



Ambulatory Medicine

ERICA LARSON

Jaw Fracture Repair in the Field

Nobody wants to find their horse with a bloody mouth, displaced teeth, and broken, displaced jaw bones. But despite their ghastly appearance most jaw fractures can be repaired relatively easily in a field setting, noted one veterinarian.

David A. Wilson, DVM, MS, Dipl. ACVS, of the University of Missouri-Columbia, described one method of repairing rostral (closest to the front of the nose) jaw and cheek fractures.

Horses, especially young ones, sustain mandibular (jawbone) and maxillary (cheekbone) fractures in a number of ways, including biting and pulling back on a stationary object, crashing through or becoming entangled in a fence, and getting kicked by other horses. Although some fractures are immediately evident, others might not be, he explained. Whether subtle or readily apparent, these horses often have signs of anorexia, difficulty eating, quidding (dropping chewed food), ptyalism (excessive salivation), halitosis (bad breath), incisor misalignment, pain, and swelling at and around the injury site.

The veterinarian will perform an oral examination and often, Wilson noted, this is the only evaluation needed to confirm injury and develop a treatment plan. Radiographs are rarely required.

The repair method requires just a few pieces of equipment, including stainless steel wire; needle holders or pliers; wire cutters; acrylic; and a drill.

The veterinarian sedates the horse and administers local anesthesia to numb the affected and surrounding anchor teeth (those that are not displaced and remain well-rooted to serve as an anchor for the healing fracture), he explained. Wilson noted that if the veterinarian needs “improved access” to the mouth, he or she can use a spool speculum or insert a piece of PVC piping between the cheek teeth to accomplish this easily.

Then, using anchor teeth and drilling the occasional hole when necessary, the



COURTESY DR. DAVID A. WILSON

Whether subtle or readily apparent, horses with mandibular (jawbone, shown) and maxillary (cheekbone) fractures often have signs of anorexia, difficulty eating, incisor misalignment, pain, and swelling.

veterinarian wires the bones back into position. Immediately after wire application, the horse will look a bit like he's wearing braces; however, the veterinarian quickly covers the metal with acrylic to prevent injury to the sensitive lip and gum tissue.

Wilson recommended administering three to five days of broad-spectrum antibiotics after surgery (“These fractures are often open with significant contamination,” he explained.) and one to three days of non-steroidal anti-inflammatory drugs. The horse should also be current on his tetanus vaccination.

He noted that horses typically can return to their normal diet immediately after surgery; however, some horses find pelleted feed or “gruel” easier to consume. He also suggested pulling hay flakes apart for easier access (the less pressure the horse needs to place on the healing fracture, such as when pulling hay out of a flake, the better chance the fracture will heal without incident). Finally, he stressed that the owner should not allow the horse to graze for two to four weeks to minimize the use of the incisors (to nip and bite grass).

For the first week, Wilson recommended rinsing the mouth at least twice daily and checking the steel for breakage.

Barring complications, Wilson said, most fractures heal in four to six weeks and “in most cases, the wires can be removed in the standing horse with minimal sedation.” Wilson said that potential complications include:

- Pus drainage;
- Bone sequestration (lack of blood flow to the bone, causing it to “die”);
- Septic osteitis or osteomyelitis (inflammation of bone beginning in the membrane encasing the bone);
- Difficulty chewing;
- Unusual incisor eruption (in horses with still-erupting teeth);
- Malocclusion;
- Wire loosening; and
- Fixation failure.

“Fortunately, the long-term prognosis for functional and cosmetic outcome is favorable,” Wilson noted.

Rapid veterinary attention can reduce wound contamination and get the horse started on the road to recovery.



Managing Severe Colic in the Field

According to a recent poll on TheHorse.com, nearly 49% of respondents named colic as their most feared horse health emergency. While some cases resolve without incident, others prove deadly. Colic surgery is an option for owners in some severe colic cases, but what if referral isn't possible? David Freeman, MVB, PhD, Dipl. ACVS, of the University of Florida, provided some insight on treating severe cases in the field.

Freeman began by discussing some considerations and decisions owners should make with their veterinarians prior to a colic emergency arising. First, he noted, it must be determined why referral is not an option in a severe colic situation. He gave four examples of common answers:

1. "Colic surgery is rarely successful."
2. "This is a pregnant mare, and it will be impossible to save her and the foal."
3. "This is an old horse, and old horses do not handle colic surgery well."
4. "This horse is much loved and valued, but we cannot justify spending the money on colic surgery in our present financial circumstances."

"Answers 1 to 3 are simply untrue," Freeman said. "Answer 4 is a reality ... even in a good economic climate, one must decide which horses in the barn warrant colic surgery and which ones do not."

Horse owners need to make another set of decisions once a horse suffers a serious bout of colic, he said, including:

- "How much am I prepared to spend? What's my financial limit?"
- "How much of my time am I prepared to commit to around-the-clock monitoring and care?"
- "Can I handle watching a horse suffer through disease?"
- "Will I change my mind or stay the course?"

If the owner questions any of these issues and the colic is serious enough, consider euthanasia, Freeman noted.

Also, the veterinarian must consider whether his or her practice has the resources to devote to 24/7 care; the diagnostic and treatment abilities to support the case; and the ability to watch the horse suffer at times during treatment.

Euthanasia Guidelines Freeman explained several indicators that euthanasia is the best or only option for a horse. However, he added, none of these should be

considered on its own without regard for all other findings:

- A heart rate persistently elevated above 60 beats per minute;
- Red, congested mucous membranes;
- Persistently absent gut sounds;
- Moderate to severe and worsening abdominal distension (swelling);
- High volumes of or persistent gastric reflux; and
- Moderate to severe persistent pain.

"Failure to respond to analgesics or recurrence of pain after analgesics should be considered an indication for surgery or euthanasia," he added.

Diagnostics in the Field In combination with clinical signs, there are a number of diagnostic tools veterinarians treating colic in the field can use, Freeman said.

“Failure to respond to analgesics or recurrence of pain after analgesics should be considered an indication for surgery or euthanasia.”

DR. TERRY BLANCHARD

A simple rectal examination can provide veterinarians with useful information. He said the procedure should be repeated because veterinarians can discover by feel some life-threatening changes over time. This procedure is especially useful for detecting small intestinal distension, tight colonic bands, and impactions, and some findings can support euthanasia.

Freeman noted that abdominal ultrasound can be useful for diagnosing a number of ailments including intestinal strangulation; peritonitis (inflammation of the membrane lining the abdomen); intussusceptions (when the gut telescopes back into itself); large colon displacements and volvulus (twist); renosplenic entrapment of the large colon (when the large intestine slips up and over the ligament between the left kidney and spleen); inguinal and scrotal hernias; and abdominal tumors.

Finally, Freeman discussed using belly taps (abdominocentesis). While the procedure can yield useful information about the nature of the colic, belly taps require

laboratory analysis to produce results for interpretation. If the time and technology are available, belly taps can support a decision for or against euthanasia, as well.

Prognosis Each assessment will yield an individual prognosis, Freeman said. There are, however, several types of colic that typically result in death or euthanasia if surgery or intensive hospital care are not pursued.

Impaction with a large enterolith (an intestinal stone) is one cause of colic that is always surgical, Freeman said.

Strangulating lipomas are fatty tumors on a stalk that strangle the small intestine and often prove fatal, Freeman said. These are most commonly found in horses older than 10 and affected horses often exhibit variable pain and small intestinal distension. In these cases, euthanasia could be the most humane choice if surgery is not an option, he added.

Epiploic foramen entrapments many times result in death or euthanasia in field settings. This condition—in which a section of small intestine threads itself through the epiploic foramen (a narrow opening connecting the two sacs of the abdominal cavity) and becomes trapped—is commonly found in horses that crib.

Uterine tears occur most commonly a few days post-foaling, he said, and are a known risk factor for developing peritonitis. While some uterine tears can resolve without issue, severe tears are indicators for either surgery or euthanasia.

Uterine torsions (twists) also are cause for concern in broodmares. These typically occur in late gestation and are a "strong indicator for euthanasia if surgery is not an option and 'rolling' the anesthetized horse is unsuccessful," Freeman said.

Finally, he noted that some fecaliths—hard concentrations of ingesta in the digestive tract—do not respond to medical treatment. Commonly found in ponies, foals, and Miniature Horses, fecaliths impacted in the small colon and nonresponsive to medical treatment must be removed surgically or the animal should be euthanized.

Managing a serious colic situation without the option of referral can be a difficult scenario. Horse owners should be prepared for such an event, knowing what will work best for them, their family, and their horse. In addition, calling a veterinarian early in a colic episode might increase a horse's chances of a full recovery.



Handling Dystocia on the Farm

In an ideal world, broodmares would foal under veterinary supervision at a clinic with the latest technology at arm's length for correcting any health emergencies. In reality, practitioners often have to deal with dystocias—difficult births—in the field. Terry Blanchard, DVM, MS, Dipl. ACT, of Texas A&M University's Department of Large Animal Clinical Sciences, discussed approaches for managing dystocias in a farm setting. He also described when and how to manage referral care.

"To be able to successfully intervene in equine dystocia in a farm setting first requires an adequate understanding of normal parturition and knowledge of the causes of dystocia," he said.

The birthing process occurs in stages, he explained. Stage 1, which can last from 30 minutes to four hours, is when the foal moves into birthing position prior to rupture of the fetal membrane ("breaking water") and birth. Stage 2 ("active labor") often lasts only 20 to 30 minutes and is when the foal proceeds through the birth canal.

"Suspect dystocia if either Stage 1 or 2 is prolonged or interrupted," Blanchard said. "Call in a vet for assistance. Early intervention improves the chance of success."

Blanchard suggested a few things you can do that will help the practitioner work optimally upon his or her arrival:

- Ensure there's a clean delivery area with good footing and good lighting;
- Have a clean bucket with soap and water available;
- Wrap or bag the mare's tail;
- Have a lip twitch available; and
- Have a truck and trailer with clean bedding ready in case of hospital referral.

While waiting for the veterinarian, keep the mare as quiet as possible to minimize fetal distress. In some cases, this might require hand walking to prevent her from lying down and straining or rolling. In the event of a "red bag" delivery (premature separation of the placenta, with the placenta coming out before the foal; this can cause the foal to suffocate if the birth is unattended), carefully cut the bag to more easily reach the foal for delivery. Prompt handling of a red bag delivery will often allow sufficient oxygen to reach the foal.

Once the veterinarian arrives, he or she should examine the mare quickly to determine the dystocia's severity and begin treatment. Blanchard recommends exam-

ining the standing mare, if possible, but said to be especially careful using stocks if the mare repeatedly tries to lie down. Sometimes veterinarians can correct mild dystocias by manipulating the foal while the mare is walking. More severe dystocias will require correction in an alternate manner, he noted.

"Develop a plan of action" before intervening, he stressed to veterinarians. It's important to determine whether the fetus is alive before selecting a course of action, as this factor could have a bearing on the action taken. Also, "keep track of time and progress," in case a referral is indicated.

“Suspect dystocia if either Stage 1 or 2 (of labor) is prolonged or interrupted (and) call in a vet for assistance. Early intervention improves the chance of success.”

DR. TERRY BLANCHARD

Blanchard explained that a host of complications can cause severe dystocias, including uterine or vaginal rupture, fetal impaction in the birth canal, posterior presentations (hindquarters present first), "dog sitting" posture of the fetus, and fetal abnormalities. Veterinarians can often correct positional abnormalities via manual manipulation, he added.

The veterinarian can apply traction (i.e., pulling the foal out) if needed, Blanchard noted, but only when the mare pushes. This typically takes more than one person to achieve, and often the foal will need resuscitation upon birth.

Finally, although veterinarians are able to resolve many dystocias without issue, they will recommend referral upon arrival if it's immediately apparent that the dystocia is unlikely to be resolved on the farm, or they'll refer if there's no progress after 15 to 20 minutes of treatment. 🐾

MORE ONLINE See TheHorse.com/AAEP2011

- The Veterinarian's Role in Equine Abuse Cases
- How to Manage Severe Laminitis

PROTAZIL

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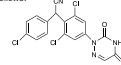
For the treatment of equine protozoal myeloencephalitis (EPM) caused by *Sarcocystis neurona* in horses.

CAUTION
Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian.

NADA #141-288 Approved by FDA

DESCRIPTION

Diclazuril, (+)-2,6-dichloro-4-(4-chlorophenyl)-4,4,5-dihydro-3,5-dioxo-1,2,4-triazin-2(3H)-yl) benzoate, has a molecular formula of $C_{21}H_{12}Cl_4N_4O_5$, a molecular weight of 407.64, and a molecular structure as follows:



Diclazuril is an antiprotozoal (antiprotazoal) compound with activity against several genera of the phylum Apicomplexa. PROTAZIL® (diclazuril) is supplied as oral pellets containing 1.56% diclazuril to be mixed as a top-dress in feed. Inert ingredients include dehydrated alfalfa meal, wheat middlings, cane molasses and propionic acid (preservative).

INDICATIONS

PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets are indicated for the treatment of equine protozoal myeloencephalitis (EPM) caused by *Sarcocystis neurona* in horses.

DOSEAGE AND ADMINISTRATION

Dosage: PROTAZIL® (1.56% diclazuril) is administered as a top dress in the horse's daily grain ration at a rate of 1 mg diclazuril per kg (0.45 mg diclazuril/lb) of body weight for 28 days. The quantity of PROTAZIL® necessary to deliver this dose is 64 mg pellets per kg (29 mg pellets/lb) of body weight.

Administration: To achieve this dose, weigh the horse (or use a weight tape). Scoop up PROTAZIL® to the level (cup mark) corresponding to the dose for the horse's body weight using the following chart:

Weight Range of Horse (lb)	mLs of Pellets	Weight Range of Horse (lb)	mLs of Pellets
275 - 524	20	1275 - 1524	60
525 - 774	30	1525 - 1774	70
775 - 1024	40	1775 - 2074	80
1025 - 1274	50	-	-

One 2-lb bucket of PROTAZIL® will treat one 1100-lb horse for 28 days. One 10-lb bucket of PROTAZIL® will treat five 1100-lb horses for 28 days.

CONTRAINDICATIONS

Use of PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets is contraindicated in horses with known hypersensitivity to diclazuril.

WARNINGS

For use in horses only. Do not use in horses intended for human consumption. Not for human use. Keep out of reach of children.

PRECAUTIONS

The safe use of PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets in horses used for breeding purposes, during pregnancy, or in lactating mares has not been evaluated. The safety of PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets with concomitant therapies in horses has not been evaluated.

ADVERSE REACTIONS

There were no adverse effects noted in the field study which could be ascribed to diclazuril.

To report suspected adverse reactions, to obtain a MSDS, or for technical assistance call 1-800-224-5318.

CLINICAL PHARMACOLOGY

The effectiveness of diclazuril in inhibiting merozoite production of *Sarcocystis neurona* and *S. falcatula* in bovine trypsin cell cultures was studied by Lindsay and Dubey (2000). Diclazuril inhibited merozoite production by more than 80% in cultures of *S. neurona* or *S. falcatula* treated with 0.1 mg/mL diclazuril and greater than 95% inhibition of merozoite production (IC_{50}) was observed when infected cultures were treated with 1.0 mg/mL diclazuril. The clinical relevance of the in vitro cell culture data has not been determined.

PHARMACOKINETICS IN THE HORSE

The oral bioavailability of diclazuril from the PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets at a 5 mg/kg dose rate is approximately 5%. Related diclazuril concentrations in the cerebrospinal fluid (CSF) range between 1% and 5% of the concentrations observed in the plasma. Nevertheless, based upon equine pilot study data, CSF concentrations are expected to substantially exceed the in vitro IC_{50} estimates for merozoite production (Dirlikov et al., 1999). Due to its long terminal elimination half-life in horses (approximately 43-65 hours), diclazuril accumulation occurs with once-daily dosing. Corresponding steady state blood levels are achieved by approximately Day 10 of administration.

EFFECTIVENESS

Two hundred and fourteen mares, stallions, and geldings of various breeds, ranging in age from 9.6 months to 30 years, were enrolled in a multi-center field study. All horses were confirmed EPM-positive based on the results of clinical examinations and laboratory testing, including CSF Western Blot analyses. Horses were administered PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets at doses of 1.5, 5, or 10 mg diclazuril/kg body weight as a top-dress on their daily grain ration for 28 days. The horses were then evaluated for clinical changes via a modified Mayhew neurological scale on Day 48 as follows:

0. Normal, neurological deficits not detected.
1. Neurological deficits may be detectable at normal gaits; signs exacerbated with manipulative procedures (e.g., backing, turning in tight circles, walking with head elevation, trunkal swaying, etc.).
2. Neurological deficit obvious at normal gaits or posture; signs exacerbated with manipulative procedures.
3. Neurological deficit very prominent at normal gaits; horses give the impression they may fall (but do not) and buckle or fall with manipulative procedures.
4. Neurological deficit is profound at normal gait; horse frequently stumbles or trips and may fall at normal gaits or when manipulative procedures were utilized.
5. Horse is recumbent, unable to rise.

Each horse's response to treatment was compared to its pre-treatment values. Successful response to treatment was defined as clinical improvement of at least one grade by Day 48 ± conversion of CSF to Western Blot-negative status for *S. neurona* or achievement of Western Blot-negative CSF status without improvement of 1 ataxia grade. Forty-two horses were initially evaluated for effectiveness and 214 horses were evaluated for safety. Clinical condition was evaluated by the clinical investigator's subjective scoring and corroborated by evaluation of the neurological examination and laboratory testing panel of three equine veterinarians. Although 42 horses were evaluated for clinical effectiveness, corroboration of clinical effectiveness via videotape evaluation was not possible for one horse due to missing neurological examination videotapes. Therefore, this horse was not included in the success rate calculation.

Based on the numbers of horses that seroconverted to negative Western Blot status, and the numbers of horses classified as successes by the clinical investigators, 28 of 42 horses (67%) at 1 mg/kg were considered successes. With regard to independent expert masked videotape assessments, 10 of 24 horses (42%) at 1 mg/kg were considered successes. There was no clinical difference in effectiveness among the 1.5, 5, and 10 mg/kg treatment group results. Adverse events were reported for two of the 214 horses evaluated for safety. In the first case, a horse was enrolled showing severe neurological signs. Within 24 hours of dosing, the horse was recumbent, biting, and exhibiting signs of dementia. The horse died, and no cause of death was determined. In the second case, the horse began walking stiffly approximately 13 days after the start of dosing. The referring veterinarian reported that the horse had been fed grass clippings and possibly hard laminitis.

ANIMAL SAFETY

PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets were administered to 30 horses (15 males and 15 females, ranging from 5 to 9 months of age) in a target animal safety study. Five groups of 6 horses each (3 males and 3 females) received 0.5 (5X), 1.5 (15X), 2.5 (25X) or 5.0 (50X) mg diclazuril/kg (2.27 mg/lb) body weight/day for 42 consecutive days as a top-dress on the grain ration of the horse. The variables measured during the study included: clinical and physical observations, body weights, food and water consumption, hematology, serum chemistry, urinalysis, fecal analysis, necropsy, organ weights, gross and histopathologic examinations. The safety of diclazuril top-dress administered to horses at 1 mg/kg once daily cannot be determined based solely on this study because of the lack of an adequate control group (control horses tested positive for the test drug in plasma and CSF). However, possible findings associated with the drug were limited to elevations in BUN, creatinine, and SDH and less than anticipated weight gain. Definitive test article-related effects were decreased grain/top-dress consumption in horses in the 50 mg/kg group.

In a second target animal safety study, PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets were administered to 24 horses (12 males and 12 females, ranging from 2 to 8 years of age). Three groups of 8 horses each received 0.1, 1, or 5 mg diclazuril/kg body weight/day for 42 days as a top-dress on the grain ration of the horse. The variables measured during the study included physical examinations, body weights, food and water consumption, hematology, and serum chemistry. There were no test article-related findings seen during the study.

STORAGE INFORMATION

Store between 15°C to 30°C (59°F to 86°F).

HOW SUPPLIED

PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets are supplied in 2-lb (0.9 kg) and 10-lb (4.5 kg) buckets.

REFERENCES

1. Lindsay, D. S., and Dubey, J. P. 2000. Determination of the activity of diclazuril against *Sarcocystis neurona* and *Sarcocystis falcatula* in cell cultures. *J. Parasitology* 86(1):164-166.
2. Dirlikov, L., Lohmer, F., Natrass, G., Bentz, B. G., Woods, W. E., Carter, W. E., Karpieski, W. G., Jacobs, J., Boyles, J., Harkins, J. D., Granstrom, D. E., and Tobin, T. 1999. Diclazuril in the horse: Its identification and detection and preliminary pharmacokinetics. *J. Vet. Pharmacol. Therap.* 22:374-379.

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