

CHEMICAL IMMOBILIZATION OF BLACK BEARS  
IN GREAT SMOKY MOUNTAINS NATIONAL PARK

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During the 1978-79 black bear (*Ursus americanus*) activity periods, personnel at Great Smoky Mountains National Park used a combination of Rompun (Haver-Lockhart) and Ketaset (Bristol Veterinary Products) to immobilize 45 bears. No problems associated with the pharmacologic properties of the two drugs were observed in bears ranging from first-year cubs to adults of both sexes. Many of the bears were removed by free-range capture from U.S. 441, a heavily traveled transmountain highway that bisects the Park, and from crowded campgrounds and picnic areas.

We attribute the successful captures to properly trained personnel and the use of Rompun and Ketaset. We favor the use of the Rompun-Ketaset combination over other immobilizing agents presently being used in bear research and management. We do not recommend using Sernylan because of its seizure-producing properties, nor M-99 due to the danger to the user, expense, and controlled use. Anectine or Sucostrin are used only as euthanizing agents.

Rompun (Xylazine), a non-narcotic compound, is a sedative and analgesic as well as muscle relaxant. Its sedative and analgesic activity is related to central nervous system depression. Its muscle relaxant effect is based on inhibition of the intraneural transmission of impulses in the central nervous system. The centrally acting muscle relaxant effect causes relaxation of the skeletal musculature, complementing sedation and analgesia.

Ketaset (Ketamine hydrochloride) is a rapid-acting, non-narcotic, non-barbiturate agent, the pharmacologic action of which is characterized by profound analgesia, normal pharyngeal-laryngeal reflexes, mild cardiac stimulation and respiratory depression. We found muscle tone usually was diminished. The anesthetic state is an unconsciousness which has been termed disassociative anesthesia in that it appears to selectively interrupt association pathways to the brain before producing sensory blockage. In contrast to other anesthetics, protective reflexes such as coughing and swallowing are maintained under ketamine anesthesia. Ketamine is detoxified by the liver and excreted by the kidneys.

Preparation of the combination involves freeze-drying or lyophilizing liquid Ketaset to achieve the powdered or crystalline pure form. Ketaset comes in a 10 ml. vial concentrated 100 mg./cc. which translates to 1000 mg. Ketaset per vial. We take 2000 mg. of Ketaset (two 10 ml. vials) in the liquid form, put the 2000 mg. in a 30 ml. serum vial, and freeze-dry the liquid. The freeze-drying process takes about 12 hours for eight vials to run simultaneously. After freeze-drying, we have 2000 mg. freeze-dried Ketaset per 30 ml. vial.

Rompun is available in a 50 ml. vial concentrated 100 mg./ml. By adding 10 ml. of liquid Rompun to 2000 mg. freeze-dried Ketaset, a 100 mg. to 200 mg. Ketaset concentration per 1.0 ml. is obtained. The freeze-dried Ketaset easily enters into the Rompun solution, becoming a clear liquid ready for injection. This combination is also very stable, with a shelf life equivalent to that of the expiration date listed on the original drug vials.

The ratio and preparation of the drug combination are very important when considering pharmacologic factors, especially when fast down-times are required during free-range captures. The combination must also provide complete immobilization for at least 30 minutes. The purpose of immobilization is to provide the most efficient ratio in an acceptable amount for rapid systemic introduction via intramuscular injection.

To provide field personnel with simple dosage information, the use of conversion factors of pounds to kilograms to cubic centimeters is avoided. A 1.0 ml. per 50 pounds of body weight dosage conversion was established for rangers. There are two reasons this weight-dosage conversion is acceptable. The range of safe administration is very broad, i.e., at the concentration provided, the drug combination ensures an extremely remote possibility of overdosing any size or sex bear. Also, the concentration and ratio of Rompun-Ketaset is ideal for dart delivery to the weight class bears handled most frequently in the Park (50-300 pounds). Resource Management personnel are responsible for immobilization of first-year cubs or family groups that present more difficult capture problems,

Bears darted with Rompun-Ketaset will typically proceed through the following stages:

1. The bear runs a few yards after darting, stops, removes the dart and walks to a more secure location.
2. Occasionally the animal returns to a food source in a picnic area or campground.
3. After approximately one minute, the bear sits or reclines and becomes preoccupied with food or garbage. The bear appears oblivious to the environment and slightly sedate.
4. About two-three minutes post injection, the anesthetic-muscle relaxant properties overwhelm the bear.
5. At four-six minutes, the bear becomes completely immobilized and the muscles are totally flaccid.

The following side effects are apparent: weaving motion of the head, rapid eye movement, and debilitation. We have not observed convulsions (as with Sernylan). Respiration, heart rate, and temperature do not appear to change. Swallowing is not inhibited and salivation does not increase. Down- (induction) times of 45 seconds in cubs to eight minutes in fat adults were observed. Most animals were down in four-six minutes. The period of complete immobilization lasts from one to three hours. Often original dosage amounts are safely administered to prolong immobilization and facilitate transportation procedures. We have encountered a problem with the eyelids staying open, requiring application of saline eyedrops during handling.

Many researchers are using the liquid forms of Rompun and Ketaset. The main problem encountered with the solutions is the large volume that must be injected into the musculature. The large volume prevents physiologically efficient drug introduction into the circulation and probably causes muscle damage. Freeze-drying the Ketaset eliminates both problems.