



**ESCOLA UNIVERSITÁRIA VASCO DA GAMA**

Mestrado Integrado em Medicina Veterinária

Case Report

**Equine Gastric Ulceration Syndrome associated with Musculoskeletal Pain  
- Case Report**

Carolina Pereira Martins dos Santos

**Coimbra, Julho de 2024**



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Dissertação de Estágio Curricular do Ciclo de Estudos Conducente ao Grau de Mestre em Medicina  
Veterinária da EUVG



## Agradecimentos

No culminar de 6 longos anos de trabalho, dedicação, estudo, lágrimas e sorrisos, em que se aproxima o final de uma tão grande e importante etapa, o sentimento que me assola em primeiro lugar, terá de ser a gratidão. Ser-me-á impossível agradecer a todos os participantes neste sinuoso percurso, mas, impossível será também, não destacar alguns deles.

A todos os docentes, colegas e funcionários da Escola Universitária Vasco da Gama e à Universidade que me permitiu concluir o curso dos meus sonhos mais antigos, na minha amada Coimbra, a única e inigualável cidade dos amores e dos estudantes, fazendo jus à tradição e ao desejo da minha família.

Ao Hospital Veterinário da Mata de Santa Iria, e a toda a equipa, que me recebeu de braços abertos, de uma forma tão espontânea e respeitadora, transmitindo-me tanto, em troca de tão pouco, e entregando-me o voto de confiança de que todos precisamos nesta fase da vida.

Ao Hospital Veterinário Equino de San Rossore, que apesar da barreira linguística, me fez aprender tanto sobre o imponente mundo da Medicina Veterinária Equina mostrando-me novas perspetivas clínicas, no país que sempre sonhei conhecer melhor, Itália.

À minha Orientadora, Professora Paula Tilley, e coorientadora Professora Vera Pessoa, por toda a paciência, disponibilidade, transmissão de conhecimentos e acima de tudo por terem acreditado do início ao fim, que estaria à altura deste desafio.

A todos os locais e colaboradores, de estágios que frequentei: Clínica Veterinária VetPóvoa, Hospital Veterinário de Lisboa, Unidade Clínica da Coudelaria de Alter Real, Escola Superior Agrária de Coimbra, Clínica Veterinária SOS Animal e Hospital Veterinário da Universidade de Trás-os-Montes e Alto Douro, o meu especial obrigado por tanta aprendizagem.

Aos meus pais, as palavras serão sempre poucas para exprimir qualquer sentimento de gratidão. Não me deram só a vida, mas sim uma vida tão feliz e completa quanto conseguiram, inspirando-me e incentivando-me sempre a concretizar os meus sonhos, ajudando-me a nutrir as asas para voar o mais alto possível, acreditando em mim quando nem eu acreditava. Que esse voo seja sempre ao vosso lado, pois tudo o que sou, é devido a vocês.

Aos meus avôs, e avós, pais em dobro, que são para mim o melhor sinónimo de amor e carinho, à Minha maior conselheira Avó Nonô, ao meu grande amigo Avô António, e. aos que já só estão presentes na memória e

coração, à minha Avó Licínia por me ensinar a força imensurável que uma mulher pode ter, e ao meu avô Martins, que me empurrou para as capas e batinas com tanto orgulho, e que me ensinou que o trabalho é a chave do sucesso, a saudade será sempre muita.

À minha tão grande e única Família, a todos os tios e tias, e a todos os primos e primas, que tornam a minha vida mais completa, que estiveram sempre tão presentes a cada passo meu, sem nunca duvidarem de mim, motivando-me a cada vez que diziam “que orgulho na nossa futura doutora dos animais”, sem vocês, também nada disto seria possível.

Às minhas manas sem ser de sangue, amigas-casa, a Kika e a Lu por estarem sempre lá, desde os quatro meses de idade, nem sei como é a vida sem vocês, e aos amigos que mesmo sendo mais tarde, também rapidamente se tornaram casa, Nocas, Dave, Francis e poucos outros. Aos meus tantos parceiros de faculdade, à minha querida Madrinha Mafalda e à minha incrível afilhada Maria João, que fizeram a palavra “família” fazer mais sentido neste mundo académico, à Bia Costa, minha dupla de faculdade imbatível, ao meu Mike, parceiro de tantas horas, ao grupo das Lokas, ao grupo dos 20, e no geral a todos os colegas que fizeram questão de se tornar também amigos neste longo curso, a cada resumo trocado, a cada copo de cerveja ao final do dia, a cada gargalhada, a cada cortejo e a cada serenata, ano após ano.

Aos que contribuíram para a minha incrível experiência Erasmus e que a tornaram na aventura bonita que um dia quero contar aos meus filhos, em especial a todos os amigos e amigas que fiz por essas terras italianas, e que levo comigo para a vida.

A todos os animais que se cruzaram comigo na vida inspirando-me a ser melhor por eles e a construir uma vida a cuidar deles, em especial, ao meu eterno melhor amigo, Matias, o meu patudo que dava conselhos com o olhar, espalhava amor em forma de pelo, que me ensinou que o melhor da vida está nas coisas mais simples, a minha pequena cobaia ao longo de todos estes anos de curso e acima de tudo o meu maior companheiro ao longo dos seus 13 anos.

Por último, à menina que um dia sonhou ser “médica dos animais” e que lutou contra tudo para lá chegar, provando que a mais pura das verdades é “que o sonho comanda a vida”.

A todos. Por mais que seja insuficiente, o meu maior obrigado.

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## List of Abbreviations

**ACTH** - Adrenocorticotrophic hormone

**Cm** – Centimeter

**CRP** - C-Reactive Protein

**EGGD** – Equine Glandular Gastric Disease

**EGUS** – Equine Gastric Ulcer Syndrome

**ESGD** – Equine Squamous Gastric Disease

**FAUs** - Facial Action Units

**GF** - Gastric Fluid

**GI** – Gastrointestinal

**HCl** – Hydrochloric Acid

**HGS** - Horse Grimace Scale

**HPA** - Hypothalamic-Pituitary–Adrenal Axis

**IM** – Intramuscular

**IV** – Intravenous

**Kg** – Kilogram

**Mg** – Milligram

**NO** - Reduced Nitric Oxide

**NGFs** - Neurotrophic Growth Factors

**NSAID** – Non-Steroidal Anti-Inflammatory Drugs

**PED** – Peptic Ulcer Disease

**pH** – Potential of Hydrogen

**PO** – *Per os* – by Mouth

**PSL** - Puro Sangue Lusitano (equine portuguese breed)

**ROMS** - Free Radicals

**SIH** - Stress-Induced Hyperalgesia

**TNF** - Tumor Necrosis Factor

**VFA** - Volatile Fatty Acids

**WBC** - White Blood Cells

## Equine Gastric Ulceration Syndrome associated with Musculoskeletal Pain - Case Report

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## Abstract

Equine Gastric Ulcer Syndrome is the most common gastric disease in horses and has been associated with various factors, such as environmental and feeding miss-management, stress from sports competitions, long distance travelling and change of caregiver, parasites, lack of teeth care, use of Non-Steroidal Anti-Inflammatory Drugs, or even the presence of *Helicobacter pylori*. However, to our knowledge there are no published papers relating this disease to Chronic Musculoskeletal Pain. This dissertation aims to relate musculoskeletal pain associated with a foreign body, the tip of a whip, in the caudo-medial region of the semitendinosus muscle of the left hind limb, with the well-known Equine Gastric Ulceration Syndrome, based on a real clinical case presented in the Equine Teaching Hospital of the Veterinary Medicine faculty of the University of Lisbon. The discussion of this clinical case addresses the likelihood of an association between pain and the stress associated with pain, with the sensitization of tissues such as the gastric mucosa.

**Keywords:** Equines; Chronic Pain; Equine Gastric Ulcer Syndrome (EGUS); Equine Glandular Gastric Disease (EGGD); Equine Squamous Gastric Disease (ESGD); Musculoskeletal Pain; Stress

## Resumo

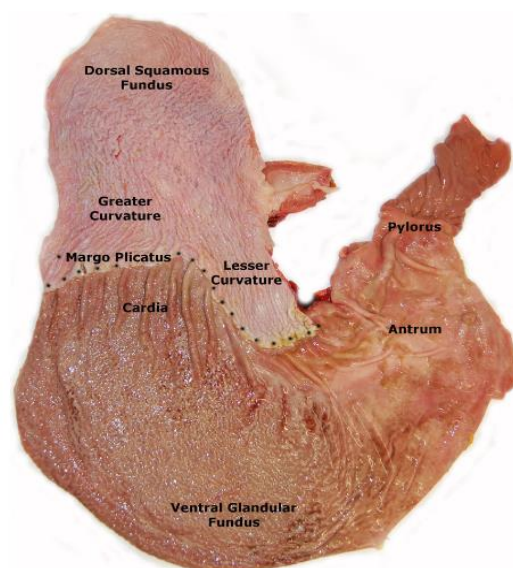
A Síndrome da Úlcera Gástrica Equina é a doença gástrica mais comum nos cavalos e tem sido associada a vários fatores, tais como má gestão ambiental e alimentar, stress por competições desportivas, viagens longas e mudança de tratadores, parasitas, falta de cuidados dentários, uso de Anti-Inflamatórios Não Esteroides, ou mesmo a presença Bactéria *Helicobacter pylori*. No entanto, tanto quanto é do nosso conhecimento, ainda não existem trabalhos publicados que relacionem esta doença com a dor crónica musculoesquelética. A presente dissertação tem como objetivo relacionar a dor músculo-esquelética associada a um corpo estranho, a última porção de um chicote, inserido na região caudo-medial do músculo semitendinoso do membro posterior esquerdo, com a conhecida Síndrome de Ulceração Gástrica Equina, com base num caso clínico real presenciado no Hospital Escolar Equino da Faculdade de Medicina Veterinária da Universidade de Lisboa. A discussão deste caso clínico, aborda a possibilidade de uma associação entre a dor e o stress associado à dor, com a sensibilização de tecidos como a mucosa gástrica.

**Palavras-Chave:** Doença Gástrica Escamosa Equina (DGEE); Doença Gástrica Glandular Equina (DGGE); Dor Crónica; Dor Musculoesquelética; Equinos; Síndrome da Úlcera Gástrica Equina (SUGE); Stress.

## 1. INTRODUCTION

### 1. 1 REVIEW OF THE EQUINE STOMACH ANATOMY AND PHYSIOLOGY

The equine stomach has a physiological capacity of approximately 5 to 15 liters, and is considered small when compared to their body weight and the amount of forage they consume on average (Simões, 2011). Their stomach is divided into two different regions: the non-glandular region (dorsal) and the glandular region (antral/ pyloric) (**Figure 1**) (Ericsson *et al.*, 2016). To divide these two regions, there is, a junction line designated *Margo plicatus*, that forms a raised irregular and sinuous edge with differences in the shape and complexity of the capillary networks (Simões, 2011). The non-glandular portion is characterized by a stratified squamous epithelium without glandular structures, mucosal protective mechanisms, and active transport capacity. In this region only the fermentative digestion of soluble carbohydrates by gastric bacteria's occurs, promoting the release of volatile fatty acids (VFA) as a result of fermentation (Hepburn, 2004). The glandular portion includes the cardia, parietal, and pyloric regions (Simões, 2011), and is characterized by a columnar glandular epithelium with invaginations known as gastric pits (Hepburn, 2004). In the parietal mucosa, there are parietal cells that produce hydrochloric acid (HCl), mucous cells that produce a protective mucus rich in sodium bicarbonate, and main cells that produce pepsinogen, responsible for the cleavage of some of the ingested protein (Hillebrant and Dittrich, 2015). The pH of the equine gastric mucosa is acidic, averaging 5.5 in the dorsal portion of the stomach and 4.1 in the region adjacent to the *Margo plicatus* (Simões, 2011).



**Figure 1: The anatomical regions of the Equine stomach (Adapted from: Sykes et al., 2015).**

## 1.2 PATHOPHYSIOLOGY OF GASTRIC ULCERATION (EGUS/ESGD/EGGD)

In human medicine, the term Peptic Ulcer Disease (PED) is used as a generic term to describe gastric ulcerative and/or erosive diseases and it is recognized that many diseases are included in it (Sykes *et al.*, 2015). In equine veterinary medicine, there is a similar generic term: Equine Gastric Ulcer Syndrome (EGUS), which has been used to describe ulcerative pathologies of the equine gastric mucosa since the 1990s (Vokes, Lovett and Sykes, 2023). However, a distinction according to the anatomical region involved, should be made between Equine Squamous Gastric Disease (ESGD) and Equine Glandular Gastric Disease (EGGD) (Sykes *et al.*, 2015).

ESGD describes lesions involving the squamous epithelium of the gastric mucosa and can be classified as primary or secondary based on the known pathophysiology of the disease (Vokes, Lovett and Sykes, 2023). Primary ESGD can occur in horses with a healthy gastrointestinal tract and is the most common form of the disease and secondary ESGD, can be due to delayed gastric emptying due to other diseases (pyloric stenosis, severe EGGD, or Inflammatory Bowel Disease) (Vokes, Lovett and Sykes, 2023). Primary ESGD has been associated with the exposure of the stratum corneum of the squamous mucosa, with minimal protective mechanisms, to HCl, VFA and bile acids. The exposure depends on the pH, time and amount and increases the permeability of the mucosal cells to hydrogen ions and may cause ulceration (Simões, 2011; Ward *et al.*, 2015). Also, the microbiota of the aglandular region of the equine stomach contains several lactate-producing bacteria, leading to higher concentrations of lactate postprandial, further contributing to acidity (van den Boom, 2022).

EGGD describes lesions in the glandular region, occurring less frequently than ESGD and it is still poorly understood (Simões, 2011). EGGD is believed to result from a breakdown of the normal defense mechanisms. Even though the factors for that have not yet been elucidated in horses, in humans *Helicobacter pylori* and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are the main causes of gastric ulceration (Sykes *et al.*, 2015). Nevertheless, in horses no gastric *Helicobacter spp.*, were found to be involved in lesions in the gastric mucosa (Husted *et al.*, 2010), and the potential for NSAIDs to cause EGGD in clinical conditions is also controversial (Sykes *et al.*, 2015). One of the protective mechanisms that may be altered is the hydrophobic mucus barrier as the result of the reduction in mucus production and/or bicarbonate production. Also, factors responsible for a decrease blood perfusion led to mucosal damage, because there is a decrease in the removal of H<sup>+</sup> from the interstitium with alterations to epithelial tight junctions and cell regeneration (Simões, 2011). Reduced nitric oxide (NO) synthesis is also associated with worsening of ulceration and poor wound healing in

various animal models, while increased NO accelerates healing, and there is a direct correlation between mucosal blood flow and increased/-decreased NO in the mucosa (R. J. Hepburn, 2004). Stress is also cited as a risk factor for gastric ulceration, even though scientific evidence of a direct relationship between stress and ulceration is scarce (van den Boom, 2022).

## 1.3 EGUS CLINICAL SIGNS

Many horses with gastroscopic evidence of gastric ulceration have nonobvious, or subtle clinical signs, not recognized by the owners. The most common clinical signs associated with EGUS are poor appetite, weight loss, poor body condition, colic, discomfort when tightening the girth strap, altered behavior, (nervousness and aggression), poor coat, teeth grinding and self-mutilation (van den Boom, 2022). Other signs like melena (Simões, 2011), flehmen response, diarrhea and bruxism, are also described (Vokes, Lovett and Sykes, 2023).

## 1.4 GASTRIC ULCERS' GRADES

In 1999 the Equine Gastric Ulcer Council, proposed a 0–4 severity grading system based upon lesion depth, size and number (Vokes, Lovett and Sykes, 2023):

- Grade 0: intact epithelium, no hyperkeratosis.
- Grade 1: intact mucosa, with areas of hyperkeratosis.
- Grade 2: small, single or multifocal lesions.
- Grade 3: presence of large single or extensive superficial lesions.
- Grade 4: presence of extensive lesions with areas of deep lesions.

The following case is a review of a real clinical case with the clinical history, clinical findings, diagnosis, treatment, and outcome. The report aims to relate musculoskeletal pain associated with a foreign body, corresponding to the last portion of a whip, inserted into the caudo-medial region of the semitendinosus muscle of the left hind limb, with EGUS.

## 2. CLINICAL PRESENTATION

### 2.1 CLINICAL HISTORY

A 10-year-old Lusitano (PSL- Puro Sangue Lusitano) stallion weighting 514 kg, was presented to the Equine Teaching Hospital of the Veterinary Medicine College, University of Lisbon for Equine Gastric Ulcer Syndrome (EGUS) diagnosis. The horse has recently been purchased for dressage but had been used in Bullfighting by the previous owner.

### 2.2 CLINICAL FINDINGS

The owners reported low performing which was mainly manifested by aborting mission before a jump, as well as unusual eating behavior, as the horse ate the grain in a non-continuous manner, interrupting the meal to walk around the box. Another complaint was the loss of weight and irritability. In the clinical exam, no changes worthy of note were found.

### 2.3 DIAGNOSIS

On the arrival at the hospital, a brief Clinical exam was carried out, followed by a gastroscopy. Gastric Ulcers were classified as grade 4 regarding the number of lesions (more than 10). The majority of lesions were located in the squamous mucosa (**Figure 2**), near the *Margo Plicatus* (**Figure 3**), although there are some lesions on the pylorus, as well. Some areas of hyperkeratosis were presented, and gastric pH was 1,5 (pH-Indicator strip Acilit®, 0-6, Merk). Various recommendations were made regarding stress reduction, such as lowering the intensity of work, releasing the animal more often in the pasture or paddock to promote, if possible, socialization with other horses, and regarding housing, improving daylight and ventilation. Some other recommendations were also made to increase the number of meals a day, decreasing the amount in each meal, distributing the meals evenly over the 24 hours. Regarding food, it was recommended that hay should always be available, alfalfa hay should be 1/3 of the total amount of the hay and vegetable oil should be added.

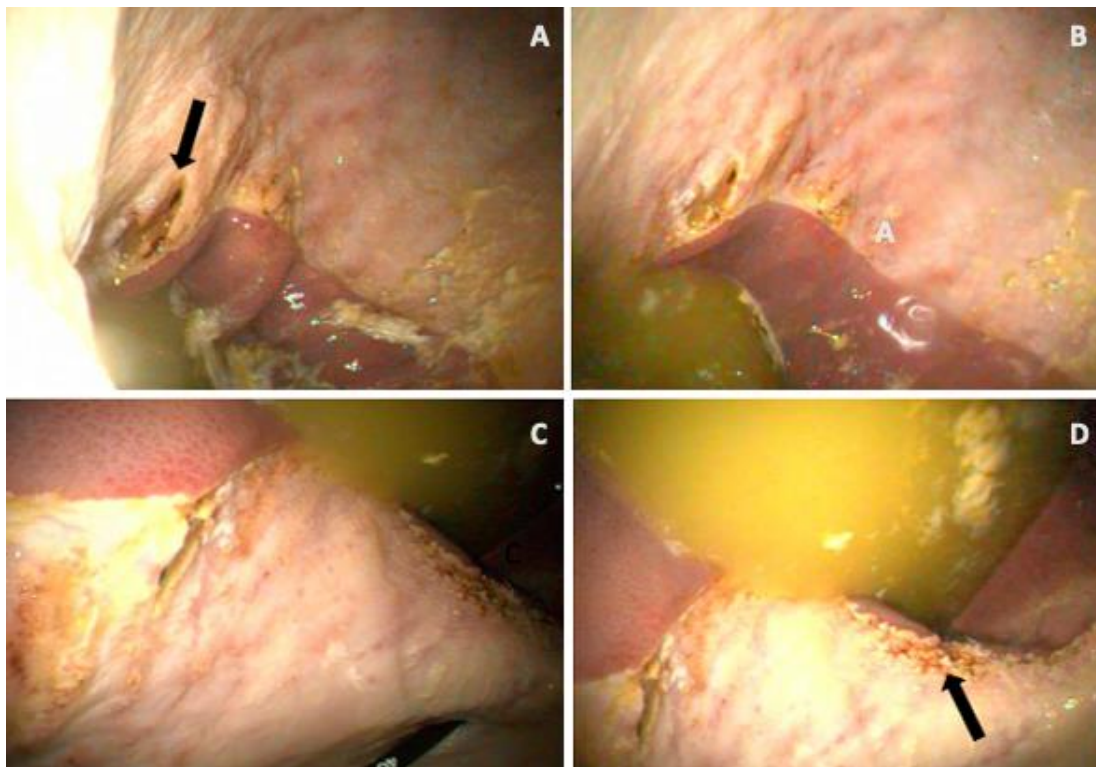


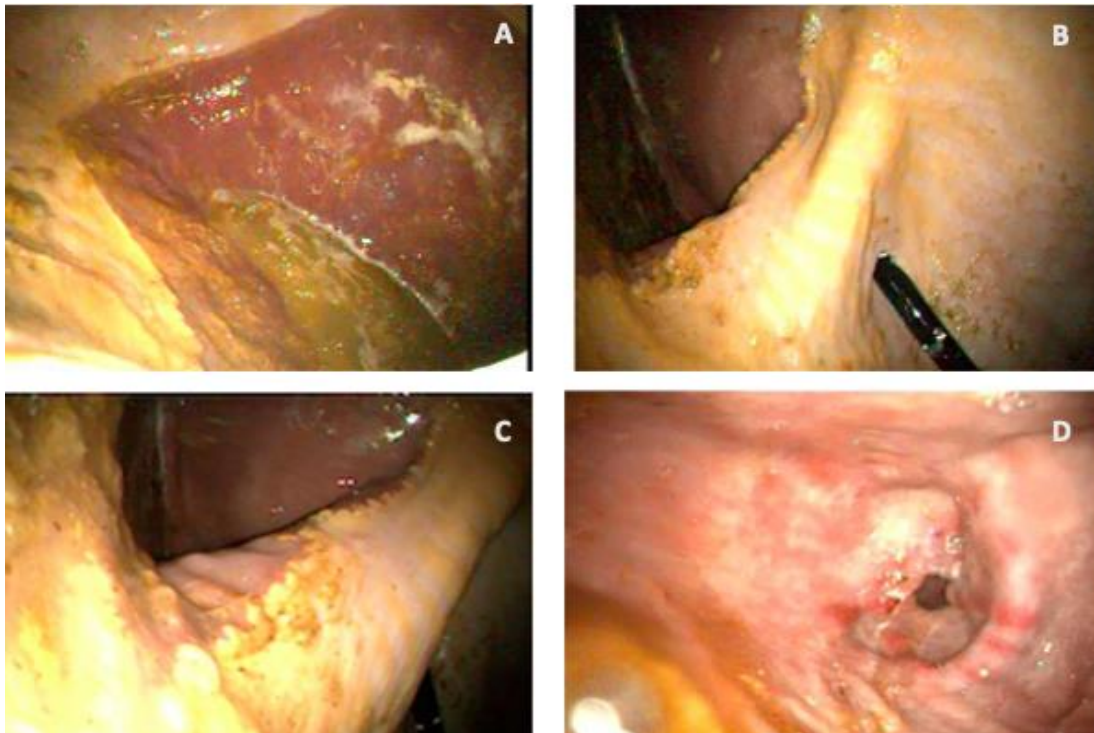
Figure 2: Gastroscopic images of the *Margo plicatus* of 10 years old stallion, showing grade 4 ulceration of the squamous mucosa, near the *Margo plicatus* (arrows), (Images by Paula Tilley).



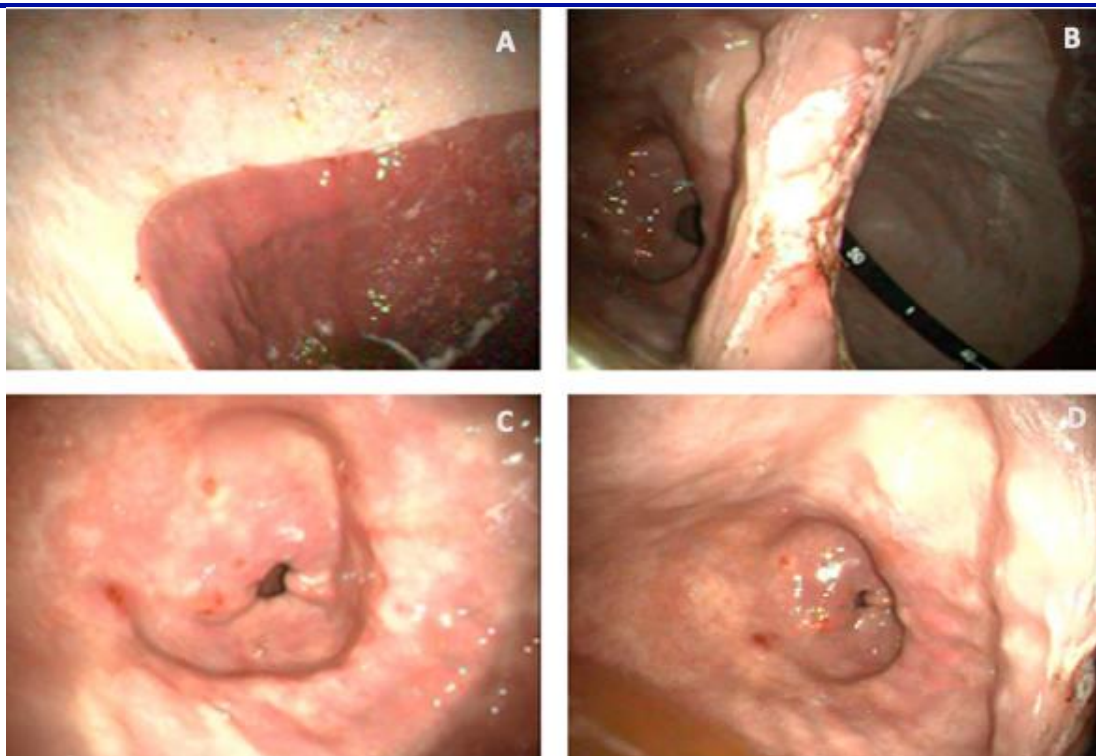
Figure 3: Gastroscopic images of ulceration in the glandular mucosa near the pylorus, (Images by Paula Tilley).

## 2.4 TREATMENT AND OUTCOME

Treatment with 4mg/kg/day omeprazole (Gastrogard®, Boehringer Ingelheim) was initiated for 28 days followed by 2mg/kg/day for another 28 days. Nevertheless, in the following 6 months, clinical signs were still present and 3 follow up gastroscopies were done. Although there are no images from the 3rd gastroscopy, the images were very similar to the 2nd and 4th gastroscopies, showing little clinical evolution. In these, some of the ulcers, mostly grade 4 were present, both in the squamous mucosa and near the pylorus (**figure 4 and figure 5**). There was also a pH variation, suggesting an inadequate response to the treatment and to the feeding management implemented.



**Figure 4: Gastroscopic images of the second gastroscopy with healed ulcers and new ulcers, (Images by Paula Tilley).**



**Figure 5: Gastroscopic images of the fourth gastroscopy with healed ulcers and new ulcers, (Images by Paula Tilley).**

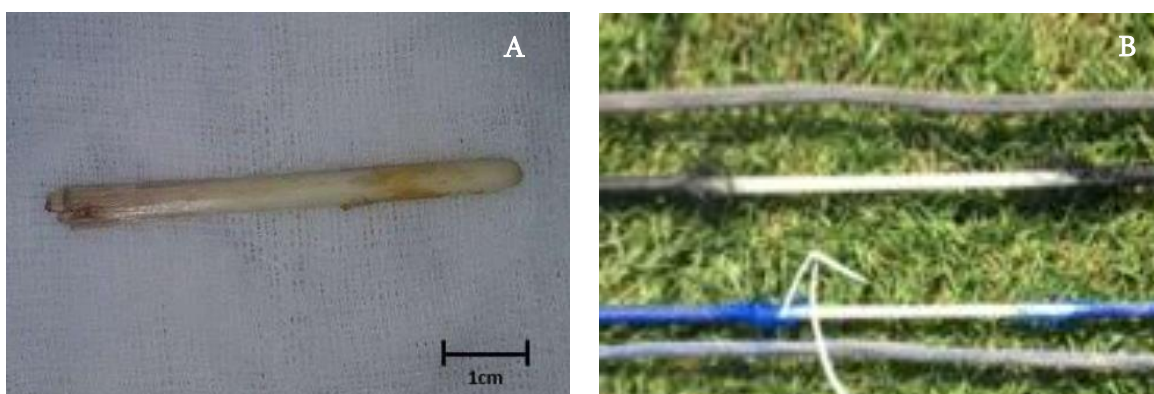
During the fourth control gastroscopy the owner demanded a 2<sup>nd</sup> opinion regarding a small fistula in the caudo-medial region of the semitendinosus muscle of the left hind limb, which had been present since this owner bought the horse. This fistula had been surgically explored a year before by the referring veterinarian but has reopened and had been continuously draining muco-purulent material since then. The owner thought that the horse showed discomfort from this, especially at work, but was not visually lame.

At this point, the horse was hospitalized. Hematological and biochemical analysis of blood were performed. The only changes seen, were a mature neutrophilia with no left shift, some lymphopenia which could indicate a stress response. A transcutaneous ultrasound examination was performed in the region concerned and there was a medial abscess with a foreign body inside it with 5,35 cm of length and 0,56 cm of diameter with an oblique position relative to the skin surface where it was 2,04 cm of depth on one end, and 1,19. cm on the other (**Figure 6**). There was hypogenecity around the foreign body, suggesting edema, pus, and granulation tissue, which could indicate a chronic situation with at least more than 10 days, with a foreign body encapsulated by dense granulation tissue.



**Figure 6: Ultrasound image of a medial abscess with a foreign body surrounded by an hypoecogenic purulent area. A: 2.04 cm in depth; B: 1.19 cm of depth, (Images by Paula Tilley).**

A treatment with 15 mg/kg/day of dihidroestreptomicina and 12.000 UI of benzilpenicilin penicillin (Pendistrep ®) and 6,6 mg/kg/day gentamicin (Gentayet®) was started, both Intramuscular (IM), and 4.4 mg/kg/day phenylbutazone (Phenylarthrite®) Intravenous (IV). Following this, a surgical intervention was done to remove the foreign body under general anesthesia. An oblong plastic piece (**Figure 7-A**) was retrieved which was very likely the tip of a whip (**Figure 7-B**).



**Figure 7: Foreign body removed (A), corresponded to an end of a whip (B), (Images by Paula Tilley).**

In the next days the surgical wound was daily cleaned with chlorohexidine and saline solution, and the stitches were removed after 8 days, with a good healing of the skin. The treatment with oral omeprazole 2mg/kg, that had been initiated for EGUS treatment, was continued for another 28 days. Almost two months later, a 5th gastroscopy was done, and no grade 4 lesions could be seen on the squamous mucosa, only very small lesions in the glandular area (in the pylorus area), suggesting a drastic clinical recovery. After this 5th gastroscopy (**figure 8**), no further gastroscopies were needed since as no EGUS clinical symptoms were exhibited.



**Figure 8: Gastroscopic images of the 5<sup>th</sup> Gastroscopy with healed ulcers and some very small lesions near the pylorus, (Images by Paula Tilley).**

### 3. DISCUSSION

Pain has been defined as, an unpleasant sensory and emotional experience associated with actual or potential tissue damage (Muir, 2010). The recognition and successful management of pain in people and animals remain among the greatest challenges faced by health care providers, and while human patients are able to provide a self-assessment of pain, in animals, is much more complex and requires an evaluation of behavioral and physiologic changes (Wagner, 2010). One of the methods of assessing pain in horses that offers the fewest limitations, is based on the horse's facial expressions, the Horse Grimace Scale (HGS) which comprises six Facial Action Units (FAUs): stiffly backwards ears, orbital tightening, tension above the eye area, prominent strained chewing muscles, mouth strained and pronounced chin, strained nostrils and flattening of the profile (Dalla Costa *et al.*, 2014).

While colic and lameness are common sources of visceral and somatic pain, respectively, other sources of pain in equine cases include ophthalmic diseases and/or surgical manipulation, and, the recognition of overt pain behaviors, such as rolling, kicking the abdomen, flank watching, lameness or blepharospasm, may be obvious, while subtle signs of pain can include changes in facial expression or head position, location in the stall and response to palpation or human interaction (Sanchez and Robertson, 2014). The physiology of pain associated with trauma, includes releasing of prostaglandins, bradykinin, neurotrophic growth factors (NGFs) and ions (H1 K1) into the injured area, and is responsible for peripheral sensitization, developing a primary hyperalgesia and allodynia (extreme sensitivity to touch), and activating immune cells that increases the production of cytokines (interleukin: IL-1, IL-6) and tumor necrosis factor [TNF]- $\alpha$  that activate central sensory neurons, amplifying the pain response (Muir, 2010).

In the case described, bearing in mind that the horse had the foreign body since it was bought off the last owner, it can be considered a case of chronic pain, which may be defined as pain that persists for longer than the expected time frame for healing, or pain associated with progressive non-malignant disease (Dr. Arno Lindner, no date). Furthermore, this type of pain which can last or recurs for over 3–6 months, especially when evolving gradually, can be difficult to assess, yet it may greatly influence equine welfare (van Loon and Macri, 2021).

The stress response represents an animal's attempt to reestablish the body's homeostasis after injury, intense physical activity, or psychological strain (Guedes, 2017). Nevertheless, when severe, cumulative or of prolonged duration, stress can produce distress (which is the inability to adapt

to stress) by disrupting normal biological functions critical to the horse's welfare (Muir, 2013) leading to an increase in metabolic rate, blood clotting, water retention, and immune function (Muir, 2010). According to Muir (2010), persistent chronic pain is appreciated for its ability to modify nervous system physiology and anatomy and has led to the conclusion that the nervous system is malleable, or plastic and that chronic pain can become pain as disease, leading to distress. Two different neuroendocrine pathways may be activated in stressful situations: the hypothalamic-pituitary-adrenocortical axis (HPA), leading to increased cortisol levels, and the sympatho-adreno-medullar system, leading to increased catecholamine levels (Wagner, 2010). This sympathetic nervous system and neurotransmission are integral regulators of the physiological response not only of stress, but also of pain, which allows us to conclude that the relationship between stress and pain and its transition to distress in horses, should not be underestimated (Muir, 2013). In addition, in the literature of pain and stress in horses, we can also find references that high levels of anxiety can actually enhance pain perception, leading to a separate phenomenon known as stress-induced hyperalgesia (SIH) (Wagner, 2010). This SIH, is a neurophysiological process that promotes healing and prevents further injury in a healthy way, but in more moderate and chronic forms of stress, the activation of stress-related circuitry in the hypothalamus triggers pain-facilitating neurons in the rostral ventral medulla, are responsible for producing hyperalgesia on previous injuries, and induce aversive behaviors in horses (Muir, 2013). In this way, we can conclude that anxiety and stress, can enhance pain perception and vice versa, just like a cycle, and should be proactively managed (Guedes, 2017). Thus, in the horse described in this case report, the tip of the whip inserted into the muscle, would probably be causing chronic pain and consequently some distress. This stress could also increase the animal's perception of pain. However, contrary to what is described in the Muir's 2013 study, in this specific case, the animal did not show any aversive behaviors.

It has been observed that there are situations that can induce stress and influence the development of EGUS, as described previously, including environmental changes, adjustments to the normal hierarchy of the group, frequent handling of hospitalized animals, or even chronic pain (Simões, 2011). The horse described here, not only had chronic pain, but was also exposed to a drastic change of environment, being bought by another owner, and used for a completely different purpose which could possibly increase the stress as previously explained.

There isn't much literature or scientific evidence that clinically or biochemically links, the relationship between stress and gastric ulceration, but stress is indeed cited as a risk factor for the disease. However, there are some theories that can correlate these two things, for example, according

to Simões, 2011, decreased blood supply to the basal layers of the keratinized epithelium has been proposed as a cause of ulcerations of the aglandular mucosa, since, for example, stress or exercise lead to decreased blood supply to the gastrointestinal tract, and poor blood flow causes changes in cell regeneration and keratinization, which act as a protective mechanism against lesions caused by acid, thus explaining the greater number of lesions found in *Margo plicatus*, since due to the microvascular pattern of this area, it will be difficult to compensate for changes in blood supply (Simões, 2011). In the case described the majority of lesions were, indeed, located in the squamous mucosa, near the *Margo Plicatus*.

On the other hand, there is a vast amount of literature linking stressful events for example, horse transportation, with gastric ulceration. Horses are frequently transported worldwide by train, road, ship, and air, for reasons such as competing, breeding, slaughtering, and veterinary treatments (Gharehaghajlou *et al.*, 2023). Nevertheless, transportation is associated with factors that may contribute to gastric ulceration such as changes in feeding practices and water consumption, changes in gastrointestinal (GI) microbiota and physiologic stress responses (increased heart rate and serum cortisol concentrations), whereby increased gastric squamous ulceration, can be explained by increased pH of Gastric Fluid (GF) a consequence of impaired gastric emptying and reflux of alkaline small intestinal content, which results in an imbalance between aggressive and protective factors compromising mucosal integrity (Padalino, Davis and Raidal, 2020). In this article by Barbara Padalino, it is also discussed that stress associated with transportation, can lead to a decrease in GI motility and consequently a greater susceptibility of the gastric mucosa to ulceration, consistent with the well-characterized sympathoadrenal neuroendocrine response, which, as previously mentioned, is also one of the neuroendocrine pathways that can be activated in stressful situations.

In addition to transport, there are other articles that link stressful events, with gastric ulceration, such as sporting events. Dionne *et al.*, 2003's study, shows that Standardbred racehorses have a higher prevalence of gastric ulceration, and among the various hypotheses that have been put forward to explain this, such as the mechanical aspects and abdominal pressure during exercise and consequently the inhibitory effect on gastric emptying, there is also the fact that the horses exposed to the stress of anticipating competitions, have an increase in the serum concentration of gastrin and therefore, decrease the stomach pH.

In the case described, as mentioned above, it is believed that the main source of stress was chronic pain and not transportation or exercise. However, these activities were also present in this

horse's life and could therefore have increased the already existing stress, we can also conclude that regardless of the source of stress being caused to the animal, the pathophysiology of gastric ulceration could quite possibly be the same.

Furthermore, in the study of Gharehaghajlou et al., 2023, is discussed the oxidative stress, which occurs as a consequence of an imbalance between the production of free radicals (ROMS) and protective antioxidant mechanisms, that has been associated with gastric ulceration in people, and it is thought that in horses, physiological and psychological responses to stressors, could also change gastrointestinal physiology and predispose to oxidative injury.

According to van den Boom, 2022, another indirect support for the role of stress in Gastric ulceration, was provided by the finding that hair cortisol concentration was inversely related to the severity of this disease, and it was postulated that high plasma cortisol concentrations associated with stress, caused lower hair cortisol through a negative feedback mechanism. Furthermore, in Sykes et al., 2019 we can find that, it has recently been proposed, that there is a relationship between exercise and physiological stress on the glandular mucosa, more specifically in the pathogenesis of EGGD, supported by the facts that horses with EGGD have increased cortisol response to exogenous Adrenocorticotrophic hormone (ACTH) administration, and horses with exaggerated response to novel stimuli are also at an increased risk of EGGD.

## 4. CONCLUSIONS

In the clinical case above described, chronic musculoskeletal pain associated with the foreign body in the caudal region of the semitendinosus muscle of the left thigh, along with other factors, led to chronic stress in this particular horse, demonstrating an association between chronic pain and stress. When the first gastroscopy was made diagnosing EGUS, a plan to reduce stress was recommended, which included reducing the intensity of work, releasing the animal more often in the pasture or paddock to promote socialization with other horses, and regarding housing, improving daylight and aeration. Even so, the animal showed signs of chronic stress, which corroborates the fact that this stress was most likely due to the animal's chronic pain. Subsequently, this stress, which could even be associated with other factors such as reduced intake or reduced water consumption, may well have been one of the main causes of EGUS that this animal presented. According to the literature, there is no evidence of a correlation between stress caused by chronic pain and gastric ulceration. Nevertheless, the clinical case above reported shows evidence that these two factors may have a correlation. This is due to the fact that once the foreign body was surgically removed and the pain was

reduced the animal's stress also reduced, and the animal showed a positive response to the previous treatment for EGUS. This response was demonstrated on the 5th gastroscopy which revealed no grade 4 lesions on the squamous mucosa, only very small lesions in the glandular area, and no EGUS clinical signs, suggesting a clinical recovery.

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