Animal Keepers' Forum

December 1987

Special Edition

13TH NATIONAL CONFERENCE OF THE

AMERICAN ASSOCIATION

OF ZOOKEEPERS

MILWAUKEE 1987

Dedicated to Professional Animal Care

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Treatment and Management of Chronic Foot Problems in an Indian Rhinoceros

By

Cyd P. Mayer, Zoo Hospital Manager
and
Ellen Saksefski, Area Supervisor Pachyderm
Milwaukee County Zoo, Milwaukee, WI

Foot lesions have been reported for approximately sixteen years on an Indian Rhinoceros at the Milwaukee County Zoo. During that period of time, this animal was treated with a variety of regimens ranging from daily topical treatments and foot management to surgical and systemic treatments, as well as dietary changes. In 1986, the lesions were found to resemble equine canker on histopathology.

Due to the size of the rhino and the nature of the disease, diagnostics and treatment were at times quite difficult and creative. Handling, diagnosis and treatment of the feet will be discussed in the following.

History

Milwaukee County Zoo's Indian rhinoceros, Rudra, arrived at the zoo in July of 1959 at the age of three. Born at Basel, Switzerland, he was reported to be the first Indian rhino born in captivity outside of Asia (Guggisberg, 1966). In 1969, he was estimated to stand 6'3" at the shoulders and weigh approximately 7000 lbs. He was paired with a female who gave birth to one stillborn calf in 1967, and in 1968 she was determined to have had a false pregnancy. Unfortunately, this was the extent of the breeding between the two and in 1975 the female died of an intestinal blockage (Martens, 1969).

Rudra always showed a mild disposition, allowing keepers and other staff to rub his forehead and body through the bars and from within the same enclosure. The extent of his docile behavior was demonstrated when he was used for semen collection for reproductive work. He was cooperative enough to allow us to manually collect semen. This manageability allowed for much easier manipulation of his feet and medical treatment on a daily basis.

Housing for the rhino consisted of a 25' x 25' inside enclosure, with an unbedded asphalt floor and moderately good drainage. The enclosure was equipped with a warm water shower. Originally, the outside enclosure consisted of a mud yard and hole. This was later sodded and a concrete pool was cleaned twice a day when soiled.

Case History

The first notation of "sore feet" in the rhino was as far back as 1961. This report reoccurred on an irregular basis, with the documentation poor as to which feet were involved and what, if any, treatment was given.

In 1971, the first notation of "growth between toes" on both rear feet was recorded. At this time the treatment was Negastat® topically twice a day. This was the beginning of a problem which never really reached an end. The problem seemed to localize in the right rear foot for many years, however, it did eventually progress to involve all four feet, with flare-ups along the way. The lesions varied from superficial to deep cracks over all areas of the foot surface as well as behind and between the nails. In later years lameness

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occurred. For 16 years there was topical treatment, and finally surgical debridement of the lesions. In 1985, after many years of treating for "cracks", the lesions were found to be "reminiscent of equine canker". (Cooley, 1985).

Diagnosis and Treatments

As many diagnostic procedures as the rhino's gentle temperament would allow were done. Since he would routinely lay down for his daily nap, this allowed for procedures such as radiography, aerobic and anaerobic cultures and even blood work. We found that by putting topical Xylocaine® on the ear vein, Rudy could be easily bled. In spite of the patient's cooperation, nothing particularly significant was ever demonstrated by the diagnostics. The cultures often grew bacteria, but they were almost always contaminants. This was not surprising since it was impossible to keep him from walking through his urine and feces. It wasn't until surgical debridement in 1985 that a biopsy was taken and the lesions were described as "reminiscent of equine canker". At long last there was something to treat.

Throughout the years, many different treatments were used on the mysterious "cracks". Some of the drugs were repeated time after time, either because of signs of improvement or because of lack of anything else to try. A list of the drugs used over the years can be seen in Figure 1. The different medications were frequently tried at various dosages or concentrations. The current drug of choice is oral Metronidazole®. Since it was not used until so many years after the onset of the problem, the improvements which it offered to this case were not dramatic.

As the lesions continued to worsen it became evident that surgical invasion was unavoidable. This would offer the opportunity for the debridement which was so desperately needed for improvement.

In 1985, Rudy was anesthetized with 2.8mg of M99®. He was assisted into position with the use of blocks and tackle, and was put on a dunnage bag to help prevent capture myopathy. He was down for one and a half hours, during which time the right rear foot was debrided everywhere that lesions were found. There was a tremendous amount of blood loss and the procedure was finished with two, separate pressure wraps. The last pressure wrap was made of cotton, gauze and elastic wrap, as well as a large piece of inner tube to offer protection to the healing foot. This was left on for about one week. Upon removal, the bandage was seen to contain fungus and mold growth due to moisture. The foot was not rebandaged because the animal would not cooperate.

After the surgery, the stall was kept clean of all hay and feed by placing the food in the adjacent cage and allowing the rhino to put his head through an opening to eat. Feces were cleaned out as soon as possible after defecation.

The lesions on the right rear foot showed almost total healing after the surgery. After five months the cracks reopened. It seemed as though the weight of the animal and the spreading of his feet when he stood were causing the cracks to split, never allowing healing. It also became evident that the other rear foot was worsening.

At the end of 1986, both rear feet had begun to deteriorate. It was once again determined that surgery was necessary. This time in addition to the debridement, it was decided to try and put shoes on the animal. The thought was that the shoe would protect the foot, hold the sole somewhat immobile to allow for healing of the wounds, and allow for normal toe movement. A farrier was consulted. An attempt to make plaster casts of the rear feet for the purpose of measurement failed. However, red dye was used and Rudy gave us some life-sized footprints on paper from which to create his special shoes. The shoe was designed with a lateral toe swivel to allow for the proper movement of toes and a bottom plate which could be removed to allow for cleaning and treatment of the lesions. The plate would also keep debris out of the wound. Once again he was anesthetized and the wounds

debrided. A lesion on the right front foot was debrided at this time. The shoes were applied much like horseshoes to both rear feet. The recovery was uneventful in a heavily bedded stall.

Within three hours, Rudy had removed the first of his new shoes. In spite of the attempts to custom design the shoes, they were a little too long. This allowed him to step on the shoe back with his other foot and remove the shoe. The remaining plate was hitting Rudy's opposite leg when he walked, causing abrasions. After this plate was removed, a nail in the shoe became loose, causing the shoe to twist and dig into the rhino's foot pad. The second shoe was removed by the staff. Over the next three months, the feet showed progressive deterioration.

Since Rudra's feet were hurting more, he began to lie down more, which caused severe bedsores and abscesses over his pressure points. He also developed lumps on his side which were sore to the touch. The areas sometimes opened as abscesses and sometimes didn't. At the time of the second surgery these were also biopsied. They showed nothing diagnostic. The bed sores and lumps were treated with 5% benzoate-peroxide, which did improve the condition of the sores on the upper half of his body. A rubber mat was added to the enclosure for padding.

He was put on systemic metronidazole for the canker, topical chloramphenicol for the foot lesions and topical gentamicin sulfate/salicylic acid for the bed sores. The metronidazole was mixed in applesauce and spread on top of hay. This was the only oral medication we were able to get him to take for an extended period of time. While he was on this combination of drugs, he suffered a sudden onset of elevated surface temperature, excessive salivation and labored breathing. Since these symptoms could indicate a drug reaction, all medications were discontinued.

Euthanasia

The front right foot began to show a swelling above the lateral nail. It was hot and edematous to the touch. This eventually ruptured into a large open area. The foot was soaked in tubs of warm water and Betadine® solution. Though he was tame, he was not tame enough to keep the foot in place long enough for the treatment to help. A wading pool, filled with warm water and Nolvasan® , was put into the enclosure. Though the weight of the animal helped this treatment to get into the cracks, it was impossible to get him to walk through the pool often enough for the treatment to be effective. Warm water hosings of the infected, sore feet were done. Plastic bags filled with warm water and Nolvasan® solution were tied onto his feet. At this point injectable antibiotics and painkillers were started.

In spite of all of the tender loving care and medical attempts, Rudy became increasingly reluctant to get up and was extremely lame on all four legs when he did. For the first time the remaining foot had developed a lesion as well. Despite an amazingly good appetite throughout, the rhino was showing a visible weight loss. The decision was made to euthanize a friend and a valuable specimen.

Recommendations

In management of similar cases, certain factors must be considered. Dry housing with good drainage is essential. A nonskid floor which is nonabrasive and/or padded could protect skin and foot lesions. Regular and frequent cleaning of the enclosure, yard and pool is essential. Outdoor pools should drain easily and yard substrates should be mud free.

Because Rudra was so docile, we were able to work with him easily. Since this is highly unusual, it is a good idea if possible to familiarize animals to: people; being touched all over; odd objects, such as syringes, poles, tubs and plastic to name a few.

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FIGURE 1

Drugs used throughout the treatment of Indian rhinoceros. Those bold-faced were used repeatedly off and on through the 16 year period.

DRUGS USED

Negastat®

Kopertox®

Insulin ointment (Aquaphore®)

Verracine® & **"Blue Liquid"**

Acroflavin®

Sulfathiazine, oral & topical

Sulfa Solution

Alum Powder

Karlan Spray

Topazone® Spray

Granulex® Spray

Mycodex®

Banamine® topical

Nolvasan®

Penicillin

Nitrosol Spray

"Blue Medication"

Tincture of Iodine

50/50 Peroxide/Kopertox®

50/50 Peroxide/Betadine® sln.

5% Formalin

5% Formalin/Betadine® sln.

Formalin/Phenol

Chloramphenicol Ointment

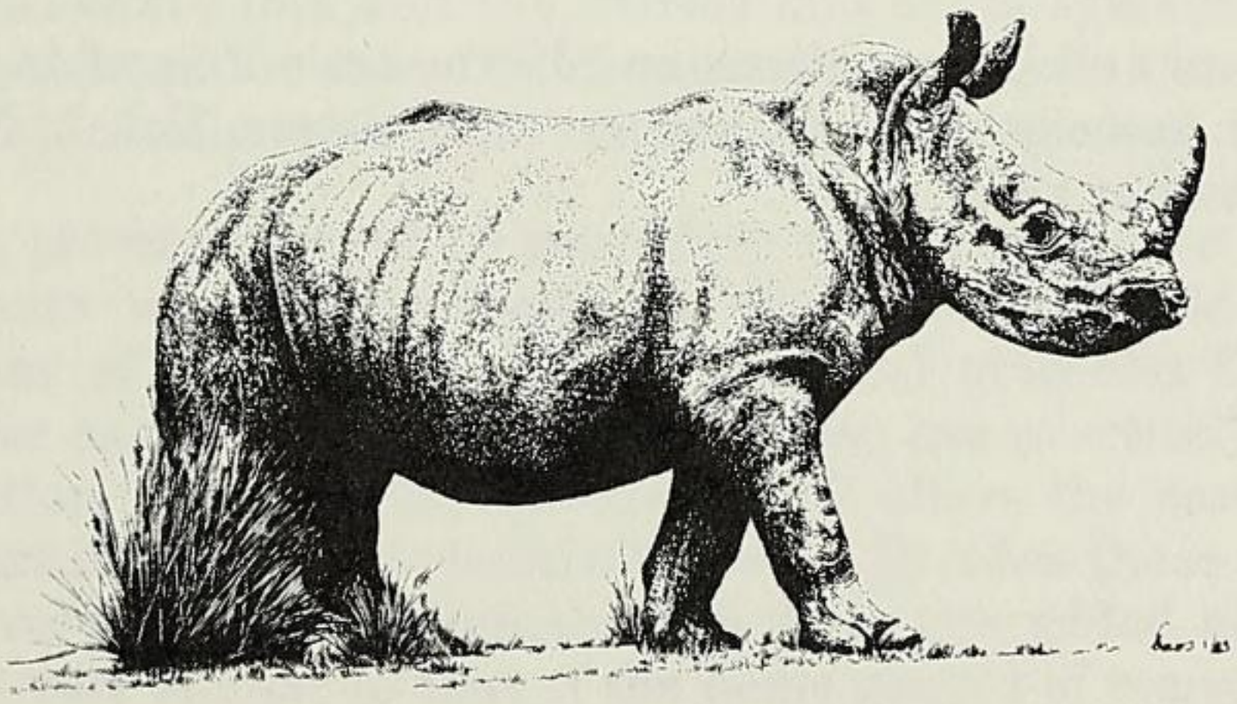
Sulfamethaoxazole/ Trimethoprim

Metronidazole

Gentamicin in Salicylic Acid Solution

Gentamicin Sulfate, injectable

5% Benzoate-Peroxide



The treatment should consist of cleaning and debriding the wounds as well as systemic treatment. Keeping the wounds clean and dry and bandaged would be ideal.

Conclusion

Rudy carried significance in the world population of Indian rhinos which is numbered at 1500 in the wild (Bradley-Martin, et al, 1982) and 32 in North American zoos (Dee, 1987).

For the last four years, semen has been collected from this animal through numerous methods from mild electroejaculation to artificial vaginas. The most successful method has been manual stimulation. At this time, his semen is believed to be the only frozen Indian rhino semen in the world. With this in mind, it is believed the knowledge that this animal has provided us will continue, as well as the chance at propagation of the species through artificial insemination.

Acknowledgments

We would like to thank Dr. Andrea Lenhard and Dr. Bruce Beehler not only for their time and frustration in treating and diagnosing this animal, but also for helping us to put all of the facts together. We would also like to acknowledge all of the pachyderm keepers, hospital staff, and other professional consultants who put in so many years and hours to try and make a good friend well.

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