DRUG IMMOBILISATION OF INDIAN ELEPHANT[1]

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(With a plate)

Critical data from the drug immobilisation of six adult wild elephants in U.P. in 1983-84, using Immobilon (etorphine/acepromazine) and Revivon (diprenorphine) are reported. A standard Distinject N60 powder rifle and accessories was used for darting, with the addition of a "radio-dart" in three cases. Complete recumbancy was achieved using doses of 3.0 to 3.5 ml Immobilon (7.4-8.6 mg etorphine, 30-35 mg acepromazine). Induction times varied between 15 and 35 minutes; "down" times between 30 and 324 minutes and revival times between 4 and 41 minutes.

INTRODUCTION

Drug immobilisation has been routinely employed for the capture of the African elephant (*Loxondonta africana*) since the mid-sixties and many reports on methodology and dosages exist in the literature (Young 1973, Harthoorn 1976). There are several reports on the use of this method with the Asiatic elephant (*Elephas maximus*) in Malaysia (Jainudeen and Khan 1977, Jainudeen *et al.* 1971) and Sri Lanka (Jones 1975, Hofmeyr 1979). In India drug immobilisation of elephants using the powerful morphine derivative etorphine hydrochloride or "M. 99", has been reported in two isolated cases only: one in Orissa (Choudhury & Patnaik 1982), and one in West Bengal (Ghosh 1982) which produced rather atypical results.

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The method has a number of potential uses in the context of elephant management in India. If used to capture elephants for domestication, in addition to being highly selective, it has the advantage of causing less disturbance to the wild herds than traditional methods such as mela shikar or khedda. In a well planned immobilisation operation the candidate can be put to sleep without ever being aware of the presence of the capture team. For dealing with crop raiders or rogues the method allows a rapid and safe capture of the culprit and subsequent translocation to a new release area or captivity. This has been achieved successfully in Malaysia (Jainudeen and Khan, l.c.). Similarly, the temporary immobilisation of a sick animal for examination and treatment can be achieved with a minimum of distress to the patient.

In the light of the above, we present information on six drug immobilisations of wild elephants, carried out during the preliminary phase of a radio-tracking study of elephant habitat utilization in Rajaji Sanctuary in north-western U.P., in 1983-84. The aim in each case was to fix a radio-collar to the immobilised animal and release it as quickly as

possible. However, the details of the procedure would apply equally well to any situation where drug immobilisation of elephants was being attempted.

METHODS

All six animals were darted with Immobilon (Reckitt & Colman, Hull, U.K.), a mixture containing 2.45 mg/ml of the narcotic etorphine hydrochloride and 10 mg/ml acepromazine maleate. The antagonist used was Revivon (Reckitt) which contains 3.0 mg/ml diprenorphine hydrochloride and is a specific antidote for etorphine. The acepromazine is not antagonised and has a residual tranquilising effect on the animal after it is remobilised. (Immobilon has been widely used in the immobilisation of African elephants and to a limited extent on the Asiatic elephant.)

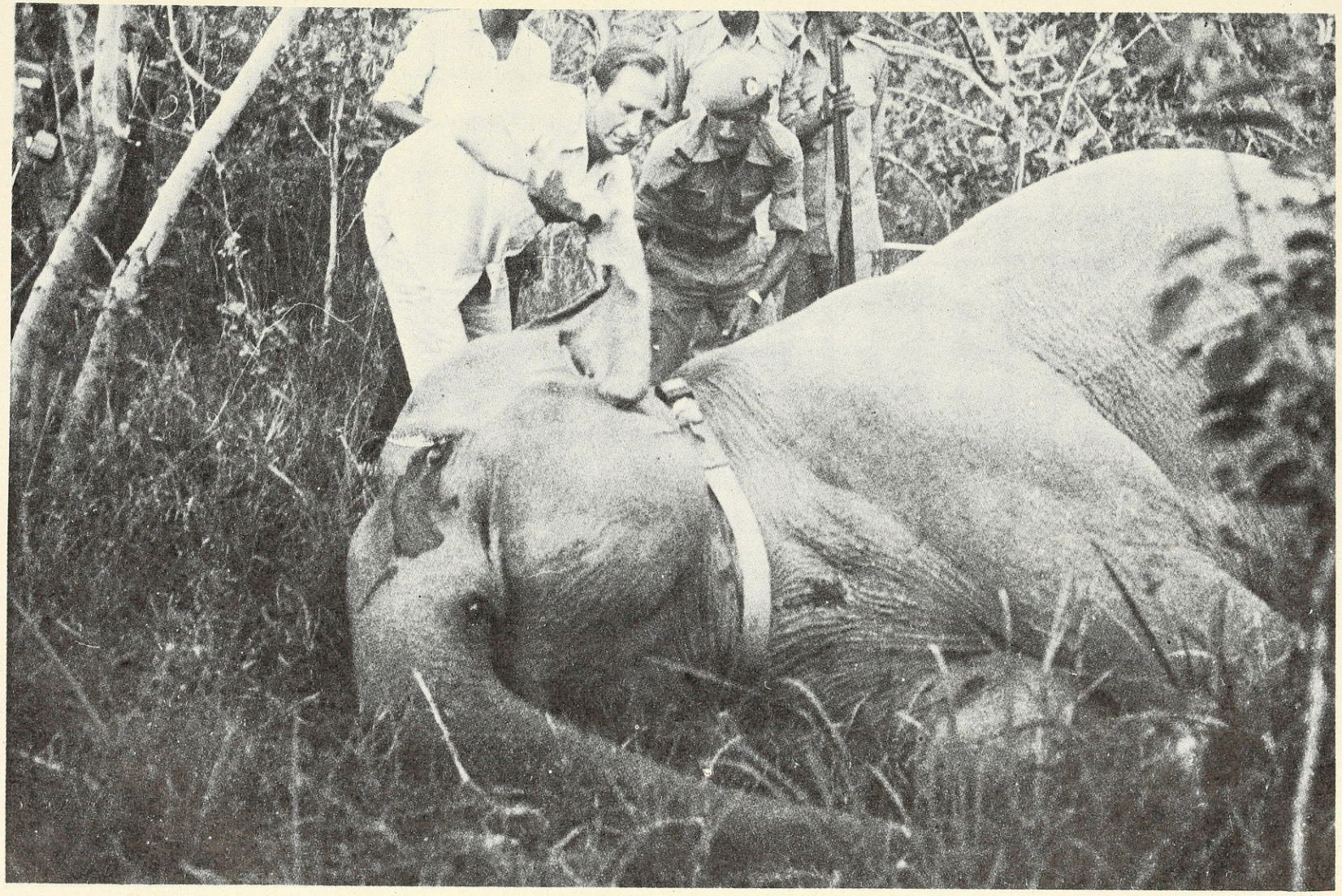
Particular care was taken to ensure that an antidote to etorphine suitable for use in humans was readily available whenever this highly dangerous drug was being carried in the field. A clearly labelled 'human' pack containing six 1 ml vials of Narcan injection of naloxone hydrochloride 0.4 mg/ml (Wintrop Laboratories, Surbiton, U.K.), a sterile 2 ml syringe and needles was always to hand, in case of accidental administration of Immobilon to a person. It was also ensured that at least two members of a capture team were conversant with the procedure for administration of the antidote should a human emergency arise.

The immobilising solution was darted into the elephants, using a Distinject N60 powder rifle and accessories (Peter Ott & Co., Basel, Switzerland). A 3 or 4 ml aluminium syringe barrel was employed and fitted with a standard Distinject NM6 needle, 63 mm long and 2 mm in diameter. This had a side hole 8 mm from the tip, in addition to a terminal hole, and a retention collar 29 mm from the tip. In three cases the dart used had a standard Distinject feathered stabiliser (flight), while in the other three a "radio-dart" was fitted. This consisted of a dart made for the Cap-Chur gun (Wildlife Materials Inc. Carbondale, Illinois, U.S.A.), modified by the replacement of the Cap-Chur stabiliser with a Distinject stabiliser which was found to give better flight characteristics.

In cases where a standard dart was employed, the prescribed 0.22 blank charge for the syringe size/distance involved was used, as per the chart provided by the manufacturers of the Distinject equipment. Likewise, the variable rear sight of the rifle was set as per the chart. When using a radio-dart, however, the most powerful (orange) charge was selected irrespective of distance and the sight setting adjusted to compensate for the additional weight of the radio transmitter in the rear of the dart.

Tracking of the radio-dart signals was achieved using a Wildlife Materials Inc. TRX 6 receiver fitted with a collapsible hand-held Yagi antenna. Radio frequencies of the transmitter-receiver systems were in the range of 150-151 MHz.

Candidate elephants for immobilisation were carefully approached on a domestic elephant in five cases and on foot in the sixth case. The aim was to fire the dart high into the hind quarters of the candidate from a distance of between 30 and 45 m. A dart sited high in the rear of an elephant is less likely to get dislodged by vegetation as the animal moves away, than one placed lower down or in the side of the animal. Darts lodged in the shoulder region are sometimes quickly removed by the animal, using its trunk, making



Adult female (Case No. 3) immobilised in safe lateral recumbancy, during radio-collaring operation. (*Photo:* V. K. Verma)

subsequent visual identification or radio-tracking of the darted individual impossible.

Every effort was made to disturb the candidate individual and its companions, where present, as little as possible prior to firing the dart. In some cases the individual was apparently totally unaware of the approach of the domestic elephant. This was also true in the case of the individual darted on foot, where the shot was fired from a tree, 4 m above the ground. Similarly, after firing the aim was not to harass the darted animal but merely to keep it in view from a distance — an extremely difficult objective to achieve in the mixed deciduous forest of the Rajaji Sanctuary.

Revivon was normally injected into a large vein in the ear, when the animal was ready for release. In one case, however, due to the partial natural recovery of the elephant making close approach difficult, the antidote was fired into the lower shoulder with a dart. (The dart was pulled out by the animal, using its trunk, shortly after revival.)

Results

Details of the six immobilisations under consideration are shown in Table 1. All individuals were fully adult and complete recumbancy was achieved in five cases, using doses of between 3.0 and 3.5 ml Immobilon, equivalent to 7.4-8.6 mg etorphine and 30-35 mg acepromazine respectively. The sixth case (No. 4 in Table 1) received only a partial dose of Immobilon (1.75 ml = 4.3 mg etorphine and 17.5 mg acepromazine) as a result of malfunction of the dart and, although immobilised, full recumbancy was not achieved.

Induction times (time from darting to going down) varied between 15 and 35 minutes in the four cases where they were ascertained. Animal No. 4 which received the smallest dose (1.75 ml) took 35 minutes to reach only partial recumbancy. However, the series is too small to provide definite conclusions about a possible relationship between dosage and induction time. In any case, there are a number of other factors which influence rate of induction, such as needle site, angle of entry and state of alertness of the animal prior to darting.

With all uses of immobilising drugs an important aim is to revive the animal as quickly as possible. With very heavy species such as elephant and rhino it is particularly important to minimise the time the animal is in a recumbant posture. Elephants in particular should not be left in sternal recumbancy for more than about 20 minutes. With these considerations in mind, Table 1 shows the time individuals were "down" (Range 30-324 minutes). This is the time that elapsed between the animal going down (induction) and getting up (revival). In cases where either time is not known a "maximum" time down is indicated which is either the time between darting and revival (Cases 3 and 6) or induction and the observation of the already revived (standing) animal (Case No. 4). Actual time down is in all likelihood appreciably less than maximum time in all three cases.

In this series of immobilisations the animals were given Revivon as soon as the radio-collar had been fitted, except in Cases 4 and 6. Where the animal was found before induction it was possible to complete the operation and get it on its feet within between 30 and 44 minutes, some 10 minutes of which was "waiting time" allowed for the drug effect to deepen prior to disturbing the animal by handling.

"Down" time in Case No. 6 was extremely long, the malfunctioning of the radio-dart resulting in a big delay in locating the elephant.

TABLE 1

DATA ON SIX DRUG IMMOBILISATIONS OF WILD ELEPHANTS IN U.P.

Case No.	Date	Age/Sex	Total time(mins) Induction	Down	Revival	Dosages ml Immobilon (mg Etorphine) (mg Acepromazine)	ml Revivon (mg diaprenorphine)	Site of dart	Remarks
1.	13.4.83	Adult M (Machna)	31	42	4	3.25 (8.0) (32.5)	4.0 (12.0)	Left of spine anterior to base of tail	On revival the animal got up quickly and walked towards the riding elephant before moving away.
2.	20.4.83	Adult M (Tusker)	22	44	9	3.0 (7.4) (30.0)	4.0 (12.0)	Right hind limb middle of thigh	Walked briskly away into the jungle after revival.
3.	27.5.83	Adult F	—	max. 78	6	3.0 (7.4) (30.0)	3.5 (10.5)	High on back on right	As animal was darted late in the evening and in very thick jungle it was not observed going down but was located 55 minutes after darting with the help of radio dart signals. It was immobilised, but neck, trunk and ears were mobile. On revival it got up quickly and immediately charged the domestic elephant but on hearing the report of a 12 bore shot gun it ran off.
4.	30.10.83	Adult F	35	max. 30	N.A.	1.75* (4.3) (17.5)	Nil	Low on left thigh	Radio dart dislodged after 500 m; animal only partially down when found and struggling to get up but unable. After 30 mins standing, swaying from side to side and charged vigorously when approached on domestic elephant; after another 30 mins gently swaying from side to side but placid; animal was left to recover without further intervention. *The dart fired contained 3.5 ml Immobilon but on recovery plunger cap was unexploded and 1.75 ml drug remained in dart, hence 3.5-1.75 = 1.75 ml only discharged into animal by impact.

TABLE 1 (contd.)

5.	3.12.83	Adult F	15	60	41	3.50 (8.6) (35.0)	3.5 +2.5 (10.5 +7.5)	Base of tail on right	Eleven minutes after being given the antidote the animal stood up slowly and then sat down again. After another 26 minutes tried to stand and then lay down again. Another 2.5 ml of Revivon was shot in after a further 4 minutes, she stood up immediately, still swaying a little. After another 18 minutes there was increased muscular movement. She attempted to charge the domestic elephant as it walked in front of her. She stood in the same spot for 7 hours, when she moved off and eventually joined her calf and herd.
6.	17.4.84	Adult M (Tusker)	—	max. 324	9	3.0 (7.4) (30.0)	3.0 (9.0)	Left back above base of tail	A radio-dart was used in this case but on impact the battery was dislodged and therefore not emitting signal. Dart subsequently fell off animal prior to going down. The animal was finally located in very thick jungle after 5 hours, 1.5 km from darting place and was too active to put on radio collar. Revivon was shot in intramuscularly in left forelimb. Immediately on getting up after the antidote was given the animal sprayed itself and stood in the same spot for another hour with its ears flapping continuously.

Although induction time is not known, the animal was presumably down for approximately 5 hours (300 minutes). Fortunately it was in lateral recumbancy and appeared to suffer no ill effects from such a long immobilisation. Body temperature was probably elevated, as indicated by the animal cooling itself by spraying gastric fluid on its body and excessive ear flapping following revival.

Doses of Revivon ranged from 3 to 6 ml (9 to 18 mg diprenorphine) and were of either equal or greater volume than the amount of Immobilon given to the animal. In Case No. 5 due to an unusually slow response to the initial intravenous injection of 3.5 ml Revivon a further dose of 2.5 ml was given after 41 minutes by dart into body muscle which brought an immediate response.

What may be regarded as normal revival times (time between injection of Revivon and animal standing up) were achieved in Cases 1,2,3 and 6, showing a range of 4 to 9 minutes. Case No. 5 took an unusually long time to get up permanently, *viz.* 41 minutes after the first (intravenous) dose of Revivon. She also took an extremely long time to regain full mobility, standing in one spot for 7 hours after revival. It is not clear what was responsible for this slow return to normality. The dose of Immobilon (3.5 ml) was the largest in the series but the etorphine should have been quickly antagonised by the equal volume of Revivon. However, the first dose of Revivon given was out-of-date stock and may have had a reduced potency. There was rapid revival after the second (intramuscular) dose of Revivon from fresh stock. However, the long period of ataxia following revival may have resulted from the high dose of acepromazine (35 mg) which has a prolonged tranquillising effect after recovery from the etorphine brought about by the antagonist (Revivon).

The radio-dart proved useful in locating the darted individual in only one case out of three in which it was employed, *viz.* No. 3. In Case No. 4 the charge proved inadequate for the distance, resulting in the radio-dart being lodged low down in the thigh from where it was soon brushed off as the animal moved away through thick vegetation. In Case No. 6, although the dart was satisfactorily sited high on the animal near the base of the tail, it became dislodged after some distance, presumably as the animal passed under a low branch of a tree. In addition, the battery was apparently displaced on impact resulting in the immediate loss of the radio signal. The immobilised animal was only found after a very prolonged visual search in particularly dense jungle.

Discussion

The results reported here indicate that a dosage of 7 to 8 mg etorphine in combination with 30 to 32 mg acepromazine, is effective for the immobilisation of wild adult Indian elephants. This upper limit is in general agreement with adult dosages reported in the literature from other countries (Jainudeen and Khan l.c.; Jainudeen *et al.* l.c.). Lower dosages than 7 mg have been used successfully by several workers but we recommend that not less than 6 mg should be used on adult elephants in order to ensure relatively rapid immobilisation without the necessity of a topping-up dose. Certainly a dose as low as 4 mg runs the risk of a long induction period or incomplete immobilisation as in Case No. 4 reported here.

The induction times in this short series show a similar range (15-35 minutes) and mean (26