CASE STUDY

Sleep Deprivation and Unwanted Behaviours in a Four Year Old Warmblood Mare with Upper Oesophageal Sphincter Aplasia.

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Abstract

Reports of unwanted behaviours in horses as a primary presentation, ranging in severity from distracting to extremely dangerous were becoming more common. This case presented with the owner rider considering retirement for the horse if its unwanted behaviours, which were at times extremely dangerous, could not be resolved. A history of an inability or reluctance to attain recumbent sleep, with resultant sleep deprivation led to further investigations. Upper oesophageal aplasia was one of the findings. Surgery to stabilise the palato-pharynx was recommended based on previous experiences with cases of sleep deprivation with accompanying upper oesophageal sphincter aplasia. Post operatively the horse was able to achieve recumbent sleep. Improvements in behaviour followed which facilitated the horses return to successful competition. A potential association between sleep deprivation, upper oesophageal aplasia, oesophageal reflux and palato-pharyngeal instability was discussed.

Key words: horse, sleep apnea, tension palatoplasty, unwanted behaviour.

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Introduction

With the introduction of animal behaviour studies and the advent of formal academic courses, unwanted behaviours were receiving more attention in veterinary practice. At times unwanted behaviours represented the owners major concern rather than those of a medical nature. Academic publications investigating abnormal or unwanted behaviours were numerous [1,2,3,4,5,6]. In addition normal and learned behaviours were being studied [7,8,9,10].

These included cases of sleep deprivation [11,12] with associated abnormal behaviours such as sleep crashing [13] or sleep terrors [14,15]. Management or environmental issues [16] and occasionally orthopaedic concerns were seen as the most common aetiologies. There had also been several cases where it was proposed that a form of obstructive sleep apnea (OSA) had been the primary cause of sleep deprivation [15,17]. In these cases a return to normal sleep parameters was seen following surgery to stabilise the palato-pharynx [18].

Case Report

Macey, a 4 year old warmblood mare purchased for show work came with a history of unwanted behaviours, some of which had the potential to cause injury to either horse, rider or handler. She was still a young horse so the new owner had hoped that these could in time be corrected. However her misbehaviours quickly became apparent.

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On the ground she was constantly alert. Any sudden movement or noise could elicit a flight response. There was an apparent lack of awareness or concern for persons or animals in her space such that on numerous occasions she had charged over or through her handler.

Under saddle she preferred to work with her head and neck extended and low to the ground. Attempts to have her take bit contact and flex or collect resulted in her threatening to buck and if pushed further she would rear. With seemingly innocuous stimulus she could suddenly charge or bolt for a number of strides before stopping abruptly. She also regularly opened her mouth during ridden exercise.

In the paddock she was constantly on guard and was frequently found digging holes. When placed in her yard in

the late afternoon, she would pace the fence in one direction, stop and stare, then turn and do the same in the opposite direction. This went on for hours at time, with the owner referring to this behaviour as 'ghosting' as she appeared to be staring at nothing.

When travelled in a float or van she would paw constantly and could also rear, charge forward or sit on her hind quarters. On one occasion she managed to turn completely around and was found facing in the opposite direction.

Her attitude to other animals had also become a concern. She had on several occasions, attacked over the fence, a pony in an adjacent paddock, locking her teeth onto its wither and shaking it. She would either kick out at, or charge teeth bared the farm dog, with only the dogs youthful agility preventing serious injury or death.

In the 13 month since being purchased, the mare had undergone intensive training at the hands of several very experienced horse persons and yet if anything the behaviours were worsening.

She had also exhibited a degree of hypersensitivity in the skin over her lower neck and shoulders and some reduced lateral range when circling to the right. To investigate whether spinal pain or stiffness was contributing to these unwanted behaviours a consultation with a veterinarian experienced in this field was arranged.

This consultation confirmed the exaggerated responses to touch and pressure, hyperaesthesia and mechanical allodynia, in the region of the lower neck, brisket and shoulders. There was also a modest degree of reduced lateral range of movement (ROM) in the lower neck. As these issues mostly involved the well protected lower cervical region of the neck it was decided that anaesthesia be utilised to facilitate lower cervical mobilisation [19].

Prior to going ahead with treatment a more complete history was obtained from the owner. This included questions about sleep habits, given that unwanted behaviours had on occasion been attributed to horses suffering from sleep deprivation [12,13,14]. In addition the owner was questioned as to any symptoms that could be attributed to oesophageal reflux associated with upper oesophageal sphincter (UOS) aplasia [20] or atonia [21,22,23].This aplasia had also been reported in some cases of sleep deprivation [15,17].

The mare had never been seen sleeping in lateral recumbency. She slept mostly in sternal recumbency with her head to the side resting on her muzzle. She was easily aroused with seemingly innocuous movements or sounds causing her to spring to her feet. Whilst in her yard in the evenings, she would utilise a hay bale to assist in her sitting sleep efforts [Diagram 1].

Sleep crashing was a known consequence of sleep deprivation [14,16]. On one occasion and without warning the mare had, whilst at the tie-ups, collapsed in front with her knees striking the concrete. She righted herself immediately. On another occasion whilst being ridden, she again collapsed in front and then scrambled back to her feet. The rider remained in the saddle. A video of the incident showed no indication of a trip or stumble and no obvious ataxia.

Diagram 1

The only abnormal noise heard during exercise was described as being similar to a wind sucking sound or a hiccup. This occurred every three or four strides and appeared to both distract and annoy the horse. The mare was not a wind sucker, had no history of repeated episodes of colic or respiratory infections and there had been no evidence of refluxed water or feed appearing at the nostrils. She did however cough repeatedly particularly at the commencement of exercise.

Endoscopic examination of the upper airway was unremarkable. Laryngeal abductor function was within normal limits. Palpation of the larynx failed to reveal any cartilaginous malformations that could indicate the presence of fourth branchial arch (4BAD) or laryngeal dysplasia syndromes [22,23].

The procedure, a cervical vertebral mobilisation under anaesthetic (CVMUA) was then performed. Whilst anaesthetised a manual examination of the UOS was undertaken. A pronounced atonia graded of 4 of 0-5 [20] was evident.

The mare was rested for 5 days and then ridden exercise was resumed. Over the following five weeks there was discernible improvement in lateral cervical range of movement and the hyperaesthesia and mechanical allodynia regressed. At the same time the unwanted behaviours remained unchanged.

After further discussion, given a history of sleep deprivation in the presence of UOS aplasia, and based on the surgeons prior experience, the owner agreed to have a tension palatoplasty (TPP) or 'Ahern procedure' [18] performed.

The first evidence of recumbent sleep came six hours post operatively when the horse was found in lateral recumbency. It remained there for around twenty minutes. The following day there were three of these recumbent periods. Twelve months later this change in sleep behaviour was firmly established. The mare would still on occasion rest in sternal

recumbency, but no longer reacted to sudden noises or movements. The hay bale was no longer utilised, but had been replaced by a small mound of sand, which the horse used to keep its head elevated during recumbent sleep [Diagram2].

Diagram 2

The first behavioural change was evidenced in an animal that was now being described as calm. Previous descriptions were of a horse with an 'alert' or 'on guard' nature. In the ensuing months other unwanted behaviours regressed, some quickly and some gradually.

The on ground panicking or bolting ceased immediately as did any associated injuries to handlers.

Under saddle the bucking and rearing also regressed and then later ceased and a willingness to collect or flex and accept the bit developed. The habit of opening its mouth during ridden exercise also dissipated.

The inspiratory noise decreased significantly in frequency (only a few times each ride) and intensity (quieter). This no longer appeared to annoy the mare as she now rarely reacted. She had previously expressed this annoyance by tossing her head.

When travelling, the float no longer rocked from side to side. There were no further untoward incidents aside from the occasional pawing, usually when the end of a journey was anticipated.

The paddock digging ceased. She would wander up and down the fence once or twice when first yarded, however the repeated pacing and 'ghosting' ceased.

Another observation was that in the first few weeks following surgery it was not uncommon to find dried faeces on her neck and rugs. She had previously manured randomly in her yard. It took several weeks to develop a new habit of manuring in a discreet pile in a corner of the yard away from where she slept.

A big change was seen in her attitude to other animals. The pony was now her mate and the dog a constant companion. Aggression had been replaced with socialising.

There had been no further episodes of sleep crashing. Ribbons in show events followed and her continually improving behaviour paralleled this success.

Discussion

In human medicine an association between gastro-oesophageal reflux, obstructive sleep apnea (OSA) and sleep deprivation had been firmly established [24]. This was thought to be a bi-directional relationship [25] such that surgery to reduce sleep apnea could result in a reduced intensity or incidence of reflux and the reverse. Emotional or behavioural consequences of reduced sleep were also documented [26,27,28]. Recent human surgical approaches [29,30] which were being ustilised to address OSA, looked more to tensing the soft palate rather than simply shortening it [31]. Palatal tensing procedures were also being used in equine surgery [18,32] which included the approach used in this case .

In dogs an increased incidence of gastrointestinal disease [33] including gastro-oesophageal reflux had been reported in brachycephalic breeds that experienced OSA [34]. Similar to the experience with people, palatal surgeries were reducing OSA in these breeds.

Sleep deprivation in horses with associated behavioural changes including sleep crashing were being more frequently reported [14,16]. UOS atrophy or aplasia was also being more commonly recognised [21,22,23]. However the possibility that horses might experience upper airways obstruction or OSA during recumbent sleep and that there may be an association between UOS incompetence and OSA had not been investigated. There were however several case studies [15,17] and a survey [20] that were suggestive of this association .

In this case there was no history suggesting an upper airways or breathing issue. However mouth opening during ridden exercise could permit the oral passage of air, which was a symptom of palatal instability [35]. Additionally collection or ventral-flexion of the head and neck caused billowing of the mid soft palate which resulted in a narrowing of the nasopharyngeal airway [36]. The TPP procedure was developed to deal both with palatal instability and nasopharyngeal narrowing caused by rostral and mid palatine billowing.

The abnormal noise during exercise was described as the same sound that was heard during episodes of wind sucking [37]. This sound created by air being drawn into the proximal oesophagus. Post operatively, both the frequency and intensity of this sound was reduced suggesting a possible relationship, between this occurrence and pharyngeal stability.

The willingness to adopt, or ability to achieve recumbency where paradoxical sleep could be achieved, was previously postulated [15,17] to be associated with a more stable upper airway achieved, as was the case in human and canine cases of OSA, with plato-pharyngeal surgical procedures.

This horses preoperative use of a hay bale to support its head in a more elevated position and similarly the sand pillow post operatively correlated well with the finding in human medicine that people suffering from gastrointestinal reflux and or OSA achieved more efficient sleep if their head was elevated [38,39].

The unwanted behaviours on the ground and under saddle were possible, and quite simply, consequences of insomnia. These included the aggressive behaviour towards other animals.

Creating an independent manure zone, was a behaviour that would normally be learnt as a foal so as to avoid contamination of their coats. This mare had not, which suggested that the reluctance to sleep in lateral recumbency had existed since she was a foal. UOS aplasia can be congenital and the repeated occurrence (heritability) in some families had been previously reported [20].

The hole digging, which was often viewed as an indication of pain, may have been a reflection of gastric or intestinal mucosal inflammation. As previously stated the association between gastrointestinal health and OSA had been firmly established in both people and dogs. This may also apply in equids.

Conclusion and Recommendations

This and prior studies were at least suggestive of an association between sleep deprivation, oesophageal reflux associated with UOS aplasia, and an equine form of OSA. This hypothesis needed further investigation.

Where sleep deprivation had been diagnosed, affected animals should undergo an upper airways assessment. This would include standing endoscopy and where indicated overground endoscopy. In addition an assessment of UOS competence should be made, either manually or by utilising ultrasonography, computed tomography (CT) or magnetic resonance imaging (MRI).

In cases of sleep deprivation with or without sleep crashing, where UOS aplasia can be demonstrated and in the absence of a positive response to environmental adjustments or medical management, surgical intervention should be considered.

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