Overview of Drug Delivery Methods in Exotics, Including Their Anatomic and Physiologic Considerations

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KEYWORDS

• Anatomic differences • Drug delivery • Injectable route • Oral route • Transmucosal • Topical • Transcutaneous • Nebulization

KEY POINTS

- Drug delivery to exotic animals can usually be extrapolated from small animal medicine.
- Specific techniques may be required owing to physiologic and anatomic differences.
- Drug administration techniques for each species should be chosen accordingly to avoid iatrogenic complications.

INTRODUCTION

To a certain extent, drug delivery to exotic animals follows similar guidelines as those for other domestic animals. However, difference in species' physiology and anatomy may hinder extrapolation and complicate straightforward treatment administration. Knowing these differences is warranted to deliver treatment through the most appropriate routes while ensuring the technique is executed properly. The aim of this review is to provide practitioners with a guide for drug delivery methods and to summarize exotic animal peculiarities that are relevant for drug administration. This article reviews drug delivery methods using injectable routes, the digestive and the respiratory systems, as well as topical, cutaneous, and mucosal dispensing methods. Whenever possible, clinicians should consider operant conditioning for nonstressful administration of drugs (see Brian L Speer and colleagues' article, "Low Stress Medication Techniques in Birds and Small Mammals," in this issue).

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DRUG ADMINISTRATION VIA INJECTABLE ROUTES

Intramuscular, Subcutaneous, Intraperitoneal, and Intracoelomic Drug Administration

Although the general principles of nonvascular parenteral drug administration are very similar between domestic animals and exotic species, some specificities remain, owing to differences in the anatomy and physiology of some species. Parenteral injection sites excluding intravascular injections, are summarized in **Table 1** and illustrated in **Figs. 1** and **2**. As a general rule, for most parenteral injection of hydrosoluble solutions, needle diameter should not exceed a 25-G diameter in the most commonly seen species.[1,2]

Subcutaneous route

In small mammals, the loose skin can easily accommodate large volume of fluid administration. Subcutaneous (SC) fluids are easily delivered using a butterfly needle, which allows the animal to move without the needle being pulled out.[3] In an attempt to reduce the pain associated with this procedure, a larger needle diameter may be chosen, resulting in fluids being pushed out with less force. Some practitioners also noted that the use of a drip system in SC fluids administration resulted in animals being less tensed during the procedure, especially rabbits (Y. van Zeeland, personal communication, 2017). In birds, large volumes can also be administered SC in specific areas despite the overall low elasticity of the avian skin.[10] Proper technique to avoid repeated punctures and subsequent leakage, or prevent inadvertent intracoelomic/intraabdominal injection, is essential. Irritant drugs, such as enrofloxacin, should be diluted to limit the risk of associated pain, skin necrosis, ulceration, depigmentation, and sterile abscess formation.[9,15] Finally, the SC route has been controversial in reptiles owing to the suspected low and variable drug absorption, because reptile skin is poorly vascularized and less elastic than mammalian skin, resulting in undesired leakage of the drug.[1,4,15,16] However, recent studies have shown an adequate therapeutic effect and less variability using the SC route rather than in the intramuscular (IM) route in reptiles.[17,23]

SC access port systems (Skin Button, Norfolk Vet Products, Skokie, IL) may be considered for the long-term delivery of SC drugs and fluids. This technique has been used by the authors in the management of rabbits with chronic renal failure for the long-term administration of fluids at home by the owner. In addition, the technique has also been described in hedgehogs to facilitate administration of fluids and drugs as the injection port remains accessible even when the animal curls.[3]

Intramuscular route

Many popular companion exotic animals including birds and reptiles have a small size and thus small muscle mass. As a consequence, repeated IM injections or use of irritant drugs can cause local pain and muscle necrosis.[1,2,24] Some authors recommend to avoid injection sites such as the muscles of caudal or lateral thigh in small mammals to prevent damage to the sciatic nerve, which could result in lameness or self-mutilation.[2,3,25] Given the high metabolic rate of many small mammals and birds,[26] large volumes may be injected proportionally to the body weight. Therefore, practitioners should fraction injected volumes in multiple injection sites. For example, some authors suggested that IM injection volume should not exceed 0.5 mL/kg by injection sites in rabbits and 1 mL/kg in birds.[9,27] Although empirical, this recommendation can be extrapolated to other exotic species.[5]

Portal systems in nonmammalian species

Regarding at the different injection routes in nonmammalian vertebrates, veterinarians may encounter the recurrent and controversial question of the influence of the renal and hepatic portal systems on clearance of drugs from the system after the use of caudal injection sites. In avian and fish species, the evidence is very scarce regarding the clinical significance of the portal systems, whereas more data are available in nonavian reptiles.