Investigation of A Cattle Mutilation in which the Animal Survived

George E. Onet, DVM, Ph.D.

National Institute for Discovery Science
Las Vegas, NV

On May 20, 2000, the owner of a ranch situated about 18 miles north of Cuba, NM, contacted NIDS' New Mexico field investigator about a cattle mutilation. The 230 cattle of different ages and breeds were kept on the ranch that was covered with vegetation typical for dry rocky soils, with many brushes and weeds (Photo 1). The water supply consisted of a small artificial lake (Photo 2).

Photo 1. Grazing area with typical vegetation

While rounding up cattle to bring them to the corral the owner noticed that a 2 years old Charolais cow had both ears missing and displayed severe upper lip lacerations.

The next day (May 21) at 7:30 AM, the investigator visited the ranch and in agreement with the owner decided to transport the animal to a local Veterinary Clinic. On May 22, 2000, the animal was closely examined by the local veterinarian and NIDS' staff. Clinical examination revealed:

Photo 2. Water source

- The nutritional condition of the animal was poor (Photo 3). She had the look of a suffering animal, with diminished mobility and responsiveness.
- The hair-coat also was in poor condition, with traces of dried darkened blood on both sides of the facial areas under the ear insertions (Photo 4).
- The internal body temperature was within normal limits.
- From the mouth, saliva with bloody striations and foamy aspect was dripping on borders of the inferior lip (Photo 5). The upper lip showed serious lacerations, with several dark crusts, especially towards the oral commisures (Photo 6). The inferior third of the muzzle and the superior lip, looked like having been burned by some corrosive chemical. The hair on the lower third of the upper lip was irregularly missing. By opening the mouth extended necrotic lesions were seen only on the upper jaw bucal mucosal membrane. Irregular necrotic lesions, with bleeding occurring after the examination process, were seen especially at the emergence of labial and upper gingival mucosae. In that area, the tissues looked very fragile and prone to bleeding. Purulent exudation, mixed with epithelial debris covered some areas. At the mergence of the right upper and lower lips, a portion of 3/2 cm of tissue had only partial adherence and could be easily removed for histology and virus isolation. The tongue epithelium was intact and no lingual lesions were detected down to its basis. The tongue was mobile. Every occasionally the animal used it to clean the muzzle and the lateral part of the lips. The lower jaw mucosae also were intact, with no erosions, bleeding or pseudomembranes, in contrast to the previously mentioned severe upper lip lesions.

Photo 3. Mutilated heifer

Photo 4. Coagulated blood under the left missing ear

Photo 5. Upper lip lacerations with hypersalivation

Photo 6. Severe upper lip laceration

- Both ears were missing, giving the strong impression that they had been cut. Especially the left ear, which seemed to have been cut from its very bottom, displayed a nude area of about 10/7 cm, where a thin crust had started to build (Photos 3 & 7). The ear canal had been obstructed by exudates, blood, and some insect larvae. The borders of the remaining skin had burgeons o epithelium that started to heal the wound. The right ear looked to have been removed from about 3 cm from its base, leaving in place some of the cartilage and the covering skin, with the ear canal partially obstructed by exudates and blood (Photo 8). The hair under both ears had traces of dried blood.
- A moderate nasal discharge had a clear aspect. There was no indication of a deeper segments respiratory illness. The breathing was normal.
- Rectal exploration showed no digestive disease. The feces had a normal aspect.
- The animal was not pregnant. No vaginal discharges were noticed. The dimensions of the uterus horns and ovaries were normal.

Photo 7. Left wound left after ear cut

- No other abnormal physical changes were observed. According to the veterinarian, the animal's general condition had improved. The fact that she could consume soft vegetation and drink was a good prognostic premise.

Photo 8. Right missing ear

The following samples were collected for laboratory analyses:
- Fresh blood with anticoagulant
- fresh blood with no anticoagulant
- fresh tissue from the lip for virus isolation
- tissue from the right oral commisure fixed in 10% buffered formaldehyde for histology.

The NIDS team also wanted to explore the local environmental conditions where the mutilation took place. For about four hours, the approximate location where the animal was first found, was inspected by walking in all directions and looking for any helping clues to explain what it could have happened. Nothing unusual was found.

Laboratory Analysis Results

Serology

Serologic tests for Brucella and for five serotypes of Leptospira were negative.

Virology

Virus isolation attempts were negative for BVD (Bovine Viral Diarrhea), IBR (Infectious Bovine Rhinotracheitis) and PI-3 (Parainfluenza-3).

A polymerase chain reaction (PCR) test for malignant catarrhal fever (MCF) virus was positive. The levels of the virus were undetermined particularly since a nested PCR was performed on the blood cells of the animal. The original 423 bp product was amplified and

followed by the second nested PCR reaction, which gave rise to a smaller product. It was undetermined whether the original PCR product was visible on a gel prior to the nested reaction. This means (a) the viral DNA may have been present in extremely low amounts, or (b) since the MCF viral genome is of the order of 150–200 kb, only a viral fragment or a defective virus may have been present. This may explain the lack of clinical MCF symptoms found in this animal.

From a clinical perspective, the significance of this positive test is also questionable. The animal did not show clinical signs suggesting an active malignant catarrhal fever infection. MCF is known to be a contagious disease, expressed by severe general symptoms, with fever, depression, enlarged lymph nodes, nasal and ocular discharges, erosions of the bucal papillae, ophtalmia, diarrhea (sometimes hemorrhagic), inflammatory and erosive lesions in the mucosa of the respiratory tract, with profuse muco-purulent nasal discharge, muco-purulent conjunctivitis, sometimes with corneal opacity. Patchy exanthema with matting of the hair and ulceration of the perineum, vulva, coronet, interdigital skin and teats may occur. Some animals show central nervous system signs such as excitability, hyperesthesia, muscular tremors, convulsions and aggressiveness.

However, existing literature data, based on serologic investigations and virus isolation, indicate that some wild ruminants and domestic sheep can carry a herpes-virus-2 (AHV-2), which is transmittable to cattle without causing clinical illness. Cattle can carry this virus with no relationship to clinical disease. Recent studies at Arizona State University have shown that from a number of 50 dairy cows tested, 21% proved positive for MCF, although they looked clinically healthy. Of that herd, only one became clinically ill and died (1). The presence of subclinical infections in such a high percentage suggests an infection with a virus strain different in pathogenicity compared to the usual MCF virus known for causing high mortality in infected animals, or the presence of a viral fragment or of a defective virus.

Histopathology

The one margin of the tissue examined consists of normal appearing lip, with no histologic changes other than a few mononuclear cells invading around vessels, which is not an unusual finding even in normal animals. As one progresses across the section, there is a transition from normal to hyperplasic with thickened and hyperkeratotic epithelium overlying mucosa that has layers of well-differentiated and parallel fibroblasts and perpendicular small blood vessels. This then progresses to an area with ulceration covered by necrotic debris, including fibrin and inflammatory cells. The inflammatory cells are mixed in nature but include some neutrophils and eosinophils. The inflammatory cells are also present in the underlying granulation tissue with is quite thick and composed of parallel bundles of mature fibroblasts and perpendicular small vessels. The underlying muscle tissue is essentially normal, except for scattered mononuclear inflammatory cells. There are also some glands in the tissue adjacent to the ulcerated areas that are normal except for infiltrations of inflammatory cells. Histologic changes found in this case did not indicate the presence of cutaneous lesions pleading for this viral infection.

ICP-MS Results

Mineral blood analysis by ICP- MS (inductively coupled plasma mass- spectrometry) revealed the following values:

- Cu - 0.748 ppm (normal 0.65–1.50 ppm)
- P - 67.1 ppm (normal 45–80 ppm)
- Fe - 0.989 ppm (normal 1.30–2.50 ppm)
- Na - 3250 ppm (normal 2900–3450 ppm)
- K - 338 ppm (normal 156–226 ppm)
- Ca - 96.6 ppm (normal 85–110 ppm)
- Mg - 21.1 ppm (normal 20–35 ppm)
- Zn - 2.94 ppm (0.80–1.40 ppm).

Serum zinc concentrations may be artificially elevated due to leaching the rubber stopper of the blood vacutainer tube used for blood collection in this case.

Follow-up Investigation

Because it was unusual to have an animal that survived a mutilation attempt, further investigation was carried out.

After a lengthy interview with the owner and her close relatives, it emerged that Tebuthiuron was applied on certain areas of the ranch several months previously to control broadleaf weeds and brush. The application was done to the soil in several areas where the cattle had access. According to the Tebuthiuron fact sheet the product is toxic for many plants. Woody plants die slowly after being absorbed through their roots. The mechanism consists of inhibiting photosynthesis. Tebuthiuron has a low toxicity for soil microorganisms. It is slightly toxic for birds, aquatic invertebrates and fish, and has a low toxicity in mammals. It does not accumulate or build up in mammals.

The average half-life is 12–15 months but in areas with low rainfall can be much longer. Tebuthiuron and its breakdown products have not been tested for chronic toxicity in terrestrial animals. LD-50 is approximately 500 mg/kg for birds and 286–644 mg/kg for mammals. In laboratory tests in rabbits, Tebuthiuron exerts a slight potential irritation effect.

A working hypothesis is that the animal had to be incapacitated before the ears were removed. Several hypotheses can be considered. Incapacitation can be achieved either (a) by using enough manpower to catch and physically immobilize the animal, (b) by using a tranquilizer administered from a distance by using a shotgun, or (c) by using a non-lethal stun device.

a. The use of manpower to physically immobilize the animal. Catching the animal in a wild environment, encompassing several thousand acres of brush, even if the animal is not in best physical condition, is very problematic. It would require several skilled people deployed on the property, which would involve the risk of being noticed by the owner and of leaving tracks.

b. The use of tranquilizers is, in principle, possible, especially if the perpetrators are equipped with adequate administering devices (special shotguns and syringes loaded with sufficient sedative drugs). The technique is routinely used for wild animals' capture and transportation, but it requires certain training and skills. Presently, on the market there are different types of disposable darts, foreseen with various gauge needles for this purpose. There are convenient long-range missile-type devices for large and small animals. Darts contain a small explosive charge, which detonates on impact and quickly injects the drug.

Thorough examination of the animal's hide in different parts of the body, by the local veterinarian and NIDS' staff could not detect any sign of possible percutaneous drug injection. The examination occurred several days after the mutilation happened.

Because the animal was found within a mile from a well-traveled road, NIDS decided to assess the likelihood that a sedative or tranquilizer might be involved. Therefore, a literature search was conducted for likely candidate sedative agents, bearing in mind that the blood sample was taken at least three days after the animal incurred the wounds to the ears. The following drugs, together with their pharmacokinetic profiles were judged probable candidates: Rompun (Xylazine), Ketamine Hydrochloride, Acepromazine and curariform drugs.

Rompun has a systemic half-life of about 50 min in large animals. The peak of the drug concentration in the plasma is reached after 12-14 minutes following intramuscular injection (2).

Ketamine is used for routine surgeries because it allows a more rapid recovery. The drug affects the central nervous system and disables the animal's ability to control or coordinate movements. It can be administered as aerosols or as parenteral injection. When given intravenously the clearance half-life is one to three hours, depending on the animal. For detecting Ketamine there are sensitive HPLC methods, but chances of finding the drug in the plasma are vanishingly small (3).

Acepromazine, when administered intravenously, has a half-life between 50 and 150 minutes. The CNS peak is at 20 minutes after administration. Certain effects, such as blood pressure and sedation may persist beyond the time of detectable acepromazine concentration, indicating that they might be caused by active metabolites, or that their timing could not result from complex pharmacokinetic compartment influence (4).

Curariform drugs, such as succinylcholine and decamethonium, are occasionally used in conjunction with an anesthetic (particularly barbiturates) to induce complete muscle relaxation. They may also used alone for very brief procedures. Because they are not anesthetics and do not have an analgesic effect, the animal may be completely paralyzed by these drugs, but it feels all painful stimuli.

c. Incapacitation of the animal using non-lethal instruments. NIDS also investigated whether the animal could have been incapacitated using current non-lethal weapon technology. Noticeable advances have been made in non-lethal weapon development in the last several years. A company, for example, developed a system able to inflict pain or temporary incapacitation in human beings. It was designed to interrupt a person's nervous system, leading to total involuntary collapse. The president of this company was contacted for specific information on this subject, and was asked about whether or not one of their systems could have been used in the New Mexico case. NIDS was informed that they have been testing their system on several large animals. The results were somewhat mixed. The currently available, off-shelf system proved insufficient to incapacitate a cow. When struck by the weapon, the cows simply moved away. A stronger prototype was tried on a 1500-pound bull. The animal could be dropped, but the effects only lasted as long as the power was being fed into the animal. As soon as the electrical shock stopped, the animal got back on its feet. Another question raised was whether any marks would be visible on the animals hide. He indicated that the small darts would penetrate the hide. However, with the hair of the animals involved it is unlikely that they would be visible at all. These were the

same darts that are used on people. Thus they must be very small and easily retrievable, with minimum damage to the skin. Therefore, while technically feasible, it seems unlikely that an electrical stun gun was used to incapacitate the animal in this case (5).

Postscript

After five days of being kept under medical care the cow was returned to the owner in significantly improved condition. Several days later her health started to deteriorate, the animal went downhill and stopped eating and drinking shortly afterwards. In spite of several requests to keep NIDS informed, the owner decided to shoot the animal and no necropsy was done. Consequently, no morpho-pathologic data on internal lesions are available.

References

1. COLLINS J.K. et all., 2000, Malignant Catarrhal Fever: PCR Survey for Ovine Herpesvirus 2 and other persistent Herpesvirus and Retrovirus Infections of Dairy Cattle and Bison, J.Vet. Diagn. Investigation, In print.

2. *** Disposable Darts: PNEU-DART Type C and P, User's guide, Pneu-Dart, Inc. P.O. Box 1415, Williamsport, PA 17703

3. WATERMAN A.E., 1984, The pharmacokinetics of Ketamine administered intravenously in calves and the modifying effect of premedication with Xylazine hydrochloride, J. Vet. Pharmacol, 7 (2), 125-30

4. MARROUM P.J., WEBB A.I., AESCHBACHER G., CURRY S.H., 1994, Pharmacokinetics and pharmacodynamics of acepromazine in horses, Am. J. Vet. Res., 55 (10), 1428-1433

5. ALEXANDER J., 2000, Personal communication