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Restraint and Anesthesia of Uncommon Veterinary Patients

Bruce H. Garver
Iowa State University

Larry L. Jackson
Iowa State University

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Bruce H. Garver, BS*
Larry L. Jackson, DVM, MS, DACVA**

Introduction

The presentation of small mammals, birds, and reptiles as patients can create considerable problems for the veterinarian. Oftentimes the veterinarian feels uncomfortable handling uncommon pets for fear of injury to the pet or clinic staff. This often sends the veterinarian searching through textbooks hoping to find a short and concise section dealing with the patient at hand. With the knowledge of large variations existing in attitude, drug sensitivities, and metabolism, veterinarians must have the ability to competently handle these animals. The manner in which veterinarians approach and handle animals is of utmost importance since the owner is often present. Evaluation of the veterinarian by the client is partially determined by the ability of the veterinarian to treat the animal in a means that the owner accepts as proper. The pet, no matter how uncommon, is important to the client on an emotional level and a financial level. Therefore, it is essential that the animal be handled, restrained, and treated with skill and confidence. This guide has been developed as a quick and accurate reference for the veterinarian to aid in the restraint and anesthesis of uncommon patients.

Restraint

The art of proper restraint involves the study and observation of various restraint methods, incorporation of these methods, and application of the methods to the patient at hand. These descriptions of restraint are not the only methods of restraint for a particular species, but methods that work.

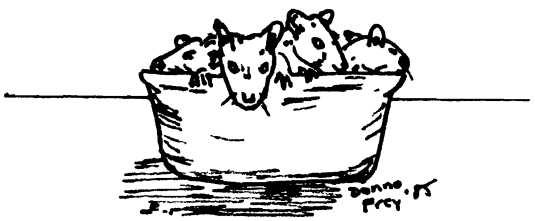
*Mr. Garver is a fourth-year student in the College of Veterinary Medicine at Iowa State University.
**Dr. Jackson is a professor of Clinical Sciences at Iowa State University.

Anesthesia

The variations in anatomical features, size, percent body-fat, metabolism, drug sensitivities, and pre-anesthetic health of the animal must be considered when anesthesia is to be administered. Ambient temperature is an important consideration. Many anesthetics alter the animals thermoregulatory mechanism, therefore, it is necessary to keep anesthetized animals warm. The method of administration of the anesthesia must also be considered. In many smaller animals it is virtually impossible to administer anesthesia intravenously, while in larger animals it may be impossible to restrain them enough to give anesthetics intravenously. Parenteral administration of anesthetics in uncommon animals is safer, because of the ease of administration and the effective dose can be controlled more closely. The therapeutic index of various anesthetics is also a major consideration when the weight and general condition of the animal have to be estimated prior to anesthesia. Anesthetics with higher therapeutic indices are preferred so that the health of the animal is not compromised. Finally, the efficacies of various anesthetics have to be considered so that the animal will be immobilized for the desired length of time without being endangered by the effects of prolonged anesthesia.

Mice

Most mice will attempt to bite when handled and should be picked up by the base of the tail. The mouse should then be placed on a rough surface, while maintaining a grip on the tail. The mouse will try to crawl away, and remain immobile. This enables the animal to be grasped by the scruff of the neck with the forefinger and thumb of the free hand. The mouse can then be lifted off the surface and handled safely.[1,2]



The more common routes of anesthesia administration in rodents are subcutaneous (SC), intramuscular (IM), and intraperitoneal (IP). Ketamine hydrochloride at the dosage of 22 to 44 mg/kg IM will provide light anesthesia for 15 to 25 minutes.[2,8] Ketamine hydrochloride at 44 mg/kg in combination with xylazine at 4 to 8 mg/kg IM will provide more muscle relaxation and a longer period of anesthesia.[10] For longer procedures the use of halothane or methoxyflurane inhalation anesthesia has been used safely. Halothane can be volatized in a stream of oxygen and pumped into a jar or small chamber for induction and the animal can be maintained on gas using a mask.

Concentrations of 1.0 to 1.5 percent are suggested.[9] The body temperature should be maintained by placing the mouse on a heating pad or wrapping it in aluminum foil.[1] The use of ether has been described. Research has shown that ether causes considerable irritation of the bronchial tree and may predispose the animal to respiratory problems postoperatively. Irritation to the eyes and the pads of the feet also occurs if the animal is not properly separated by padding from the ether.[1]

Hamsters

A pet hamster can be handled by cupping the palms of the hand and lifting the animal clear of the cage. However, if the animal is uncontrollable it may be grasped by the scruff of the neck. The skin in the region of the neck is very loose, and a good amount of skin must be grasped to prevent the animal from turning and biting the handler. This is necessary when performing clinical procedures. Bites from these small rodents are painful but rarely cause serious injury. If the animal bites and refuses to relax its grasp, do not try to pull it free, but place the animal back in its cage. Once within its cage the animal will release its grasp.[1,2]

Ketamine hydrochloride at a dosage of 44 mg/kg IM is recommended for short periods of anesthesia in the hamster. This will provide light anesthesia for a period of 20 to 25 minutes.[8] Ketamine at 44 mg/kg with xylazine at 4 to 8 mg/kg IM will provide 45 to 60 minutes of analgesia.[10] Sodium pentobarbital has also been described for use in hamsters at a dosage of 60 to 90 mg/kg IP. The IP injection given in the lower abdomen just off the midline produces an anesthetic state for 30 to 45 minutes.[2,10] Like the other rodents, hamsters can also be induced in a jar on induction chamber with methoxyflurane or halothane and then maintained at 1.0 to 1.5 percent with a mask using a non-rebreathing apparatus.[8]

Gerbils

Gerbils that are handled regularly can often be picked up in the palm of the hand. However, if the animal is aggressive it can be picked up by the base of the tail and grasped by the scruff as described for the mouse. Caution should be exercised to avoid injuring the delicate skin of the tail.[1]

Ketamine hydrochloride at a dosage of about 44 mg/kg IM is suggested for short procedures of 15 to 25 minutes.[2] Ketamine and xylazine combinations at 44 mg/kg and 4 to 8 mg/kg respectively, given IM, provide longer periods of analgesia and sedation.[10] Anesthesia of two to three hours can be obtained by the SC or IP injection of a sodium pentobarbital at 60 mg/ml.[4,10]

The use of methoxyflurane or halothane in an induction chamber and maintenance using a mask at 1.0 to 1.5 percent concentration are also suggested.[8]

Metomidate 50 mg/kg and fentanyl 0.05 mg/kg, diluted in saline to give a convenient volume, can be mixed and administered SC to give about 45 minutes of anesthesia.[1]

Rats

Pet rats are usually not aggressive and can be safely handled by picking them up with the hand around the shoulders. Grasping the rat too tightly will cause the animal to panic and bite the handler. The rat resents most clinical procedures, and the thumb of the hand grasping the rat can be placed under the mandible to prevent the animal from biting. If the rat is very agitated it can be handled like the mouse. Rats should not be grasped by the scruff of the neck because it is very uncomfortable to the rat.[2]

Short periods of anesthesia can be obtained by IM injection of ketamine hydrochloride at the dosage of 20 to 50 mg/kg. The lower end of the dosage range should be used for younger rats.[2] Sodium pentobarbital can also be used IM in rats at the dosage of 30 to 50 mg/kg. This has proven to be a safe means of anesthesia in rats and has been used for years in lab animal medicine.[9] A combination of ketamine at 50 mg/kg IM followed by sodium pentobarbital at 20 mg/kg IP gives good analgesia for approximately one hour.[10] Thiopental has been used for short anesthetic procedures in the rat at a dose of 4 mg/ 100 gm of body weight IP.[10] Methoxyflurane or halothane at two to three percent can be used for induction in a chamber or jar.[8,9] Maintenance, using a mask, at a concentration of 1.0 to 1.5 percent is another highly recommended protocol.[8,9] The use of ether is not recommended.[1]

Guinea Pigs

Unlike other rodents guinea pigs rarely bite, but are easily frightened. Guinea pigs move quite rapidly and can be difficult to grasp. Handling is much easier if the animal is in a small box or cage which limits its movements. Guinea pigs should be picked up around the shoulders and supported in the hindquarters.[1]

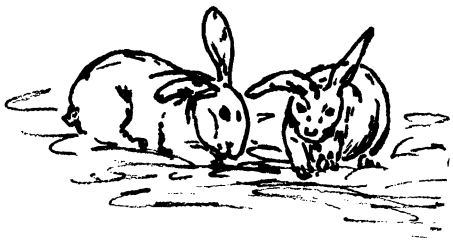
Ketamine hydrochloride at a dosage of 22 to 44 mg/kg IM provides light anesthesia for about 20 minutes. Xylazine at 5 mg/kg or acepromazine at 2 mg/kg in combination with ketamine at a dosage of 20 to 40 mg/kg IM provide good analgesia for about 30 to 45 minutes. This anesthetic combination can also be used as a premedication for inhalation anesthesia. The anesthetic requirement may vary depending on how active the animal is.[8,10] Fentanyl and droperidol (Innovar-vet®) has been used in guinea pigs at 0.4 to 0.8 ml/ kg IM, but the occasional development of lameness accompanied by self-mutilation in the injected limb warrants that this drug not be used in guinea pigs.[2,4,11] When sodium pentobarbital is given at 28 mg/kg IP, it takes about 15 minutes for anesthesia to develop and lasts 30 to 90 minutes. Sodium pentobarbital at 20 mg/kg in combination with chlorpromazine at 25 mg/kg IP lengthens anesthesia to at least 50 minutes.[4,10] Guinea pigs should be fasted for six to 12 hours prior to barbiturate anesthesia to prevent vomiting and dose miscalculation due to a full stomach.[10] Complete recovery may take as long as 12 hours and it may be necessary to supplement heat and turn the animal periodically to prevent pulmonary congestion during that time.[4,10]

Guinea pigs can also be induced in a chamber and maintained on methoxyflurane or halothane at 0.75 to 1.75 percent with a mask on a non-rebreathing system.[2,10] Because the guinea pig produces a copious amount of secretion in the respiratory tract it is necessary to aspirate the endotracheal tube periodically or administer 0.1 to 0.5 mg SC atropine as a premedication.[4,8] Methoxyflurane produces less salivation than halothane and for this reason is the gas anesthetic of choice in guinea pigs.[4]

Ferrets

Ferrets can inflict serious bites. Wearing thick leather gloves is advised for additional protection.[1,3] Many pet ferrets, accustomed to being handled, can be grasped by the scruff of the neck and tail. If the animl is fractious it should be distracted and grasped by the tail and lifted clear of its cage. The ferret should be allowed to grip a rough surface and then grasped by the neck and chest.

Anesthesia of ferrets should be preceeded by a period of 12 hours of withholding food. Atropine at 0.04 mg/kg SC should be given as a premedication. Anesthesia can be easily induced by placing the ferret in an induction chamber using methoxyflurane at 2 to 3 percent and maintained with a mask or endotracheal tube on a non-rebreathing system at 1 to 2 percent.[11] Ketamine hydrochloride at 26 mg/kg and acepromazine at 1.1 mg/kg given together IM provide 15 to 45 minutes of anesthesia.[4,11] Weasels can also be anesthetized in a similar manner.[9]



Rabbits

Rabbits should never be handled by the ears but should be grasped by the scruff and supported in the hindquarters. Wild rabbits and hares must be handled carefully because they can scratch with the forepaws while raking the handler severely with the rear paws if not properly controlled.[3] The animal should be held close to the handler's chest when being carried and released if a violent struggle ensues. Injury to the vertebral column can result if the animal continues to struggle, resulting in permanent posterior paralysis. If the animal becomes severely stressed, shock and cardiac arrest can occur.[1,3]

Rabbits can be restrained and immobilized for short periods of time through hypnosis by, placing the animal on its back with one hand placed gently on the rabbit's thorax while stroking from the bridge of the nose, between its eyes, up onto its forehead. The success of this procedure can be gauged by the amount of relaxation of the animals limbs, contraction of the pupils, and by an increased depth of breathing. The rabbit will awaken if stimulated by sound or if the stroking of the head ceases.[4] Hypnosis can be obtained by stroking the chest with the flat surface of the four fingers on the chest while supporting the head with the other hand.[4]

Rabbits should be fasted for 18 to 24 hours with water *ad lib* prior to anesthesia. Nitrous oxide should not be used in rabbits because it will cause gastric distention. Atropine given at 0.08 mg/kg SC is helpful in controlling oral secretions.[8] Ketamine hydrochloride alone at 44 mg/kg does not produce adequate analgesia. Ketamine, combined with acepromazine at adequate analgesia. Ketamine, combined with acepromazine at 5 mg/kg, diazepam at 5–10 mg/kg or xylazine at 5 mg/kg IM, produces good analgesia, muscle relaxation and smooth recovery. The duration of anesthesia is also lengthened 20 to 70 minutes[4,10] Sodium pentobarbital at a dosage of 30 to 50 mg/kg IV can be given via the lateral ear vein. There is a wide variation in reponse, so the pentobarbital should be injected only until the desired level of anesthesia is obtained. The depth of respiration is the best indicator of anesthesia; it should be slow, regular, and deep. Thiopental can be used in the rabbit at a dose of about 50 mg/kg. If 2.5 percent thiopental is used, the dose is 2.0 ml/kg IV. Anesthesia is brief, lasting five to 15 minutes and recovery is rapid.[4,9]

Inhalation anesthesia in rabbits using methoxyflurane provides good relaxation and analgesia. Premedication of the rabbit is done with ketamine at a dosage of 44 to 50 mg/kg IM given with atropine at 0.04 mg/kg IM or 0.08 mg/kg SC. Induction is accomplished in an induction chamber and the rabbit can be intubated or maintained by mask. It may be necessary to use a firm stylet within the endotracheal tube to obtain intubation.[4,8,9]

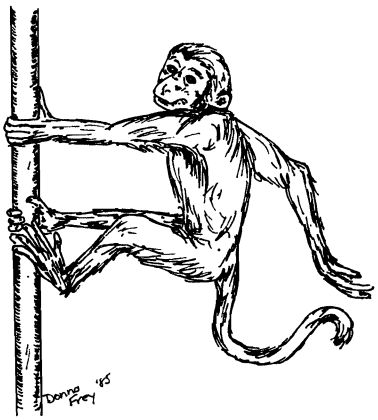
Since many rabbits have upper respiratory problems, fluid accumulation in the trachea during anesthesia may necessitate tracheal suction during the procedure.Intubation and the anesthetic may cause further tracheal irritation requiring the administration of corticosteriods and antibiotics.[4,9]

Primates

The restraint of non-human primates should never be attempted without proper protective equipment. Primates are strong and possess sharp teeth and claws capable of inflicting serious wounds. Even juveniles that appear docile can turn on handlers and cause serious injury. Whenever handling primates the handler should wear thick longsleeved garments and leather gloves to avoid injury and prevent disease transmission. Primates weighing less than 1 kg should be restrained by grasping the animal around the neck and chest. This allows restraint of the head and upper body without choking the animal. Primates weighing two to 12 kg should be restrained by pinning both upper arms behind the back of the animal with one hand and grasping the hind limbs firmly in the other hand.[4] Primates over 15 kg should not be handled without the use of chemical restraint to render the animal immobile.[4]

Chemical restraint of non-human primates holds two major considerations; selecting a drug with a high therapeutic index, and withholding food for at least six hours prior to assure efficacy and safety.

Ketamine is very useful for restraint, sedation, and light anesthesia of primates. Ketamine dosage is 7 to 15 mg/kg IM, and varies with species. The lower end of the dosage range is suggested for the use in apes, while the higher doses may be necessary for the smaller primates. Atropine at 0.02 to 0.04mg/kg IM, should be given to control salivation and vagal effects.[8] The higher end of the do-



sage range of ketamine can be used for short clinical procedures or intubation, with anesthesia lasting 20 to 40 minutes.[4] Phencyclidine hydrochloride has been used for chemical restraint and as a preanesthetic agent. The dosage range varies from 0.25 to 3.0 mg/kg IM, depending on the species and the effect desired. Lower doses, such as 0.5 mg/kg, are effective for restraint in apes.[2]

When ketamine is used as a preanesthetic agent, the animal can be induced with either sodium thiamylal or thiopental at a calculated dosage of 8 to 10 mg/kg IV.[8] Sodium pentobarbital can also be used for induction at a dosage of 20 to 25 mg/kg IV.[2] One half of the intravenous anesthetic dose should be administered initially followed by small increments until the desired effect is obtained. The animal can then be intubated and maintained on halothane or methoxyflurane at 1.0 to 1.5 percent.[4]

Small primates can be induced without premedication by using an induction chamber or by masking the animal down with halothane at 1.0 to 1.5 percent. Halothane allows rapid mask induction and rapid recovery of the species capable of being restrained physically.[2] Laryngospasm can occur in primates if intubation is attempted before the animal is anesthetized deeply enough. One percent lidocaine can be sprayed on the laryngeal structures to prevent or lessen the spasm.[8] Primates less than 7 kg should be maintained on a non-rebreathing system and require close observation of hydration and body temperature during surgical procedures.[2]

Raptors

Trained raptors will usually sit on the fist of the gloved handler to permit a visual inspection. The use of a hood to cover the bird's eyes will aid in pacifying nervous raptors. Birds not trained or not accustomed to wearing a hood should be examined in a darkened room, which is the principle behind the use of hoods. Closer inspection of an injury may necessitate the casting of the bird by approaching the bird from behind with a towel and, when the wings are in a normal resting position, grasping the bird firmly holding the wings against the body. The feet are pulled backward and the body is wrapped in the cloth. The use of Vetrap® has been described for the wrapping of the body of the bird to allow a secure wrap without sticking to or damaging the feathers.[2,4,5]

The talons of the birds should then be taped to prevent the inadvertent clawing of an ungloved examiner.

Ketamine hydrochloride is useful for restraint and anesthesia. A dosage of 15 to 30 mg/kg IM is sufficient for minor procedures and intubation. The bird will become anesthetized in two to eigth minutes post injection and anesthesia will last 20 minutes to 6 hours, depending on the dosage given. The bird will be groggy for 12 to 24 hours during recovery.[2] Ketamine at 30 to 40 mg/kg and diazepam at 1.0 to 1.5 mg/kg IV produces good anesthesia.[2] Owls require less anesthesia due to increased percentage of body fat, and can be successfully anesthetized with 25 mg/kg of ketamine and 1.0 to 1.5 mg/kg of diazepam IV.[4,10,11] Recovering raptors should be kept in a warm, quiet area and be disturbed as little as possible.

Caged Birds and Psittacines

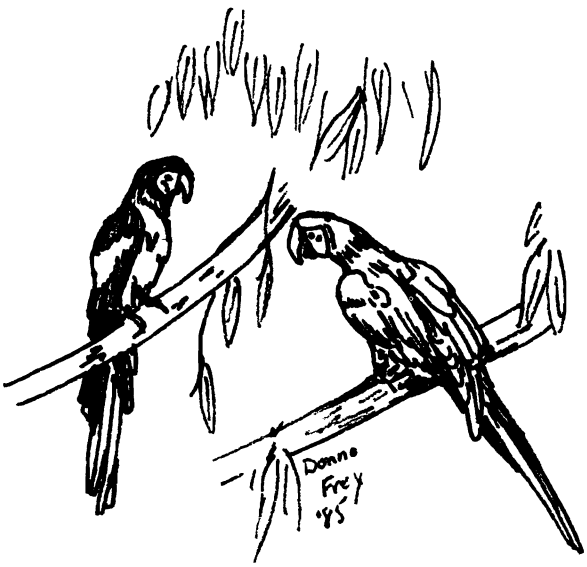
The capture and restraint of caged birds should not be attempted until the owner has been forwarned of the possible consequences. Most sick birds can be examined while remaining in their cages. The stress of capturing sick (or healthy) birds can be fatal. It may be wise and less stressful to have the owner capture and restrain the bird. Also, if the bird dies, it will have died in the hands of the owner.[5]

Capturing caged birds, especially parakeets, may result in the "cardiac racing syndrome." In this syndrome, due to fright, the heart rate exceeds normal limits to the point

where blood cannot fill the atria and ventricles. Death can occur in less than a minute.

In order to safely capture a bird in a cage it is necessary that all perches and toys be removed from the cage prior to attempting the capture. Parakeets, canaries, and finches will freeze in their position in the cage when the room lights are lowered. Leather gloves are not needed when capturing these birds but exam gloves may be worn as protection from pecking by the birds. A parakeet should be held in the palm of the hand on its back with the thumb and forefinger placed securely around the bird's neck just under the head. The little finger can be placed over the birds legs while the rest of the hand loosely cradles the bird.[9] Do not place any fingers over the breast of the bird, because the bird cannot breathe if the sternum is not allowed to move with the respirations.[5]

Larger birds require more skill to capture. If the bird is approachable then it can be captured in a towel. Approach the bird from behind, while someone distracts the bird, and throw the towel over the bird. The mandible of the bird must be grasped quickly and firmly, placing the hand around the back of head with the thumb and forefinger on each side to secure the mandible. Wilder birds may have to be pinned in a corner of the cage before being secured, and leather gloves should be used.[2,5,6]



The anesthesia of caged birds is very difficult and requires the close evaluation of the physical condition, weight, and temperament. The bird's respiratory and cardiovascular systems should be evaluated and the metabolic status estimated by the muscle mass and body condition. Food and water should not be withheld before anesthesia. Any physical restraint should be minimal and gentle to avoid injury and prevent shock.[2,10]

Ketamine has been used successfully in caged birds, but to state one dose which will be efficacious in all sizes of birds is impractical. There are recommended dosage ranges for different weights of birds tht are helpful as guidelines in determining the proper dosages for the IM ketamine.

1. Birds weighing less than 100 gm (canaries, finches, parakeets, and small birds) should receive 0.1 to 0.2 mg/g.
2. Birds weighing between 200 and 500 gm (parrots, pigeons, and other medium sized birds) should receive 0.05 to 0.1 mg/g.
3. Birds weighing between 500 and 3000 gm (chickens, owls, hawks, and other large birds) should receive 0.02 to 0.08 mg/g.
4. Birds weighing more than 3000 gm (ducks, swans, and geese) should recieve 0.02 to 0.05 mg/g.[4,9]

Periods of excitement during the recovery from ketamine are common, so it is important that recovering birds be placed in dark, quiet, and padded cages to prevent the bird from injuring itself.[4,9]

Halothane works well as the means of anesthesia in birds. The induction and recovery periods from gas anesthesia are faster than for mammals. This may be because the blood/gas coefficient is lower than in mammals and the vascular-respiratory interface is relatively larger in birds. A major problem encountered is a too rapid induction leading to respiratory arrest.[2] Birds that are manageable can be induced with a mask or induced in a chamber at 2.0 percent halothane and maintained at 1.0 to 1.25 percent halothane on a non-rebreathing system. Birds weighing over 100 gm can be intubated quite easily, with the glottis present at the base of the tongue. The use of gas anesthesia, without premedication, is less traumatic during the recovery period than recovery from injectable anesthesia.[2,4]

Methoxyflurane may be used similarly to

halothane with birds, but due to its increased solubility its blood/gas ratio is higher and the time for induction and recovery is longer.[2]

Reptiles

The safest means of restraining reptiles is by letting the owner control the animal and ideally these animals should only be handled when absolutely necessary. Many non-poisonous snakes can be handled quite safely without major precautions. It is important that snakes, when being picked up, are held with the thumb and forefinger on each side of the base of the head to assure proper immobilization. The body of the snake should also be supported to prevent injury to the snake. The skulls of reptiles have only one occipital condyle supporting their skulls. Rough handling can cause cervical dislocation or fracture.[2,7]

Restraint of poisonous snakes and larger pythons require the use of the snake hook, the basic tool used in pinning the head. The snake hook consists of a long rod with a hook fashioned as a 'C' on the end. To pin the head, the snake must be positioned so that the head is facing away from the handler. The hook is then placed on the back of the head and held securely applying enough pressure to hold but not injure the snake.[2] The middle finger and thumb are placed behind the sides of the head with the forefinger on the top of the head. The hook is then set aside and the free hand supports the body of the snake.[7] It is important that transfers from hand to hand not be attempted. An alternate method of restraint consists of obtaining clear plastic tubes of various diameters and allowing the snake to crawl into the tube. The tube may be capped on one end or left open. Holes or slots in the tube allow procedures to be carried out on the snake while in the tube. The tube must be just larger than the diameter of the snake to prevent the snake from turning in the tube. Once the snake enters the tube to one-third of its length, the tube and snake are grasped at the point where they meet. The hold on the snake and tube is held until the snake is ready to be released.[2]

A turtle or tortoise can be restrained by picking it up by the side of the shell and rendered immobile by wrapping the shell with elastic bandage. Placing them on a brick or similar pedestal will prevent them from moving with the head and tail and permit examination.[7]

Lizards in a small enclosure can be grasped around the neck and body and picked up. Do not grasp small reptiles by the tail because the tail-ends break away and can create a source of entry for bacteria. Most lizards can be immobilized for short periods of time by applying gentle inward pressure upon their eyes for a few seconds. This pressure produces a vagal response which briefly slows the heart-rate and lowers blood pressure. This procedure is quite effective for short procedures such as radiography. Loud noises and touch can awaken the lizards but the procedure can be repeated as needed. The effect may last up to ten minutes but carries the risk of the reptile awakening at any time.[7]

Absorption and excretion of anesthetic agents by reptiles is affected by temperature, since metabolism is temperature-dependent in poikilotherms. This factor complicates anesthesia of reptiles. The health status of the animal should also be carefully evaluated,with ill patients receiving minimal doses. Recovery is slower in reptiles than in mammals and birds. The patient should be kept in a warm (29.5° C) and draft-free environment.

Ketamine hydrochloride can be used successfully in snakes, turtles, and lizards. At 44 mg/kg IM, small snakes and turtles can be immobilized for minor procedures.[8] Major procedures require doses of 66 to 88 mg/kg IM. Turtles have been reported to require doses of 88 mg/kg IM to obtain adequate muscle relaxation. These animals may appear deeply sedated, but they may strike at any time. Complete recovery varies depending on the temperature, dosage given, and on the health of the animal.[10]

Barbiturates are not recommended for use in reptiles.[2]

Halothane is the most common volatile anesthetic used in reptiles. Induction times, using a face mask at 3 percent halothane or methoxyflurane, vary from one to 30 minutes depending on the animal and its respiratory rate. Anesthesia is usually maintanined at 1.0 to 2.0 percent halothane and 0.5 percent methoxyflurane.[8] The ventilation rate of snakes, which is normally 2 to 4 resp/min, should be maintained while the snake is under anesthesia. Care should be taken that the lungs are not over-inflated and to observe the movement of the chest wall to ensure adequate ventilation.[7]

Conclusion

The presentation of uncommon veterinary patients should not be a point of uncertainty for veterinarians. If veterinarians are faced with a patient that they are not familiar with it would be reassuring to know that there is a brief guide available that gives accurate and short presentations on restraint and anesthesia. This guide has been compiled for just that reason, to aid the veterinarian.

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BOOK REVIEW

Clinical Laboratory Animal Medicine. **By Donald D. Holmes, DVM, Iowa State University Press, Ames, Iowa, 1984, 126 pages, $9.95.**

This book was "prepared as an introduction for those planning to pursue further training in laboratory animal medicine, as a text for veterinary medical students, and as a practical guide to veterinarians in private practice". To accomplish this purpose a chapter is devoted to each of the following species: mice, rats, mongolian gerbils, Syrian hamsters, guinea pigs, rabbits, ferrets, nonhuman primates and reptiles. Ferrets and reptiles, though not widely used as laboratory animals, are included because of their increasing popularity as pets and the lack of information about these species in the traditional veterinary curriculum.

Each chapter addresses common characteristics, biology, husbandry, techniques, diseases and miscellaneous conditions. It is appropriate that considerable information is presented on biology and husbandry of each species, as many animals presented to practitioners are suffering the consequences of improper management. The diseases and miscellaneous conditions discussed are the so-called "common" diseases which, while infrequent in well managed laboratory animal facilities, may well be encountered in pets or animals raised commercially for meat or fur. The disease discussions are brief, containing pertinent clinical information, recommended treatments, and minimal pathology. It is assumed that, given the unique characteristics and common diseases of each species, the reader will apply the basic clinical principles appropriate for other species.

There are three appendices in this book: Drug Dosages, Normal Values (Reproductive Data, Physiologic Data, Hematologic Data and Biochemical Data) and Perferred Food of Selected Reptilian Species. The table of Drug Dosages is an eighteen-page listing of drugs according to species and type of drug (antimicrobial, parasiticides, anesthetics and others). All of the appendices, drug dosages in particular, provide a concise, accessible reference that alone justifies the price of the book. Eleven pages of references are included as a resource for more in-depth reading on any of the species covered.

In summary, *Clinical Laboratory Animal Medicine* is clearly written, inexpensive and well organized. It provides good basic information on management, common diseases and treatments of laboratory animal species.

—Dr. J. G. Hopper