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Monkeypox and veterinarians: The rise of a new pandemic?

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Abstract
The world is still facing the first pandemic of the century, SARS-CoV-2, and another virus that appears to have been spreading silently the Monkeypox, and has the potential to become public health. Although is not very yet a serious problem, due to their zoonotic potential veterinarians should be informed regarding this disease not only to identify the symptoms in animals but also to clarify the owners regarding the care that they should have with their pets.

Keywords: Monkeypox, zoonoses, mammals, Orthopoxvirus

Introduction
The world is still facing the first pandemic of the century, SARS-CoV-2, and another virus that appears to have been spreading silently Monkeypox. This virus may have the potential to become public health. It was a virus that was confined to a small region of Africa and only a few cases were reported outside the region associated with tourism or illegal animal commerce [1, 2]. Since May 2022, cases of monkeypox have been reported to WHO in 30 different countries that are not endemic to this virus since the beginning of June 2022. Epidemiological investigations are still ongoing, however, the origin of the outbreak has not been established yet [3]. Although his behaviour is completely different to SARS-CoV-2, veterinary practitioners should be informed and know to recognise the clinical signals in animals. It is possible that in veterinary practice start to appear animals contaminated with monkeypox since it is a zoonotic disease.

Monkeypox virus is an enveloped double-stranded DNA virus that belongs to the Orthopoxvirus genus of the Poxviridae family. This virus was first reported in the Democratic Republic of the Congo in the 1970s [4, 5]. Were identify two distinct clades: the central African (Congo Basin) clade and the West African clade [1]. This disease is currently endemic only in Central and West Africa [2].

Transmission and affected species
All mammals are susceptible to monkeypox. The virus has been reported in numerous animal species as Old and New World monkeys and apes (rhesus macaques, cynomolgus monkeys, languors, baboons, chimpanzees, orangutans, marmosets, gorillas, gibbons, owl-faced monkeys, and squirrel monkeys are some examples), African hedgehogs, rodents (including rats, mice, squirrels, and prairie dogs), pigs and rabbits. No cases have been reported in cats and dogs. The natural reservoirs of monkeypox are not still very well defined. Two species of African squirrels, the *Funisciurus anerythrus* and *Heliosciurus rufobrachium* have been suggested as possible reservoirs or vectors. It is not known whether primates also maintain the infection in the wild or are only incidental hosts [6, 7].

The transmission from animal to an animal may occur through the touch of skin abrasions, respiratory droplets and inhalation of the aerosolized virus, inhalation of organic matter enclosing virus particles, bites, body fluids, or ingestion of infected animal tissue. The route of transmission of monkeypox from animals to humans is through direct contact with infected animals (e.g., bites, lesions, blood, body fluids), aerosols, eating inadequately cooked meat and other animal products of infected animals [6, 8, 9].

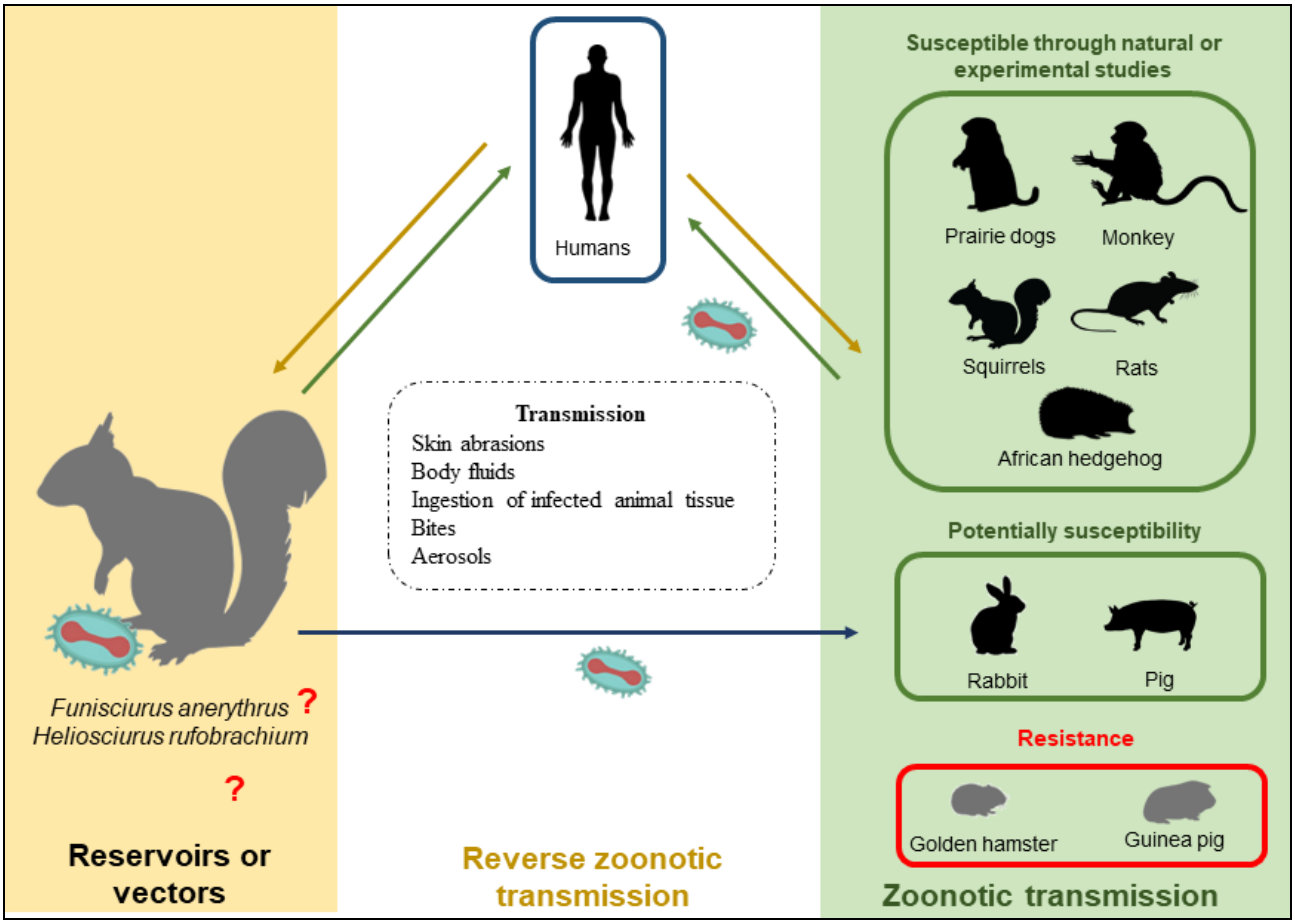

Fig 1: Possible origin of Monkeypox and transboundary transmissions between humans and animals.

Clinical signs, *Postmortem and mortality* in animals

Infected animals may be contagious 1 day before and up to 21 days after the initial symptoms appear, or until all skin lesions have formed scabs and no other symptoms are present. Depending on the specie, the symptoms can differ. In non-human primates, the initial symptoms are a fever and cutaneous papules (1-4 mm), which develop into pustules and then crust over ("pocks") or patchy alopecia. These lesions can be seen over the body, but are more common on the face, limbs, palms, soles, and tail. The crusts over the pustules eventually drop off, leaving small scars. Fever, conjunctivitis, coughing, nasal discharge, facial oedema, dyspnoea, anorexia, oral ulcers, pneumonia, or lymphadenopathy occurred in more severe cases in non-human primates and the first one to appear in other species like rabbits, rodents, and prairie dogs. These animals also develop the characteristic "pocks". Asymptomatic infections also can occur [5, 9].

At *postmortem* exam, some of the lesions observed in infected animals are skin papules, umbilicated pustules ("pocks") with central necrosis, or crusts over healing lesions. The size of the skin lesions may vary from barely detectable, single small papules to extensive lesions. Other lesions as multifocal necrotizing pneumonitis, bronchopneumonia, orchitis, fibrinous pleuritis, pericardial effusion, peripheral lymphadenopathy, lymph node congestion, facial exanthema, ulcerative cheilitis, gingivitis, papulovesicular pharyngitis, gastritis or ulcerative stomatitis are some of the other lesions observed in infected animals [3, 6].

Has been reported sporadic cases of monkeypox in wild primates in Africa and some in captive primates. The morbidity rate tended to be high and the mortality rate low. Mortality has been seen mainly in infants. The morbidity and mortality rates are not well documented in rodents [6].

Veterinarians and cases of monkeypox

Veterinarians' practitioners that treat animals with suspected monkeypox should use infection control precautions to protect themselves, staff, clients, as well as other animals, present in the clinic since it is a zoonotic agent [3, 6]. Veterinarians should be alert, especially to animals that were in contact with infected humans, susceptible species that were imported from Africa or illegal commerce of exotic pets.

The suspected animals should be immediately isolated, and all the treatment and diagnostics should be performed in an examination room specifically for infection contagious cases. The number of staff allowed in the exam room and that come in contact with the animal should be limited to as few persons as possible. During the exam and manipulation, the staff should always: 1) proper hand hygiene after contact with animals and contaminated superficies; 2) always use personal protective equipment; 3) the material and surfaces in contact with the contaminated animals should be decontaminated (e.g., laundry should be clean with hot water, detergent, and chlorine bleach) and the disposable material must always be deposited in the heated suitably for the disposal of potentially infectious products [3, 6].

In the case of owners infected with Monkeypox, health authorities recommend that the pets more susceptible to the disease as rodents, should be removed from the house and isolated for 21 days, and be tested for the virus. In the case of other species, such as dogs and cases, should be separated from the infected person in the householder and checked regularly by the veterinary [6].

Diagnose and treatment

The characteristic skin lesion and symptomatology can be the first indicator of Monkeypox infection.

A skin biopsy or *post-mortem* material of tissues that present lesions (e.g., skin, lungs, lymph nodes, liver spleen, kidney, gonads) should be collected and placed in 10% formol and sent to histopathology. The same type of samples should be collected aseptically for virus isolation. The samples should be refrigerated, without a transport medium, to perform a polymerase chain reaction (PCR). Other methods of diagnosis are immunohistochemistry, ELISA, and serology [3, 7, 9].

In animals, the treatment is usually symptomatic. Most the animals recover without treatment. In non-human primates, there is available a vaccine as prophylaxis since many primate species are in decline and their populations are near extinction [3, 6].

The guidelines of the Centres for Disease Control and Prevention (CDC) recommend that all animals with suspected and confirmed monkeypox should be euthanized to prevent the spread of the disease [6].

Conclusion

Is still very yearly to determine if monkey pox will be the next global pandemic, but the rising number all around the world is alarming. It is important that the veterinarian is informed and can act correctly not only when exam and also have a role in stopping the dissemination of the disease to animals. Although is not determined yet if the transmission can occur from humans to animals, there is a possibility, that particles in pets were there's are more close and prolonged contact. According to health associations, the occurrence of a "spill over" event, could potentially lead to the virus establishing itself in the wildlife population, although it is considered a "very low" risk. The main concern now regarding animals, is that if monkeypox infects animals could become what's an endemic zoonosis in the regions outside Africa, and the disease would jump between animal species and is constantly present in that population, being very difficult to eradicate. More than ever One Health concept is more needed ever. Veterinarians have an important role in stopping the dispersion of zoonoses as monkeypox and help to understand how the virus travels in the populations and environment.

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Conflicts of Interest: The authors declare no conflict of interest.

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