THE USE OF M99 ETORPHINE AND ACETYLPROMAZINE IN THE IMMOBILIZATION AND CAPTURE OF FREE RANGING ROCKY MOUNTAIN BIGHORN SHEEP[1]

by

Tom Thorne, Research Veterinarian
Wyoming Game and Fish Commission

ABSTRACT

Seventeen of 22 attempts to capture free ranging Rocky Mountain bighorn sheep were successful using M99 etorphine in combination with acetylpromazine administered via projectile syringes. Four attempts were unsuccessful because of incomplete drug injections. There was one mortality which was caused by a drug underdose followed by excess violent struggling and shock.

INTRODUCTION

The immobilization of 22 free ranging Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) using M99 etorphine and acetylpromozine was attempted from April, 1969 through December, 1970 on the Wyoming Game and Fish Commission Whiskey Basin Game Winter Range near Dubois, Wyoming. The objectives of the immobilization attempts were to evaluate the effects of the immobilizing drugs and antagonists, to capture bighorn sheep for research purposes and transplantation and to provide physiological data (Franzman and Thorne 1970).

M99 etorphine is a thebaine derivative which is chemically related to morphine (Amer. Cyan. 1966), but has narcotizing and analgesic activities many times those of morphine (Harthorn 1966). Its action is on the central nervous system. The drug has been used effectively on a wide variety of wild mammals (Wallach 1969). Acetylpromazine is a phenothiazine derivative tranquilizer which is rapidly absorbed and produces central nervous depression at a low dosage. M285 cyprenorphine and M50-50 diprenorphine are also thebaine derivatives developed as specific antagonists for M99 (Amer. Cyan. 1966).

MATERIALS AND METHODS

The immobilizing drugs were administered in combination using automatic projectile syringes and a CO_2 powered Cap-chur gun (Palmer Chemical and Equipment Company, Inc., Douglasville, Georgia). The automatic projectile syringes ranged from 3 to 5 cc in size. The sheep were darted, as nearly as possible, in the hindquarters at ranges of 15 to 30 yards. The sheep, which were on the winter range at the time of immobilization, were darted from a vehicle or by approaching

---

[1]A contribution of Federal Aid in Wildlife Restoration Project, Wyoming FW-3-R.

slowly on foot. All sheep were standing when darted and none were pursued prior to darting. Barbed syringes were used on only two sheep; collared syringes were used in all other cases. Immobilizing drug concentrations were 1 mg/cc and 2 mg/cc for M99 and 10 mg/cc for acetylpromazine. The antagonists were administered in concentrations of 2 mg/cc for M285 and 4 mg/cc for M50-50 using a hypodermic syringe.

Immediately following capture each sheep was given an intramuscular injection of 750,000 units benzathine penicillin G, 750,000 units procaine penicillin G and 1,250 mg dihydrostreptomycin and a combined parainfluenza-3 vaccine and *Pasteurella* bacterin. An eye ointment was placed over the cornea for protection of the eye. The sheep were placed in a dark, enclosed crate covering a pickup bed as soon as they began to regain coordination and strength following administration of the antagonist.

RESULTS AND DISCUSSION

Of the 22 immobilization attempts, 17 (77%) were successful and resulted in the capture of sheep. Four of the five attempts which were unsuccessful were felt to be due to incomplete drug injection and the fifth unsuccessful attempt was due to a mortality. The drug dosages and sheep reactions in the 17 successful attempts are given in Table 1.

The sheep did not seem to be markedly frightened when hit by the projectile syringe, except when barbed syringes were used. The sheep would generally run as long as the syringe remained imbedded. One ram ran approximately a quarter of a mile until a barbed syringe fell out. All other sheep ran a distance of 5 to 150 yards. They were not frightened by the report of the CO_2 rifle and did not seem to associate it or the shooter with the projectile syringe hitting them. Maximum effective range was about 30 yards, and precautions were taken to keep the CO_2 rifle from becoming too cold to fire effectively.

Most of the individuals returned to feeding shortly after they were darted, and some continued eating after they had gone down. Generally the first visible sign of drug effect was mild ataxia which took the form of an unsteady gait or uncertain stance. The first signs of reaction to the drug occurred an average of 3 minutes, with a range of 2 to 5 minutes, after injection. Ataxia generally progressed rapidly until the sheep would lie or fall down. Some went down on their knees first and then lay down. Most were able to remain in sternal recumbency. Many of the sheep continued to eat during the entire period of ataxia, and a few continued to eat even after they went down. The onset of ataxia did not seem to alarm the individuals, and other sheep in the herd payed little attention to the drugged animals. Immobilization time (given as the time from darting until the animal was in hand) ranged from 4 to 40 minutes with an average of 9.4 minutes. If the one ewe which required 40 minutes (Table 1) is not considered, the average immobilization time was 7.5 minutes. After a sheep was down it was not approached until one-half to 2 minutes elapsed. There did not seem to be any difference in reaction to the drugs between males and females.

Table 1. Sex, age, weight and drug dosages used in the capture of 17 free-ranging Rocky Mountain bighorn sheep using combined M99 and acetylpromazine.

Sex	Age	Weight (lb)	M99 Mg	M99 Mg/lb	Acetylpromazine Mg	Acetylpromazine Mg/lb	Immobilization Time (Min.)[A]	Antidote[C] M285(Mg)	Antidote[C] M50-50(Mg)	Reversal Time (Min.)
F	3	---	3.0	----	10	----	6.5	7.5	---	0.5
F	Mat.	---	2.5	----	10	----	4.5	7.5	---	1.0
F	2	---	2.5	----	10	----	4.5	7.5	---	0.5
F	4	---	3.0	----	10	----	40.0[B]	9.0	---	1.0
M	1	---	3.0	----	10	----	7.0	8.0	---	0.5
M	2	---	3.0	----	10	----	12.0	8.0	---	1.0
F	2	100	3.0	.030	8	.080	5.0	---	9.0	0.3
M	3	122	3.0	.025	8	.066	7.0	---	9.0	0.3
F	3	105	3.0	.029	7	.066	7.0	---	9.0	1.0
F	4	106	3.0	.028	7	.066	4.0	---	9.0	1.0
F	3	114	3.0	.026	10	.088	7.0	---	9.0	0.3
F	4	130	3.0	.023	10	.077	15.5	---	9.0	0.5
M	1	111	3.0	.027	10	.090	5.0	---	9.0	1.3
M	2	---	3.0	----	7	----	20.0	---	9.0	0.3
M	1	114	3.0	.026	7	.061	6.0	---	9.0	0.8
M	1	---	3.0	----	7	----	8.0	---	9.0	0.3
M	1	119	3.0	.025	7	.059	8.0	---	9.0	0.8
Average:		113	2.9	.027	8.2	.073	9.4	---	9.0	0.66

A Immobilization time given is the time required to capture the sheep after it was darted.
B This ewe had to be pursued 500 yards before she was captured.
C In all cases approximately two-thirds of the antidote dosage was administered intravenously and the remainder intramuscularly.

About one-half of the sheep did not seem to be concerned when approached and handled by their captors. The others made efforts to escape such as feeble struggling, running on the front or all four knees for a short distance, or running in one instance about 500 yards. Once captured, the sheep either did not struggle or struggled only slightly.

When immobilized, the reaction of the sheep to the drug depended upon the degree of narcosis. Respiration was generally slow and shallow. A few of the sheep displayed clonic convulsions of the neck and back muscles. Nystagmus was present in some. Excess salivation and bloating were not problems. Some of the drugged subjects displayed pronounced chewing and grinding of the cheek teeth. The grinding of the teeth, which was audible and visible from short distances, often took place before immobilization.

M285 was administered at 2-1/2 to 3 times the M99 dosage, and M50-50 was administered 3 time the M99 dose. With both antagonists 2 times the M99 dose was given intravenously and the remainder intramuscularly. The average reversal time (time required for an animal to be able to struggle or stand) was about 40 seconds with a range of .3 to 1.3 minutes. The intramuscular injection of antagonist was given to prevent any latent or prolonged effects of the M99 which might occur. The sheep remained sedated for several hours due to the effect of the tranquilizer used.

The single mortality occurred in a 2-year-old ram weighing 152 pounds. This animal was dosed with 3 mg M99 and 10 mg acetylpromazine. Ataxia was first observed in 4.5 minutes and the subject went down in 6 minutes. Immobilization was far from complete and the ram regained his feet and was pursued for an additional 10 minutes before being captured. The sheep was able to struggle violently and four personnel were required to carry it toward the pickup. While being carried to the pickup, approximately 20 minutes after capture, the sheep died. Rectal temperature was 107.4F at the time of death (normal for immobilized sheep is 101.5F). Necropsy revealed that death was due to shock, stress, and injuries suffered while struggling to regain freedom. Approximately, one fourth of the ram's lung capacity had been destroyed by lungworms (*Protostrongulus* sp.) which may have contributed to his death by reducing reserve capacity and strength.

In retrospect, it was felt that this death could have been prevented in either of two ways: once the sheep was observed to be incompletely immobilized, no further attempt should have been made to capture him; or once he was captured, additional M99 should have been administered to achieve complete immobilization and prevent struggling. The former of these two methods would probably be the most suitable.

The wide safety margin of the M99 and acetylpromazine combination and the availability of a fast acting M99 antagonist make this a very satisfactory method of capturing free ranging Rocky Mountain bighorn sheep. The induction time is reasonably rapid, and adverse side side effects are minimal. Capture with this method avoids most of the effects of stress, exhaustion, and possible injury associated with

trapping. The primary disadvantages are the limited range and accuracy of the Cap-chur gun, and difficulties in keeping the darted animal in sight until immobilization occurs.

LITERATURE CITED

American Cyanamid. 1966. General information M99 etorphine. American Cyan. Co., Princeton, N. J. 3 p. Mimeo.

American Cyanamid. 1966. General information M285 cyprenorphine. Report. Ameri. Cyan. Co., Princeton, N. J. 3 p. Mimeo.

Franzmann, A. W. and E. T. Thorne. 1970. Physiologic values in wild bighorn sheep (*Ovis canadensis canadensis*) at capture, after handling, and after captivity, J. A. V. M. A., 157(35):647-650.

Harthoorn, A. M. 1966. Restraint of undomesticated animals, J. A. V. M. A., 149:875-880.

Wallach, J. D. 1969. Etorphine (M99) a new analgesic-immobilizing agent, and its antagonists. Veterinary Medicine and Small Animal Clinician. 64(1):53:58.

DISCUSSION

QUESTION BY WAYNE SANDFORT, G & F, COLORADO: It is my understanding that M-99 isn't generally available for use. Is this true? How can you get it?

REPLY BY THORNE: It is not readily available. M-99 is a narcotic related to morphine. A narcotics permit is required to dispense it. You are not required to have a narcotics license to use it. The drug is still in experimental stages. The company that puts it out, American Cyanamid, is hard to work with and they are getting more difficult. I think this is because they imported their supply from England and they are running out. They are not sure there is enough money in it to produce it for wildlife work. There are problems in getting it, but if we are persistent enough they will give it to us. They charged us for the first time for the last batch. They charged, I believe, $87 for 60 milligrams. I don't consider that to be too expensive. I would rather they gave it to me in 1 milligram per cubic centimeter dose or concentration and I don't like that, so I'd rather they concentrate it a little more if they are going to charge for it. I feel this is a good enough drug and I wouldn't use any other drug on sheep.

QUESTION BY AL WOOLF, RACHELWOOD: I'll add to that. It is apparently more difficult now with the new forms. They don't really consider it a narcotic, but they put it on a Schedule 1 of the Narcotics and Dangerous Drug Act. (There is now a new bureau under the Department of Justice.) In addition, using M-99 would require that a research proposal for the use of the drug be sent to the Department of Justice and you would need

a permit in your own name to be able to use it. I think that one of the drawbacks of some of the game departments in getting it would be its access.

REPLY BY THORNE: That must be relatively new because I didn't know of it, although I have a narcotics permit, I have not been using it. I have the University dispense it to me on their narcotics permit. So, I may have trouble getting it next time, but if I can get it, I certainly would use it over any other drug for sheep.

The big problem is to avoid exerting the sheep or any other animal because that will kill them. Overdose them rather than underdose them because you are much safer on an overdose. That is hard to understand for those of you who have used succinylcholine where the dose is so critical.

REPLY BY WOOLF: Over the past three years we have immobilized maybe a couple hundred animals of different species and maybe 25 or 30 of these were bighorns - some of them repeated attempts, some of them on mouflon, some on hybrids.

The only animal that we have ever killed with M-99 is one that we intentionally tried to kill. This was a white-tailed deer. I don't think you can overdose an animal with M-99. We killed with an underdose and it died in much the same way that your sheep did. Had we wanted to save the animal early in the game, we probably could have done so.

We gave it a light dose. This struggling is very characteristic of a light dose because you don't get a complete immobilization. The animal laid there and started hyperventilating, breathing rapidly and shallowly. If we had given it the antagonist to reverse it, the animal would have been fine or had we given more M-99, it would have been fine.

By the way, I give it intravenously in a case like this and it very rapidly immobilizes them thoroughly. Or you can give a tranquilizer but it would have to be given intravenously for an extremely rapid affect. In the case of this deer we did nothing. We just wanted to watch it to see what would happen. It had reached a point of excitement and hyperventilation so that it died of respiratory alkalosis (?) in about three hours. This is probably why your sheep died. Giving it something else might have done it. Probably, just letting it go wouldn't have.

REPLY BY THORNE: He was relaxed enough. I had the tranquilizer in it and I don't believe he'd have been in any trouble if we had let him go. I won't use M-99 on deer anymore. I don't feel it is a good drug for deer. It's good for elk, moose and sheep. I haven't tried it on antelope yet so I don't know on them.

QUESTION BY TONY MORRIS, GRADUATE STUDENT CSU: Have you ever used crossbows? In South Africa we need a much larger dose than you can deliver in a small projectile when working with rhinos and elephants.

We have modified the crossbow to deliver a large dart. The effective range is between 60 and 100 yards and it is very accurate. These guns just wouldn't do. We shoot them from helicopters. We use M-99 for everything except carnivores. We also include the tranquilizer in the initial dosage. When we get to the rhino or elephant we inject half the antidote. This wakes it half up and we stand the animal half up and load it into the truck.

Have you had trouble with the weight of the dosage with larger animals here?

REPLY BY THORNE: We haven't used the crossbow in Wyoming. We have one but it has a broken string and I haven't gotten around to fixing it. We used the 32 gauge shotgun that has the 22 caliber modifier. We use that on the larger animals in Wyoming. Two weeks ago, after my air rifle quit working, I killed a sheep with the 32 gauge shotgun. I shot a mature ewe with the smallest charge at about 20 yards. We hit her just perfect in the hind leg behind and perhaps a little above the knee. My assistant thought the dart had bounced out. The sheep ran off, laid down and went through the symptoms of being drugged. We caught and loaded it. The sheep was doing fine. We painted its horn and give it antibiotics. I just started giving the antidote and she started fading. I couldn't raise a vein in the neck or leg. In desperation, I put it in the lung but by then she was gone.

We opened the sheep up and she was full of blood. The dart had entered the hind leg, had penetrated clear into the mass of the hind leg. Then it turned and went behind the femur, went up and forward, passed into the abdomen just under the skin and just under the udder, went into the abdominal cavity and then penetrated into the pregnant uterus. This punched a hole about the size of my finger in the uterus and she bled to death through this hole. During pregnancy, the uterus of course, is extremely gravid.

I have decided not to use the shotgun any more on sheep and if I can't get my air rifle working, I probably won't shoot a sheep. The shotgun with the 22 blank modifier is better than the old type using the blank shotgun shell, but it is still unreliable. One will go out hard and the next one easy.

I think your crossbow could be used well in Wyoming on our larger animals such as moose. Of course you cannot use the air rifle on moose and we have a little trouble getting into range of moose, even with our shotgun.

REPLY BY MORRIS: Any bow-driven projectile does not have the shock power. A hunting arrow kills through hemorrhage not through shock power. Whatever hits the animal, even from a pretty powerful bow, hasn't got shock which will do damage.

QUESTION BY AL WHITAKER, G & F, COLORADO: Is there a possibility of using M-99 in a powdered form?

REPLY BY THORNE: The very first samples I got were in a powdered form. I think the people in Africa are lucky because, unless it has changed, they can get it in a powdered form. I wish we could work with the English company instead of the American company on this. I use the powder to mix concentrations of up to 4 milligrams per cubic centimeter and it was great. Now they dilute it. Apparently it is more expensive to produce in the powdered form. Hopefully, if enough of us who use it keep asking for it, maybe we can get it. It will preserve longer in a powdered form and you can make it up into your own concentrations.

In Africa, they will actually use the tranquilizer in some cases as the diluent. I was using a cubic centimeter promazine base for ten milligrams. I could mix a couple of milligrams of the M-99 with the tranquilizer rather than using a sterile saline or diluent fluid and come up with a total volume of only 1 cubic centimeter. This would have everything I would need to capture a sheep.

REPLY BY WHITAKER: Might this be injected in a powdered form?

REPLY BY THORNE: There are a couple of companies that are experimenting right now with possibilities of administering drugs in powdered forms. Apparently they are having fairly good luck. Again, their problem is acquiring the powdered form. One company is using a syringe. The other, a hollowed out bullet.

REPLY BY WHITAKER: Have you used succostrin on sheep at all?

REPLY BY THORNE: No, I haven't. Some people have and it can be used, but they have had a higher mortality rate than I have had. I like M-99 so much better on any animal except a deer that I think it is what we ought to use.