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ANIMAL CAPTURE AGENTS

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Final Report

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This research is written in response to concerns about the safety of using animal capture agents by security police. The report discusses the chemical immobilizing agents, current delivery equipment, first aid and emergency protocols for cases of accidental human exposures. <i>Keywords: chemical agent delivery systems, exposure physiology; toxicity; therapy;</i>				
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I. INTRODUCTION

A. Purpose: This report was prepared in response to concerns about the safe use of animal capture agents by security police at the request of the 3280 Technical Training Group. This report discusses the chemical immobilizing agents, current delivery equipment, first aid and emergency protocols for cases of accidental human exposure.

B. Problem: There are no particular Air Force guidelines or protocols when such agents are employed. The use of animal immobilizing agents has become common practice at many Air Force installations. It is essential that the use of these chemical agents and delivery weapons pose no immediate danger to either the user, the animal being captured or innocent bystanders.

C. Scope of the Study: The intent of this report is to make recommendations based on the safety and effectiveness of the agents and delivery systems reviewed. Questionnaires were sent to 137 Air Force bases to obtain information about the chemical agents and delivery systems used by animal control personnel. A literature review included chemical agents, delivery methods, toxicity information and emergency procedures from inadvertent exposure to humans.

II. DISCUSSION

A. General Information: There is widespread use of the "drug dart" or projectile syringe with a variety of delivery systems currently available to animal control activities. The method of capturing free ranging animals is not a new development as it originated in 1953 when Hall, Taft, Baker and Aub captured large numbers of deer in order to study antler growth.(6) The need to develop a method to easily and safely immobilize animals resulted in the development of the "drug dart." Early darts were crudely constructed and afforded little accuracy and limited range. Over the years, improvements in both the dart and the delivery weapons have improved accuracy and the effective range.(6)

The list of available drugs used to immobilize animals has continually grown with a wide variety of physiological and psychological responses. No single drug or combination of drugs is equally effective for all species. It is not possible to recommend a precise dose rate to suit all animals and circumstances. There is a wide intra- and inter-species variation in the level of sedation achieved with a given dose rate.(7) Some currently available drugs are neither safe nor effective. Locally developed procedures should address chemical restraint that has a wide margin of safety, is effective, and provides minimal adverse physiologic response that could endanger the restrained animal.

B. Chemical Immobilizing Agents

1. Ketamine (Ketalartm, Ketasettm, Vetalartm)

a. Composition: Ketamine hydrochloride is a rapid-acting non-narcotic, nonbarbiturate agent for anesthetic use in cats and for restraint in subhuman primates. It is chemically designated dl (2-o-chlorophenyl)-2-(methylamino) cyclohexanone hydrochloride and is supplied as a slightly acid (pH 3.5 to 5.5) solution for intramuscular injection in a concentration containing the equivalent of 100 mg ketamine base per ml and contains 0.1 mg/ml benzethonium chloride as a preservative.(2,4)

b. Drug classification: Cataleptic anesthetic. A phencyclidine derivative.

c. Use: General "anesthetic"-like agent. Users should familiarize themselves with catatonia in general and particularly that its successful use as an immobilizer doesn't necessarily mean that the animal cannot feel pain. Ketamine has been administered principally to cats and man, although its use in mice, rats, dogs, primates, pigeons, and exotic species has been reported. (Chen et al., 1966; Bree, 1967; Bree and Gross, 1969; Kaump et al., 1969) Generally accepted in practice as an animal immobilizing agent in a wide variety of species including carnivores.

d. Warnings: Excessive salivation and tachycardia may occur 10-60 minutes after administration to cats. Can cause convulsions and barking fits in dogs, which do not occur when it is added to other psychotropic drugs, i.e., xylazine.

e. Dosage:

<u>Species</u>	<u>Route</u>
Hogs.....20 mg/kg	IM
Opossums.....10 mg/kg	IM
Rabbits.....15 mg/kg	IM
Cats.....5-20 mg/lb	IM
Dogs.....10 mg/lb	IM

f. Caution: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

2. Xylazine (Rompuntm, Bayer 1470, Bay Va 1470)

a. Composition: Xylazine 2(2,6-Dimethylphenylamino)-4 H-5, 6-dihydro 1,3 thiazine hydrochloride 11.4%; inert ingredients 88.6%. Supplied in 20 ml vials (20 mg/ml) and 50 ml vials (100 mg/ml).(2,4)

b. Drug classification: Sedative, analgesic.

c. Use: Produces good relaxation (light narcosis) as a preanesthetic sedative-analgesic in animals. Used in dogs and cats for restraint, minor procedures and a preanesthetic. Appears useful when combined with ketamine.

d. Warnings: Do not use in conjunction with tranquilizers. Produces vomiting in cats before sedation occurs. Temperature rise is usually noted after use. Not for use in food animals.

e. Dosage:

<u>Species</u>	<u>Route</u>
Cats.....0.5-1.0 mg/lb	IM
Dogs.....0.5-1.0 mg/lb	IM

f. Caution: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

3. Acetylpromazine (Acepromazinetm, Plegiciltm)

a. Composition: 10-[3-(Dimethylamino) propyl] phenothiazine-2-yl-methyl ketone. Supplied in 50 ml vials with each ml containing 10 mg Acepromazine maleate.(2,4)

b. Drug classification: Potent neuroleptic agent with low order of toxicity. Tranquilizer, antiemetic.

c. Use: As an aid in tranquilization and as a preanesthetic agent in dogs. To control intractable animals for a variety of minor procedures. Can be used in conjunction with ketamine.

d. Warnings: Prohibited use in food animals. May potentiate toxicity of certain organic phosphorous compounds.

e. Dosage:

<u>Species</u>	<u>Route</u>
Dog.....0.25-2.0 mg/lb	IM
Cat.....0.50-1.0 mg/lb	IM

f. Caution: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

4. Succinylcholine (Sucostrintm, Anectinetm)

a. Composition: White odorless solid marketed as an aqueous solution with a pH of 3.2 - 3.5. Succinylcholine is prepared as a chloride or an iodide anhydrous salt; the chloride is 1 1/2 times as potent as the iodide. Because it is similar to two molecules of acetylcholine, it is sometimes referred to as diacetylcholine.(2,4)

b. Drug classification: Muscle relaxant. A synthetic quaternary ammonium compound.

c. Use: Short-acting depolarizing neuromuscular blocking agent. The greatest use has been in horses, less commonly it has been used for wild and zoo animals. Not a common immobilizing agent because of a narrow margin of safety.

d. Warnings: Administer with caution. Prolonged apnea may occur. Prevent accidental exposure in man. Risk of death is a possibility.

e. Dosage: Not recommended for use.

f. Caution: Not recommended for use. Discard as a medical hazardous waste.

5. Nicotine sulfate (Capchur-Soltm): No longer available and should be discarded as a medical hazardous waste. The company previously manufacturing this agent has suspended the product as a result of a Federal Court order.(9)

C. Delivery systems: The discussion of equipment listed below is not intended to be an indorsement for any particular manufacturer. It is a description of the weapons that are currently available and widely accepted as a means of chemical capture.

1. Palmer Cap-churtm equipment(3,9,11)

a. General description: The Palmer Cap-Chur gun is essentially a CO₂ powered rifle or pistol designed to deliver a dart syringe. The sole purpose is to administer an effective dose of a variety of commonly used agents to immobilize an animal. Dart charges with variable load characteristics are used to inject the drug from the dart on impact.

b. Effective range: With this system, it is possible according to (Lumb and Jones) to inject from 1 to 10 ml of any liquid into an animal for distances up to approximately 40 yards. The pistol is better suited for shorter distances less than 20 yards because of lower muzzle velocities. For longer range, a similar rifle powered by a blank .22 cal charge is available.

c. Use characteristics: According to Thomas (1961), who used the gun in zoo practice, it seldom misfired or failed to inject the full quantity of drug. The range and accuracy vary somewhat and experience is necessary for best results. The key to effective use is training and practice. Keeping the weapon well maintained is critical to effective use and operation. Follow the manufacturers guidelines.

d. Target zone: The preferred "target zone" is the thick muscles of the hip. Reasonable care to avoid critical organs and bones is essential in avoiding serious consequences and unnecessary damage to the animal, including death.

e. Company information:

Palmer Chemical & Equipment Co., Inc.
P.O. Box 867
Palmer Village
Douglasville GA 30133
(404) 942-4395

2. PAXARMS Mark 24 Rifle(10)

a. General description: The standard rifle and pistol are designed to utilize one standard load for all ranges. The standard rifle uses the "PAX 22" load and the pistol uses the "BLUE TIP" charge. The system offers a velocity adjustment for range potential and impact control from 18 fps to 700 fps. It does not use explosive charges for injecting the drug load. Darts are charged with compressed air to afford safety and reliability. The impact of the dart is proportional to velocity determined by the angle of trajectory.

b. Effective range: The Mark 24 rifle offers a stated accuracy up to 100 yards. The pistol is best suited for ranges of 30 yards or less. Range is determined by velocity adjustment and angle of trajectory.

c. Use characteristics: The weapon is stated to reduce dart syringe impact that causes bone fractures in small and medium sized animals. Injects the drug on impact utilizing compressed air. Reduced noise minimizes startling animals at close range.

d. Target zone: The preferred "target zone" is the thick muscles of the hip. Reasonable care to avoid critical organs and bones is essential in avoiding serious consequences and unnecessary damage to the animal, including death.

e. Company information:

Faxarms
P.O. Box 317
Timaru, New Zealand

D. Assessing the Emergency: The most important danger to the operator using immobilization drugs is accidental injection (poisoning). In all cases of accidental injection, whatever the agent, the immediate danger to life would be either ventilatory or circulatory collapse.(6)

1. Respiratory failure: Four mechanisms contribute to respiratory failure or compromise.

a. Central depression with depression of the respiratory center and resultant hypopnea or even apnea.

b. Respiratory difficulties arising from loss of consciousness, reduced muscle tone, and upper airway obstruction.

c. Rarely there will be allergic reactions, primarily angioneurotic edema of the larynx with upper airway obstruction.

d. Ventilation will also be compromised if central stimulation occurs with generalized convulsions. Asphyxia is caused by the tongue blocking the airway during uncontrolled convulsions.

2. Circulatory failure: Circulatory failure may be related to the effect of the drug on the vaso-motor center, the heart or the blood vessels. Anaphylactic reaction may cause circulatory collapse in rare instances.(6)

3. Clinical signs of respiratory insufficiency: The principle signs of respiratory impairment include restlessness, changes in breathing characteristics (obstruction), cyanosis, increased pulse rate and early on a rise in blood pressure. All the signs may occur simultaneously leading to loss of consciousness.(6)

4. Clinical signs of circulatory failure: The predominant signs of ensuing circulatory collapse are restlessness, pale, cold and clammy skin, increased pulse rate and in most instances, a drop in blood pressure.(6)

5. Central nervous system signs: Signs may vary depending on the action of the drug that is accidentally injected. Depressant drugs may lead to comatose state without any signs of restlessness. Nausea and vomiting could complicate the clinical assessment. Some drugs cause anxiety, hallucinations, hyperexcitability and possibly convulsions.(6)

E. Treatment of respiratory failure: Treatment of the emergency can proceed after careful assessment of signs and symptoms. Resuscitation is critical and should be done promptly and correctly (CPR). Specific drug antagonists may be beneficial in counteracting the effects of the accidentally injected agent. This is a medical emergency and requires immediate intervention.(6)

F. Treatment of circulatory failure: Circulatory failure is a life threatening crisis and must be promptly treated by medical personnel. The basic principles of treating circulatory failure include the following:

1. Maintain adequate ventilation.
2. Administer IV fluids.
3. Elevate legs to facilitate venous return.
4. Use steroids if anaphylactic reaction is suspected.
5. Judicious use of vasopressors.

III. CONCLUSIONS

A. There are inherent dangers when chemical restraint methods are employed. Preparedness for the possible inadvertent human exposure is lacking.

B. As emphasized by Sedgwick and Acosta (1969), many disastrous errors have been made by inexperienced individuals attempting to use capture equipment and immobilizing drugs. At best, techniques lack precision. Many mechanical and physiological variables affect drug administration, absorption, distribution, and elimination.(3)

C. The site and accuracy of injection, the mental state and general health of the animal, and climatic conditions all influence the effect produced from chemical capture.(3)

D. Some bases reported the use of Capchur-soltm. This agent has been removed from the market by the Palmer Company in response to a Federal Court order and should not be in any inventory.(9)

E. Some bases are still using succinylcholine. It has a very narrow margin of safety and should not be used. This item should be disposed of as hazardous medical waste.

F. Drugs were being maintained in inventory by animal control activities with no direction from a veterinarian. The ability to adequately audit drug use was lacking.

G. The majority of bases that use chemical restraint agents use a combination of xylazine (Rompuntm) and ketamine (Kecalartm, Ketasettm, Vetalartm) as a bolus dose IM via a dart syringe.

H. Suprisingly, only a small percentage of respondents had well written guidelines (operating instructions, safety, training, and use). This indicates that specific guidance is needed to establish a comprehensive base plan for the use of chemical restraint agents and delivery systems.

IV. RECOMMENDATIONS

A. The base should have a regulation pertaining to animal control that addresses the methods for animal restraint and capture. The responsible agencies for animal control should be identified with specific guidance on implementation of such a program.

B. Specific operating instructions are needed. This includes how, when, and where weapons are used. A training plan to maintain operational proficiency is essential.

C. All drugs used for capture should be requested through the base veterinarian. This is essential as all agents discussed are licensed veterinary drugs that must be administered by or on the order of a licensed veterinarian.

D. Personnel should be familiar with the restraint agents. This includes the drug's actions, safety precautions, dosage, etc. Coordination for appropriate training may include base safety, security police, medical and veterinary personnel.

E. Recommend the use of ketamine and xylazine as the agent of choice for ease of administration and wide margin of safety. The mixture is made by combining 2 ml of Ketamine (100 mg/ml) with 20 ml of Rompun (20 mg/ml). The mixture is administered at the rate of 1 ml per 20 pounds of body weight.(8) Ketamine has not been approved by the FDA for use in the dog. However, some practioners feel that it can be safely and effectively used in dogs. Ketamine in combination with xylazine is now commonly used in the dog for general anesthetic purposes.(1)

F. There should be coordination with medical personnel to insure that first aid and treatment measures for inadvertent exposure are available if needed. Each emergency medical unit must be aprised of the specific chemical agents used by animal control authorities on the installation.

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