Review Article

Assessment and Management of Chronic Pain in Working Equines

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Abstract

Management of chronic pain in animals is complex because of the multi-dimensional nature of pain (intensity, frequency and duration) and the absence of an assessment tool, which quantifies these different dimensions. Recently, many researchers have been working to develop behavioural assessment tools to quantify chronic pain in equines, especially in conditions such as chronic laminitis in horses, with varying amounts of success. In animals, using a self-reporting technique is not possible; therefore, behaviour assessment is the gold standard under most conditions, especially in the field. Pain related behaviours are species specific. Therefore, there is a need to have an individual assessment tool for each species (such as separate assessment tools for donkeys, horses and mules). Working equines in developing countries are at greater risk of chronic pain than equines in the developed world due to the strenuous work in which they are involved. Equines working in highly regulated environments as in economically developed countries, also suffer from chronic pain due to conditions such as laminitis, navicular disease, several kinds of arthritis and back pain, for which assessment and management tools are currently very limited. This paper discusses some strategies to assess and manage chronic pain in working equines.

Keywords: Equines, Chronic Pain, Behaviour, Pain Management, Pain Assessment

Introduction

The International Association for the Study of Pain (IASP) has proposed a working definition of pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" [1]. Zimmerman [2] defined pain in animals as "an aversive sensory experience caused by actual or potential injury that elicits protective motor and vegetative reactions, results in learned avoidance behaviour, and may modify species-specific behaviour, including social behaviour". Molony and Kent [3] defined pain in domestic animals as "an aversive sensory or emotional experience representing an awareness by the animal of damage or threat to the integrity of its tissues; it changes the animal's physiological response and behaviour to reduce or avoid damage to decrease the likelihood of recurrence and to promote recovery". Green [4] described chronic pain as aberrant somato-sensory processing in the peripheral or central nervous system (CNS) that is sustained beyond the normally expected time course relative to the stimulus and is often insidious vague, and difficult to pinpoint.

The experience of pain (acute or chronic) in animals depends on five important factors. The strength of the nociceptive noxious stimuli; perception of the unpleasant experience (subjective feelings); amount of primary and secondary hyperalgesia developed (exaggerated pain response at the site of pathology and beyond); hypersensitivity of affected area (low threshold to noxious stimuli); and the response of the animal to that pain in terms of behaviour alteration [5]. In addition, other factors determine the experience of pain are age, sex, environment, and individual differences along with the neurogenic origin of pain [6]. All of these factors determine the intensity, duration and frequency of pain, making the assessment and management of pain cumbersome in animals, whether it is acute pain or chronic pain. However, it has become widely accepted that pain in animals causes adaptive behaviour change, which can be assessed, leading to better assessment and management of pain in animals [7].

Pain in working equines of developing countries is usually chronic in nature as they suffer from chronic injuries such as sad-

dle sores and work associated lameness. This is compounded by general acute health problems that are either not treated, or sometimes mistreated for a long time due to lack of infrastructure for veterinary health service or because of a lack of scientific approach to health problems. As working equines constitute majority of the population of equines in the developing countries, addressing this issue will have a huge impact on the welfare of these animals. There are many lameness associated conditions when chronic pain is experienced by equines, such as navicular disease [8], chronic arthritis, laminitis [6] and tendonitis in working equines [9]. Chronic pain of spinal origin was reported as a source of abnormal gait, particularly where the range of spinal joint movement was restricted stiffness [10]. All the above-mentioned conditions could be very relevant in the case of working equines in India where abnormal gait affects 99% of working equines [11]. In working equines, apart from lameness, another condition associated with chronic pain is injuries caused by harness during work. Continuous persistence of noxious stimuli such as a protruding nail from the harness constantly cutting in to the tissues may also lead to a state of chronic pain in equines due to peripheral and central sensitizing mechanisms [12]. In both cases (lameness and injuries), the high percentage of abnormal gait in working equines could be an outward sign of an adaptive behaviour change to avoid painful conditions or could be simply because of mechanical limb deformity.

Swann [9] suggested that chronic pain and dehydration are the most important reasons for depressed or 'switched off' working horses, mules or donkeys in developing countries. He suggested that a depressed or 'switched off' animal might not be aware of developing integument lesions and body injuries thereby succumbing to more health and welfare problems. Swann [9] concluded this by looking at the results of a previous study by Pritchard., *et al*. [11]. Pritchard., *et al*. [11] assessed behavioural response of an animal such as general attitude in its own environment, response of an animal when observer walking down the side, chin contact by observer and tail tuck in donkeys when approached. It's interesting to note that around 10% of these animals were apathetic in general attitude and the same percentage of animals were not responding to 'observer walking on the side' thereby clearly showing the link of a 'switched off' animal not responding to its environment. This review paper discusses the recent work regarding chronic pain assessment and management in equines, problems specifically relating to working equines in developing countries and suggested improvements for the future.

Behavioural indicators for assessing chronic pain in Equines

Behavioural indicators developed for equine pain could be either non-specific (the behaviours which do not indicate the source or type of pain), or specific (the behaviour pinpointing the actual pain site, e.g. abdominal pain, limb pain or dental pain) [13]. Development of non-specific behaviour indicators (e.g. posture of head) help mainly in the better recognition of nonspecific pain in horses and donkeys [14] whereas specific behaviour indicators (e.g. flank watching) usually help to identify and quantify pain of abdominal origin. Quantification of behavioural time budgets can also be used to assess changes in behaviour caused by pain. For example, there were significant differences between a painful and a non-painful horse spending time on eating, drinking and positioning at the front of the box in horses following surgery [15]. A horse suffering from pain will also display abnormal postures such as lowered head and apathy.

Behavioural indicators of acute and chronic pain in equines may differ. In chronic pain, responses may include guarding behaviour in movement and posture, avoidance of pain-aggravating influences, seeking of pain-relieving factors and environments and self-care of a painful region [16]. Other behaviour changes recorded in equines due to chronic pain are gait changes, uneven limb loading causing or associated with muscle atrophy, changes in eating and drinking leading to weight loss, changes in sleeping/recumbency times, changes in social behaviour and changes (decreases) in responses to external stimuli [17]. In acute pain, the behaviour and physiological responses are overt [16] whereas in the case of chronic pain behaviour responses could be very subtle and physiological responses may not be sustained in a chronic paradigm. For example, some studies show that high cortisol concentrations are not sustained where there is continuous stressful stimulation such as in chronic pain [18].

Chronic pain can be of somatic (skin and muscle) or visceral (abdominal) in origin [5]. The physiological and behavioural response to both somatic and visceral pain could also differ. Visceral pain is poorly localized and may be referred to different parts of the body [18]. Many visceral organs do not react to crush injury but can induce severe pain if distended.

Behavioural assessment of chronic pain can be performed by quantifying the observed behavioural changes under normal environmental conditions, or by quantifying the behaviour response to a particular stimulus (i.e. an evoked response). Both types of be-

havioural measures have their positive and negative aspects. Measuring behaviour under normal conditions reduces any individual animal variability, but are prone to many confounds like weather, noise etc. On the other hand, measuring behaviour to an evoked response will have high individual animal variability. Some of the common behavioural indicators developed to assess pain in animals currently are time budget allotment of the affected animals (e.g. eating or lying time), response to some evoked behaviour (e.g. response to an observer), and nociceptor threshold testing and posture and event behaviour quantification.

Pain scoring to measure severity of pain

Pain scores based on behaviour of the animal are used to quantify the presence and severity of pain [13]. Some of the techniques commonly used are visual analogue scale, numerical rating scale and simple descriptive scale. The reliability of these scoring systems is quite variable even within one species. In addition, their effectiveness has not been studied thoroughly in a chronic pain paradigm. The biggest drawback for some of these methods is the unidirectional mode [19] of assessing pain which reduces the sensitivity. Rietmann., et al. [20] suggested that a composite multifactorial scale which incorporates behavioural alteration and physiological variations particularly indicators like heart rate variability (HRV) may be more relevant for chronic pain measurement. As chronic pain is multidimensional (intensity, frequency, duration) a unidirectional tool like visual analogue scale which assess only the intensity or severity of the pain may not be sufficient for chronic pain assessment. A recent study evaluating the association between HRV and behavioural indicators in laminitic horses concluded that assessment of HRV offers reliable complementary evidence in pain assessment, although it may also be affected by other factors [20]. Objective methods of assessment of locomotor pain and dysfunction include techniques such as force plate analysis and kinematic analysis. In force plate analysis the percentage of body weight the animal is able to carry on the particular limb is measured objectively for locomotor pain. On the other hand in kinematic analysis, motion analysis is used to make an objective judgment on the loco motor pain.

In a multimodal pain assessment especially in human medicine, serum concentrations of nitric oxide along with behavioural assessment have been promising. Nitric oxide can act as a biological signal and effectors molecule during inflammation, immunity and pain processing [21]. The involvement of Nitric oxide in central sensitization has been demonstrated for spinal and supra-spinal sites [21]. Additional work needs to be done to test its effectiveness in non-human animals.

Management of chronic pain in equines

Traditionally pain management protocols for equines were restricted to providing drugs which have analgesic and anti-inflammatory properties. Even provision of these drugs were highly dependent on the owners and veterinary health provider's sensitivity to the subject of pain [22]. There was not much credence given to the species differences within equines (for example, donkeys and horses) in terms of dosage or the mechanism of action by which the drug acts. Non Steroidal Anti-Inflammatory (NSAID) Drugs were the commonly used for pain management drugs in all equines. The problem of pain management in different equine species was exacerbated because of the absence of a proper assessment tool and also because of the lack of knowledge of the mechanism of development of chronic pain.

Chronic laminitis, navicular lameness, arthritis, tendonitis and pain of spinal origin lead to chronic pain, which need long term pain management. Traditionally these conditions were also maintained with NSAIDs which were clearly inadequate as shown by research in human medicine [23]. NSAID's just reduces the inflammatory responses which is responsible for the primary hypersensitivity of pain and may not be of much use to cut short the other modes of mechanisms of pain like central sensitization, central biasing mechanism and disinhibition. Now, as more clear evidence is emerging regarding the neural plasticity regarding chronic pain, there has been more interest to understand the mechanism behind this neural plasticity so that management becomes more effective.

Any pain management protocol should address the four issues as described by Valverde and Gunkel [24]:

- Selection of drugs that control the type of pain elicited by the insult e.g. Opoids for abdominal pain and not for lower limb pain

- Selecting techniques of analgesic drug administration that act on pathways or anatomical locations where the nociceptive information is being processed or originating from e.g. Local or regional or systemic route

- Combining analgesic drugs that act on different pain pathways e.g. Anti-inflammatory, opiates and alpha 2 agonist.

- Provide the best possible comfort for the animal.

Mechanism based pain management or balanced analgesia is the best method to mitigate some of the draw backs of traditional management. The main goal of this approach as described by Dressen., et al. [25] is as follows:

- Blockade of nociceptive signal generation in primary afferent terminals (tissue infiltration with local anaesthetics)

- Suppression of primary hyperalgesia (local anaesthetic agents, NSAIDs, opioids);

- Blockade of the peripheral transduction process, thereby preventing any development of secondary hyperalgesia (nerve blocks with local anaesthetics);

- Inhibition of spinal nociceptive signal transmission and inhibition of secondary hyperalgesia (epidural, local anaesthetics, opioids, alpha 2 agonists, systemic opioids, ketamine, NSAIDs)

- inhibition/decrease of the pain experience by interfering with cerebral nociceptive pathways

- Intervention at the level of signal processing (systemic lidocaine, opioids, alpha 2 agonists, ketamine, NSAIDS).

Novel medicines like gabapentin and fluphenazine is recommended nowadays for chronic pain in companion animals [26]. More research needs to be done to validate the use of these medicines in equines. Fluphenazine is a potent antipsychotic drug used to treat schizophrenia and other psychotic symptoms in humans. Co-administration of meloxicam and rofecoxib with aminoguanidine hydrochloride has been tried as an alternative approach for the treatment of neuropathic pain in rat models [27].

Pre-emptive analgesia to reduce the formation of hyper sensitisation and allodynia is also recognized as a good method of prevention of chronic pain. One of the specific therapy used for management of chronic pain recently is Cervical Vertebral Mobilization under Anaesthetic (CVMUA) [10]. CVMUA is a physical therapy for the treatment of cervico-spinal pain and stiffness in equines.

Management of Chronic pain in working Equines

Working equines are at a greater risk of conditions that may cause chronic pain than other equines and is worthwhile to discuss the management practices to reduce pain which could be relevant for them. Working equines generally belong to the poorest society in developing countries and any management should be cost effective. Additionally, as many animal owners rely on their animals to earn a living appropriate rest and recuperation may not be possible. Some of the management practices which can advised for management of chronic pain are as follows:

- Convince the animal owner to provide more rest in cases like arthritis and saddle wounds

- Convince the animal owner to provide more freedom for the animal to express its normal behaviour like lying down and rest which may not be possible with restrictions like hobbling.

- Physiotherapy is one area which have lot of potential because animal owners frequently provide massage for many painful ailments particularly for limb oriented pain.

- Any surgical interventions carried out in these equines should consider the fact these economically poor animal owners may not spent much money in correcting chronically painful conditions if it develops as a side effect of the surgical procedure.

- Veterinarians and veterinary health workers who are treating these animals should have good awareness on pre-emptive analgesia and mechanism based analgesia.

Conclusion

In conclusion, the most significant pain-associated welfare issue for working equines lies in unrecognized, untreated pain resulting from chronic conditions such as lameness and saddle associated injuries. Chronic pain causes a switched off horse, donkey or mule which may lead to trips and falls incurring more lameness issues and integument lesions. Considering the fact that a large percentage of the world equine population is in Asia and Africa still used as working animals, the welfare breach is significant. Significant progress has been made to identify chronic pain through behavioural and physiological indicators and thereby providing opportunities to better manage chronic pain in working equines. Improved understanding of the patho-physiology of chronic pain also provides us more options for management of chronic pain. This understanding of behaviour based assessment of pain and pathophysiology based treatment of pain will improve the health and welfare of equines in general. Moreover, validating the usefulness of rest, comfortable environment and physiotherapy for many loco motor ailments with chronic pain in working equines could tremendously help to make a bigger impact on the welfare of these animals.

Bibliography

1. IASP. "Pain terms: A list with definitions and notes on usage". *Pain* 6 (1979): 249-252.

2. Zimmerman M. "Behavioural investigation of pain in animals". In Proceedings. Workshop for Assessment of Pain in Farm Animals (1986):16-27.

3. Molony V and Kent JE. "Assessment of acute pain in farm animals using behavioural and physiological measurements". *Journal of Animal Sciences* 75 (1997): 266-272.

4. Greene SA. "Chronic pain: Pathophysiology and treatment implications". *Topics in Companion Animal Medicine* 25.1 (2010): 5-9.

5.   Robertson SA. "What is pain?" *Journal of American Veterinary Medical Association* 221.2 (2002): 202-205.

6.   Jones E., *et al*. "Neuropathic changes in equine laminitis pain". *Pain* 132 (2007): 321-331.

7.   Mogil JS and Crager SE. "What Should We Be Measuring in Behavioral Studies of Chronic Pain in Animals?" *Pain* 112 (2004): 12-15.

8.   Rose RJ. "Navicular disease in the horse". *Journal of Equine Veterinary Science* 16 (1996): 18-24.

9.   Swann WJ. "Improving the welfare of working equine animals in developing countries". *Applied Animal Behaviour Science* 100 (2006): 148-151.

10. Ahern TJ. "Laminar corial hyperaesthesia in chronic forelimb lameness". *Journal of Equine Veterinary Science* 15.11 (1995): 460-463.

11. Pritchard JC., *et al*. "Assessment of the welfare of working horses, mules and donkeys, using health and behaviour parameters". *Preventive Veterinary Medicine* 69 (2005): 65-283.

12. KeefeFJ., *et al*. "Behavioural approaches in the multidisciplinary management of chronic pain: Programs and issues". *Clinical Psychology Review* 6 (1986): 87-113.

13. Ashley FH., *et al*. "Behavioural assessment of pain in horses and donkeys: Application to clinical practice and future studies". *Equine Veterinary Journal* 37 (2005): 565-575.

14. Roy RC., *et al*. "Controlled field trial of a behaviour pain assessment tool in donkeys". In: Proceedings of Sixth International Colloquium on Working Equines, India Habitat Centre, New Delhi, India, (2010).

15. Price J., *et al*. "Preliminary evaluation of a behaviour-based system for assessment of post-operative pain in horses following arthroscopic surgery". *Veterinary Anaesthesia and Analgesia* 30 (2003): 124-137.

16. Anil SS., *et al*. "Challenges of pain assessment in domestic animals". *Journal of American Veterinary Medical Association* 220.3 (2002): 313-319.

17. Driessen B., *et al*. "Pain: From diagnosis to effective treatment". *Clinical Techniques in Equine Practice* 6 (2007): 126-134.

18. Molony V and Kent JE. "Validation of a method for assessment of an acute pain in lambs*". Applied Animal Behaviour Science* (2002): 215-238.

19. Turk DC and Rudy TE. "Towards a comprehensive assessment of chronic pain patients". *Behaviour Research and Therapy* 25 (1987): 237-249.

20. Rietmann TR., *et al*. "The association between heart rate, heart rate variability, endocrine and behavioural pain measures in horses suffering from laminitis". *Journal of Veterinary Medicine* 51 (2004): 218-225.

21. Koch A., *et al*. "Nitric oxide and pro-inflammatory cytokines correlate with pain intensity in chronic pain patients". *Inflammation Research* 56 (2007): 32-37.

22. Hugonnard M., *et al*. "Attitudes and concerns of French veterinarians towards pain and analgesia in dogs and cats". *Veterinary Aneasthesia and Analgesia* 31 (2004): 154-163.

23. Stannard C., *et al*. "Evidence based chronic pain management". Blackwell publishing Ltd, (2010) West Sussex, UK.

24. Valverde A and Gunkel CI. "Pain management in horses and farm animals". *Journal of Veterinary Emergency and Critical Care* 15.4 (2005): 295-307.

25. Driessen *et al*. "Neuropathic Pain Management in Chronic Laminitis". *Veterinary Clinics of North America: Equine Practice* 26.2 (2010): 315-337.

26. Merck Veterinary Manual. "Pain management: Chronic pain". Merck and Co., Inc. (2008) Whitehouse Station, NJ . USA.

27. Dong XW., *et al*. "The antipsychotic drug, fluphenazine, effectively reverses mechanical allodynia in rat models of neuropathic pain". *Psychopharmacology* 195 (2008): 559-568.