Navigated Trigeminal Rhizotomy In Horses

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The project assesses safety and effectiveness of a novel surgical treatment for trigeminal-mediated headshaking, a debilitating condition in horses for which current treatments are often ineffective.

Trigeminal-mediated headshaking (TMHS) is a painful neurological condition in horses. It is often compared to trigeminal neuralgia in humans, which is described as one of the most painful disorders known, particularly in severely affected people. Tellingly, it is also referred to as “suicide disease”. Likewise, affected horses experience sudden episodes of intense facial pain. This negatively impacts their quality of life and, in severe cases, leaves no alternative to euthanasia. The exact cause of TMHS remains unknown, and current treatment options are often ineffective.

Inspired by a procedure known as trigeminal rhizotomy, which is applied in humans with trigeminal neuralgia, and given our vast experience with computer-assisted surgery (CAS), we hope to develop this technique to soon help severely affected horses. Rhizotomy techniques target the pain fibers within the trigeminal ganglion at the base of the skull. The ganglion is hard to reach and surrounded by vital structures, including major blood vessels that supply blood to the brain. These structures must be avoided when accessing the ganglion. Years ago, a group of researchers attempted trigeminal rhizotomy in horses, but discontinued, even after successful treatment of one horse, due to the inability to avoid vital anatomical structures. In addition to improvements in diagnostic imaging, advances in surgical navigation can now facilitate neurosurgical procedures with much greater accuracy and precision, and therefore increased safety and higher chances for success.

With nearly a decade of clinical experience with CAS, specifically surgical navigation in horses, the advantages of this technology are clear. CAS has revolutionized human neurosurgery and is already playing a critical role in our ability to perform technically challenging procedures in veterinary patients as well. This is the key to making neurosurgical approaches and rhizotomy safe, effective, and a realistic option for the treatment of affected horses.

Over the last three years, we have conducted a series of cadaver studies applying the same state-of-the-art computer navigation system to which we have access at the University of Bern, Switzerland, and at the Preclinical Surgical Research Laboratory at Colorado State University (CSU), and with advanced imaging modalities. This work was done in preparation for us to now attempt the first safety trials on live, anesthetized horses. The knowledge and experience gained from these cadaver trials allowed us to develop a computer-assisted minimally invasive approach to access the targeted trigeminal ganglion. The proposed study now aims to evaluate this novel technique in live horses.
We have shown that the CAS system provides accurate surgical planning and real-time intraoperative guidance to safely introduce a large needle into the trigeminal ganglion while safely avoiding vital anatomical structures. Through this needle, a balloon-tipped catheter is advanced to reach the trigeminal ganglion and selectively compress the pain fibers as the balloon is inflated. The focal pressure exerted by the inflated balloon will change the function of the implicated pain fibers. During and after the intervention, we will assess its safety by recording any potential side effects or complications and measuring how effectively and selectively it changes the function of the targeted pain nerve fibers.

With this work, we hope to establish the first effective surgical treatment for horses suffering from severe TMHS. Ultimately, the techniques learned in this project will advance the field of computer-assisted neurosurgery in horses and open new possibilities for effective treatments of other important neuroendocrine conditions that are commonly found in horses.

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Importance to Industry: With this study, we aim to provide the equine industry with a novel, minimally invasive surgical treatment for horses suffering from trigeminal-mediated headshaking (TMHS) that no longer respond to medical therapy. This will help address major welfare concerns and economic losses linked to this painful condition, which often forces the early retirement or euthanasia of valuable horses. Beyond TMHS, the project will advance computer-assisted surgery by demonstrating its use for therapeutic neurosurgical procedures in horses. Wider adoption of surgical navigation systems will become more attractive for equine referral centers, improving access to this technology. As shown in our hospital, navigation greatly supports minimally invasive approaches in numerous complex surgeries, thereby raising the overall standard of care. Many horses and their owners will therefore benefit from safer, more precise surgery and shorter recovery times.

This research will also provide critical insights into advanced monitoring technologies for equine neurosurgery, a field that remains largely underexplored. The knowledge gained will lay the foundation for refined treatments of other neurologic and neuroendocrine disorders, such as Cushing's disease or cervical nerve compression. Cushing's disease, one of the most common disorders in older horses, is caused by dysfunction of the pituitary gland. The proposed surgical approach can also safely access this gland, enabling surgical treatment. Current medication (pergolide) helps about 75% of affected horses but requires lifelong administration. Having a surgical alternative for treatment would not only benefit horses unresponsive to medication, but also affected broodmares with continued fertility issues, or cases where daily treatment is impractical or too costly. Expanding treatment options will thus improve welfare, extend working life, and reduce losses for the equine industry.

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