Quarantine protocols and preventive medicine procedures for reptiles, birds and mammals in zoos

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Summary: The author describes the basic preventive medicine procedures, including quarantine, which should be applied to reptiles, birds and mammals in zoological parks. The quarantine protocol for institutions accredited by the American Zoo and Aquarium Association is described as an example.

KEYWORDS: Preventive medicine — Quarantine — Vaccination — Veterinary medicine.

INTRODUCTION

PREVENTIVE MEDICINE

Preventive medicine is the most fundamental aspect of the medical care of captive wildlife. In the zoological park, the value of the old adage: ‘An ounce of prevention is worth a pound of cure’ is magnified by the difficulty of applying extensive medical treatments to many wild animals and the innate tendency for clinical signs to be concealed until a disease process is well advanced.

Preventive medicine has many components. Obvious measures may be taken by the veterinarian, such as vaccination of each species against appropriate diseases (e.g. large felids may be vaccinated against feline panleukopenia). Whenever possible, vaccination should be practised using killed products. If modified live virus vaccines must be used, reports of previous experience should be examined for advice on how to proceed. Routine examinations for parasites should be performed, in most instances, on an annual or twice-yearly basis. Many parasites may be commensal and non-pathogenic in the wild, whereas they may produce disease in captivity due to repeated exposure (lack of pasture rotation in most zoological exhibits) and stress. Although many of the more specialized parasites – especially those requiring intermediate hosts – may not occur in captive animals, an active programme of vermin control is also crucial in preventing the transmission of disease within a collection.

One of the basic components of any health programme, and especially a preventive programme, is the performance of complete necropsies on all deaths in a zoological collection. In many animals, there may be no apparent clinical signs until late in the course of a disease, and therefore necropsy often becomes the final, absolute method of diagnosis. Thorough necropsy also ensures that any other complicating factors are

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not overlooked. Additionally, necropsy may provide the final confirmation that a test is effective: e.g. if animals yield negative results in a skin test for tuberculosis, are they also without signs of disease at necropsy?

Preventive medicine should also take into consideration a number of broader issues. Although detailed consideration is beyond the scope of this article, exhibits and management techniques which take into account animal behaviour and social structure can produce major health benefits by reducing stress. Care must be taken to avoid the mixing of species which are incompatible for reasons of disease susceptibility. Examples include the placement of Asian species of hoofed livestock near African species which may be carrying malignant catarrhal fever (MCF) virus, or – due to the possible transmission of herpesviruses – placing owl monkeys (Aotes trivirgatus) near patas monkeys (Erythrocebus patas).

An additional area of research and recent advancement which affects preventive medicine is the nutrition of non-domestic species. Proper nutrition is integral to avoiding both obvious nutrient deficiencies and more subtle subclinical problems which may contribute to other disorders. For many species (e.g. browsers), considerable work remains to be done before nutritional requirements can be addressed with full confidence.

Specific disease problems for each species, and recommendations for their prevention, can be obtained from the literature, from general zoo management knowledge and, in North America, from Advisors to the Veterinary Species Survival Plan (SSP) Committees of the American Zoo and Aquarium Association (AZA). Similar Regional Species Conservation Plans (RSCPs) exist in many other areas of the world. For example, it is currently recommended that all black rhinoceros (Diceros bicornis) be vaccinated with leptospiral bacterins, as this spirochete is associated with some cases of haemolytic anaemia. It is recommended that all cheetahs (Acinonyx jubatus) be tested for feline immunodeficiency virus (FIV) prior to being moved into or out of an established colony.

For all species, particularly those with few individuals or short histories in captivity, it is important (and often difficult) to determine the diseases to which they are susceptible. Again, the Veterinary Advisor to an RSCP plays a vital role in serving as a central repository of veterinary data on each species. Perhaps the most challenging question is: ‘What diseases do/might the animals contract which are not yet recognized?’ An example of emerging recognition of a disease is FIV infection in large felids. Further complications arise due to the number of diseases which have yet to be studied in many species (a dramatic example of this problem is the further study of retroviruses in a number of species). The open-ended nature of these questions prevents the zoo or wildlife veterinarian from making an absolute guarantee of health.

**QUARANTINE**

Quarantine is a basic component of preventive medicine programmes in zoological parks, and it is the most fundamental step in the prevention of the spread of disease into an animal collection. Indeed, this is reflected in the origin of the word ‘quarantine’. In medieval Venice, forty days (quadruginta is Latin for ‘forty’) was the length of time for which human immigrants were separated from the general population to limit the spread of bubonic plague. Although the prevention of disease is the primary function of quarantine, the procedure also offers an opportunity to
establish the 'baseline' health status of new arrivals. The principles which apply to quarantine for animals transferred between zoos, or introduced from the wild, are also crucial for zoo animals being reintroduced into the wild, and should also be considered in transfers of animals between wildlife areas.

Recognizing the importance of quarantine, in 1989, the AZA requested that its Animal Health Committee draft a written protocol to be included as part of the requirements for AZA accreditation. The protocol was adopted by the AZA Board in 1994. The following discussion is based on that protocol. One challenge of the original process was to create regulations which were appropriate and detailed, yet which allowed the institutional veterinarian to use his/her judgement when exceptions might be advisable.

Additionally, in the regulations, the risk of disease had to be weighed against the risk to the animal (e.g. anaesthetizing giraffes for routine testing would require weighing the risk of disease against the high risk involved in anaesthesia) and the ability of institutions to comply (e.g. not all zoological parks have the facilities necessary to quarantine an elephant). However, pre-shipment testing and other procedures performed prior to shipment may assist in reducing the risk of disease transfer from introduced animals. The regulations governing quarantine of great apes (Hominidae) recognize the limitations of some smaller institutions, and permit isolation of a primate either at the shipping institution (if there is no contact with other non-human primates during shipping) or at an approved primate institution.

Finally, it is important to note that the AZA regulations were intended to be minimum standards, and that they should be adapted to each situation. Those who wish to exceed these minimum standards are encouraged to do so. It is anticipated that these regulations will be open to continuous review and modification. The present AZA regulations are summarized below.

**QUARANTINE PROCEDURES RECOMMENDED FOR INSTITUTIONS ACCREDITED BY THE AMERICAN ASSOCIATION OF ZOOS AND AQUARIUMS**

**QUARANTINE FACILITY**

A separate quarantine facility should be provided, with the ability to accommodate mammals, birds, reptiles, amphibians and fish. If a specific quarantine facility is not present, newly-acquired animals should be isolated from the established collection in such a manner as to prevent physical contact, transmission via fomites, and contamination via aerosols and drainage. Such separation should be obligatory for primates, small mammals, birds and reptiles, and should be attempted wherever possible with larger mammals (e.g. large ungulates, carnivores, marine mammals and cetaceans). If the receiving institution lacks appropriate facilities for the isolation of large primates, a requirement for pre-shipment quarantine – at an institution accredited by the AZA or the American Association of Laboratory Animal Science – must be incorporated into the protocol of the receiving institution. In such a case, shipment must take place in isolation from other primates. More stringent local, state or Federal regulations take precedence over the AZA recommendations.
DURATION OF QUARANTINE

Quarantine for all species should be conducted under the supervision of a veterinarian and should consist of a minimum of thirty days (unless otherwise directed by the staff veterinarian).

Mammals

If, during the 30-day quarantine period, additional mammals of the same order are introduced into a designated quarantine area, the 30-day period must begin again.

Birds, reptiles, amphibians and fish

The 30-day quarantine period must be closed for each of the above classes (i.e. birds, reptiles, amphibians and fish must be kept in isolation from members of the same class). The addition of any new birds into a bird quarantine area therefore requires that the 30-day quarantine period begin again on the date of the addition of the new birds; the same applies for reptiles, amphibians and fish.

QUARANTINE PERSONNEL

Ideally, a keeper should be designated to care only for quarantined animals; otherwise, a keeper should attend quarantined animals only after fulfilling responsibilities for resident species. Equipment used to feed and clean animals in quarantine should be used only with these animals. If this is not possible, then equipment must be cleaned with an appropriate disinfectant (as designated by the veterinarian supervising quarantine) before use with post-quarantine animals.

Institutions must take precautions to minimize the risk of exposure of animal handling personnel to zoonotic diseases which may be present in newly-acquired animals. These precautions should include the use of disinfectant footbaths, the wearing of appropriate protective clothing and masks (in some cases), and minimizing physical exposure in some species (e.g. with primates, by the use of chemical rather than physical restraint). A programme of tuberculin testing and surveillance must be established for zoo/aquarium employees, to ensure the health of both the employees and the animal collection.

QUARANTINE PROTOCOL

During the quarantine period, certain prophylactic measures should be instituted. Individual faecal samples, or representative samples from large numbers of individuals housed in a limited area (e.g. birds of the same species in an aviary or frogs in a terrarium), should be collected, on at least two occasions, and examined for gastrointestinal parasites. Treatment should be prescribed by the attending veterinarian. Ideally, release from quarantine should be dependent on obtaining two negative faecal results at a minimum interval of two weeks, either initially or after parasiticide treatment. In addition, all animals should be evaluated for ectoparasites and should receive appropriate treatment, if necessary.
Vaccinations should be updated as appropriate for each species (1). If the animal arrives without a vaccination history, it should be treated as being immunologically naïve and should be given an appropriate series of vaccinations. Whenever possible, blood should be collected and sera stored in a freezer (not frost-free) at either –70°C or –20°C. Such sera could provide an important resource for retrospective disease evaluation.

The quarantine period also presents an opportunity to identify permanently all unmarked animals, when anaesthetized or restrained (e.g. tattoo, ear notch, ear tag). Also, whenever animals are restrained or immobilized, a complete physical examination, including dental examination, should be performed.

Complete medical records of all animals should be kept, and should be available for consultation during the quarantine period. Necropsy should be performed, under the supervision of a veterinarian, on all animals which die during quarantine; representative tissues should be submitted for histopathological examination.

**QUARANTINE PROCEDURES**

Evaluation of faecal samples for parasites is required for each species. Ideally, at least two negative results should be obtained from samples taken with a minimum 14-day interval, although other protocols are necessary for some parasite infestations. As noted above, all appropriate vaccinations should be performed. Recommendations and suggestions for appropriate quarantine procedures for several animal groups are presented below.

**Mammals**

**Primates**

The AZA regulations for primates require a minimum of two negative tuberculin tests using a tuberculin containing at least 1,500 units/ml or other appropriate regimen as necessary for the species in question (e.g. orang-utans [*Pongo pygmaeus*], New World primates). As most primates should be anaesthetized for this procedure, a complete blood count (CBC) and serum chemistry profile are also required. In appropriate species, serology should be performed for *Herpesvirus simiae* (herpesvirus B) and other appropriate viruses. Faeces should be cultured for *Salmonella*, *Shigella* and *Campylobacter*. Chest radiographs and urinalysis are strongly recommended.

**Hoofed livestock**

Hoofed livestock species should undergo the following tests, whenever possible:
- tuberculosis testing
- CBC
- serum chemistry profile
- appropriate serology (e.g. leptospirosis, brucellosis, MCF, infectious bovine rhinotracheitis, bovine virus diarrhoea), using paired titres, if possible
- urinalysis
– appropriate diagnostics for *Mycobacterium paratuberculosis* (if history of disease in herd of origin)
– equine infectious anaemia testing (for equids).

**Small mammals and carnivores**

Whenever possible, blood should be collected from small mammals and carnivores for CBC, serum chemistry profile and appropriate serology (feline infectious peritonitis, FIV, feline leukaemia virus). Urinalysis and testing for heartworm should also be conducted in appropriate species.

**Birds**

In appropriate bird species (e.g. psittacines and columbiformes), serological and faecal tests for *Chlamydia psittaci* are required.

In addition, CBC, serum chemistry profiles, faecal cultures for *Salmonella* spp., and faecal Gram staining are strongly recommended.

**Reptiles and amphibians**

Whenever possible, reptiles and amphibians should be examined by a veterinarian. As for other classes, CBCs and serum chemistry profiles are strongly recommended. Paramyxovirus titration should be performed on appropriate species.

**Marine mammals**

A facility should be available which can provide for the isolation of newly-acquired marine mammals in such a manner as to prevent cross-contamination resulting from physical contact, disease transmission, aerosols, drainage, or the re-use of untreated water. The location of ocean pens must prevent disease spread between animals resulting from natural water movement; such pens should be located at an adequate distance from other penned animals (as judged by the supervising veterinarian).

Isolation practices should be instituted on the basis of the prior medical history of the newly-arrived animals. Isolation is recommended in situations with one or more of the following characteristics:

1. animals recently collected from the wild (less than 30 days prior to arrival)
2. animals recently exposed to a new arrival for which an adequate medical history is not available (less than 30 days prior to arrival)
3. animals with no documented medical history
4. animals with apparent medical problems at the time of arrival
5. any other animals, as directed by the supervising veterinarian.

In addition to CBC, serum chemistry profiles, and rectal culture for *Salmonella* spp. and related organisms, blood zinc levels should also be considered for most species. In cetaceans, blow-hole swabs are also recommended; in pinnipeds, titres should be evaluated for leptospira and morbillivirus.

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PROTOCOLES DE QUARANTAINE ET MÉTHODES DE PROPHYLAXIE APPLIQUÉS AUX REPTILES, OISEAUX ET MAMMIFÈRES DANS LES PARCS ZOOLOGIQUES. – R.E. Miller.

Résumé : L’auteur expose les méthodes élémentaires de prophylaxie, dont la quarantaine, qui devraient être appliquées aux reptiles, oiseaux et mammifères dans les parcs zoologiques. Il décrit, à titre d’exemple, le protocole de quarantaine destiné aux établissements agréés par l’American Zoo and Aquarium Association (Association américaine des parcs zoologiques et aquariums).

MOTS-CLÉS : Médecine vétérinaire – Prophylaxie – Quarantaine – Vaccination.

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PROTOCOLOS DE CUARENTENA Y PROCEDIMIENTOS DE PROFILAXIS PARA REPTILES, AVES Y MAMÍFEROS DE PARQUES ZOOLOGÍCOS. – R.E. Miller.

Resumen: El autor expone los procedimientos básicos de profilaxis, entre ellos la cuarentena, que deberían aplicarse a reptiles, aves y mamíferos en los parques zoológicos. A título de ejemplo, describe el protocolo de cuarentena que aplican las instituciones acreditadas por la Asociación Americana de Zoológicos y Acuarios.

PALABRAS CLAVE: Cuarentena – Medicina veterinaria – Profilaxis – Vacunación.

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REFERENCE