

CASE STUDY

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On January 16, 2007 at 9:36 pm, a 21 year old thoroughbred mare was admitted to the University of Pennsylvania's New Bolton Center. The mare, who weighted 460 kg., presented with an approximate 36 hour history of colic. The signs of colic that the mare demonstrated at the farm were; laying down, depression, decreased /hard manure, and possibly straining to defecate. She was treated by the referring veterinarian with the non-steroidal anti inflammatory Flunixin Meglumine intramuscularly on either side of the neck. The referring veterinarian felt that the spleen was displaced medially upon rectal examination. The mare was referred to New Bolton Center for further workup.

On arrival to New Bolton, a physical exam was performed by the clinician. Physical exam results revealed the mare was mildly febrile with a rectal temperature of 101.7°F, was tachycardic with a heart rate of 64 beats per minute and was tachypneic with 44 breaths per minute. There was no increase in respiratory effort, and the mare's lungs ausculted within normal limits. Borborygmi marginally decreased in three of the four quadrants. The mare's mucous membranes were pink, slightly dry, and had a slightly prolonged capillary refill time of 2.5 seconds. Her limbs were cool and digital pulses were within normal limits. No murmurs were ausculted and she was in normal sinus rhythm. Mentation was dull and depressed, and no ataxia or weakness observed.

As the physical was performed, and history obtained from the owner, the nursing team obtained blood work from the mare. Blood work submitted included; venous blood gas, complete blood count, chemistry profile, fibrinogen, packed cell volume, total protein, and lactate measurement. Results from the blood work revealed an increased packed cell volume of 50% with a total protein of 7.5 g/dl, indicating hemoconcentration, and thus dehydration. The complete blood count was within normal limits with a white blood count of 7,260 uL (neutrophils accounting for 84%), and a red blood cell count of 10,050 uL. There was a slight hyperfibrinogenemia at 430 mg/dl. Her chemistry profile was unremarkable for the most part. Her blood glucose was 181 mg/dl, but may have been increased due to stress. Her creatinine was elevated at 2.7 mg/dl, and her AST, Ggt, BUN and CPK were mildly increased. Her lactate was marginally elevated at 1.3mmol/L. She was mildly hyponatremic with sodium level of 130mEq/L and mildly hypochloremic with a Chloride of 88mEq/L.

Nasogastric intubation was performed to check for reflux. The mare produced twelve liters of sour smelling greenish/yellow reflux. After nasogastric intubation the mare's heart rate decreased to normal at 44 beats per minute. A rectal exam was performed by the clinician and some mildly distended loops of small intestine were felt. Dry manure was felt in the rectum.

The differential diagnosis at this time was anterior (proximal) enteritis or a displacement. Since the mare's stomach was relieved, her heart rate was normal, and she was not showing any overt

signs of pain, the plan was to monitor, administer intravenous fluids, keep off feed and water, and perform routine nasogastric intubation to check for reflux.

A 14 gauge 5 ¼ inch over the needle intravenous catheter was placed in the mare's right jugular vein, and secured in place with suture (2-0 Ethilon® on a straight needle). Intravenous fluids were then started at a bolus rate of 10 liters per hour for the first hour, and consisted of the basic electrolyte solution Normosol-R®. After the initial bolus, the mare was maintained on Normosol-R® with 20mEq potassium chloride added per liter. She also received 20 mls of calcium per liter in the next 20 liters. Her fluid rate for the first eight hours was 2-3 liters per hour, before dropping to just 2 liters/hour.

Upon continuous monitoring of the mare through the night, her heart rate and respiratory rate were within normal limits. Her temperature did increase to 102.1°F at 12:3am, but did lower to 101.7°F by 5:30am, with no anti-pyretic treatment instituted. The mare was checked for reflux via nasogastric intubation at approximately 2am and 6 am, and both instances produced two liters of foul smelling reflux. The mare passed a pile of normal manure at 2am. She remained comfortable, and was showing no overt signs of colic. Around 6 am a packed cell volume and total protein were rechecked and revealed a PCV of 37% and a TP of 5.4 mg/dl. She was well hydrated from the intravenous fluids overnight.

Her physical in the morning was fairly normal, with the exception of slightly warm front feet and prominent digital pulses in the front. This was very important to note, and to monitor, since the mare could progress to laminitis. The mare picked up all four feet and walked well. The plan for the day was to offer the mare water and start grazing, while performing some scheduled checks for reflux. She was to be maintained on intravenous fluids still, and be closely monitored for signs of colic.

Throughout the 24 hours after admission the mare improved steadily in her treatment for colic. She remained fairly quiet and dull, but perked up when she went out for a walk and graze. She had a good appetite for grass, and was not refluxing any more. Her vitals remained within normal limits, and she was passing normal manure. A white blood count and creatinine level were rechecked as well. The white blood count lowered to 6,000 uL and the creatinine lowered to 1.9 mg/dl.

Just after midnight on January 18, the mare became febrile again with a fever of 102.8°F, and was more depressed and dull. The mare was lying in sternal recumbency and it took us approximately five minutes to encourage her to stand. The emergency clinician was notified of the mare's vitals and attitude. I was instructed to continue to monitor the mare. It was decided not to give an anti-pyretic medication at the time due to the mare's still elevated creatinine. We were to recheck the temperature at 3am.

At 3am the mare's temperature decreased to 101.6°F. She had spent the past two hours lying down quietly and remained quiet and dull. Once again, it took approximately five minutes to

encourage the mare to stand. I took the mare outside for a walk. On return to the barn, she balked at the doorway, and had to be backed in to the barn. She took an unsteady step while turning around, and once was back in her stall she stood camped out and was leaning to the left. Due to her deterioration, I alerted the clinician. We passed a nasogastric tube and obtained no reflux. The mare swallowed the tube well. Due to the unsteadiness and leaning, the clinician also had me run a pen down her back to check for a stimulus response. The mare was unresponsive. The mare's eyes were looking heavy, and she started hanging her head low and shaking her head like she was agitated. Her tail tone was markedly decreased from prior we noticed as we went to recheck her temperature, but she remained to have tongue tone. The mare also developed a swelling on the right side of her ventral neck. The on-call clinician was on her way to evaluate the mare.

When the clinician arrived, she agreed that the mare's signs had progressed rapidly. She was leaning while standing, and acting like she was going to fall over. She could prehend food, but it was unsure how adequately she was swallowing. The mare's heart rate at this time was 36 beats per minute, and her feet were cool. She still had decreased tail tone and now decreased eyelid tone as well. Tongue tone was moderate. Due to the progression from colic and fever to neurologic deficits and altered mentation, botulism was a likely differential.



We decided to carefully move the mare to an adjoining stall that was equipped with a hoist, in case her signs progressed and she became recumbent and needed to be assisted with a sling. We moved her slow and steady with much support. Once she made it to the stall she remained leaning, dull, depressed, and her head was on the ground. The mare appeared sedate. The plan would be to muzzle her to avoid possible choke and aspiration if she could not properly swallow. If necessary the mare would be fed via nasogastric tube the following morning. The mare was maintained on intravenous fluids.

The on-call veterinarian consulted with the attending veterinarian on the case, and the owner was called at 4:00am. The owner was updated to the mare's progressed deterioration, and was asked if the mare was vaccinated for botulism. The mare was not vaccinated. The most important recommendation was to administer the botulism antitoxin plasma. We did start with rechecking the mare's packed cell volume which was 35%, total protein which was 5.3 g/dl, and a blood dextrose of 106 mg/dl of which all values were within normal limits. An ammonia level was also checked due to the acute neurologic signs, and was low at 1umol/L. After this blood work was complete, one unit of botulism antitoxin was started in the form of one liter of plasma. I administered the antitoxin to the mare over one hour's time, and I closely monitored for a reaction during administration. The infusion was started at a slow drip, and progressed to a moderate drip, then steady stream. The mare's temperature remained between 101.2°F and 101.4°F, her heart rate at 40 beats per minute and respiration at 20 breaths per minute. The mare was held still during this treatment to give the antitoxin the best chance of binding with pre-formed botulinum toxin, and not destroying receptors from the mare moving. The mare was also started on Potassium Penicillin to treat a potentially toxico-infectious form of the disease.

After the antitoxin administration was complete, we tried to leave the mare alone, but she became very agitated, shaking her head. She also had generalized muscle fasciculations. Per clinician's orders, the mare was sedated with 150 mg Xylazine IV via intravenous catheter. At this time, we also noticed that the edema present on her neck was expanding, and almost her entire neck, including jugular groove and pectoral region was markedly edematous. The edema was pitting in places, as well as emphysematous with it appearing as air was in the subcutaneous region.

The mare did have a diagnostic esophagoscopy performed which was within normal limits.

Due to the mare's edematous neck region, myositis was suspected. The mare was sedated, and lidocaine line blocks were performed by the veterinarian in the area over the edema.

Fasciotomies were performed and revealed some dark black muscle and gas pockets. Swabs were obtained for culture and cytology. On cytologic examination a spirulating single population of large rods were seen, consistent with a clostridial species were found. It was believed this was due to wound botulism. Feces were also submitted with the swab for culture. The fasciotomy sites were flushed with hydrogen peroxide to kill the anaerobic spores.



The owner was updated, and agreed to treatment of the mare for botulism. The mare was treated with antibiotics with penicillin, anti-inflammatory treatment with flunixin meglumine, and isotonic intravenous fluids with dextrose added. The mare's jugular intravenous catheter was removed due to the edema, and a lateral thoracic intravenous catheter was placed. The mare was started on a constant rate infusion of potassium penicillin and closely monitored.

Throughout the day the mare remained dull and depressed, but stable. Her fasciotomy sites were draining, but the area was cleaned frequently to prevent scalding of surrounding tissue. The mare's vitals and basic blood work stabilized and she was starting to get some of her muscle tone back. She still had some mild muscle fasciculations.

The mare continued to make steady progress, and was slowly started back on small amounts of grain over the next few days as her swallowing improved. She was passing normal manure and showing no signs of colic. She continued to hold her neck down, as it seemed painful for her to raise her neck. She was maintained on the potassium penicillin CRI and on isotonic fluids for the next six days. The dextrose supplementation was discontinued after she began eating. Her vitals did remain within normal limits with the exception of a low respiration of 4 breaths per minute the night after the initial deterioration. The cultures from the feces and the fasciotomy sites did not confirm botulism, but the initial treatment was still thought appropriate due to the clinical signs, and the history of not being previously vaccinated for botulism and being given intramuscular flunixin meglumine in the area of the myositis lesions.

The mare's continued progress was slow but steady. She was closely monitored by nursing, students and clinicians. She had developed some scalded areas by where the fasciotomy sites

were, but those areas were cleaned and treated with ointment. The mare was vaccinated for *Clostridium botulinum*, and a booster was given two weeks after the initial vaccine.

The mare was nursed with supportive care, and maintained on the non-steroidal anti-inflammatory medication phenylbutazone until the eighth of February. This was to help with the inflammation of her fasciotomy sites as well as the pain associated with the myositis. The mare's antibiotics were changed from the potassium penicillin to ceftiofur sodium at the end of the six day treatment, and then changed again to trimethoprim sulfa on the third of February. All medications were discontinued by the eleventh of February and the mare was monitored, walked, and had care of her fasciotomy sites maintained.

The mare was discharged from New Bolton Center exactly one month from presentation, with the only care to be caring for the fasciotomy sites and applying ointment, and performing physical therapy exercises which consisted of tempting the mare with a treat to move her neck. It was recommended to vaccinate the other horses at the farm for botulism and booster annually. This was a very rewarding case for myself, as well as all that worked on it. It made us all realize that some cases are not typical and sometimes are not what they seem. It also reminds us to how acute some disease processes are.

This case had multiple facets of nursing care. As I was not present at admission of this case, I do the same basic workup on many cases. The nursing responsibilities for colic triage and workup include making sure that the history is obtained and written down, getting baseline vitals, obtaining blood work and performing basic stall side blood work (packed cell volume, total protein, lactate and blood dextrose). Other nursing responsibilities include preparation and placement of an intravenous jugular catheter. Once catheter placement is complete the intravenous fluids are administered. Nasogastric intubation is one of the most important skills for a colic emergency, due to the inability of horses to vomit on their own due to physiologic shortcomings. Having the skill to know how to anatomically manipulate the tube to get into the stomach takes practice. This is truly a lifesaving procedure as if the stomach is not emptied it may rupture. Close monitoring is a vital part of the nursing role in a colic, as well as documentation. Preparing for diagnostics is also of importance, and knowledge of specific preparation equipment and supplies. Abdominocentesis, rectal exam, and ultrasound exam are all areas that we will prepare for and provide supplies, equipment. It is important to have knowledge of all procedures, even the ones performed by the veterinarian so you can be of assistance.

As the care continues from workup to monitoring, it is still vital for the horse to be closely checked and be treated. Monitoring the horses' mentation, manure, and hydration are key areas of monitoring a colic case. Checking for reflux and monitoring the size of the animals' abdomen are also very important. Abdominal distention could indicate gas accumulation. Monitoring intravenous fluids and making sure that the animal is keeping up with any ongoing losses is a key monitoring skill. Once again, documenting the patients' status and communicating to the veterinarian any changes is emphatically important.

With this case, I started my nursing shift the night that the mare progressed into showing signs of botulism. As far as everyone that was involved believed, the mare was a routine colic. As her signs started to change, it set off a warning to me that something not associated with colic was beginning to unfold. Sometimes things aren't always as cut and dry as they seem. In this case, it was the close monitoring and the knowledge of normal equine behavior and broad knowledge of equine disease that helped me to bring my concerns to the on-call veterinarian.

The advanced skills that I performed included foremost the monitoring of the mare's mentation and comfort level and vitals, and knowing the normal values. I maintained the mare on intravenous fluids using a gravity drip administration set, performed nasogastric intubation, administered the botulism antitoxin plasma and monitored for reaction, as well as set up a potassium penicillin constant rate infusion on a pump, helping with physical therapy, wound treatment, and medication administration intravenously, and per os. Other skills that I assisted the clinician with were placement of lateral thoracic intravenous catheter, and preparing the site for the fasciotomies.

This case shows us the progression of one disease into two with the second being two-fold. There are a few key things to mention looking back. Those key things include that it was documented that the mare received the flunixin meglumine intramuscularly in the neck, that she was not vaccinated for botulism, that her clinical signs changed and that as those signs were changing, everyone's thought process changed gears and did not just focus that this mare was just a colic patient.