

Contagious ecthyma in a Rocky Mountain bighorn sheep from Utah

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Abstract. In December 2008, near Flaming Gorge Reservoir in northeastern Utah, a 2 ½-year-old male Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) was reported in poor body condition with bloody lesions covering the muzzle area. The sheep was euthanized, and samples were submitted to the Utah Veterinary Diagnostic Laboratory in Logan, Utah. The gross and microscopic lesions confirmed the diagnosis of contagious ecthyma (CE). This is the first documented report of CE in bighorn sheep from Utah.

Key words: contagious ecthyma, contagious pustular dermatitis, human–wildlife conflicts, orf, parapox virus, Rocky Mountain bighorn sheep

CONTAGIOUS ECTHYMA (CE) is a parapox virus known to affect domestic sheep and goats worldwide. Clinical CE is commonly referred to alternatively as contagious pustular dermatitis, orf, soremouth, or scabby mouth; it causes pustules followed by scabbing on the muzzle, face, and lips of ruminants (Figure 1; Karstad 1970, Blood 1971, Samuel et al. 1975, Yirrell et al. 1989). Lesions can also form inside the mouth, on the coronary band above the hooves, on the udder, or on the genitalia. The incubation period from exposure to the virus until development of clinical signs is 1 to 2 weeks (Merck Veterinary Manual 2006). Contagious ecthyma is not usually lethal, and lesions typically disappear within 2 to 4 weeks, but death may result if secondary complications, such as bacterial infections or myiasis, develop. Additionally, lesions can be quite painful and hinder feeding in adults or nursing in lambs and kids, leading to emaciation and death, depending on the severity of the infection (Karstad 1970, Blood 1971, Samuel et al. 1975, Yirrell et al. 1989). Viral transmission occurs when the virus enters mucous membranes or skin through abrasions or cuts (Karstad 1970). The virus can survive for extended periods in the environment, including in scabs, for at least 12 years (Center for Food Security and Public Health 2006). The disease also can be transmitted by fomites (inanimate objects that carry infectious organisms; Blood 1971, Centers for Disease Control and Prevention 2006). Vaccines or natural immunity

following ≥ 1 episode of orf (i.e., a viral disease widespread among sheep and goats) are both of limited effectiveness in preventing future outbreaks, including the development of clinical signs, if animals are exposed to the virus again. Subsequent lesions are usually less severe, but CE is not eradicable (Higgs 1996, Lloyd 2000).

Contagious ecthyma is infectious to humans and is considered an occupational hazard for shepherds, with lesions typically found on the hands as a result of direct contact with animal lesions (Yirrell et al. 1994, Uzel et al. 2005, Centers for Disease Control and Prevention 2006). However, not all CE cases in humans are confined to those in contact with sheep or goats (Ballanger 2006). The clinical signs of CE, including scabs or ulcers on hands, usually do not persist in humans for longer than 24 weeks (Leavell 1968), but lesions resistant to treatment or recurring lesions in absence of exposure to animals over periods of up to 8 years have been reported (Tan 1991). There is no treatment for CE infection in humans or animals that has been found to be widely effective or that is accepted as definitive therapy. Antibiotics, anti-inflammatory drugs, antiviral drugs, and surgical resection usually have only limited success; the disease usually has to run a course for at least several weeks (Ballanger 2006, Nadeem et al. 2010).

CE was first documented in Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) in North America in 1953 (Connell 1954). Clinical



Figure 1. Contagious ecthyma is evident on the muzzle of this Rocky Mountain bighorn sheep.

signs of infection have been documented in many populations of bighorn sheep (Blood 1971, Samuel et al. 1975, Lance et al. 1981, Merwin and Brundige 1982, L'Heureux et al. 1996), Dall's sheep (*Ovis dalli dalli*; Smith et al. 1982), and Rocky Mountain goats (*Oreamnos americanus*; Samuel et al. 1975) throughout western North America. However, there have been no previously published reports of CE affecting bighorn sheep in Utah, and this report represents the first known occurrence.

Reports of CE in bighorn sheep usually occur from late June to mid-September in relation to lambing periods. Nevertheless, cases also have been reported in winter months from October to February when animals are closely associated in wintering areas. This seasonality is likely related to increased close contact among animals, as well as increased physiological stress from lambing or cold weather (Blood 1971, Hosamani 2009).

Methods

On December 2, 2008, a 2½-year-old male Rocky Mountain bighorn sheep in the Carmel Campground near Sheep Creek Canyon in Daggett County of northeastern Utah was reported by a member of the public to the Utah Division of Wildlife Resources (UDWR) as having a bloody nose. Upon investigation, UDWR personnel observed ulcerated papular lesions, including frank red blood on the lips and muzzle with marked swelling and crusting

around all edges of the lesions (Figure 1). The ram was in poor body condition and appeared unable to eat while being observed by UDWR personnel over a period of several days. The animal was lively and alert, behaved normally, and was with a group of approximately 30 other bighorn sheep. In addition to the male, 1 adult female was also observed with scarring and small scabs covering the muzzle area; she was still in good body condition and appeared to be eating. No other detectable lesions or scarring could be observed on the remaining bighorn sheep in the group.

The affected ram was euthanized by gunshot by UDWR personnel. Portions of the muzzle and oral mucosa were submitted fresh to the Utah Veterinary Diagnostic Laboratory in Logan, Utah, on December 4, 2008. No other lesions of CE were observed on other body sites by UDWR personnel. Histopathological sections were made of the junction between normal skin and the lesions on the lips and muzzle. The remainder of the carcass was removed from the campground area and was buried.

Results

Sections of haired skin from the sample had diffuse acanthosis and hyperkeratosis, with numerous intracorneal vesicles and pustules. Some hair follicles were abscessed. Moderate numbers of bacterial colonies were observed among superficial keratinized epithelial cells. There was multifocal intracellular edema of keratinocytes of the stratum spinosum. The superficial dermis was infiltrated with numerous lymphocytes, plasma cells, neutrophils, and macrophages.

The history, gross lesions, and microscopic lesions histopathologically confirmed the diagnosis of CE. The lesions were considered pathognomonic, based on the findings reported above (T. Baldwin, Director, Utah Veterinary Diagnostic Laboratory, personal communication).

Discussion

In 1982, 21 Rocky Mountain bighorn sheep were translocated from Whiskey Basin, Wyoming, to Sheep Creek Canyon, Utah. Recruitment of new lambs was slow, with the estimated lamb:ewe ratio varying between

13:100 in 1992 to a high of 61:100 in 1995. By 2000, only 33 sheep were observed during classification counts in August. Contagious ecthyma was one of the possible causes for low lamb numbers in this population. Because dead lambs that are found fresh enough for necropsy are uncommon, only 2 lamb mortalities were collected and sent to the Wyoming State Veterinary Diagnostic Laboratory in Laramie, Wyoming, for necropsy. Pneumonia-lungworm complex was identified as the cause of death in both cases. Clinical signs of CE were never observed and never diagnosed before 2008.

It has been reported that lambs may suffer the most from CE infections (Blood 1971, Samuel et al. 1975, Lance et al. 1981, Merwin and Brundige 1982, Zarnke et al. 1983). However, mortality and overall recruitment of lambs in a population of Rocky Mountain bighorn sheep were not found to be significantly affected by CE in a study in Alberta, Canada, during the 1990s (L'Heureux et al. 1996), and no signs of CE were reported in previous observations and counts of lambs in Utah. Because this report represents the first documented case of CE in Utah, it is unknown whether the previous low lamb production in this population may have been associated with CE. It is unlikely that the original population was the source of this outbreak of CE, given the short incubation period of 1 to 2 weeks for orf (Merck Veterinary Manual 2006) and that no diagnoses of CE were made and no clinical signs of orf were reported by UDWR personnel or the public for 26 years.

It also has been reported that CE may be an important factor for bighorn sheep known to be infected with high numbers of helminths, bacterial infections, or to be in states of poor nutrition (Samuel et al. 1975, Goldstein et al. 2005). In an attempt to treat the Sheep Creek Canyon bighorn sheep population against lungworm infections, baiting sites were established in 1996 using apple pulp mixed with anthelmintics. The baiting and treatment sites have been spread across the range to try to reach all of the small sub-populations; no more than a dozen sheep have been observed using the bait sites at any time. Typically, all apple pulp and medication were consumed in a single feeding. In some populations, salt blocks that were used to supplement sheep may have

served as a reservoir for the virus and may have contributed to its spread (Blood 1971). Salt used on highways and in campgrounds may also serve as a potential fomite for transmission of CE (Samuel et al. 1975). No artificial salt sources have ever been provided to the Sheep Creek Canyon population of bighorns in Utah. It is unknown whether supplementation with medications would have the same effect. The virus can stay dormant within the soil in scabs for at least 12 years (CFSPH 2006); thus, use of bait sites may have allowed spread of the virus.

After the low population count in 2000, a decision was made to supplement the herd with Rocky Mountain bighorn sheep from Almont and Basalt, Colorado, over a 2-year period, beginning in 2000. This bighorn population in Colorado also had no history of clinical signs or diagnosis of CE. Following both the supplementation of the population and the treatments with anthelmintics described earlier, the estimated population of bighorns in this Utah population increased to nearly 100 sheep, with lamb:ewe ratio of 65:100, compared to the lamb:ewe ratio of 31:100 that was observed in the early 1990s (UDWR, unpublished data).

The Sheep Creek Canyon population of bighorn sheep is highly visible to the public, and lesions associated with contagious ecthyma were never reported prior to December 2008. Therefore, euthanasia of the severely affected ram was elected because of repeated public concern regarding his appearance and the possibility of transmission of the disease to humans, including touching something that the ram had previously contacted. Similar to questions raised by Lance et al. (1981), the sudden onset of CE in this population leads to the question of how the disease was introduced. It is known that the virus can lay dormant in soil for years (CFSPH 2006). This area of northeastern Utah has been utilized by this population of bighorn sheep since its initial release. Therefore, if the virus had lain dormant for years, whatever conditions caused the infection to become active are unknown. L'Heureux (1996) suggested that high density and intraspecific competition may explain a sudden outbreak of CE as observed in this population. Nevertheless, there are no reports

of contact between this affected population of Rocky Mountain bighorn sheep and domestic sheep, goats, or other ruminants. Domestic sheep or goats have not had access to areas near this flock of bighorn sheep for >50 years.

Following diagnosis of CE, UDWR personnel responsible for management of this herd elected to visually monitor the animals for further visible signs of CE. After >1 year, no further cases of CE were observed by UDWR personnel or reported by the public.

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