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ROSSDALES EQUINE HOSPITAL

Cotton End Road, Exning,
Newmarket CB8 7NN,
Tel: 01638 577754

E: hospital@rossdales.com
www.rossdales.com



Equine Brain

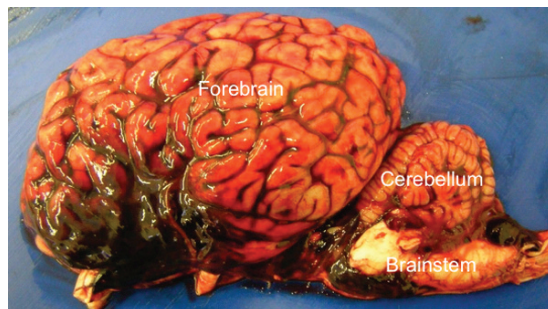
Brain diseases are very uncommon in horses. Figures on the exact prevalence are not available but review of recent cases seen by the medical team at Rossdales Equine Hospital suggest that just over 0.5% of horses admitted for complex medical problems have disorders of the brain.

There are a number of important infectious diseases worldwide that can affect the equine brain but we are fortunate that currently in the UK these diseases are not endemic. The two most common causes of equine brain disease in the UK are head trauma and a group of diseases that together are classified as metabolic encephalopathy. Occasionally horses suffer from epilepsy, although not as often as dogs. Meningitis is mainly a disease of the young and very rarely, we see young horses which congenital or developmental problems.

Anatomy and functions of the brain

In simple terms, the brain can be divided into several regions:

- The forebrain or cerebral cortex is where consciousness resides and this area is responsible for perception, information processing and voluntary control of movement. Damage to this area leads to change in behaviour, loss or reduction in consciousness and can lead to central blindness – where the signals are coming in from the



The brain can be divided into three broad regions: the cerebral cortex or forebrain, cerebellum and brain stem. This horse has sustained trauma to its brain by rearing over backwards and there is massive haemorrhage along the lower surface of the brain. Following the fall, the horse immediately seized and then lost consciousness.

eyes but the brain is not capable of processing that information.

- The cerebellum sits behind the cerebral cortex and provides fine control and co-ordination of movement.
- The brainstem serves as a bridge with interconnecting neural tracts coming down from the cortex and cerebellum and leaving towards the spinal column. This is also where specialised areas called cranial nerve ganglia are located. These are groups of cell bodies from the cranial nerves form interconnections critical to their control. These cranial nerves include the trigeminal and facial nerves which co-ordinate sensation and movement of the face, and the vestibular ganglia that controls the position of the head, eyes and trunk relative to gravity. Damage in this area can cause loss of muscles of the cheek which compromises swallowing, loss of muscle tone

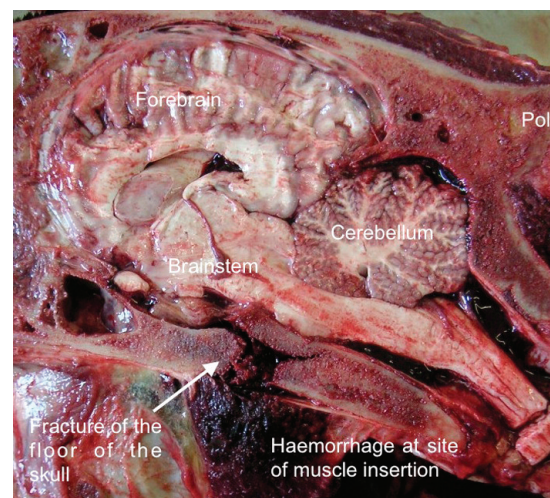
around the lips, ear and eyelid, and if the vestibular system is damaged, the horse will develop a head tilt and lose its balance. Vestibulospinal tracts integrate with the spinal column and disruption of these critical connections affects the horse's gait.

Brain Trauma

Horses are prone to trauma and when this involves the head, the consequences can be particularly devastating. Clinical signs can range from mild disorientation through to seizures, profound depression or coma. Horses that rear up and fall over backwards are particularly prone to damage along the lower surface of the brain. This is because momentum tends to carry the falling horse backwards while that force is counteracted by strong muscles running up the neck to insert onto the basisphenoid bone that serves as the floor of the bony

Disorders in adult horses

By Celia M Marr, Rossdales Equine Hospital and Diagnostic Centre, Newmarket

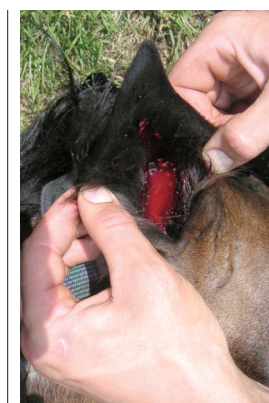


Trauma at the poll often leads to damage to the lower aspect of the brain, and the brainstem in particular. This is because the backwards force generated in the fall is counteracted by strong muscles running up the neck attaching to the basisphenoid bone on the floor of the skull creates fracture at a weak point in this bone.



Horses with severe brain trauma may have loss of consciousness and fixed dilated pupils, in this case due to poll trauma and basisphenoid fracture.

cavity protecting the brain. The end result can be fracture of the skull or, even if the bone remains intact, the forces can lead to major haemorrhage from the large venous sinus that is located between the brain and the skull. Basisphenoid fracture can be suspected if there is leakage of cerebrospinal fluid from the ear. Horses with major brain trauma may have fixed dilated pupils. It is also possible that skull fracture can damage the optic nerves causing blindness. Not every case of skull trauma is quite so



Leakage of cerebrospinal fluid via the ear is suggestive of skull fracture.

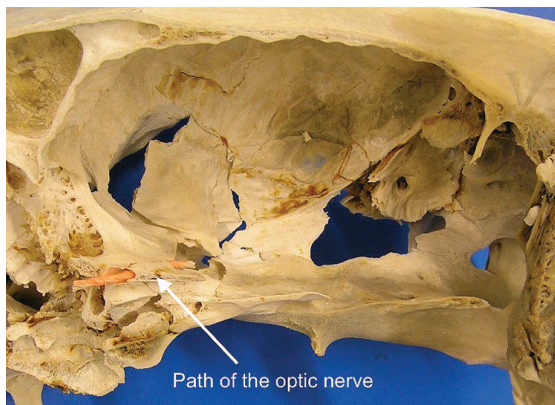
devastating. The brain is encased with bone and therefore it is essential that brain swelling be reduced. Initial first aid for brain swelling includes the administration of anti-inflammatory drugs and antioxidants. Intravenous infusions of drugs to draw fluid out of the brain and, if there is no bony damage or major haemorrhage, clinical signs which have developed dramatically can disappear very rapidly. Early intervention is critical – call your

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VET PROFILE



Celia M Marr BVMS, MVM, PhD, DEIM, DipECEIM, MRCVS
Celia is a European and RCVS Specialist in Equine Internal Medicine and works with both inpatients and outpatients with medical problems at Rossdales Equine Hospital, where she is responsible for internal medicine and cardiology. Her clinical and research interests are in cardiovascular medicine, internal medicine, adult and neonatal intensive care and medical imaging. She has published over 50 research papers and educational material relating to a range of medical disorders of the horse, concentrating on cardiovascular disease and diagnostic methods in medical disorders including editing a book on Cardiology of the Horse, the second edition of which was published in 2010. Celia is an Honorary Professor of the University of Glasgow, Editor-in-Chief of Equine Veterinary Journal, and Chairman of the Veterinary Advisory Committee of the Horserace Betting Levy Board.



Damage to the optic nerve is an alternative cause of dilation of the pupils. This horse has sustained a complex fracture to the skull that includes a fracture line that has severed the optic nerve as it exits the skull towards the eye.

vet immediately if you suspect your horse may have sustained brain trauma so that first aid can be instituted.

Although it may seem important to identify the extent of bone damage using CT or radiography, moving the injured horse to an appropriate medical facility for further diagnostic tests can be very challenging. Often it is more practical to administer first aid at home and if clinical signs improve in the first 24–72 hours, the horse can be moved at that time to gain information that will help your vet to provide a more accurate prognosis for the long-term outcome.

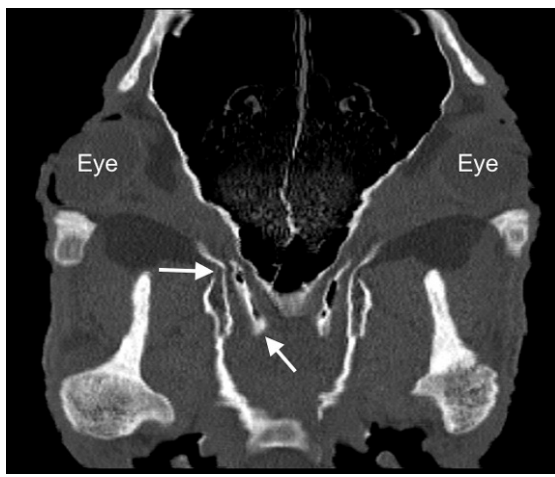


This horse sustained brain trauma during a fall while exercising. His initial response to first aid was excellent but he was left with an abnormal eye position.

Metabolic encephalopathy

The term metabolic encephalopathy refers to a group of problems where disease outside the brain is causing chemical changes in the body that are affecting brain function. The best recognised is liver failure. The liver has many functions, which includes removing toxic

substances from the body. Bacteria within the gut produce ammonia and other chemicals that mimic the effects of natural neurotransmitters. If the liver is not able to perform this function, levels of these chemicals in the bloodstream rise and this in turn, affects brain function. Although the underlying liver disease may have a slow progression, hepatic encephalopathy usually comes on very rapidly so the problem seems very acute. Horses with hepatic encephalopathy are profoundly depressed, they press or lean their heads on walls, they can stagger around and show central blindness. Additional signs of liver disease such as weight loss may be present and the false neurotransmitters can also affect other nerves in the body (outside the brain) so that there may be paralysis of the larynx with obstruction to breathing, gait abnormalities and sometimes colic due to paralysis of the



CT is the most sensitive imaging technique for bone damage. A CT scan performed some time after the initial trauma showed that there is damage to the bone around the path of the abducens nerve which controls one of the muscles which functions to control the eye position and movement. The arrows indicate where the bone has enlarged and compressed the nerve.

stomach. The onset of neurological signs in a horse with liver disease is a poor prognostic sign. However, if the underlying liver disease is amenable to treatment, around 50% of cases will recover. The onset is rapid, and veterinary attention should be sought immediately. If laryngeal paralysis is present, an emergency tracheotomy with insertion of a tube to allow airflow can be lifesaving. Horses can be given various drugs, which will help reduce absorption of chemicals from the gut and counteract their effects. Similar signs are occasionally seen with intestinal disease. Damage to the intestinal wall allows entry to the bloodstream of large quantities of chemicals that would normally be contained safely in the intestine. Again the signs are dramatic, but with appropriate veterinary treatment, the prognosis can be excellent, so it is essential that the horse owner is patient and allows the horse time to recover from what might seem a very serious problem. Admission to an equine hospital if often necessary to provide intensive care but the results can be good and setting a target of around 3–7 days for signs of recovery to be evident is realistic.

Epilepsy

Epilepsy is the medical diagnosis reached when horses have intermittent seizures (or fits) but in between the horse is apparently healthy and physical examination by a veterinarian reveals no abnormality. Seizures can take many different forms and may be partial or complete: the signs are



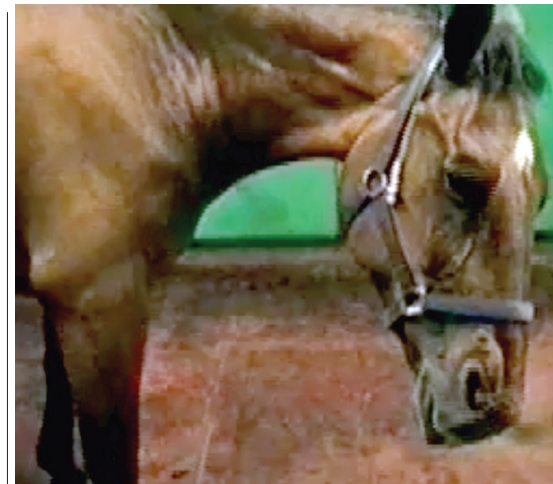
This pony mare shows signs of metabolic encephalopathy, she is fairly unaware of her surroundings and pays no attention to her handler how is struggling to stop her stumbling forwards.



After five days of intensive care, the pony mare has made a full recovery and is behaving normally.

centred on the head and can be subtle – a seizure may simply be involuntary twitching and grimacing of the lips. As they increase in intensity there can be ear twitching, twisting of the neck through to circling and spinning of the whole body and most dramatically the horse falls over its limbs and can paddle violently. They can last only a few seconds through to almost continuous seizure activity.

There is great potential for people around these horses to be injured and it is essential that where a horse is known to have had a seizure in the past, everyone who may come in contact with that horse understands that attempting to restrain the horse is pointless because it will not stop seizure activity. It is also very

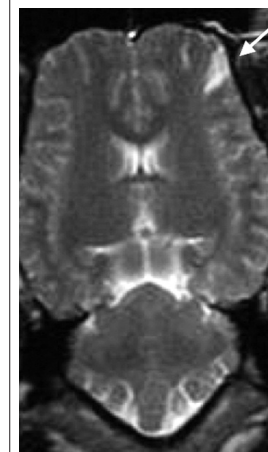


Seizure activity generally starts around the lips: this gelding is grimacing, his ears are twitching and his head and neck are twisting, all signs of the onset of a seizure.

dangerous as the horse is completely unaware of what it is doing and can easily kick out or otherwise injure bystanders. It is best to stand back and wait until seizure activity ceases no matter how much damage the horse is doing to itself and its surroundings. Clues that the horse may have had a seizure while unobserved include unexplained injury or damage to its stable.

Appropriate investigations for adult horses that are seizing are to use blood tests to rule out liver disease or other illness elsewhere in the body. It is very helpful if the activity can be documented on camera, and very achievable nowadays as many people have a smartphone in their pockets. This will allow your vet to confirm that a seizure has occurred and the horse is not showing other signs such as sleep deprivation or fainting, which may suggest a cardiac problem. Most horses with intermittent seizures do not have any primary structural

abnormalities of the brain but occasionally seizures can be the first sign of a lesion such as brain abscess. In this case, the seizures may be frequent and accompanied by other clinical signs. MRI is the most appropriate advanced imaging modality to investigate seizures because it shows the soft tissues within the substance of the brain more clearly than CT (which is superior for bone).



MRI is the optimal tool for imaging the soft tissue of the brain. In this case of idiopathic epilepsy, the arrow points towards a brain infarct. This could be the underlying cause of epilepsy but it is equally possible that this lesion has arisen secondary to a previous seizure episode.

Seizures can damage the brain and promote more seizures therefore it is helpful if the seizure activity can be suppressed. Drugs similar to those in humans with epilepsy can be used in horses to control seizures. However, horse owners should think very carefully before commencing therapy. Even if seizure frequency is reduced considerably there is never a guarantee that occasional seizures will not continue and the drugs used to treat seizures generally have a sedative effect so it may not be appropriate to ride a horse that is receiving these medications. Ultimately this is a decision that the horse owner must make himself or herself weighing up the practicality of keeping a horse that requires daily medication and close supervision that is dangerous to ride.

Conclusion

Although the equine brain is vulnerable to trauma and initial signs of brain disease can be dramatic, with appropriate and prompt first aid, horses can make remarkable recoveries from brain disorders. The advanced imaging modalities CT and MRI are important tools for reaching a diagnosis.