In horses with trigeminal-mediated headshaking, is neuromodulation with EquiPENS™ more effective than with electroacupuncture?

A Knowledge Summary by

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KNOWLEDGE SUMMARY

PICO question

In horses diagnosed with trigeminal-mediated headshaking, is EquiPENS™ therapy more efficacious when compared to electroacupuncture in terms of remission of clinical signs?

Clinical bottom line

Category of research question

Treatment

The number and type of study designs reviewed

Three papers were critically reviewed, all three were descriptive case series

Strength of evidence

Weak

Outcomes reported

Remission was achieved following both EquiPENS™ and electroacupuncture therapy in a proportion of horses for variable lengths of time. Median remission times appear to be longer with repeated treatment of EquiPENS™ compared to electroacupuncture

Conclusion

The evidence for EquiPENS™ treatment is more robust than for electroacupuncture, and remission defined more clearly, and so could be recommended with greater confidence

How to apply this evidence in practice

The application of evidence into practice should take into account multiple factors, not limited to: individual clinical expertise, patient's circumstances and owners' values, country, location or clinic where you work, the individual case in front of you, the availability of therapies and resources.

Knowledge Summaries are a resource to help reinforce or inform decision making. They do not override the responsibility or judgement of the practitioner to do what is best for the animal in their care.

Clinical Scenario

You are presented with a 7-year-old warmblood gelding used for eventing who has been diagnosed with trigeminal-mediated headshaking. He responds to the use of a nose net but is not allowed to compete in one. The owner has heard that electroacupuncture is a treatment option and would like to know how it compares to EquiPENS™ treatment.

The evidence

Three descriptive case series have been published on the topic of neuromodulation treatment for trigeminal-mediated headshaking in horses, which in terms of strength of evidence, is weak.

Summary of the evidence

Roberts et al. (2016)	
Population:	Horses diagnosed with trigeminal-mediated headshaking, referred to Langford Veterinary Services Equine Centre between August 2013 and August 2014. Horses included were not known to be seasonally affected and thus were all displaying clinical signs at the time of treatment, at least 1 month had elapsed since any prior alternative treatment trials.
Sample size:	Seven horses
Intervention details:	The horses were sedated and the skin anaesthetised before the probe was inserted 1 mm superficial to the infraorbital nerve prior to stimulation with frequency alternating between 2 Hz and 100 Hz every 3 seconds. The voltage was set (0.2 to 2.7 volts) to stimulate facial twitching whilst maintaining patient tolerance for 25 minutes bilaterally. An initial course of three treatments with further treatments on re-emergence of clinical signs was followed.
Study design:	Descriptive case series
Outcome studied:	Efficacy in terms of remission defined as return to previous level of work or higher. Safety in terms of adverse effects. Owner reported outcomes (presence and severity of headshaking, and competition record where applicable). Follow-up was between August 2013 and August 2014.
Main findings: (relevant to PICO question):	Haematoma formation occurred in three horses; slight increased clinical signs occurred in two. Six horses entered remission after their first treatment, five of which continued to respond with further procedures. One horse did not enter remission at all. Median remission: 1st treatment: 3.8 days (range: 0–8 days, n = 7) 2nd treatment: 2.5 weeks (range: 0–8 weeks, n = 7) 3rd treatment: 15.5 weeks (range: 0–24 weeks, n = 5) 4th treatment: 20 weeks (range: 12–28 weeks, n = 2) 12 weeks was the minimum time of remission following the 4th treatment in two horses that received the 4th treatment. One horse was in remission at the time of follow-up.
Limitations:	• Weak level of evidence in terms of study type • Small sample size • Owner reported outcomes • Incomplete follow up and lack of long-term follow-up • Seasonality unknown in three cases • No control group

Roberts et al. (2020)	
Population:	Horses diagnosed with trigeminal-mediated headshaking referred for treatment with EquiPENS™ neuromodulation at 13 referral centres that were trained to carry out neuromodulation (UK and Europe) between August 2013 and November 2017. On enrolment, horses were not receiving any other treatments. Horses must have been in ridden or lunge work before displaying signs of headshaking in order to assess remission. Median age: 9 years (2–21) Most common breed groups: Sports horses 49/160 (31%) and Warmbloods 42/160 (26%), other breeds include Pony, Cold Blood/Cob, Thoroughbred 69/160 (43%) – 8/168 (5%) not recorded Sex: Geldings 120/165 (73%), Mares 42/165 (25%), Stallions 3/165 (2%) – 3/168 (2%) not recorded Use: General riding 94/168 (56%), other uses include Dressage, Eventing, Showjumping, Showing, Driving, Racing, Hunting, Trotting, Police, Lunged 72/168 (43%) – 2/168 (1%) not reported Seasonal effect: 21/158 (13%) Spring/Summer affected, 62/158 (39%) affected all year, 75/158 (48%) unknown as affected for less than 1 year – 10/168 (6%) not reported
Sample size:	168 horses
Intervention details:	EquiPENS™ was carried out on sedated horses: the skin was anaesthetised before the probe was inserted 1 mm superficial to the infraorbital nerve prior to stimulation with frequency alternating between 2 Hz and 100 Hz every 3 seconds. The voltage was set (0.2 to 2.7 volts) to stimulate facial twitching whilst maintaining patient tolerance for 25 minutes bilaterally. An initial course of three treatments with further treatments on re-emergence of clinical signs.
Study design:	Descriptive case series
Outcome studied:	Remission was defined as a return to previous levels of work within 3 weeks of the last treatment. Assessment was made by the owners and obtained via telephone. Probabilities were calculated for length of remission and response to first/second treatments while management, referral centre and clinical history were assessed as potential hazards to remission. Follow-up period was between August 2013 and November 2017.
Main findings: (relevant to PICO question):	156/168 horses completed the initial three-procedure course at the time of follow-up, 20 of these were out of work or otherwise lost to follow-up. Of 136 horses, 72 (53%) went into remission following the initial course. Median remission duration was 9.5 weeks (2 days–156 weeks). Complications: 8.8% of all procedures. At the time of follow-up, roughly half the cases (33/72) were in remission, individual response was widely variable with no predictors found.
Limitations:	• Incomplete patient details • No control group • Owner assessments of treatment efficacy

	• Some horses lost to follow-up due to illness or injury preventing the horse from working • Variable diagnostic work up

Devereux (2019)	
Population:	Four horses and two ponies considered to be affected with trigeminal-mediated headshaking by the author and referring vet or referral practice, showing clinical signs of headshaking at the time of presentation. Data collected over a 19 month follow-up period. Dental and oral examination, nasopharyngeal and guttural pouch endoscopy was performed on all horses. One horse had dental radiographs, and one had computed tomography. All had 'negative' results. Three horses were sensitive to sunlight, two were known to be seasonally affected.
Sample size:	Six horses
Intervention details:	Horses were sedated, an acupuncture needle was placed under the infraorbital nerve with a second needle in the brachiocephalic muscle ipsilaterally. With either one of two different electrical stimulators, current was increased in 0.1 mA increments with frequency settings alternating between 2 Hz and 80 Hz until visible nostril twitch was maintained for 25 minutes. Treatment was repeated on re-emergence of clinical signs.
Study design:	Descriptive case series
Outcome studied:	Headshaking was graded 0–3 at rest and exercise by owners, remission was not defined.
Main findings: (relevant to PICO question):	Reduction in grade of headshaking was seen in all horses. Median remission times: 1st treatment: 5.5 days (0–13 days, n = 6) 2nd treatment: 8.5 days (7–21 days, n = 6) 3rd treatment: 18 days (6–71 days, n = 6) 4th treatment: 27.5 days (11 days–23 weeks, n = 6) 5th treatment: 13 weeks 5 days (5–46 weeks, n = 5) 6th treatment: 24 days (13–41 days, n = 3) No complications reported, although post-treatment worsening of clinical signs was seen.
Limitations:	• Post-treatment, the three horses sensitive to sunlight wore a UV mask and nose net – some of these horses had previously had a good response to nose net or mask, possibly confounding results • Owner reported response to treatment • Two different electrical stimulators used • Small study size • No control group • Remission not defined

Appraisal, application and reflection

Trigeminal-mediated headshaking is a neuropathic facial pain condition in horses. Clinical signs are of vertical headshaking, often accompanied by sharp vertical ticks and associated with signs of nasal irritation such as snorting, sneezing, rubbing the nose and striking at the face.

When assessing the scale of the welfare implications of this condition it is important to consider prevalence in the population and impact to owners, horses and the industry. A review article by Roberts (2019) concludes that about 1% of the UK horse population are significantly enough affected by the pain associated with this condition to require veterinary attention and that more severely affected horses are either unable to perform, dangerous or unmanageable to the point where euthanasia is required due to the pain experienced. In terms of level of suffering, trigeminal-mediated headshaking can be graded, various systems exist for this but essentially the worst affected suffer at rest. These horses experience no relief or respite from their pain, it is not known what proportion of horses are in this category, but this information would further our understanding of the impact.

An assumption may be made that the severity of signs is an indication of the severity of pain experienced based on extrapolation of reports from people suffering from neuropathic pain. People describe their nerve pain as anything from tingling sensations to electric shock like pain and that their quality of life is directly affected by increased pain levels (Derbrota et al., 2014).

Aetiopathogenesis for trigeminal-mediated headshaking is poorly understood. The trigeminal nerve appears structurally unaffected (Roberts et al., 2017) but is functionally abnormal with a lower threshold for activation (Aleman et al., 2013) appearing to result in neuropathic pain. That it is functionally abnormal but structurally normal increases the potential for reversal of the condition which may be supported by the fact that between 1/3 and 2/3 of horses are affected seasonally (Aleman et al., 2013; Madigan & Bell, 2001; and Mills et al., 2002) and that 5% can be expected to go into spontaneous remission (Mills et al., 2002). There are a number of management options for horse owners to try, none of which are resoundingly successful and provide individual levels of relief (Mills et al., 2002). Some options are not permitted during certain competitions or levels of competition such as medications or nose nets. Electrical neuromodulation has been used as a technique that may offer relief from neuropathic pain (Roberts et al., 2016). Two such techniques, electroacupuncture and percutaneous electrical nerve stimulation (PENS), have been studied and reported above. PENS is an approved therapy in people under the National Institute for Health and Care Excellence (NICE) guidelines for the management of neuropathic pain. No such guidelines were found for the use of electroacupuncture.

All three studies reviewed in this Knowledge Summary suffered from the reduced reliability of owner reported assessments, although all of them attempted to compensate for this by using a grading system and, both EquiPENS™ studies specified remission as return to previous levels of work. Similarly, each study had essentially incomplete data sets with some patients lost to follow-up due to illness or injury. Length of follow-up and cut off times for publishing data meant that some horses that were still in remission had falsely short remission times reported, this was particularly evident in Roberts et al. (2020). The strongest evidence was presented by Roberts et al. (2020) with larger sample population, longer-term study and assessment of probabilities of outcome and potential hazards. However, all three studies are descriptive case series and provide no control group, blinding or randomisation.

The nature of headshaking precludes ‘strong’ study designs, most pertinently due to the ethics involved in, for example, withholding treatment in a placebo trial or delaying treatment in a cross over design trial. The strength of evidence is also confounded by the fact that headshaking may undergo spontaneous or seasonal remission, is dynamic in its severity, responds so variably to treatments and that its aetiopathogenesis remains elusive.

Median remission times were comparable in each of the three studies but appear to be longer with ongoing treatments for EquiPENS™ compared to electroacupuncture. Current level of evidence for use of neuromodulation in the treatment of trigeminal-mediated headshaking in horses is weak but indicates that it can provide safe and effective remission of varying timescales from days to years for a proportion of horses.

The evidence for EquiPENS™ treatment is more robust than for electroacupuncture and so could be recommended with greater confidence. Hopefully these two treatment options will continue to be investigated.

Increasing our understanding of neuromodulation in the treatment of horses with neuropathic pain provides an opportunity for translational research for treatment in people. Despite differences in pathogenesis, similarities in symptoms between horses with trigeminal-mediated headshaking and people with trigeminal neuralgia may allow both to benefit from further studies into the use of PENS.

Methodology Section

Search Strategy	
Databases searched and dates covered:	CAB Abstracts 1973 to Present using the OVID interface PubMed 1910 to present accessed via the NCBI website
Search terms:	**CAB Abstracts:** 1. (horse.mp OR horses.mp OR equine.mp) 2. (headshaking.mp) 3. (electrical.mp) 4. 1 AND 2 AND 3 **PubMed:** (horse.mp OR horses.mp OR equine.mp) AND (headshaking.mp) AND (electrical.mp)
Dates searches performed:	10 May 2020

Exclusion / Inclusion Criteria	
Exclusion:	Not regarding electrical neuromodulation for the treatment of trigeminal-mediated headshaking in horses Not a clinical study
Inclusion:	All clinical studies regarding electrical neuromodulation in the treatment of trigeminal-mediated headshaking in horses

Search Outcome

Database	Number of results	Excluded – not a clinical study	Excluded – not regarding electrical neuromodulation	Total relevant papers
CAB Abstracts	7	2	2	3
PubMed	4	1	1	2
Total relevant papers when duplicates removed				**3**

CONFLICT OF INTEREST

The author declares no conflicts of interest.

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