Practitioners' Corner Le coin des praticiens

Yamal and anthrax

Robert Gainer

As a retired veterinarian with a penchant for travel, an active bucket list, and a 50-year fascination with anthrax, I felt compelled to visit Siberia — in particular, Yamal, which in the language of their ancient Nenets people means "End of the Land." In January 2016, I made arrangements with a tour group to spend 10 days living with reindeer herders in the Salekhard area (Khanti and Komi mixed-native group). At the top of my list was talking with the local veterinary practitioner and technicians (not named). I discovered, that even today, people in Russia prefer not to be named for obvious bureaucratic concerns. I made a point of visiting various levels of abattoirs and observing the husbandry of reindeer, horses, and cattle in the little Ob region as far as 160 km south of Salekhard on the winter road to the town of Muzhi.

The Yamal Autonomous Okrug is Siberia's most northwestern federal district, the center of which is the Yamal Peninsula jutting into the Arctic Ocean on the east side of the Ural Mountains. Most of its 500 000 population lives along the north-south Ob river and its several parallel branches. Its habitat is primarily taiga that transitions to tundra in the north near its capital city of Salekhard, population 50 000, latitude 68°; approximately the same as Inuvik, population 3000, in the Northwest Territories, population 40 000.

Yamal is also home to approximately 1 million reindeer. There are several reindeer populations (wild tundra only, wild tundra summer and taiga winter, and wild taiga only) herded by the various native groups. The natives enjoy a mix of herding and hunting of wild animals, plus their continuous capturing and taming. Reindeer meat is an important economic commodity to the approximately 50% native population of the region, but also for retail sale at various levels. Virtually all of the tame male reindeer are castrated before 6 mo of age. Inspected meat for sale in retail outlets is almost totally derived from the castrated animals averaging 2 to 3 y of age. Reindeer are also traditionally used as draft animals, but much less so now since the advent of snow machines.

Livestock have been raised along both branches of the Ob river for several hundred years, especially since the Soviets took power in the 1920s and agriculture was designated a priority. The most important animals were horses, primarily larger types for draft purposes, followed by cattle for meat and dairy, followed by pigs. Further upstream to the south about a 1000 km on the Barabinsk steppe (prairie) is found the area which supplied much of Europe during the last century, especially Britain, with the famous Barabinsk butter and cheese. Since 1991 and the dissolution of the Soviet Republic, the importance of Yamal's domestic livestock industry has been reduced considerably in the larger communities due to their access to modern means of transportation, but reindeer meat is still in high demand.

At the time the Soviets were expanding the Yamal livestock industry, the region became infamous for its anthrax. By the late 1920s, the disease had devastated the livestock and reindeer industries to such a degree that it became known in Russia, a country already well-known for anthrax, as Yamal disease. Some years it virtually wiped out the reindeer industry. Of the anthrax outbreaks that I have heard of, this was the largest in terms of numbers.

The livestock, the supposed source of infection, would have originated upstream on the Ob. This large and slow-moving river is suitable for barging domestic animals. Recently, mention was made of the river eroding its bank and exposing a giant pit that contained several hundred carcasses from an anthrax epizootic in the early 1900s near Tobolsk (latitude 58°), about 1000 km upstream of the Ob's termination. Even though the steppe was considered the origin of the disease, the effects on the livestock and especially the reindeer in the taiga and tundra regions to the north across most of Siberia was far more devastating.

The first thing I learned in my visit was that anthrax was no longer a problem. About 1930, a Pasteur type of attenuated live vaccine (non-spore) was introduced. All the livestock and as many reindeer as possible were vaccinated annually for many years in Yamal and all across northern Siberia and in Russia in general. This virtually eliminated the disease in Yamal, even in the reindeer despite the fact that probably 80% or more were not vaccinated. The program in the taiga and tundra was so successful that the government gradually stopped its regular vaccination, doing so only when outbreaks occurred. Authorities noticed that outbreaks happened only when unvaccinated animals from the south were brought in on the river barges. That is, the vaccination program had eliminated the disease from the taiga and tundra, but not from the steppe regions.

From this, Kolonin (1) came to several conclusions about the source and transmission of anthrax. First, he considered that

Retired veterinary practitioner and biologist.

Box 1058 Hanna, Alberta T0J 1P0.

Address all correspondence to Dr. Robert Gainer; e-mail: gainer.bob@gmail.com

the soil in Yamal was unsuitable for spore maintenance, and that its importance during outbreaks was minor. If it did play a role, it may have been to maintain and initiate an occasional infection, and this role was eliminated by vaccination programs. Instead the infection was maintained in host animals with latent infections, especially sedentary domesticated host animals, and not the soil.

Second, Kolonin (2) went on to say that blood-sucking insects, not spores ingested orally, were how the disease was transmitted in Yamal-type regions. It has long been recognized in Western literature that tabanids could transmit the disease (3), but this required a source of the septicemic, peracute infection, and the level of infection that insects transmitted was inconsequential, virtually like a vaccination. Peracute infections could only be demonstrated experimentally with massive oral doses of spores. Anything else, including insect transmissions, would cause levels of infection from which animals could recover and develop resistance.

Anthrax outbreaks are characterized by a significant proportion of the indigenous population dying from the peracute infection. The implication from experiments was that there would have to be a dramatic change in the population's oral exposure to spore doses. Instead Kolonin (2) posited there was a change in the population's resistance to the disease. Early in the summer, June 15 to July 15, tabanid activity is at its maximum. He considered these insects to be extremely stressful, even to the indigenous animals. Their depredation is more than some animals can endure. Animals that were otherwise resistant or had active immunity to anthrax now became vulnerable, including those with latent infections and with antibody titers to the bacterium and otherwise inconsequential infections that may have formerly been a basis for resistance developed peracute infections. The timing of the transmission of the disease and the population's vulnerability to it were maximal in effect.

During my career, I have seen several areas which have had recurring anthrax outbreaks; most of them under horrendous environmental conditions. In Africa, these periods were typically during and following the hot rainy season when tsetse-fly activity was most intense. Additional environmental stressors were often high temperatures, drought for plains game, a shortage of pasture and potable water, and calving and breeding. In Tanzania from 1971 to 1973, as part of a Master's thesis (4), I collected several hundred soil samples from drying waterholes and other suspect locations and submitted them to the country's diagnostic lab in an effort to locate the source of the spores. Not a single isolation was accomplished.

Closer to home, in 1982 to 1983 in Wood Buffalo National Park in northernmost Alberta and southernmost Northwest Territory, an area known for its anthrax outbreaks, I collected about the same number of soil samples from several suspect waterholes and old carcass burial sites. These were submitted to a diagnostic lab in an attempt to find spores, and again not one isolation was made. The outbreaks in this area also had intense insect activity and bison breeding. So much for my success as a microbial investigator.

From 1980 to 2005, I was a private mixed-animal practitioner in this same area. The first 7 years, I was based in Fort Vermilion, northern Alberta, and the next 2 years in Fort Smith, Northwest Territories, on the edge of Wood Buffalo National Park. In the next 15 years, I was based in Hanna, southern Alberta, where I provided a consulting service and 6-times-a-year satellite service to Fort Smith. While in the north, I usually maintained a few head of my own cattle and horses, and this duty of care along with my position as practitioner gave me an empirical understanding of the stresses on livestock in the region (5). Surprising to many in the south, food and shelter were not that difficult to provide. The No. 1 problem was the summer insect activity. At the height of the problem, several species of insects would surround and cover the livestock. The more weakened and withdrawn the animal, the more attractive it seemed to insects, sometimes even coating them. If you wiped your hand along their hide it would be covered with blood.

My clients with riding horses had to provide good shelter from the tabanids in the summer. During the winter, the animals could free-range on the slough hay meadows abundant in the area. Cattle were not so affected by horseflies, but were more affected by blackflies, and mosquitos. Cattle also required more shelter in the winter, protection from predators, and more nutritional supplementation than horses. Horses, especially the local crossbreeds ("cayuses"), were easily maintained in the north. Johnny, the cayuse in Fort Smith who owned my family, was a 10-year old Norwegian fjord cross gelding used as a cart and sleigh pony; he had his own little shed attached to our house. For 10 months of the year he lived on poor quality slough hay and was fat and sassy, but for 2 months of the year when the lush, tender, nutritious, higher ground meadow grasses were available, he lost weight and spent much of the time in his shed. The more high strung, hot-blooded Arab-style breeds were especially distressed by tabanids. Occasionally, people would trailer horses up to the area for use on the extensive trail network in the Fort Smith area. These well-bred horses were desperate to get back to their trailer after only a few minutes of exposure to the insects. The local cayuse was the most able to handle the harassment.

Bison appeared to be more reactive to tabanids than cattle, more like hot-blooded Arab style horses. Bison in general are a more high-strung, hyper-reactive animal than cattle, hence the almost universal need for crash gates despite their increased domestication in the south. In the Park, the response from bison to insects appeared to be mostly towards tabanids. Sometimes their distress was evident in their rolling-and-wallowing activity, and other times in their running and looking for areas with wind. Other people told me that when they were boating, they had seen bison jumping in Pine Lake or the Slave River. Bison obviously found tabanids extremely distressing and it was all they could do to endure the harassment. The effect on their bodies' ability to resist the disease would most certainly be as Kolonin (2) described. Gail Steed of Fort Smith, a long-time client of mine and owner of several horses, always told me she could predict the degree of anthrax activity in the Park's bison in August by observing the June 15 to July 15 effects of tabanids on her horses.

Wood Buffalo National Park most resembles Yamal in all pertinent respects. We don't really know the origins of the disease

here, but it could stem from the livestock introduced into the region early in the last century, or even with the introduction of plains bison from the United States (http://canadianbison.ca/consumer/Nature/conservation_success.htm). Unfortunately it is difficult to evaluate a vaccination program on free-roaming animals. Such programs in farmland adjacent to the southwest in the Fort Vermilion area have eliminated the disease as well as in many other areas in farmland further south, but not all areas; and there are soil types in the Park which are typical of what are suspected to be the type that is supportive of spore maintenance. In Africa especially, the soil types in anthrax areas are as Kolonin (2) recognized to be more suited to spore maintenance where vaccination does not eliminate the disease.

Further to the complexities recognized in the Park, at this moment (July 20, 2016) there are several newspaper accounts of an anthrax outbreak in Yamal after no outbreaks for 75 years. The authorities think that an exceptionally warm summer thawed out a reindeer carcass buried in a permafrost pit that was a source of spores. Kolonin may still be comfortable with this information if vaccination and better disposal of carcasses resulted in the elimination of the disease.

Fifty years of my interest and involvement in anthrax as a mixed-animal practitioner makes my practitioner's intuition conclude there is much to be learned from the Yamal model of anthrax area epizootiology, especially when it is obvious that the oral, dose-dependent soil spore model doesn't always fit. Hugh-Jones (6) in his description of the epizootiology makes reference to insects and latent infections, but not in conjunction with environmental stressors, their effect on the resistance and level of latent infections in indigenous animals, and the ability of tabanids to transmit potentially peracute infections; and, of most importance, why the disease in some areas will disappear when vaccination programs eliminate the host's role for maintenance and source of the infections.

References

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2. Kolonin GV. Evolution of anthrax II. History of the spreading of the disease and formation of nozogeographic areas. Zh Mikrobiol Epidem Immunobiol 1971;48:118–122.
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4. Gainer RS, Saunders JR. Aspects of the epidemiology of anthrax in Wood Buffalo National Park and environs. Can Vet J 1989;30:953–956.
5. Gainer RS. Livestock raising in the Northwest Territories. Can Vet J 1987;28:103–104.
6. Hugh-Jones ME. Anthrax. The Merck Veterinary Manual Online, 2015.

Answers to Quiz Corner
Les réponses du test éclair

1. **B)** The incubation period is long, possibly longer than 2 to 5 years.

B) La période d'incubation est longue et peut être d'une durée supérieure à 2 à 5 ans.

2. **B)** This cat most likely has diabetes mellitus, and the presence of ketonuria suggests diabetic ketoacidosis. Short-acting insulin therapy should be initiated and continued until ketonuria resolves. Glycosuria and ketonuria are not typically associated with chronic renal disease.

B) Ce chat souffre probablement de diabète sucré et la présence d'acétonurie suggère de la cétoacidose diabétique. On devrait débuter un traitement à l'insuline à courte durée d'action et le maintenir jusqu'à ce que l'acétonurie disparaisse. La glycosurie et l'acétonurie ne sont pas associées de façon caractéristique à la maladie rénale chronique.

3. **C)** The correct answer is horse. The most common cause of dermatophytosis in the horse is *Trichophyton equinum*. The horse is the reservoir host for this organism.

C) La bonne réponse est le cheval. La cause la plus commune de dermatophytose chez le cheval est *Trichophyton equinum*. Le cheval est l'hôte réservoir pour cet organisme.

4. **B)** Griseofulvin (D), is an antifungal drug but has no activity against *Malassezia;* A, C, and E are not antifungal drugs.

B) La griséofulvine (D) est un agent antifongique mais elle n'a aucune action contre *Malassezia;* les choix A, C et E ne sont pas des médicaments antifongiques.

5. **D)** Skin, serum, and patch testing are not reliable methods for diagnosing food allergy. A skin biopsy is not diagnostic for this condition.

D) Les épreuves cutanée, sérologique et épicutanée ne sont pas des méthodes fiables pour le diagnostic des allergies alimentaires. Une biopsie cutanée n'est pas non plus une épreuve diagnostique pour cette affection.