

Indian Lakes report for 7/1/10:
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Traveled to the "Broken Arrow" or "Indian Lakes" holding facility to observe the castration procedures used by BLM personnel on adult mustang stallions at the facility. Present were Dr. Richard Sanford, Mr. John Neil, and 4 other wranglers. The following comments are based on my observations that day, as well as personal experiences in similar operations over a number of years.

Condition of horses: The 35 adult stallions to be castrated were all in good physical shape, with BCS scores of 5 or 6, except for one palomino with a score of 4.

According to Dr. Sanford, these horses were regarded as a "high risk group" because of their size and temperament. Gelding of horses by BLM personnel is governed by Instruction Memorandum 2009-063, (Gelding of Wild Horses and Burros and Gelding Vouchers) a policy that requires that all male horses in BLM holding facilities, that are weanlings and older, be gelded. This policy was

implemented in January, 2009 after the National Wild Horse and Burro Advisory Board recommended it to BLM. The reasons for gelding older stallions include avoiding the risks of breeding when mares are located at the same long term holding facility, avoiding the risk of a stallion escaping and causing problems with horse owners that live nearby and often adjacent to long term holding facilities, decreasing fighting in holding facilities between stallions, improving potential for adoption for geldings, and population control if horses were released to the range.

I agree that castrating older stallions carries greater risks based on previous experience with castrating adult wild horses. Castrating these horses was done by BLM regulations and was not up to the discretion of the facility personnel.

Additionally, regulations covering the disposition of cryptorchids state: since cryptorchid animals can remain partially fertile and cause serious problems when unknowingly adopted or sold to the public. Special care is taken with these animals so as not to allow them to move between facilities, get into the public's hands, or be placed in long-term

holding. If the animal is a single cryptorchid, the descended testicle should never be removed unless the retained testicle is removed at the same time. If the animal cannot be fully castrated at the facility where it is prepped for adoption or at LTH, it will be regarded as having a serious physical defect and will be euthanized in accordance with the euthanasia policy.

This is done before the animal has recovered from anesthesia or as soon as possible thereafter. We did not observe any cryptorchid surgeries on July 1, but this policy is reasonable to insure safety of adopters and humane care of the horses. It should be noted that bilateral cryptorchid stallions are extremely rare. So the need for euthanasia would apply to a very small number of horses.

Handling of horses in chute: as observed in previous trips to the Indian Lakes facility, the horses worked relatively quietly through the holding pen, crowding alley, and chute. The last 5 or 6 horses to go through the chute did rear and struggle in the alley. One of these horses cut its lip and another received a superficial skin

wound on one of its front legs over the cannon region. Neither wound required further treatment. The open sided bucking chutes which are used for holding immediately behind the squeeze do contribute to horses being agitated, because they can see activity around the chute. John Neil and I discussed the advisability of making these units "blind" with solid sides. Apparently, the facility at Palomino Valley does have a blind alley behind the chute and the horses work more quietly there, though horses still rear and attempt to turn in the alley at times. One would expect some degree of escape behavior in wild horses, regardless of the chute configuration. The reason given for having the chutes open was that the crew could more easily identify horses as they came in to the squeeze and see if an animal was getting into trouble in the alley. This could be fixed by mounting a video camera above the alley, with a monitor near the chute. The ones used for foaling mares are durable and inexpensive. However, if the horses cannot be easily observed in the alley, they have to be caught in the chute just to be identified when they are being sorted. The necessity to actually catch each horse, rather than observe it in the alley and then let it through the chute, could lead to more injuries in the long run. This all comes down to even with the optimal handling techniques and equipment in place at Indian Lakes, wild horses will always be at risk for injury and changes in corral configurations will trade one set of problems for another.

The wranglers worked the horses quietly and efficiently, being careful not to crowd them or make them more anxious. It is evident that the crew was concerned about the welfare of the horses and had a lot of experience.

Anesthesia and recovery: The anesthesia protocol used consisted of administering succinylcholine at a dose of approximately 40 mg IV while the horse was restrained in the chute. The chute was then opened and the horse walked out into a sand paddock in front of the squeeze. The horse became recumbent within seconds. The legs were tied (left front to left hind and right front to right hind). Once it was established that the horse was breathing, xylazine and ketamine were administered IV, to provide unconsciousness and short term analgesia. The horse was held in dorsal recumbency for surgery. Following castration, the legs were untied and the horse was put on its side and allowed to recover unassisted. All horses recovered quietly, without falling and with minimal ataxia. Though there are some serious concerns with this anesthetic regimen (see below), by comparison to other protocols for field anesthesia, the approach used was extremely efficient and provided very safe recoveries. The horses stood up quietly, were quickly alert, and walked or trotted immediately to join the other horses.

Surgical procedure: The castrations were performed by a standard open technique, using the Henderson Castration device. Dr. Sanford obviously has a lot of experience with the use of this approach and made an effort to avoid undue trauma to the inguinal canal (which can result in evisceration). The surgical skin prep was minimal, but within commonly accepted standards. Providone iodine was used to sterilize the instruments, the horse's scrotal skin, and the surgeon's hands. All the horses castrated had 2 descended testes. So I did not have the chance to observe the

cryptorchid protocol used at this facility. In discussions with Dr. Sanford, I found that he uses a small parainguinal incision to locate and remove abdominal testes, which is then sutured. Recently a bilateral cryptorchid stallion was euthanized, based on the protocol mentioned above. Again, this is a very rare event. None of the horses castrated had any evidence of hemorrhage post operatively. One stallion remained recumbent longer than the others, but stood eventually and did not seem to have other problems.

Post operative care: After surgery, the horses are exercised daily by mounted wranglers to prevent premature incisional healing and swelling. No antibiotics or analgesic/ anti-inflammatories are administered unless the horses are showing such clinical signs as increased respiratory rate, serious swelling, colic, anorexia, or separation from the herd. I discussed the concerns about one colt pictured in a video sent to me, who was tachypnic and off by himself after being castrated. Dr. Sanford's comment was that this horse would have been run back through for antibiotic administration and analgesic/anti-inflammatory administration by their protocol. I did look at pens of geldings that had been previously castrated. The degree of sheath /scrotal swelling was greatest in those that had been done a week previously, but none were seriously affected. It is common for field castrations to have some degree of swelling around a week post operatively. The condition of the geldings, was about what would be expected following a field castrations anywhere.

Overall impression of castration procedures and concerns: The process was done very skillfully, by a team that obviously has a lot of experience, and none of the horses castrated had significant injuries or complications. This is especially important considering the 'high risk' nature of the population of stallions. My concerns come with the anesthetic technique, in particular the use of succinylcholine (a depolarizing neuromuscular blocking agent or NMBA) and the lack of analgesia. First, I have to say that this is NOT a simple problem. The regimen used at Indian Lakes may very well be the best, GIVEN the population of horses being castrated, and, as a result, I am not sure that even after a lot of thought on the issue that I have a better answer.

Like other NMBA's, succinylcholine provides muscle weakness and immobilization without any effects on consciousness or pain perception. Its main advantages are: rapid immobilization, small intravenous dose, and very short duration of action (minutes). These are attractive when working with horses that are hard to restrain safely, have to be handled in a chute (where IV injections can be difficult), and who tend to have difficulty recovery from anesthesia. It is a basic tenet of equine anesthesia that recovery is the most dangerous part of the whole process for ones patient. Horses that are excited ('fight or flight' response has been initiated) and who are not trained to accept hand restraint often have difficulty getting to their feet when recovering. If they stagger at all they become even more frightened and will bolt, when they are not yet ready to walk. This results in falling, more fright, more falling, and injuries. Succinylcholine's rapid metabolism allows the horse to attain a stable standing position immediately after surgery. In the protocol used

here the dosages of xylazine (an alpha 2 sedative with some analgesic properties) and ketamine (a dissociative agent with some analgesic properties) were much less than I would have administered to similar horses being induced and anesthetized in a chute. It is primarily the dissociative agent (ketamine) which prolongs anesthesia and promotes postoperative ataxia (staggering). The lower doses (of ketamine) afforded by the Indian Lakes regimen resulted in adequate, but shorter-term anesthesia, and excellent recoveries. Had a more standard dose of xylazine and ketamine been used the horses would have been recumbent for a longer period of time and there would have been more postoperative falling. This could have resulted in injuries. Further, the process of sedative/dissociative anesthesia requires some time (several minutes) between administration of the xylazine and the ketamine. During this period of time, the sedated horse can “overcome” the sedation, become more agitated and injure itself in the chute or simply lay down (making anesthetic induction much more difficult and dangerous). In other words, the quick “knock down” and “stand up” effects of the succinylcholine makes much of the anesthetic process easier and safer.

On the other hand, the down side of NMBA's is significant. First of all drugs like succinylcholine not only paralyze the skeletal muscle that moves the legs, but it also effects the muscles of respiration. In extreme cases this can result in asphyxiation and death. While the doses of succinylcholine used were just adequate to immobilize the horses, the respiratory patterns immediately after the drug took effect were all abnormal. In some individuals this only lasted a few seconds. However, several of the stallions did not ventilate and were given resuscitation with a bellows device attached to a tube placed in their nose. Since the horses did not have a nasotracheal tube placed, these efforts did not result in a chest excursion and I am not sure that they were very effective. All the horses did start breathing spontaneously and recovered. However, availability of pressurized oxygen, tracheal intubation, and a demand valve is generally regarded as necessary for ventilatory support in a horse. Succinylcholine also has autonomic and cardiac effects that result in changes in heart rate and blood pressure. Dr. Sanford noted that, rarely, horses have died during or after anesthesia with evidence of pulmonary hemorrhage using the succinylcholine regimen. This was attributed to hypertension induced either by the drug directly or by anxiety (see below). No statistics were available to identify the incidence of these deaths.

Besides these potential respiratory and cardiac complications, it must be remembered that succinylcholine induced patients are completely conscious. The use of this drug as the sole “anesthetic” (actually immobilizing agent) for castration of horses is currently regarded as “barbaric” by veterinary anesthesiologists (Muir and Hubbell's [Equine Anesthesia](#)). Humans who have been given succinylcholine for emergency intubation have described the frightening experience of feeling completely helpless and paralyzed, while conscious. It must be emphasized that this is NOT what is being used by the BLM to castrate these horses. On the other hand, several minutes elapse between the succinylcholine taking effect and the administration of the anesthetic that takes away the horse's consciousness and pain

perception. While no surgery began until the xylazine and ketamine are given, the horses were recumbent, having their legs tied, being rolled over, and often having some difficulty breathing while being restrained by the NMBA (succinylcholine) alone. This would, no doubt, be frightening to an already anxious animal and could contribute the very rapid, strong pulse that all the horses exhibited. Increased cardiac rate and contraction may be responsible for the rare hypertension induced pulmonary hemorrhage.

Finally, humans given succinylcholine have complained of muscle pain. This could occur in horses too, though no studies are available to answer this question. None of the horses appeared stiff or lame after recovery.

The only analgesia that these horses received was provided by the xylazine and ketamine. These would be very short acting (minutes), especially since a low dose of ketamine was used. The necessity for providing analgesia in field castrations in the form of anti-inflammatories, local infiltration of anesthetics, or centrally acting analgesics is controversial. The standard of practice currently does not require the use of any of these. While there is little down side to most of these drugs many practitioners do not use them for reasons of efficiency, economics, or perceived lack of efficacy. There have been, in fact, been very few studies demonstrating positive effects of analgesia for castration in the horse. However, HSVMA clinics do use several analgesic techniques that could be incorporated into the protocols used by the BLM. Butorphenol, a synthetic opioid agonist-antagonist, is given with xylazine. Though short acting, it does have analgesic properties, as evidenced by its synergistic effect with xylazine in treating colic. The biggest argument against incorporation of butorphenol into the protocol is that it may not contribute greatly to the horse's comfort and may create more post-op staggering. However, I would recommend its use. Flunixin meglumine (Banamine) is also used in our clinics. It would not provide much immediate post operative analgesia if given under anesthesia, as it takes some time to take effect, but may make horses more comfortable for the 12 hours after surgery. Some veterinarians are concerned about anti-inflammatories like flunixin decreasing the swelling in the inguinal canal and predisposing castrated horses to evisceration in the immediate post operative period. There is no objective evidence that this is a real concern, and this has not been my experience in a few thousand castrations. We also use injection of lidocaine into the spermatic chord and the floor of the scrotum. This is not a commonly used practice and some surgeons feel that the analgesia provided does not warrant the effort. However, there is some objective evidence in the dog that the analgesia provided by injections of lidocaine into the spermatic chord prior to castration provides some analgesia as long as 24 hours. Again the use of these techniques, though I support and use them, is controversial and not considered "standard of practice" by state veterinary boards.

In summary: The anesthesia used did not result in injuries or complications. I am concerned about the degree of pain and anxiety the average stallion undergoing castration may experience. However, objective assessment of pain and anxiety is

very difficult in animals, and these horses showed little evidence of post-operative discomfort. This may be the best approach in this population of horses. With this group of adult stallions, the other injectible anesthetic regimens available would almost certainly resulted in more difficult recoveries and possible injuries to the horse in recovery. I would like to see the statistics on castration complications from Indian Lakes and Palomino Valley, and will ask the BLM to provide what they have.

Other general observations at the facility: The horses uniformly were in good body condition, were shedding out, and responded to humans as if they were acclimating to the facility.

I asked personnel about the respiratory disease occurring in the young horses of two months of age and more, though I did not see any horses with respiratory signs on the particular day that I visited Indian Lakes. The protocol for treatment was to catch the foals in the paddock and administer penicillin intramuscularly. The cultures done on nasal swabs and necropsy specimens had all yielded *Streptococcus zooepidemicus*, a common equine respiratory pathogen of the beta hemolytic group of 'strep's'. These are uniformly sensitive to penicillin and other beta-lactam antibiotics. The affected foals are kept in the pens as all individuals have been exposed to the viral and bacterial agents prevalent in this population. Attempts to quarantine would not provide any control of transmission and would stress the sick individuals as well as other animals in the paddock.

We also discussed the stallions that had died previously of broken necks and backs during previous castration days. These occur when a particularly wild individual tries to run through the chute and slams in to the head gate. The crew attempts to keep the horses as quiet as possible, and by my experience working in other facilities, the personnel at Indian Lakes does a better job than most. It is possible that making the alley immediately behind the squeeze blind would help reduce the incidence of these very tragic injuries, though complete elimination of injuries in a large number of horses held in concentration is not realistic.

There have been concerns voiced about the feeders and exposure to sand. Since my last trip to Indian Lakes, the feeders have been modified to keep out sand and prevent smaller horses from injuring their chests trying to get to the hay. Additionally, there is a crew that constantly goes through to clean sand and debris from the feeders and keep the hay where there is easy access.

While shades and wind breaks have not been built, I doubt that the potential for injury from more posts in the paddocks warrants any improvement that these structures would afford. It can get hot and cold in Fallon. However, it is not different from the climate in the rest of northern Nevada, including the Calico range. If anything it can get a lot colder on the range and the horses do not have to travel to get to water. On the range treks to water sources may be many miles.

I hope the above observations will be useful and contribute to the welfare of the horses. To this end the comments are as objective and impartial as I can make them. However, I am going to take the risk to make one statement on the overall situation at Indian Lakes: the problems experienced at this facility are those that occur whenever any population of animals is concentrated in numbers greater than it has been prepared to survive by evolution. Indian Lakes is a well-designed facility, with a dedicated and skilled staff. However, just like cattle feed lots, large dairies, concentrated swine operations, thoroughbred race tracks, chicken battery cages, animal shelters, or densely packed human communities (military bases, prisons, etc) there is going to be increased disease transmission, injuries, and abnormal behavior. While years of research and experience has helped control these problems, all the engineering and science in the world will not make up for the fact that millions of years of adaptation cannot be turned in a different direction in a few decades. The horses in holding facilities are going to experience health problems and trade-offs will have to be made. These will involve the lesser of evils, like the anesthetic protocol discussed above, with no hard and fast way of knowing what is really the best for the horses. The real solution will be an economic, environmental, political, and philosophical agreement between stakeholders with interests in the lands and resources where these horses live. When the name calling stops, "success" is defined, and choices based on objective information are discussed there will be a chance of a better life for horses. This was not the case with the original Wild Horse program, which predicated that mustang adoption would control range numbers without any real proof that the adopters who could provide a good quality of life for horses existed in numbers adequate for the task. Veterinary medicine and animal husbandry in holding facilities will be a poor 'band aid' in the mean time.