMU-based postural sway assessment can be in identifying compensatory responses that occur during horse lameness.

METHODOLOGY

Animals

We performed an in-depth study on each horse hospitalized for primary ophthalmologic illness between October 2020 and October 2023. Horses were omitted from this study if they were 6 months old, arrived for excision, were hospitalized for more than 48 hours, or had severe or contradictory comorbidities (e.g., laminitis, temporohyoid, osteoarthropathy).

Medical Data

The patient's age, sex, breed and ophthalmologic diagnosis were the details gathered. The dosage and frequency of analgesic drugs were gathered. Records were examined. Data on treatment-related problems and clinical advancement were also gathered.

Assessment of Pain

For daily patient evaluation, veterinarians used Horse Grimace Scale (HGS) and Behavior Pain Assessment (BPA) to score pain. Before scoring, horses were permitted to adjust to a bright sensation without eye protective masks. The patient's medical record included pain ratings. The following scores were given: The Horse Grimace Scale (HGS) scored horses on facial activity units are ear location, tension above eye, orbital tightening, chew muscle prominent and strain chin prominence and nostril strain, mouth strain and profile flattening. A score ranging from 0 indicating non-presence to 2 indicating over presence was assigned to each facial action units. Thus, each facial action units had a score range of 0 between 2 and overall HGS ratings indicating more pain. Physically painful actions, neck location, ear location, stall location, spontaneous movement or response when approached and

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willingness to raise feet were the six behavior pain assessment (BPA) categories. The BPA score ranged from 6 between 24, with higher ratings indicating more pain. Each behavior was scored 1 between 4.

Advances in Clinical Practice

The three categories for clinical advancements were: (a) hospital release after medical therapy; (b) eye surgery or (c) excision. The study covered two separate periods. Period 1 included all horses excluding those who received eye surgery before the initial 12 hours of arriving. Period 2 included all non excision surgeries performed on horses and covered the time interval from eye surgery until the happening of a second clinical advancement. Figure (1) demonstrates Medical Outcomes and a hospital stay Duration for Horses. The first period covered the period from hospital entry to the first clinical result (excision, eye surgery, or discharge). The study excluded horses that had eye surgery before 12 hours of entry for period 1 but included them for period 2. The second period was between the first and subsequent clinical results.

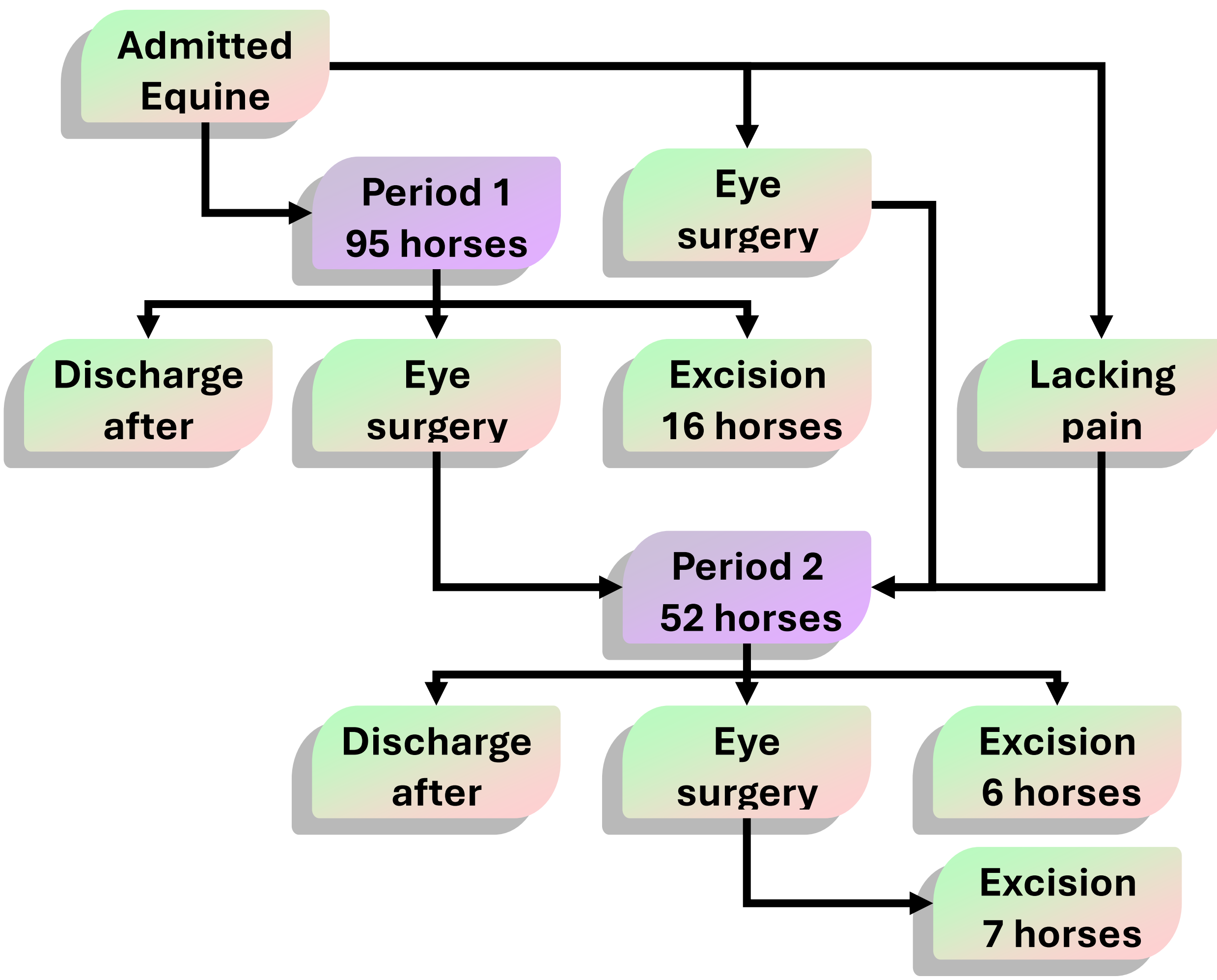

Figure (1). Medical Study Periods in Equine Healthcare

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Statistical Analysis:

Handheld Goniometer Scores (HGS) and Behavioral Pain assessments (BPA) temporal patterns in equines with Eye Syndrome were examined using linear regressions. Entry score y-intercepts and medical management, eye surgery and excision in patient care slopes were computed. Horses were categorized by clinical advancements and nonparametric tests were employed due to slope and intercept non-normality. The significance level was set at $P \leq .05$. We examined slope-intercept-advancement relationships. We utilized median and range for descriptive summaries when data was inadequate for statistical analysis.

RESULTS AND DISCUSSION

The Population and Eye Conditions

The research included a broad group of horses from different breeds, consisting of 64 mares and 36 geldings. The average age was 12 years old. Quarter Horses, Paints, Thoroughbreds, Warm bloods, Appaloosas, Miniature Horses, ponies and Morgans were among the notable breeds represented. Table 1 lists the kind of horse breed.

Table (1). Breed of horse

Breed	No of Horses
Quarter Horses	25
Paints	20
Thoroughbreds	15
Morgan	6
Ponies	8
Miniature Horses	7
Appaloosas	9
Warmbloods	17
Draft breeds	3
crossbreeds	4
Total	114

The horses had a variety of eye problems: 40 had keratitis, 25 had neoplasia, 20 had primary uveitis and 15 had trauma.

Treatment for horses

All horses underwent non-steroidal anti-inflammatory medicines (NSAIDs), including flunixin meglumine, except one that had chronic azotemia. Due to presumed diagnoses, some horses were given gabapentin and butorphanol, while others were transferred to firocoxib.

Inpatient Stay and Results of Treatment

Inpatient care time depended on the disease and therapy. The median inpatient care length for horses with keratitis was 14 days for medicinal therapy, 2 days for ocular eye surgery and 4 days for excision. Most horses with primary uveitis were hospitalized for 7 days, with one requiring eye surgery after 3 days. The median time for neoplasia ocular operation was 12 hours, but the one horse receiving excision took 4 days. Horses with trauma had eye surgery on the first day of inpatient care, while one was released after 30 days of medical care.

Period 1: Entry to the first stage of clinical advancement

This research examines the management, treatment results and associated variables of ocular diseases in 95 horses throughout the first period. A wide variety of conditions were present in the horses, such as keratitis, primary uveitis, ocular neoplasia and traumatic ocular injuries.

Patient Characteristics and Overall Results

The study's equine population consisted of 36 geldings and 64 mares, with a median age of twelve. Breed diversity was substantial, representing a wide range of equine characteristics. Among the 95 horses, 46 were discharged following medical therapy, 33 received eye surgery after more than 12 hours of treatment and 16 had excision.

Inpatient Stay and Duration of Clinical Advancement

A wide variety of illness development rates was shown in the duration from admittance to medical advancement, which ranged from 3 to 60 days. The Average medically treated horse inpatient care was 14 days, highlighting the variability of the diseases. Eye surgery or excision occurred in 4 days.

Data on Pain assessments and Comparative Examinations

A complete analysis was possible with pain assessment data from 75% of the total inpatient days. Medically managed horses and those receiving eye surgeries had similar Horizontal Gaze Score (HGS) entrance scores, HGS slope, Blinking Pain assessment (BPA) entry scores and BPA slope. Horses enucleated had greater HGS slopes, lower BPA entry scores and higher BPA slopes than those handled medically. Equine excision increased BPA slope compared to eye surgery. At entry, the HGS and BPA scores highlighting their interplay in assessing equine ocular abnormalities.

Analysis by Disease

Horses with medicinal keratitis had a median Horizontal Gaze Score (HGS) of 5, whereas those having eye surgery had higher HGS values. Keratitis-enucleated horses had a median HGS on entry of 1. Horses discharged after medical treatment for primary uveitis had minor HGS and Blinking Pain assessment alterations. Most ocular neoplasia instances were operated within 48 hours, with one horse enucleated. Except for one horse treated medically, most traumatized eye injuries required eye surgery on the first day. Equinine ophthalmology requires specialized methods due to the diverse clinical trajectories and therapy tactics for different eye disorders.

Period 2: From the first clinical advancement to the second

In the second period, 52 horses received eye surgery within 12 hours of entry, five horses had lacking pain assessment data (not in period 1) and 33 horses from period 1 remained hospitalized following eye surgery. This segment discusses eye surgery outcomes, procedure times and pain assessments.

Results of Eye Surgery and Recovery Times

The majority of horses were discharged after initial eye surgery with medical care, whereas 7 had a second eye surgery and 6 had excision. Surgical discharge, second eye surgery, or excision took 2–53 days. Keratitis horses

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spent 24 days in the hospital after ocular eye surgery. Uveitis horses spent 29 days in the hospital after ocular eye surgery. None of the horses with uveitis had a second eye surgery or excision. In neoplasia, ocular eye surgery median discharge time was 4 days. Neoplastic horses did not undergo subsequent procedures or excision. The median time after eye surgery for traumatized horses was 27 days. One horse had excision after eye surgery, but six had a second eye surgery.

Analysis of Pain assessments

Data on pain assessments were available for 70.8% of total inpatient days in period 2. Due to the small number of horses receiving ocular eye surgery or excision, statistical comparisons were not made. After ocular eye surgery, keratitis patients had a median Horizontal Gaze Score (HGS) of 4.5 along with a median Blinking Pain assessment (BPA) of 10, with a median change of -0.15 in HGS and -0.12 in BPA. Horses having acute uveitis discharged after eye surgery had HGS and BPA of 0.2 and 6, respectively, with no changes over time. After neoplasia eye surgery, horses discharged had median HGS and BPA of 0 and 6, respectively, with no changes over time. After traumatic ocular eye surgery, horses discharged had median HGS and BPA of 2 and 6, respectively. HGS and BPA median pain assessments changed by -0.044 and -0.0032, respectively.

Excision after eye surgery and second eye surgery

The majority of horses did not require a second operation and excision following eye surgery was rare. The second period of the study focuses on various surgical outcomes and pain assessment differences across different ocular disorders, providing useful insights into the horses' recovery and care tactics.

Our study provided valuable information, but it had limitations such a small size of sample, lacking pain evaluations, early identification and therapy heterogeneity as well as veterinarians assessing pain differently. Inter-rater reliability mitigated the impact of various viewers on the Horizontal Gaze Score (HGS) despite these challenges. Our data suggest that horses having excision had higher HGS and Blinking Pain assessment (BPA) over time than those discharged following medical treatment or ocular eye surgery, although statistical analysis was not possible due to the limited sample size. Higher entry HGS and BPA were related to hospital discharge in horses having excision. HGS and BPA show potential as methods for pain evaluation and Medical choices with ocular illness in horses.

CONCLUSION

Our study focuses on the serious health issue of Equine Eye Syndrome (EES) in horses, to improve early detection and treatment of ocular discomfort. We investigated the clinical outcomes of horses with ophthalmologic problems in a retrospective observational study that lasted from October 2020 to October 2022, defining improvements as excision, ocular operation and release with medical care. Among the 114 eligible horses, unique patterns developed, with 46 successfully discharged after medical therapy, 33 getting eye surgery and 16 requiring excision. The Horse Grimace Measure (HGM) and Pain Index for Behavior (PIB) were used to assess temporal patterns using linear regression. Notably, during entry, medically managed horses had higher PIB levels than those who eventually needed excision. Furthermore, horses having excision had a greater increase in HGM and PIB during their hospital stay than those managed with medicine. Surprisingly, the increase in PIB was greater in excision cases compared to ocular eye surgery cases. This shows that pain scoring, as measured by HGM and PIB, is a useful method for tracking the course of and reaction to eye illness treatment in horses.

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