

Chronic Foot Disease – One Rhino’s Story

By

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The Greater One-Horned or Indian rhinoceros is the second largest rhino of the five species weighing approximately two tons. Classified as seriously endangered, two protected areas hold the remaining wild populations, approximately 1200 in India, and according to the 2005 WWF census, 352 in Nepal. Unlike the rhino of Africa, the Indian rhino thrives in tall grasslands and riverine flood plains spending up to 70% of their time in water either feeding or resting. Worldwide, about 150 animals live in zoological institutions. The greatest challenge to captive management is providing an ex situ environment that mimics their natural habitat to circumvent their high susceptibility to chronic foot disease (CFD). Chronic Foot Disease, also referred to as Pododermatitis, has been found to afflict 100% of all captive breeding age male, and 80% of all captive breeding age female Greater One-Horned Rhinoceros according to a European survey cited at the 2002 Rhino Tag.

Our subject is Mohan, a 4,000 lb, 37 year old, wild-caught Greater One-Horn who resided at Smithsonian’s National Zoological Park for five years. Medical records show that Mohan has suffered from CFD since at least 1989. Yearly immobilization procedures to surgically trim overgrown pads and remove grossly infected or necrotic tissue had become a way of life since 1990. He had been afflicted with and treated for Pododermatitis during his tenancy in his previous facility at Miami Metro Zoo and while at Smithsonian’s National Zoological Park. The following pictures will show a surgical foot trim procedure from immobilization through reversal. Pre and post surgical comparisons show the progression of foot disease that led to the first ever application of aluminum shoes on a rhinoceros. We will discuss his habitat in captivity, his symptoms, and our management including several immobilizations, and the progress of foot disease over the five-year period. We continue to monitor the progression of his foot disease in cooperation with his current facility in Florida, and will show the impact of his move to a more natural habitat and substrate.

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Pododermatitis is a chronic foot disease characterized by overgrowth of the central nail, bruised pads, exuberant growth of granulation tissue, occurring at the separation of the footpad from the sole of the central toe, and in non-healing, chronically infected, deep fissures.

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Wild Indian rhino are “sole -walkers”; bearing the majority of weight on the nail and sole. Captive rhino become “pad-walkers”, bearing the majority of weight on the delicate pad of the foot. In captivity, the hard, abrasive surfaces which cause chronic trauma, the lack of moisture and humidity, especially during winter internment indoors, and the lack of free or constant access to water are regarded as primary causes of the disease (Prof. D. H. Geyer, 2001).

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Mohan has had a long, painful history of CFD. He had been chemically immobilized six times to manage this condition while at SNZP. It is unclear how many immobilizations he had undergone prior to 1998. Being highly tractable, and responding well to tactile reinforcement, we were able to “scratch” Mohan into an easily accessible position for anesthetization. As is common to rhinos, Mohan often went down with his head in a corner,

and would have to be re-positioned using several keepers, and several ropes. This picture shows the rope just prior to breaking.

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During the procedure, a tourniquet was utilized for anti-biotic distal digital perfusion. In spite of full sedation and a locally injected Lidocaine block, while paring down exuberant tissue and cracked soles on his left rear foot, caution was constantly maintained as Mohan often still kicked.

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Following the procedure, 4x4's filled with Tetracycline hydrochloride powder were placed on the newly trimmed areas and held in place with Elasticon. After the antagonist was administered, Mohan would repeatedly smash his head on the concrete floor in an attempt to become sternal. We then had to monitor him for mouth soreness, and possible broken teeth, as full impact on his lower jaw often resulted as he attempted to stand.

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The photo comparisons of the last five years clearly show the degeneration of his footpads, massive overgrowth of tissue, and separation of footpad from central toenail. Despite a constant effort on the part of the keepers to trim excess tissue and keep his feet moist to prevent the formation of cracks and infections, there is no cure for CFD at this time.

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The greatest exacerbating factors appear to be housing on improper substrate, and lack of access to a year round source of water for relieving feet from the weight of his body. When Mohan had the opportunity in summer months, he spent more than 50% of his time in the water, which significantly slowed the progression of exuberant tissue growth. Also, there were no abscesses and no pressure sores. Daily keeper reports documented the onset of cyclic symptoms, hind foot tenderness and fraying footpads, 7 days after the seasonal closing of the outside pool.

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Unfortunately for SNZP's rhino, temperatures 40 degrees or below for much of the year prohibited necessary access to wallows and pools resulting in a minimum of 16 hours a day confined to indoor concrete floors. In six other cases zoos reported that lesions healed much better and faster with maximized access to natural substrate; soft soil, mud, and constant access to water. Keepers played a significant role in relieving some symptoms. Extra effort to provide significant moisture to maintain the soft skin of the feet, especially in climates which exclude pool use for significant periods of the year, and a thick bedding or rubber matting (if possible) to combat pressure sores seem essential.

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While at SNZP, the physical and behavioral signs of CFD appeared to be cyclical and therefore predictable. A marked change from an otherwise highly tractable animal to one of increasing irritability, charging, snorting, and vocalizing, was a key indicator of this cycle of pain. Keepers identified a noticeable decrease in activity level, appetite and stool output

coinciding with severe hind foot tenderness which progressed to an almost non-weight bearing state. Pressure sores at elbows and hips developed due to many hours spent lying down.

Hind leg instability and muscle fasciculation were observed on several occasions in conjunction with physical and behavioral signs of increasing pain. A history of focal (partial) seizures; the rhythmic muscle contractions in one or both hind legs, and at least two grand-mal seizures involving the complete body in convulsion, may have been linked to pain.

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During the trimming procedure, one of the disadvantages and risks of using a local injection of Lidocaine was the potential for site abscesses. Mohan developed several abscesses, which erupted out of the top of his foot and in between his toes. The unfortunate location of the eruptions led to a lengthy healing process, as they would not drain naturally, and had to be repeatedly opened and cleaned.

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During his final procedure at SNZP, a subcutaneous injection of Baytril was given in the pectoral region.

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The area was chosen as it was anticipated that the injection site would abscess, and this part of the body was easily accessible for treatment.

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Operant conditioning was a critical element in the treatment of Mohan's symptoms and complications, i.e. stationing for trimming, soaking feet in foot baths, scrubbing abscesses, drawing blood samples, and was crucial for a facility without a restraint device. Keeper's keen powers of observation and knowledge of the individual's behavior patterns were essential to recognizing the initial stages of pain. Strong communication skills kept veterinarians and supervisors apprised of increasing levels of discomfort or associated illnesses so that treatments were appropriate and timely.

Supportive therapies included oral anti-inflammatory and pain reducing medications; hydrotherapy, diluted Nolvasan solution/ Tetracycline hydrochloride footbaths and a Beta dine scrub to treat abscesses. Chemical antiseptics or antibiotics in the long term cannot prevent contamination with common bacteria due to the inability to reach all the niches that form within the crevices. Administration of large quantities of oral medications, especially antibiotics, caused a decrease in appetite resulting in a significant loss of healthy body condition. Additionally, body and feces emitted a foul odor. Keeper ingenuity, persistence, and a warm mash fed several times a day seemed to stimulate the appetite. In an attempt to restore body condition, further diet modifications included an equine performance feed and an increase in quantity and frequency of produce. In an attempt to restore bacteria and natural flora, access to the female's stool was given daily.

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As a proactive measure, it was suggested we attempt to "shoe" Mohan in an effort to provide for more natural toenail growth by minimizing the abrasion of the concrete flooring. During one of the trimming procedures, a traced outline was made of all of Mohan's toes, to be used in the fabrication of the shoes. The mostly-completed aluminum shoes were then ground to a perfect fit while Mohan was anesthetized.

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Using an epoxy and Kevlar adhesive, the shoes were affixed to Mohan's feet. It was anticipated that the shoes would last at most six weeks. They ended up lasting more than twice that long.

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Although we did see significant improvement in Mohan's foot condition and a more natural nail re-growth, applying shoes without making necessary changes to the captive habitat may be recreating CFD characteristics by allowing re-growth of the central toenail to unnatural lengths.

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The procedure of shoeing then becomes a cycle of immobilizations for trimming and re-shoeing. The application of shoes *in conjunction with* a permanent change to a more natural habitat in captivity; soft, non-abrasive soil, loam or mud and year round pool access can significantly improve foot condition and may provide animals in Mohan's condition with an overall better quality of life.

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Mohan and our female Mechi were sent to White Oak Conservation Center in June of 2003 after the decision was made that we would not attempt breeding at SNZP. We were hopeful that the more natural substrate offered at White Oak would improve the condition of Mohan's feet and delay the re-growth of exuberant tissue. Our female had begun showing signs of CFD while at SNZP, and we had been opportunistically trimming her feet whenever she lay down at the front of her enclosure. We hoped the move to Florida would drastically slow, if not eliminate the progression of her affliction.

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While at White Oak, Mohan underwent only one immobilization for foot trimming, with a small amount of work done on his feet during a second immobilization for electro ejaculation.

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The slightly excessive growth of both back central toenails was trimmed off, and what was left of the shoes was removed. From the slide, you can see what an improvement moving to a natural substrate alone can do in the battle against CFD.

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As keepers, your intimate knowledge of your animals is the greatest asset you have in the battle against CFD. You are the first line of defense in detecting and recognizing the symptoms, and thereby initiating treatment that can minimize the effects of this disease. It may be a critical element that you have an operant conditioning program in place to aid you in the treatment of CFD, with or without a restraint device. Training should be proactive – you

may find that frequent trimming, daily topical solutions, footbaths, constant monitoring and too frequent immobilizations may become a way of life for those of you caring for breeding-age Indian rhinos. For those facilities housing Asian rhinos that do not have proper flooring, substrate, or pool access, become familiar with the early signs of CFD. At this time, ongoing studies are in the beginning stages of identifying all the causes of CFD, and more research is needed. Factors may well include things other than substrate and pool use, but we have seen firsthand how these small changes can make a dramatic improvement, and how damaging the lack of them can be. As keepers, communication with each other – via listservs, presentations, conferences, workshops, or word of mouth – about symptoms, successful methods of treatment, or better ways of management may help to prevent rhinos currently not afflicted from developing this incurable disease, or to improve the quality of life for those rhinos that are.

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References: Atkinson, M. 2002. Capture and Translocation of Greater One-Horned Rhinoceros, *Rhinoceros unicornis*-An overview of major health concerns in captive *R. unicornis*.

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