Proceeding of the NAVC
North American Veterinary Conference
Jan. 8-12, 2005, Orlando, Florida

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**MYXOMATOSIS**

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Myxomatosis is a viral disease caused by a poxvirus in rabbits. The pathogenicity and subsequent morbidity and mortality are influenced not only by the virulence of the particular viral strain, but also the host infected by the organism. Following its initial recognition in Uruguay in 1896, it has spread, frequently with man’s intentional assistance, to four continents, North America, South America, Europe and Australia. The virus was intentionally introduced to Australia in 1926 in an effort to control the rampant pest European rabbit, Oryctolagus cuniculus. The effort was relatively successful, decimating the rabbit population by 1953. Since then, it has become endemic, with periodic outbreaks associated with high mortality. As genetic resistance has risen, the mortality has dropped from 90% to 25%.

Its spread into Europe was again an intentional introduction. While governments were debating the wisdom of bringing an infectious disease to the continent, an ambitious French landowner imported the virus to aid in the control of the rabbit population upon his lands. It spread rapidly, and within one year had been identified, not only in France, but also in Belgium, the Netherlands, Germany, Luxembourg, Spain and England. The first North American case of myxomatosis was diagnosed in San Diego in 1928. It is believed that the virus originated in infected domestic rabbits imported from Mexico.

Myxomatosis is now found in four continents. It has been a classic model of an infectious disease whose etiologic agent has modified over time concurrently with the host species to a state of equilibrium. It is now endemic in wild rabbits of the genus Oryctolagus in South America, Europe, Australia and New Zealand. Rabbits of the genus Sylvilagus are endemic in both North and South America.

**ETILOGIC AGENT**

Myxomatosis is caused by on of several strains of a myxoma virus, Leporipoxvirus, of the poxvirus family. These strains have varying degrees of virulence with the California strain being one of the most devastating. California strains have been known to cause over 99% mortality. The neumomyxoma and Nottingam strains of Europe have both been associated with substantially less mortality and hence less virulent.

Another member of the Leporipoxvirus genus is the rabbit fibroma virus (Shope fibroma virus). This virus occurs naturally in the eastern cottontail rabbit (Sylvilagus floridanus) and causes benign fibromas in European rabbits (Oryctolagus cuniculi). The fact that the viruses are different species is important to recognize, as the lay literature often confuses the fibroma-causing virus with myxomatosis. From a clinical perspective, it is significant to note that the two viruses cross react; as a result, the vaccine manufactured to protect rabbits against myxomatosis is an attenuated fibroma virus. Additionally, rabbits infected by the fibroma virus naturally are resistant to myxomatosis.

**EPIDEMIOLOGY**

In the western hemisphere, the myxoma virus is generally endemic in the wild rabbits of the genus Sylvilagus. In particular, the California strain in the West is found in the brush rabbit (Sylvilagus bachmani). It is from close indirect contact with this native rabbit species that most pet domestic rabbits are infected in California.

The disease is transmitted by blood sucking arthropod vectors, typically mosquitoes and fleas. Transmission is mechanical upon the mouthparts of the vector; therefore the species of arthropod is not significant. Generally, the virus is acquired from the superficial layers of skin, often around the eyes and ears. Other arthropods may act as mechanical vectors; biting gnats, mites (*e.g.* Cheyletiella parasitovorax), lice and flies are capable of carrying myxoma virus. It has even been postulated that the talons of carnivorous birds and even thorns may act as agents of transmission. Transmission may also occur directly from rabbit to rabbit.

The female mosquito has a life span, and therefore the transmission potential, of only 2-3 weeks. It can, however, range for up to 14 miles. The flea, on the other hand, has a limited range, but may feed actively for over a year. The virus has been found to remain active in fleas without rabbit contact for 105 days. The virus will also persist for an extended time period in hutches and bedding.

**CLINICAL SIGNS**

The clinical signs of myxomatosis vary dependent upon the strain of virus involved and the species of rabbit infected. For the practitioner, however, the signs of the disease will be quite consistent within an area. The most important area affected in North America appears to be California, in which significant outbreaks are often seen coinciding with the peak mosquito months of the summer and fall.

The Sylvilagus spp. appear to be relatively resistant to infection, as they seem to be the natural host for the virus. Development of firm swellings, fibromas, at the site of insect inoculation is the most common clinical finding in affected individuals. Young animals may succumb to the generalized disease, similar to that seen in Oryctolagus spp. Hares (*Lepus spp*) are similarly resistant to infection with occasional observation of generalized infections in certain individuals.

Of particular importance is the effect the myxoma virus has upon the domestic, pet rabbit, Oryctolagus cuniculus. As the California strain is the one most commonly seen in North America, the signs described will generally be attributed to this viral strain. In general, as the virus is exceptionally virulent, the clinical signs seen by the clinician are directly related to the survival time of the infected rabbit.

The peracute form of the disease will typically cause death within 7 days of infection. Minimal signs are seen in these individuals. Lethargy and edema of the eyelids are frequently the only signs seen in these individuals. Pyrexia is noted occasionally.

Rabbits with the acute form tend to survive for 1-2 weeks. Edema of the eyelids, typically seen 6-7 days post-infection, gives the rabbit a sleepy appearance. Shortly thereafter, edema and swelling around the nose, anus, mouth and genitalia is noted. Fivers of 104-107 ° F are not uncommon. Most rabbits die by the tenth day with cutaneous hemorrhage and seizures often occurring.

Only rarely is a chronic form of this strain of virus noted. Those individuals may develop a mucopurulent blepharoconjunctivitis and swelling around the base of the ears. The swelling may proceed to resemble that of the less virulent strains of virus. The classically described myxoma is only rarely seen.
Less virulent forms of the disease will take a more protracted course. These individuals may develop generalized tumors in addition to the edema and blepharoconjunctivitis. Dyspnea may occur and most die within two weeks.

**DIAGNOSIS**

In most cases, diagnosis of myxomatosis is difficult and generally done postmortem. The classically described myxoma nodule with its homogenous mucinous material in the center is easily described in the European cases. Definitive diagnosis in the California strain affected rabbits is much more difficult. The rapid onset and death of the rabbit with minimal premonitory signs is suggestive. Eccymosis of the subcutis and subserosa of the gastro-intestinal tract are also suggestive. Biopsies of affected skin lesions show undifferentiated mesenchymal cells, inflammatory cells, mucin and edema. Often, it is the absence of any postmortem change that is most diagnostic. Virus isolation is easily performed on embryonated chicken eggs or cell culture.

**TREATMENT AND CONTROL**

The viral etiology and rapid progression of the disease tend to make attempts at treatment frustrating. Administration of palliative remedies, fluids, vitamins, and forced feeding are typically not rewarding. To this date, the use of anti-viral medications have shown no promise in the reversal of the typical clinical progress of the infection. Lately, there have been a number of anecdotal reports of both treatment and prevention of myxomatosis using an immunostimulant mycobacterial cell wall extract (Equimune IV, Bionoche Animal Health Canada Inc, Belleville, Ontario, Canada). To date, this product has not been evaluated scientifically; therefore its use remains anecdotal, at best.

Most efforts are directed towards the prevention of myxomatosis. This is particularly important in areas where the virus is endemic in wild rabbit populations. Vector control, particularly fleas and mosquitoes is typically employed. Screening is the most effective mechanism for exclusion of the vector. Use of appropriate flea control products is also valuable in eliminating vectors. Rabbit owners should be discouraged from providing food and shelter for feral or wild rabbit species in the area in which the pets are maintained. Rabbits should not be permitted to remain outdoors during the peak mosquito activity periods of dawn and dusk. Obviously, quarantine of new arrivals and ill animals is important in preventing entry through and infected host. The use of the fibroma virus live vaccine has not been consistently protective. An attenuated myxoma virus vaccine has provided an immunity for 9 months, but it is not available within the US.

While the effects of myxomatosis may seem to affect only those in California, even the practitioners in the Midwest and east should remain vigilant. The mechanical nature of the vector and the ease of transmission imply that the virus may be introduced to any rabbit-bearing population with ease. The rapid movement of rabbits from coast to coast has increased commensurate with the increase in the popularity of the animal as a house pet. It may only be a matter of time before other areas are beset with the tragic losses of treasured pet rabbits.

**RECOMMENDED READING**