BTAP Manual

Wild tiger capture and immobilisation

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Wild tiger capture and immobilisation

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Cover photo: First successful immobilisation and translocation of a tiger by Bangladesh Forest Department and Wildlife Trust of Bangladesh in the Sundarbans in February, 2011. Photo credit: Christina Greenwood.

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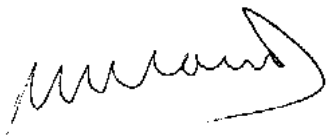
ENDORSEMENTS

The safe capture and anaesthesia of wild animals such as tigers is a specialist task best carried out by trained and experienced staff. This manual outlines best practice in such endeavors, taking into account the particular circumstances that arise in Bangladesh. Techniques are described that have been tried and tested over many years in other countries by experienced wildlife biologists and vets working together. Only those drugs that have proven dependable and safe are advocated, and guidance is given throughout concerning the safety of both humans and animals. However, merely reading a manual does not make the reader an expert and it is the authors' stated aim that practical training from specialists in the field will be offered to accompany this manual. As a result, Bangladesh Forest Department staff should receive only the highest standard of training in this difficult work."

Dr. John Lewis
Veterinary Director, Wildlife Vets International

This manual is well presented and comprehensive for use when immobilising, in particular, large carnivores like tigers. It has general sections applicable to a wide range of species. The equipment and drug combinations, discussed and explained, reflect considerable practical experience in working with these animals and represents the current standard. All the systems available (remote delivery and drug combinations) have advantages and disadvantages, with no system ideal for all circumstances and conditions. This needs to be considered by the responsible veterinarian prior to undertaking an immobilisation of wildlife and after appropriate consultation with experienced colleagues. I would like to endorse this manual and recommend its use to colleagues.



Dr. Richard A. Kock
Professor of Wildlife Health and Emerging Infectious Diseases, Department of Pathology and Infectious Diseases, Royal Veterinary College, London

Capturing wild tigers and their immobilization requires special skills and competencies and they can not be achieved without training, knowledge, experience and practices. In order to train up such human resource a manual like this will be immensely valuable. Available wildlife knowledge taking together with real life situation of Bangladesh has given the manual special value and it will be able to serve local needs and add to the knowledge of wildlife management. Bangladesh although is famous for having Royal Bengal Tiger as its home, its professionals either biologists or vets have made very little contribution towards generating and accruing such knowledge and practical knowhow. This manual will be the beginning of such efforts and will provoke to produce many more documents in this line. I strongly believe this manual will not only be helpful to practitioners but also to the undergraduate veterinary students. I wish its wide circulation and use. I sincerely thanks to its authors for producing such a useful document.

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We are very grateful to Dr. Richard Kock (Senior Veterinarian, ZSL) for his review, suggestions for improvement, and endorsement of this manual. We are also thankful for the advice and input from Md. Anwarul Islam, James L. D. Smith, John Goodrich, Nitish C Debnath, and Christina Greenwood. It is also important to note that for the content of this document we have relied on several other documents for information and figures (Palmer Cap-Chur Inc. 2003; Kreeger and Arnemo, 2007; Lewis and Goodrich 2009).

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EXECUTIVE SUMMARY

Tiger human conflict (THC) is a serious conservation issue in the Bangladesh Sundarbans; every year many people and livestock die from tiger attacks and tigers are also killed when they stray into villages. This manual is aimed at providing the Bangladesh Forest Department (FD) with guidelines for immobilisation and capture of wild tigers in the Sundarbans of Bangladesh. The information in this manual is organised in sections that reflect the sequence of decision points commonly encountered in a stray tiger situation: Situation assessment, capture, drug preparation and delivery, and transport and release. The situation assessment includes environment, people, and tiger assessments. These assessments are needed to plan a course of action that will minimize the risk of injury or death to humans and tigers during the tiger capture and immobilisation. The capture section outlines the common methods of tiger capture (box-traps, snares and free darting); in each case noting their advantages and disadvantages, together with set up and monitoring instructions. The drug preparation and deliver section contains information on how to prepare drug dosages of the required strength, and details the various drug delivery methods suitable for immobilising tigers in Bangladesh (dart gun, blow pipe, and jab stick). The monitoring section outlines how to check if the tiger is fully immobilised, how to give an overall general heath check, and how to monitor the tiger's vital rates and recovery during anaesthesia. This section also contains instructions on how to respond to potential anaesthetic complications. The last section provides guidelines on how to safely transport and release tigers that have been captured. The overall information provided in this manual is basic, and it is strongly advised that FD staff do not use this manual without practical training and experience in the methods outlined. Also, it is strongly advised that immobilisation of wild animals by FD staff is done under direction of a qualified veterinarian. Furthermore, this manual covers how to immobilise and capture a wild tiger, but does not provide guidance on when to make the decision to carry out such an operation. Guidance on when to use immobilisation and capture as a management tool is provided in a separate THC protocol document

1. INTRODUCTION

Tiger human conflict (THC) is a serious conservation issue in the Bangladesh Sundarbans (Barlow et al. 2010). Every year many people and livestock die from tiger attacks and tigers are also killed when they stray into villages (Barlow 2009). Stray tigers are often killed because the authorities currently do not have immobilisation skills that would allow additional management interventions, such as relocation and collaring, to help mitigate the conflict (Barlow et al. 2010).

Immobilisation of wild animals is the act of limiting their movement or making them incapable of movement temporarily. Wild animal capture and immobilisation is commonly used for managing many wildlife species (Kreeger and Arnemo 2007), and an integral part of wildlife research (Goodrich et al. 2001). Wild tigers may need to be captured and immobilised for various purposes like rescue, relocation, monitoring, diagnostic testing, management of disease, and euthanasia (Sanjay 2010). However, wild tiger capture and immobilisation requires specialist training to ensure the process is carried out as safely and humanely as possible.

This manual is aimed at providing the Bangladesh Forest Department (FD) with guidelines for immobilisation and capture of wild tigers in the Sundarbans of Bangladesh. The manual is focused specifically on situations where tigers have strayed into villages, but the information presented may be of use in other situations, such as immobilising and capturing tigers inside the forest, or for capturing tigers for research or monitoring purposes. The information in this manual is organised in sections that reflect the sequence of decision points commonly encountered in a stray tiger situation (Fig. 1).

Figure 1. Sequence of decision points to capture and immobilise stray tigers.

The FD capture and immobilisation team should ideally be made up of 6-7 staff, including a leader, someone to liaise between the team and the authorities/villagers and village tiger response teams (VTRTS – who are trained to help mange the crowd in stray tiger situations), someone to dart the tiger, someone to monitor the tiger during anaesthesia, and 2-3 assistants. It is important to note that the information in this manual is basic, and it is strongly advised that FD staff do not use this manual without practical training and experience in the methods outlined. Also, it is strongly advised that immobilisation of wild animals by FD staff is done under direction of a qualified veterinarian.

This manual covers how to immobilise and capture a wild tiger, but does not provide guidance on when to make the decision to carry out such an operation. Guidance on when to use immobilisation and capture as a management tool is provided in a separate THC protocol document (Greenwood et al. in prep.).

2. SITUATION ASSESSMENT

2.1. Environment assessment

It is important to assess the local environment where the immobilisation and capture will take place in order to minimize the risk of potential hazards (Box 1). After darting, the anaesthetic agent will take several minutes to take effect. In the time between darting and complete anaesthesia, the tiger may move; becoming lost inside the forest, drowning in water, or getting injured where it falls. Weather, temperature, and time of day should also be taken into account. The weather may influence decisions or equipment needs, because the aesthetic agent will hinder the tiger from regulating its body temperature so blankets may be needed to keep the tiger warm, or a supply of water or ethanol to keep it cool. The number of daylight hours available for the immobilisation team to work in will also influence equipment needs and plans for monitoring and release.

In the majority of cases, conditions will be far from ideal, and there is ample scope and need for improvisation. It may be also necessary to plan moving the tiger once anaesthetised to a more suitable area if, for example, there is nearby water in which tiger could drown or high areas that it could fall off of during recovery.

Box 1. Instructions: Environment assessment

- Identify and mitigate (as far as possible) potential physical hazards.
- Assess and prepare for number of daylight hours available.
- Assess and prepare for weather conditions.
- Incorporate environmental factors into plan for moving or releasing tiger after anesthetisation.

2.2. People assessment

When a tiger strays into a village, people often surround the tiger. As time goes on, the crowd grows as people arrive in the area to see the tiger. If the authorities cannot control the crowd then the tiger is normally killed. A large crowd and noise can make the tiger nervous and scared and so may provoke the tiger to attack nearby people. The crowd may be so angry that it is impossible or unsafe for the immobilisation team to approach and deal with the tiger. Furthermore, the people situation may influence options for monitoring, moving, or releasing the tiger after it has been anesthetized. So it is wise to manage the crowed from the beginning of the incident and keep the crowd safer distance (Box 2) from the tiger.

Box 2. Instructions: People assessment

- Assess number and mood of crowd.
- Coordinate crowd control with Village Tiger Response Teams, local administration, Bangladesh Rifles, Coastguard, and police.
- Keep the crowd at least 100m away from the tiger.
- Incorporate people factors into plan for, immobilising, monitoring, moving, and releasing tiger.

2.3. Tiger assessment

Prior to anaesthesia, there are several factors to be assessed: weight, sex, age, physical condition, and psychological condition (Box 3). In case of a wild tiger that has strayed into a village, only visual assessment is possible. Don't get too close to tiger (Box 4). Use binoculars to assess the tiger from a distance. The weight needs to be estimated to calculate the amount of drug to use. Two people should do this and discuss their estimates. Sometimes it is not always easy to get a close look at the tiger, but for the Sundarbans, female tigers will weigh roughly 75-85 kg and males may weigh 110-140 kg (Box 29). Young tigers may require more and older tigers may require less drug per unit body weight than prime-age adult tigers. Furthermore, a starved, sick, exhausted, or malnourished tiger will usually require less dosage than a healthy, well-fed tiger. There is a higher risk of mortality for tigers in bad physical condition, despite everything being done correctly. Excited tigers require higher anaesthetic doses, take longer to become recumbent, and are prone to more anaesthetic complications. A critical period of stress for a tiger is the period between when it first detects a person nearby and when it is anaesthetised; stress levels increase dramatically when a tiger detects a person nearby and the tiger may hurt itself trying to escape.

Box 3. Instructions: Tiger assessment

- Estimate weight, sex, and age of tiger.
- Assess physical and psychological condition of tiger.
- Minimize excitement to tiger prior to anaesthetic induction.

Box 4. Working safely with tigers

When working with tigers the following precautions may reduce the risk of injury or death to people or the tiger. A forked stick can be very useful to hold or beat off a tiger or make yourself look more threatening. A gun can be used to either scare away the tiger with a blank fire, or to shoot the tiger as a last resort if human life is being threatened. It is also important to be aware that tigers will naturally attack animals that are afraid of them and are trying to escape. If you face the tiger together as a team then the tiger may be less likely to attack. Also, the more the tiger feels threatened or angry (for example if people are throwing stones at the tiger) then the more likely the tiger is going to attack. Likewise a tiger may feel threatened if someone is too close. It is therefore a good idea to keep at least 100 m away unless you have to get closer to save someone's life or capture the tiger. Surrounding the tiger may also give the tiger no option but to attack. Leaving an escape route gives the tiger the option of running back to the forest

Instructions: Working safely with tigers

- Carry a stick or gun.
- Do not turn your back on the tiger or run away.
- Make noise and back away slowly (if the tiger makes a charge).
- Do not make the tiger angry.
- Never surround the tiger.
- Do not get too close to the tiger unless absolutely necessary.

3. CAPTURE

For any capture method you must aim to minimise the potential for pain, distress, or suffering. There are three main ways to capture tigers: box-traps, snares, and free darting. Box-traps and snares are best used when trying to catch a tiger in the forest, whereas free darting is best for capturing a tiger in a village.

3.1. Box-traps

The advantages of the box-trap are that the captured tiger is safer for humans to approach and that the tiger can be safely observed until it has recovered from the drugs. A drawback of box-traps is that there is some risk of the tiger breaking its teeth when it tries to escape or charge in the direction of approaching people. To reduce this risk a wooden box-trap should be used instead of a metal grill type cage (Fig. 2). The wooden box also has the advantage that it will reduce the risk of the tiger overheating.

Figure 2. Wooden box-trap design for catching tigers in Sumatra.

If a box-trap is used then it is baited with live/dead animals to encourage the tiger to enter. If the tiger is captured then drugs can be given with a blow pipe or jab stick. Care should be taken to prevent curious people getting close to the trap which may lead to the trap being activated or stressing any captured tiger. To minimise the time spent by the tiger in the box-trap, the traps should be ideally set with trap transmitters and checked at least twice a day (Box 5). This is essential to minimise the chances of stress, overheating, or injury to the tiger. When checking the box-trap

the team should also approach as quietly as possible to avoid stressing any captured tiger. After capture of any tiger all box-traps should be closed to avoid the chance of unnecessary re-capture.

Box 5. Instructions: Box-traps

- Keep people away from the box-trap area.
- Set trap transmitters and check box-traps at least twice a day (morning and evening).
- Approach the box-trap quietly.
- Use a blowpipe or jab stick to deliver anaesthetic if needed.
- Close all box-traps after a tiger is captured.

3.2. Snares

Two types of snare are commonly used: the Aldrich snare and the Thailand snare (Fig. 3) (Frank et al. 2003). Swelling of the paw and minor abrasions are a common injury with snares, and there is also a small risk of more severe lacerations (Goodrich et al. 2001). Breaking of toe bones or breaking of legs is also possible, but extremely rare (Goodrich et al. 2001). Snares can take several hours to set up but are easy to transport. Setting snares safely to minimize danger of injury to tigers and people involved requires training by experts and experience, so snares should only be used by trained, experienced personnel. Jonkel (1993) provides detailed information on snare safety and Flaa et al. (2009) provide detailed information acceptable components and construction.

Snares can be set up on any trail or path that the tiger uses (indicated by tracks, spray, or scrapes), or they can be set up around bait or a tiger's kill. To set up snares around bait of a tiger's kill, block off most directions and place snares in the remaining paths leading to the bait/kill. When the tiger is snared then a darter and assistant can approach the tiger to dart it. People must be kept away from the snare area to avoid people stepping in snares or encountering a tiger. It is important to fix snares to immovable objects (Box 6), and to make the connection as short as possible (less than 1 m is best) so that the tiger cannot escape or injure itself. If a tree is used it should have a width of at least 30 cm. Small trees and low branches close to the snare should be removed so that a snared tiger cannot get entangled and hurt itself or twist and break the snare. Tigers in snares can be exceptionally dangerous for local people because snared tigers can be very aggressive. Further, a captured tiger may hide quietly and attack when a person has approached too closely. Therefore, care should be taken to prevent curious people getting close to the snares which may lead to the snare being activated or stressing any captured tiger.

To minimise the time spent by the tiger in the snare, the snares should be checked at least twice a day, or be fixed with trap transmitters. This is essential to minimise the chances of stress, overheating, or injury to the tiger. When checking the snare the team should make some noise when approaching to avoid surprising the tiger or having a dangerous confrontation. Delivering drugs to snared tigers is best done with a dart gun from 10-20 m away. After capture of any tiger all snares should be closed to avoid the chance of unnecessary re-capture.

Box 6. Instructions: Snares

- Keep people away from the snare area.
- Fix snares to immovable objects (like trees >30 cm diameter).
- Make the connection of the snare to the object as short as possible (>1 m is best).
- Remove small trees close to the snare tree and low branches.
- Check snares twice a day (morning and evening).
- Make noise when approaching a snare set.
- Deliver drugs using dart gun.
- Close all snares after a tiger is captured and anesthetised.

Figure 3. Aldrich (A) and Thailand (B) snares.

3.3. Free darting

In some circumstances (such as a stray tiger situation) it is necessary to dart a tiger without first catching it in a snare or a box-trap. The darter normally hides in a tree or camouflaged cage and darts the tiger when it comes close (Smith 1983). Alternatively, sometimes it may be possible to dart a tiger in a village area by approaching it on foot, although this may be dangerous. The advantage of this method is that it reduces the risk of the tiger injuring itself on the snare or the box-trap. The big disadvantage of free darting is that, because it will take several minutes for the drugs to work, the tiger will have a chance to be lost or the tiger may succumb to anaesthesia in water and drown. If possible, it is good to choose a site for darting that has high visibility so that the tiger's movements can be tracked more easily after darting (Box 7). Darting from a camouflaged cage, building, or vehicle will ensure safety to the darting team, but if this option is not available then the darting team should include 2-3 people that are equipped and ready to defend themselves should the tiger attack. Using darts with radio transmitters will help track the tiger's movements after darting and reduce the risk of losing the tiger, but such darts are heavier, so fly relatively poorly and there is a greater chance of injuring the tiger with a dart. Some of the immobilisation team should be ready to track the tiger's movements immediately after darting to also avoid losing the tiger.

Box 7. Instructions: Free darting

- Select darting site with high visibility.
- Dart from cage, building, or vehicle whenever possible.
- Use radio-telemetry darts if available.
- Have some of the team ready to track the tiger's movements after darting.

4. DRUG PREPARATION AND DELIVERY

4.1. Drug preparation

"Zoletil" or "Telazol" is the anaesthetic of choice for tigers in Russia, Thailand, and Bangladesh, and is used for many other wild animal species, particularly large cats like leopards and jaguars (Lewis and Goodrich 2009). There are, however, other drugs that are available for immobilising tigers (Box 9). Zoletil is a combination of two drugs (Tiletamine and Zolazepam) in equal amounts. It is available in freeze dried pellet form and is very stable in ambient temperature. Properties include a rapid induction, a wide safety margin, minimal depression of breathing, and a dose dependant effect; the more Zoletil given, the deeper and more prolonged the anaesthesia achieved. It is very soluble which allows the use of very small volumes of liquid. Its disadvantages include a prolonged ataxic, sometimes a stormy period of recovery, lack of a specific reversal agent, and instability when reconstituted with water. Swallowing and gag reflexes are often preserved under Zoletil anaesthesia which can make intubation difficult.

Zoletil is supplied in packs containing one vial of 250 mg (Zoletil 50) or 500 mg (Zoletil 100) powder plus one vial of sterile water (5 ml). Adding all the water in a vial of Zoletil 100 to the vial of powder produces a 100 mg/ml solution (Box 8). Stronger solutions up to 500 mg/ml can be prepared by adding less water (by adding 1 ml water in a vial of Zoletil 100). But it is very important to take necessary safety measures when dealing with any immobilisation drugs (Box 10).

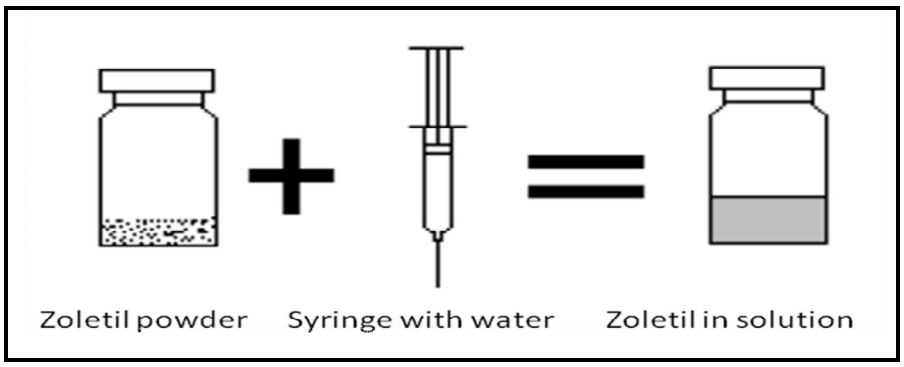


Figure 4. Adding water to Zoletil powder to make solution.

Box 8. Instructions: Drug preparation

- Draw up vial of water supplied with the Zoletil for injection using a sterile needle and 5 ml syringe.
- Inject the water into the vial of Zoletil 100 (Fig. 4).
- Remove the syringe from the needle, but leave the needle in the vial of Zoletil momentarily to relieve any excess pressure in the Zoletil vial.
- Remove the needle from the vial and shake gently to dissolve.
- Label the vial with date and concentration.
- The Zoletil is now ready for use. Store in a fridge for up to 3 weeks, then discard.

Box 9. Drugs for tiger immobilisation

Drug	Dose	Trade name
Ketamine plus Medetomidine	Ketamine: 3mg/kg Medetomidine: 0.07mg/kg	Ketamine: *Ketaset®,Vetalar®* Medetomidine: *Domitor®*
Ketamine plus Xylazine	Ketamine: 11mg/kg Xylazine: 0.8mg/kg	Ketamine: *Ketaset®,Vetalar®* Xylazine: *Xylazin® Rompun®*
Tiletamine Plus Zolazepam	Equal volume of Tiletamine + Zolazepam: 5mg/kg	*Zoletil® 20, Zoletil® 50, Zoletil® 100*

Notes: *Ketaset®, Vetalar® contains 100mg Ketamine/ml in a 10 ml vial.*
Domitor® contains 1mg Medetomidine/ml in a 10 ml vial.
Xylazine® contains 23.32 mg equivalence to 20 mg Xylazine/ml in 10 ml vial.
Rompun® contains100mg Xylazine/ml in 50 ml vial.
Information in this table was reproduced from Kreeger and Arnemo (2007).
It is important to note that the use of the Ketamine-Medetomidine combination has resulted in tigers and leopards recovering very quickly, which can be very dangerous in a field situation (Lewis and Goodrich, personal communications)

Box 10. Human safety with immobilisation drugs
Accidental human exposure to anaesthetic drugs may happen by being hit with a loaded dart or by accidental self injection/contamination whilst preparing darts or injecting animals. Extra caution should be taken during these procedures. It is a good idea to work in pairs in the field, especially when preparing anaesthetic agents to avoid mistakes. Anaesthetic drugs, in both liquid and powdered form, can be absorbed from the mouth, through the eyes, and from cuts on your hands so gloves and eye protection should be used when loading darts and syringes where possible. At least one person on the team should have basic first aid training in case of emergencies. To avoid accidents, it is necessary to treat all capture guns, darts, and syringes as if they were loaded firearms. This means checking the gun that is passed to you to see if it is loaded, and not pointing the gun at anyone under any circumstances. Also it is necessary to use safety caps on darts and syringes. Loaded darts, and used darts and syringes should be stored in non-breakable, leak-proof containers. Carry water and/or eye wash for rinsing of body parts that have come into contact with drugs.

Instructions: Human safety with immobilisation drugs

- Work in pairs in the field and check your partner's work.
- Use gloves and eye protection.
- Have team member trained in first aid.
- Check any gun passed to you to see if it is loaded.
- Never point a gun at anyone under any circumstances.
- Use the safety caps on all darts and syringe.

4.2. Drug delivery

4.21 Cap-Chur dart gun

Dart preparation

Cap-Chur darts have three main parts: nose plug, syringe barrel and tail piece (Fig. 5). When a dart contacts the target animal, the Cap-Chur charge is automatically triggered and the expanding gas generated drives the rubber plunger forward, injecting the animal with the drug (Palmer Cap-Chur Inc. 2003). One end of the Cap-Chur charge is solid with rounded ends. The other end also has a rounded end but the centre can be pushed down ('Swaged' end). The solid end must be put into the rubber plunger for the syringe to work properly (Fig. 6). There are different strengths of Cap-Chur charge, but for 5 cc darts the orange charges should be used. Preparing a dart will take about 3-5 minutes. It is very important to check that the dart fits smoothly into the gun barrel, because if not it will not fire or get jammed (Box 11). It is also essential to check that the needle is clear of obstruction. You can do this by pushing a syringe needle through the needle.

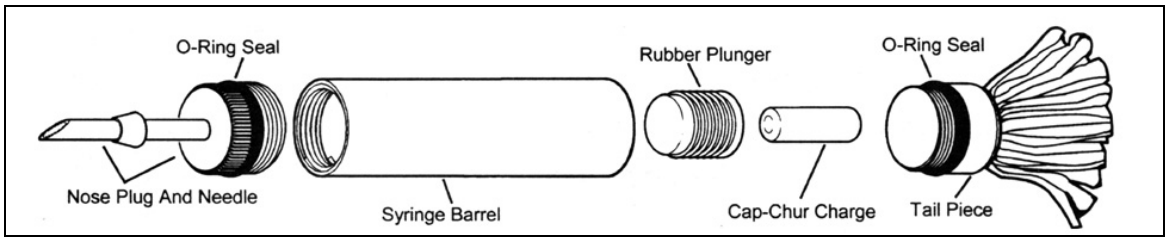


Figure 5. Different parts of a dart.

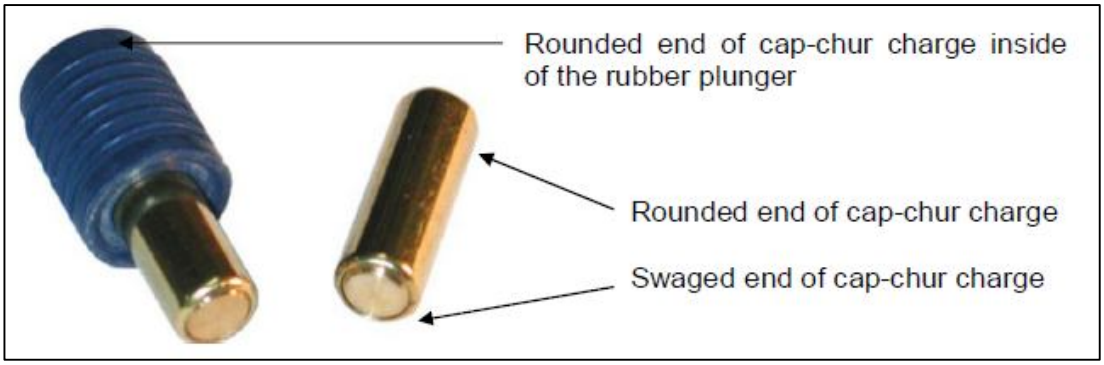


Figure 6. Cap-Chur charge in position.

Box 11. Instructions: Dart gun dart preparation

- Make sure dart fits smoothly into gun barrel.
- Push syringe needle through needle to make sure it is clear of obstruction.
- Lubricate the rubber plunger with silicone lubricant.
- Use positioner to push the rubber plunger through the inside of the syringe barrel several times.
- Place the Cap-Chur charge into the rubber plunger. The solid end is inserted into the rubber plunger with the 'Swaged' end pointing toward the tail piece.
- Insert the rubber plunger containing the Cap-Chur charge into the syringe barrel.
- Screw the tail piece onto the syringe barrel until the O-ring is at least half way into the syringe barrel or until it is hand tight.
- Inject the drug into the syringe barrel.
- If medication does not fill the syringe to bottom of the threads, finish filling it with sterile water.
- Secure nose plug into syringe barrel.
- After you recovering a syringe, always remove the tail piece first to release any pressure.

Dart gun use

The most widely used remote drug delivery system is a dart gun. There are various types of dart gun available. Some use compressed CO_2 to propel darts, some use compressed atmospheric air or 0.22 blank cartridges to propel darts. To immobilize wild tigers in Sundarbans, a .22 calibre blank-powered dart gun (e.g. Cap-Chur Extra Long Range Projector) is recommended because it is

relatively easy to use and difficult to damage. This kind of projector needs to be cleaned regularly; otherwise darts may jam in the barrel and will not work properly (Box 14).

Power loads (Fig. 7) are used only in the extra long range projector; they fire the syringe from the barrel of the projector to the target. There are four different types of power load. They differ from one another in terms of colour and power. The power load has a lip on one end; the other end has a star crimped with a small amount of paint to denote the power level. For firing 5 cc darts use brown power loads (low strength) for short range (8-15 m), and green power loads (medium strength) for medium range (15-30 m). Follow the instructions to use a dart gun (Box 12). Selection of the wrong power load may result either the tiger being missed (in the case of too low power load) or the tiger being killed or injured (in the case of too high power load).

Figure 7. Power load.

Box 12. Instructions: Dart gun use

- Open the projector (Fig. 8) by pushing down on the breech lock release (Figure 11).
- Remove blank adaptor (Fig. 8).
- Make sure there is no syringe in the barrel.
- Insert the syringe to be used, needle forward, into the barrel.
- Use the blank adaptor to push the syringe into the barrel of the projector.
- Place the correct power load (brown for 8-15m, green for 15-30m) into the chamber of blank adaptor.
- Insert the Blank Adaptor into the Barrel.
- Close the Projector.
- To fire Projector cock the hammer (Fig. 9), aim at you target (Box 19) and pull the trigger.

If the gun is not fired it will be necessary to remove the syringe from the barrel (Box 13).

Box 13. Instructions: Dart gun use

- Open the projector (Fig. 8) by pushing down on the breech lock release (Fig. 9).
- Remove the blank adaptor.
- Insert a rod into the breech end of the barrel and push the syringe out of the barrel just far enough to remove it by hand.

Box 14. Taking care of the projector

The extra long range projector uses gun powder (.22 cal Power Loads) to fire the syringe from the barrel; it must be cared for just like any other firearm. Care must be taken to insure gun oil does not build up in the barrel of the projector. This will damage the tail piece. Likewise, excessive amounts of cleaning oil left in the blank adaptor can cause misfires. A common cause of damage is when the gun is fired without any charge. This damages the blank adaptor so that charges can no longer be inserted (making the gun unusable). If such damage occurs it can be fixed by boring out the charge hole in the blank adaptor with a knife or other hard, sharp object. It is not necessary to take the blank adaptor apart each time to clean it. You can use a small brush to clean the threads on the nose pin of the blank adaptor. Always check that there is no power load in the chamber and that there is no syringe in the barrel before attempting to clean or dismantle the projector. Never point the projector at any person for any reason. Always handle the projector as if it fully loaded.

Instructions: Taking care of the projector

- Lubricate all moving parts sparingly with gun oil as needed.
- Do not fire the gun without any charge.
- Never point the gun at any person.
- Clean the gun barrel after use.

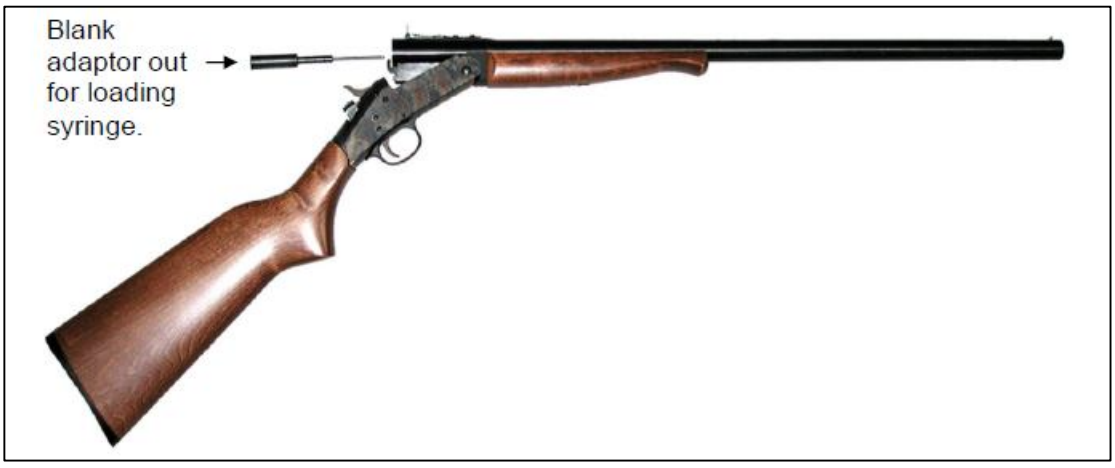


Figure 8. Taking out blank adaptor.

Figure 9. Hammer and breech lock.

Figure 10. Chamber for power load and nose pin in firing position.

It will also be necessary to remove any fired power load from the blank adaptor (Box 15).

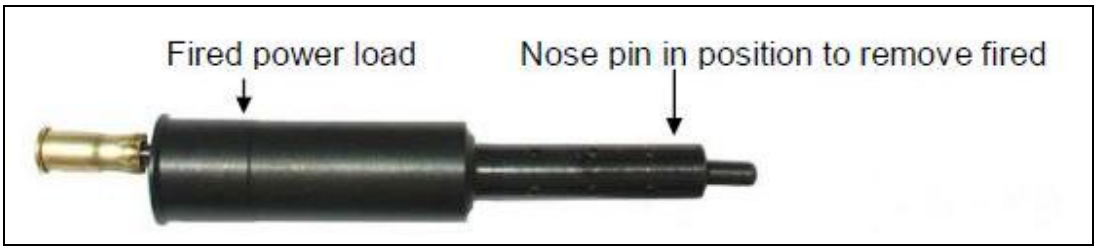


Figure 11. Nose pin in position to remove fired power load.

Box 15. Instructions: Removing fired power load

- Hold the blank adaptor by the nose piece (Fig. 10) in your hand.
- Turn the nose pin clockwise (5 to 6 turns) to loosen.
- Push the nose pin back into the blank adaptor (Fig. 11) to push out the fired power load casing.

4.22 Blow pipe

Blow pipes (Fig. 12) are quiet and they usually cause little trauma to the animal because the dart strikes the animal with low velocity. Blow pipes are used primarily on captive animals (Wenker, 1998), but they can be used effectively at short to medium ranges on free ranging animals under the right circumstances, such as treed animals, animals approached closely by vehicle, or captured animals (Kreeger and Arnemo 2007). This kind of blow pipes is usually known as a conventional blow pipe. There are some other types of blow pipes which are powered by compressed air or CO_2, but they are not available in Bangladesh, and so will not be covered in this manual.

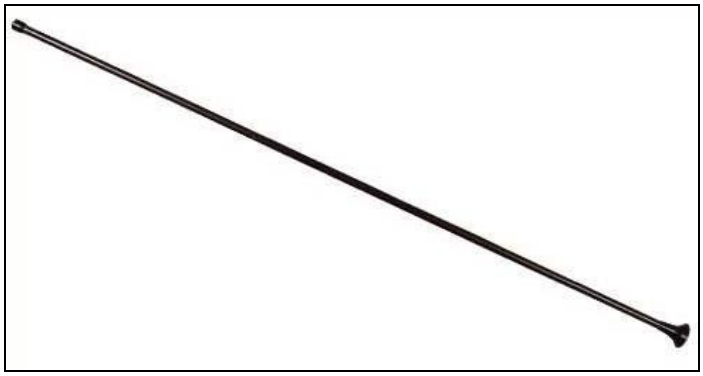


Figure 12. Blowpipe.

Dart preparation

There are four parts of a blow pipe dart; a needle with lateral opening, drug chamber with black plunger, air chamber with red/blue plunger, and a tail piece (Fig. 13). Preparing the blow pipe dart involves injecting air to move the front plunger into the appropriate position for the amount of drug being delivered (Box 16). For example, a plunger can be pushed to the 2 ml mark in a 3 ml dart. Air bubbles in the drug chamber are not a danger to the animal and do not influence the function of the dart.

Figure 13. Blow pipe dart components: Silicone needle plug (a) lateral opening of needle (b), drug chamber (c), front plunger (d), air chamber (e), tail piece (f).

Box 16. Instructions: Blow pipe dart preparation

- Take off the tail piece.
- Hold the dart upside down and inject air into the drug chamber using air filling syringe fitted with a coupling device (Fig. 14).
- Fill the drug into the drug chamber (black plunger) of the dart.
- Fill the drug chamber so that it is 100% full, topping up with saline-solution or sterile water if needed.
- Firmly attach the dart needle after checking that the lateral hole is clear so that it does not come off under pressure.
- Carefully push the silicone needle plug in turning movements onto the needle until the lateral opening is completely covered.
- Cover the needle with the safety cap.
- Hold the dart with the needle pointing up, insuring that the movable red air plunger falls to the bottom of the rear chamber.
- Fill the air filling syringe (with a coupling device) with 20-30 cc of air and connect it to the air chamber of the dart (TeleDart GmbH & Co.KG. 2009).
- Press air into the air chamber until it gives a strong backpressure.
- Keep the air filling syringe pressed and at the same time take it off in a fast twisting movement.
- Attach the dart tail piece.
- Carefully check the needle and plug for any sign of leakage.

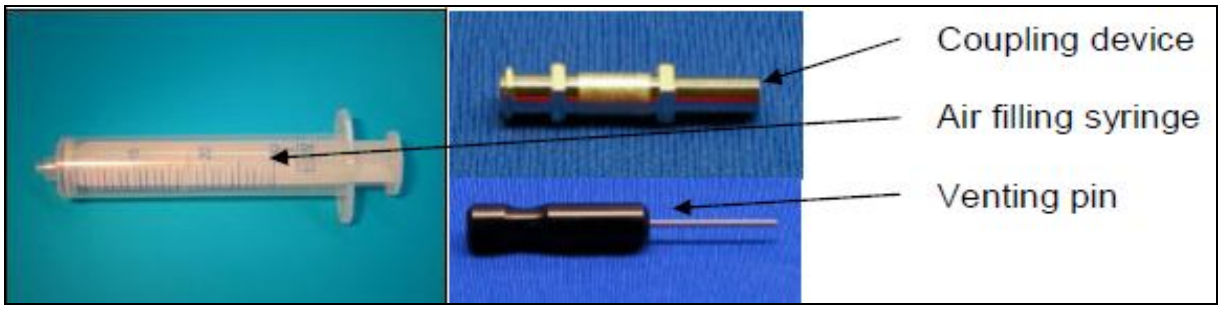


Figure 14. Air filling syringe, coupling device, and venting pin for blow pipe dart.

Blow pipe use

Traditional (lung-powered) blow pipes are very simple and made from one or two piece aluminium tubes. Length of blow pipes should not be more than 2 m which are suitable for propel 11 mm diameter darts having a maximum capacity of 3 ml. Their effective ranges is limited to <20 m (Kreeger and Arnemo 2007). See below instructions on how to use a blow pipe (Box 17).

Box 17. Instructions: Blow pipe use

- Take off the safety cap.
- Insert the dart through the mouth piece of the blow pipe.
- Place lips to the mouth piece to ensure a tight seal.
- Aim at target (Box 19), then inhale through nose steadily, and then expel air sharply (but not explosively).

4.23 Jab stick

A jab stick or pole syringe (Fig. 15) is a modification of hand syringe. In a pole syringe, the plunger of the syringe is attached on the end of a pole. Pole syringes provide a safe, fast and simple means of injecting drug to tigers in box traps or not fully immobilised, but approachable tigers. It can be prepared easily and quickly (Box 18). A pole syringe can inject up to 10 ml of drug within the range of 0.5-3 m, depending on the length of the pole (Kreeger and Arnemo, 2007).

Box 18. Instructions: Jab stick

- Pull the plunger to the mark of your required volume of drug.
- Introduce the drug through the cone of the syringe body.
- Attach the needle (Fig. 16). Use 16 to 18 gauge needles for tiger.
- Target the thick muscle mass (Box 19) of the tiger to discharge the drug.
- Inject the drug intra muscularly rapidly and firmly.

Figure 15. Pole syringe.

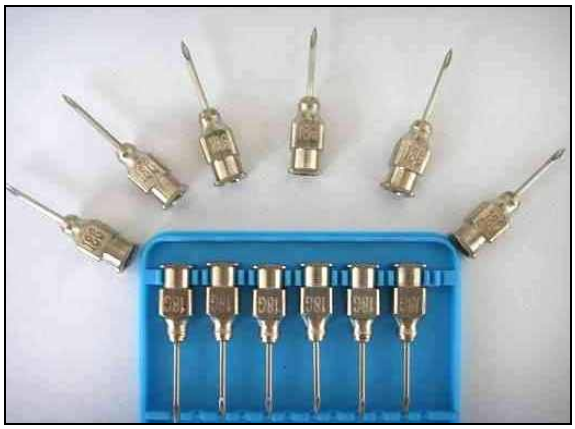


Figure 16. Pole syringe needles.

Box 19. Where to dart a tiger

Aim to dart the tiger in the large muscle masses present at the front of the upper hind leg or around the shoulder area (Fig. 17). Avoid the head, chest wall, abdominal wall, lower legs and genital area. Injections in those areas are very painful and may injure vital organs like eye, ear, heart or reproductive organs.

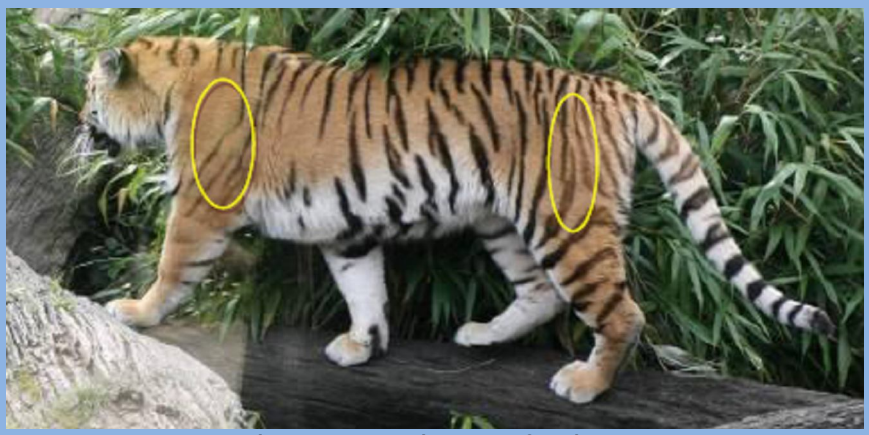
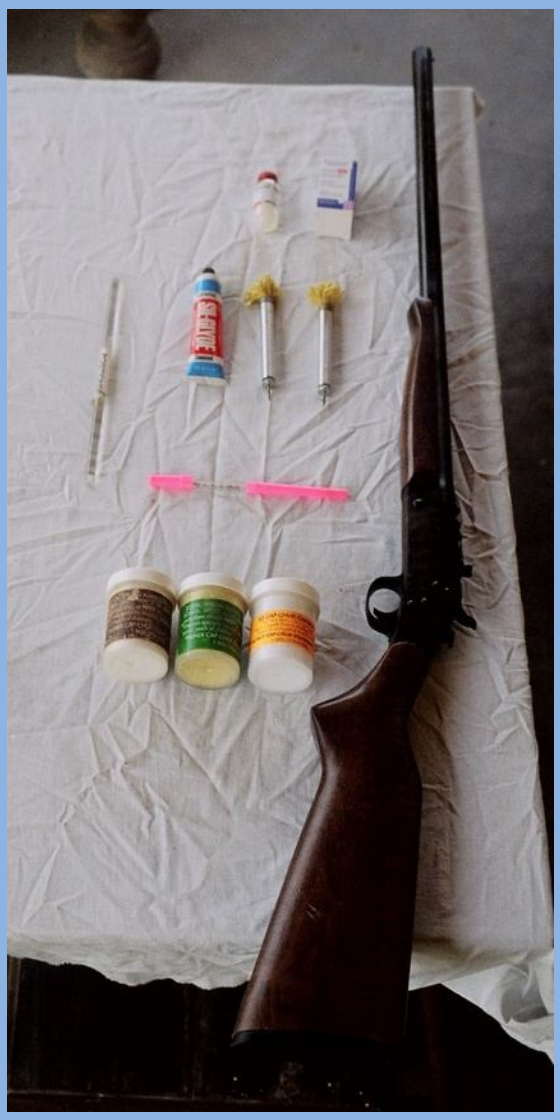


Figure 17. Darting area for tiger.

If possible, animals should be darted when standing still. The loose skin folds present when sitting or lying down will often absorb much of a dart's impact energy, resulting in subcutaneous delivery or even failure to penetrate the skin at all. If an animal is moving when darted, there is a higher risk of dart deflection and inaccurate placement.

Box 20. General equipment list for immobilising a wild tiger

Head torch and batteries x 4
Powerful flash lights and batteries x 4
Pepper spray x 2
Sticks x 3
Digital watch x 1
Sheet (3m x 2 m) x 1
Tarpaulin (3m x 2 m) x 1
Ball of string x1
Rope x1
Jungle knives x 3
Penknife x 1
Pliers x1
Wire cutters x1
Tape measure x 1
Weighing scale (0-150 kg) x1
Digital camera x1
Box for charges and drug equipment x 1
Dart gun x 1
Brown gun charges box x 1
Green gun charges box x 1
Dart charges box x 1
5cc darts x 10
Cleaning rod x 1
Mouth props x 4
Hobbles x 4
Ophthalmic lubricant x 1
Syringes (5-10cc) x 10/needles
Mercury thermometers x 3
Real-time thermometer x 1
Injection water (5ml) x 10
Zoletil (500mg vials) x 10
Carprofen x 3
Amoxycillin (LA) x 3
Oxytetracycline (LA) x 3
Doxapram x 1
Adrenaline x 3
Glycopyrrolate x 1
Dexamethasone
Long forceps x 1
BS kit x 1
First aid kit x 1
Jerry cans (5ltr) x 3
Stethoscope
Iodine bottle x 1
Vicryl sutres + needles
Endotracheal tube x 1
Scissors x 1
Swabs x 5



5. MONITORING

5.1. Check tiger is immobilised

To avoid human injury, after the tiger has been darted with an anaesthetic it is very important to check that the tiger is completely immobilised. Test the tiger's responsiveness by throwing stones or sticks from a few metres away to land lightly on the tiger's body, breaking sticks, and clapping your hands to create sudden noise. Finally, tap the tiger with a long stick from behind starting at the tail and finishing with the ears (West et al. 2007). Approach the tiger very carefully from behind and be ready for any sudden arousal (Box 21). Be aware that it can take 15 - 20 minutes for drugs to be fully absorbed from the site of an intramuscular injection (longer if the injection was subcutaneous or into a fat deposit). If the tiger responds to your approach or other stimuli and 20 minutes have not yet passed since darting, consider waiting. If the tiger responds after 10 minutes, it is tempting to give more anaesthetic drugs. This may be unnecessary and may increase the eventual depth and length of anaesthesia. In extreme cases, a dangerously high amount of drug may be given inadvertently. If the dart is still in the tiger, check that it has completely injected its contents. Partial injections will lead to partially anaesthetised animals.

When close to the tiger, check whether the jaws can be opened, and the tongue can be pulled with little or no resistance. Check the tiger's responses by pinching between the toes, pressing hard across the tail, pinching the ear, and lightly brushing a finger across the eyelashes. Once it has been established that the tiger is safely immobilised, correct its position, extending the head and neck, to allow ease of breathing. The head should be slightly lower than the rest of the body, so any excess saliva can flow easily out of the mouth. Remove any snare from the tiger's foot and apply rope hobbles to the front and back legs. Eyes of the immobilised tiger remain open so, it is very important to take necessary precautions to protect the eyes (Box 22).

Box 21. Instructions: Check tiger is immobilised

- Approach tiger cautiously.
- If tiger still responds after 20 minutes then re-dart with full dose.
- Test the tiger's responsiveness.
- Check if dart has completely injected its contents.
- Check if the jaws can be opened, and the tongue can be pulled with little resistance.
- Place tiger on its side, extending the head and neck, and ensuring that the head is slightly lower than the rest of the body.
- Remove any snare from the tiger's foot and apply rope hobbles to the front and back legs.

Box 22. Protecting the tiger's eyes
Direct sunlight onto tigers eye's during anaesthesia may cause serious damage to the retina. Although covering the eyes with a cloth will prevent this, it will also make accurate monitoring of an anaesthetic difficult.

Instructions: Protecting the tiger's eyes

- Place a small amount of an ophthalmic lubricant with aqueous base onto the surface of the eyes to prevent drying of the cornea.
- Do not allow the sun to shine directly into the eyes of an animal at any stage during anaesthesia.
- Place a cloth over the eyes to protect them from dirt and leaf litter.

5.2. Check "ABC"

After the tiger is fully immobilised it is necessary to check "ABC" (Air way, Breathing and Circulation) to assess the initial vital signs.

5.3. Checking A (Airway)

The first important part in ABC checking is examining the airway. If there is any obstruction in the airway tiger may suffocate. The airway may become blocked by the tongue, vomit or by any foreign materials. Follow the below instruction to check airway (Box 23).

Box 23. Instructions: Checking A (Airway)

- Check that the head and neck are in as straight a line as possible.
- Open the mouth wide and check that nothing is obstructing the animal's airway, e.g. vomit.
- With the mouth held open and a mouth prop in place between the canine teeth, pull the tongue forward and using a torch check that the larynx is clear (Fig. 18).
- Check that nothing is pressing on the outside of the neck (e.g. radio-collar).

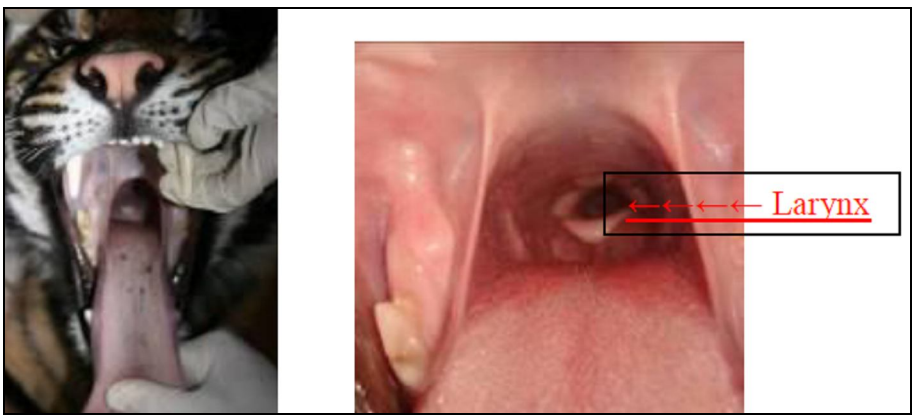


Figure 18. Position of larynx at back of mouth in tiger.

5.4. Checking B (Breathing)

After checking the airway it is important to check breathing (Box 24). It is recommended to check breathing by stethoscope. In the absence of stethoscope check breathing by observing fall and rise of the tiger's chest. Checking the breathing can also often be done from a distance before the tiger is fully anesthetized).

Box 24. Instructions: Checking B (Breathing)

- Check that the animal is breathing regularly, paying attention to the rate, depth and quality of breaths.
- Listen for abnormal breathing sounds; snoring, for example may indicate that there is a partial obstruction to breathing.

5.5. Checking C (Circulation)

Most anaesthetic drugs decrease the heart rate and weaken the pulse rate and interfere with an animal's ability to regulate its body temperature (Box 25). When working in cold conditions a dangerous loss of heat can occur (hypothermia) which can be fatal if left uncorrected. Conversely when working in hot conditions overheating can occur (hyperthermia) which is equally dangerous to the animal. Hyperthermia can also result from excessive pre-anaesthetic excitement or seizures at any stage.

Box 25. Instructions: Checking C (Circulation)

- Listen to the heart with a stethoscope.
- Feel and record the pulse rate and quality (Fig. 19). Normal pulse rate of tiger is 70-80 beats per minute. Weak and decreased pulse rate means heart is not functioning well.
- Examine the mucous membranes, noting the time it takes a mucous membrane to return to pink after being pressed with a finger tip. This should take 2-3 seconds. Significantly longer capillary refill time (CRT) may indicate inadequate cardiac function. Pale or even white mucous membranes may indicate that the circulation in the capillaries is inadequate and a blue colour that respiration is ineffective.

Figure 19. Taking pulse of tiger from femoral artery.

5.6. General health check

After checking ABC one should check the general health condition of the tiger (Box 26). Observe body coat first. A healthy tiger should have a glossy hair coat. Then check whole body for both old and new injuries like skin scars, leg fractures, old and fresh wounds, and contusions. Open the mouth with two hands and observe the teeth colour and their condition. Use a mouth gag for safety reasons when doing this. Check eyes and nose opening for any kinds of secretion. Record all findings on a data sheet (Appendix 1). Also check the amount of body fat and degree of emaciation. If the captured tiger is (judged by a vet) to be unfit for release back into the wild, the tiger should be removed from the wild following the FD's THC protocol (Greenwood in prep.). Examples of conditions that may make the tiger unfit for release include serious injury such as leg fracture, emaciation, or disease. If there are no rehabilitation centres available then euthanasia (Box 38), with permission of the Forest Department, may be considered, following the THC protocol (Greenwood in prep.).

Box 26. Instructions: General health check

- Observe body coat.
- Check for old and new injuries in the body.
- Check teeth colour and there condition.
- Check eyes and nose for any abnormal secretion.
- Record all finding in a data sheet.

5.7. Monitoring vital signs

After initial assessment of vital signs (Box 27) it is essential to monitor vital signs every five minutes and record them in a data sheet (Appendix 2) to assess the tiger's state under anaesthesia and to quickly identify problems; essentially repeating the B and C parts of the initial ABC check. Before

monitoring breathing (Box 28), circulation (Box 29) and body temperature (Box 30) of an immobilised tiger one should be familiar with the notes on anaesthetising tigers (Box 31).

Box 27. Vital signs check list
Breathing:
- Quality and rate of breathing.

Circulation:
- Heart rate and Pulse rate.
- Capillary refill time.
- Mucous membranes colour.

Body temperature:
- Rectal temperature.

5.71 Monitoring B (Breathing)

Box 28. Instructions: Monitoring B (Breathing)
- Monitor number of breaths per minute, depth of breathing, any abnormal sounds. Note any changes in the breathing rate and depth. As an animal arouses from anaesthesia, it will likely breathe more rapidly and more deeply.

5.72 Monitoring C (circulation)

Box 29. Instructions: Monitoring C (Circulation)
- Monitor number of pulses per minute. Generally this will be the same as the heart rate, and although it is worth checking that this is the case, it is more significant to detect a pulse than a heartbeat. If a pulse cannot be detected, immediately check the heart with a stethoscope. The strength of the pulse should also be noted. Note changes in the pulse rate over time. Slowing of the pulse rate may indicate deterioration in cardiac or respiratory function and conversely, acceleration of the pulse rate may indicate that an animal is waking up.
- Measure capillary refill time. It should be between 2 and 3 seconds. Significantly longer CRT's may indicate inadequate cardiac function.
- Note any change over time. The colour of the inside of the mouth in a healthy animal is pink. Pale or even white mucous membranes may indicate that the circulation in the capillaries is inadequate and a blue colour that respiration is ineffective.

5.73 Monitoring rectal temperature

Box 30. Instructions: Monitoring rectal temperature

- Take temperature by inserting thermometer in rectum of the tiger.
- Monitor and record the temperature every five minutes. Either hypothermia or hyperthermia can kill the tiger by ceasing the function of both heart and lung. The rectal temperature of tiger lies between 37.8 ^{0}C-39.4 ^{0}C (100-103^{0}F).

Box 31. Anaesthetic notes on Sundarbans tigers (*Panthera tigris*)

Weight: Adult female = 75-85 kg, adult male 110-140 kg.
Normal rectal temperature: 37.8 ^{0}C-39.4 ^{0}C (100-103^{0}F).
In tigers, core temperatures above 39.4°C require reduction by externally applied water and increased air cooling. Core temperatures rising above 40.6°C (105^{0}F) demand more aggressive therapy.
Normal adult heart rate: 50-100 beats/minute (bpm).
Normal adult breathing rate: 8-15 breaths/minute but only at rest when cool. Higher if excited prior to anaesthesia or hot.
Anaesthetic of choice: *Zoletil (Telazol*).
Dose rate: 5 mg/kg - Use higher dose rates in smaller specimens and excited animals.
Normal pattern of anaesthesia: Induction: Smooth.
Length of anaesthesia: Approximately 40-60 minutes.
Intubation: Use 16-20mm ET in adults.
Prolonging anaesthesia: *Zoletil* should NOT be used to prolong anaesthesia. Theoretically, anaesthesia should be prolonged with intramuscular injections of Ketamine (2-3 mg/kg). But prolonging anaesthesia can also be done with low dose intravenous Ketamine if gaseous anaesthetic is unavailable. Hence, to avoid the need to prolong anaesthesia, conduct high priority procedures (e.g. fitting radio-collar and collecting blood) as quickly as possible.
Recovery: No specific reversal agent. Progressive return of consciousness with moderate ataxia. Ensure that the animal's position is good and make a final check on its vital signs.

5.8. Responding to anaesthetic complications

Modern anaesthetic drugs are very safe, but emergency situations can and do still arise. The most common serious anaesthetic complications are respiratory depression, cardiac arrest, shock, hyperthermia, hypothermia, and convulsion. These complications could be managed successfully by following the instructions given below (Box 32 to Box 37).

5.81 Respiratory depression

Respiratory depression is the most common anaesthetic complication and frequently occurs during anaesthesia. Application of too much anaesthetic drug is the main cause. Sometimes air way obstruction and severe pain can cause this complication (Box 32).

Box 32. Signs and response instructions for respiratory depression

Signs:

- Decreased respiratory rate (about half of the normal rate).
- Shallow or slow breathing.
- Cyanosis of mucous membrane.
- Violent and frequent attempts by the animal to draw in breath.

Instructions:

- Discontinue all anaesthetics.
- Check and establish patent airway.
- Begin artificial ventilation via an endotracheal tube. If an ET isn't available, close the mouth and intermittently breath air into the tiger via the nose.
- Apply 1-2mg/kg Doxapram IV.
- If possible, administer appropriate antagonist IV.

5.82 Cardiac arrest

Cardiac arrest is a condition when heart fails to contact effectively. This is a most serious complication and needs to be corrected within a few minutes (Box 33).

Box 33. Signs and response instructions for cardiac arrest
Signs:
- Absent of palpable pulse
- Absent of heart sound
- Cyanosis (blue coloration) or pallor of mucous membranes
- Increased respiratory rate, abnormal pattern, or cessation of breathing
- Dilated pupils

Instructions:
- Stop applying anaesthetics.
- Check and establish patent airway.
- Begin external cardiac massage.
- Give intravenous or intra-cardiac adrenaline at 0.01 mg/kg. This is equivalent to 0.1ml *"Adrenaline injection 1:1000"*/10 kg of animal. Repeat adrenaline every 3-4 minutes if necessary.
- If the heart re-starts, give glycopyrrolate by slow intravenous injection at 0.01 mg/kg. This is equivalent to 0.5ml *"Robinul"*/10 kg of animal.

5.83 Shock

Shock is a state when the organs and tissues of the body are not receiving an adequate flow of blood (i.e. a failure of the microcirculation). If the tiger suffer from severe blood or fluid loss, shock may arise. Shock may also arise if the tiger get severe pain and mental trauma (Box 34).

Box 34. Signs and response instruction for shock
Signs:
- Rapid and weak heartbeat.
- Low blood pressure (slow capillary refill).
- Pale or cyanotic (bluish) mucous membranes.
- Hyperventilation or shallow sporadic breathing.
- Cold extremities.

Instructions:
- Cease all further administration of immobilizing drugs.
- Administer 30ml/kg Lactated Ringer's solution IV.
- Administer 1 mg/kg dexamethasone IV.
- Check and establish patent airway.

5.84 Hyperthermia

When core body temperature rise above the normal range (37.8-39.4 ^{0}C) due to failure of thermoregulatory system than it called hyperthermia (Box 35).

Box 35. Signs and response instructions for hyperthermia
Signs:
- Body temperature increase above 40.5^0 C/105^0 F.
- Rapid, shallow breathing.
- Increased heart rate and pulse become irregular.
- Mucous membrane becomes red or bright pink in colour.

Instructions:
- Move the animal into the shade or create shade over it.
- Cool the body (especially the abdomen, groin and feet) with water or alcohol. Alcohol is more effective but shorter acting. Apply the water and/or alcohol frequently to maintain a large temperature difference between the animal's core and its surface. Small animals can be immersed up to their necks in buckets of cold water, ponds, rivers etc.
- Pack cold water bags against the skin of the abdomen, groin and head.
- Fan rapidly with anything at hand to create a breeze close to the wet skin.
- Wait 5 minutes, and recheck the temperature.
- Use enema if temperature does not go back down to the normal range.

5.85 Hypothermia

When core body temperature fall below the normal range (37.8-39.4 ^{0}C) then it can be defined as hypothermia (Box 36).

Box 36. Signs and response instructions for hypothermia
Signs:
- Decreased rectal temperature (<35^0 C/95^0 F).
- Shivering (only in a conscious animal specially observed prior to anaesthesia).
- Decreased heart rate and blood pressure.
- Cold extremities
- Pale mucous membranes

Instructions:
- Keep the anaesthetic period as short as possible. The only actual treatment for hypothermia is to warm an animal.
- Place a foam pad underneath the animal.
- Wrap the animal in blankets.
- Cover the feet with gloves, socks, hats, or whatever is available.

5.86 Convulsion

Convulsion is a condition where body muscles contract and relax rapidly and repeatedly, which results an uncontrollable shaking of the body (Box 37). Convulsion is very common post anaesthetic complication of Ketamine-Xylazine preparation.

Box 37. Signs and response instructions for convulsion

Signs:

- Uncontrolled muscle spasms.
- Twitching and jolting of limbs
- Drooling at mouth.

Instructions:

- Administer 10 mg Diazepam IV slowly.
- Maintain normal body temperature.

Box 38. Euthanasia

Euthanasia is a Greek word meaning "good death". This implies that death occurs without pain or distress (Gannon and Sikes 2007). Euthanasia must be performed with a respect for its effect on other animals (including human observers). If a captured tiger is seriously diseased, injured, or unable to lead a quality life euthanasia could be performed on that tiger but it should be evaluated carefully. There are a number of possible methods for euthanasia in the field. Pentobarbital sodium (Euthasol, Euthatal, Euthanal) is recommended drug for euthanasia (Tasker 1993). It can be used @ 150 mg/kg body weight, intravenously, or intra cardiac in anaesthetised animals. Saturated solution of Magnesium Sulphate (MgSO4) can be used @ 80 mg/kg through intravenous or intracardiac route after general anaesthesia. MgSO4 is cheap and available in Bangladesh. Potassium Chloride (KCl) is also a cheap chemical and it's saturated solution can be used intravenous or intra cardiac route @ 50 mg/kg in deeply anaesthetised tiger(Lewis and Goodrich 2009). For tigers in field conditions guns are usually available and a deeply anaesthetised animal may be euthanized quickly and painlessly by firing a shot into the first cervical vertebrae (i.e., into the neck where it connects to the skull) with the muzzle of the gun placed directly against the cat. As an absolute last resort, a deeply anaesthetised animal can be destroyed by preventing it breathing. Hold the mouth and nostrils firmly closed until the heart fails from hypoxia. Vigorous terminal attempts to breath may be seen, which may be distressing for onlookers.

Euthanasia options:

- Pentobarbital sodium given intravenously @ 150 mg/kg body weight.
- Saturated solution of Magnesium Sulphate through intravenous or intra cardiac route @ 80 mg/kg in anaesthetised tiger.
- Saturated solution of Potassium Chloride through intravenous or intra cardiac route @ 50 mg/kg in deeply anaesthetised tiger.
- Firing a shot into the first cervical vertebrae.
- Hold the mouth and nostrils firmly closed until the heart fails (last resort).

6. TRANSPORTATION AND RELEASE

6.1. Transportation

An immobilised tiger should be transported to a safe place at the beginning of the anaesthesia using a stretcher or a wooden box (Box 39). Avoid transporting anaesthetised tigers in cages over roads. It is all too easy for an unconscious tiger to be thrown into an awkward position in the crate by the motion of the vehicle, which may lead to a respiratory obstruction and eventually death. If transport is necessary use crate over water as it will provide a smooth and comfortable journey for an immobilised tiger.

Box 39. Instructions: Transportation

- Transport the tiger at the beginning of anaesthesia.
- Cover wooden boxes with black cloth while transporting.
- Choose water way to transport an immobilised tiger.
- Avoid transporting of an immobilised tiger in cages over roads.
- Be aware that direct sunlight on an anaesthetised tiger for prolonged periods can lead to hyperthermia

6.2. Release

Wherever possible release the tiger at the site of capture or close by (Box 40). Ideally, all animals should be allowed to recover from anaesthesia undisturbed in quiet, dimly lit conditions within an area free from physical hazards such as water bodies or steep areas. Precautions must be taken to prevent overheating during recovery. Protect the eyes from direct sunlight and ensure that the entire body will be shaded during recovery. Remember to move the tiger to a safe place at the beginning of anaesthesia because it may not be possible to do so as the tiger is awakening. Before leaving the tiger to recover, final checks on its vital signs should be made using the ABC approach. Pay particular attention to ensuring that the tiger's airway is clear; remove excessive amounts of saliva and any food material, or foreign bodies that may be present in the mouth. Monitoring of pulse, respiration and temperature should continue until it is no longer safe to do so, or until such interference disturbs the tiger. Continue to observe the tiger discretely for as long as possible after recovery. Some tigers have been reported to show signs of partial anaesthesia from 1 to 5 days following apparent full recovery. To date this has not been documented as a problem in wild tigers (Kreeger and Armstrong, 2009).

Box 40. Instructions: Release

- Release the tiger not far from the capture site.
- Provide a calm, cool, shady place to recover.
- Perform ABC check
- Monitor the tiger from distance.

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APPENDIX 1: GENERAL HEALTH CHECK DATA SHEET

Tiger details						
ID:						
Body measurements						
Sex	Demographic group	Body length	Tail length	Height at shoulder	Chest Circ.	Weight
Male/Female	Cub/Transient /Adult	....cm	....cm	....cm	....cm	....kg

Teeth condition				
Key: W/D = White/Discoloured, I/B = Intact/Broken, S/BL = Sharp/Blunt, M = Missing				
Tooth type	Upper		Lower	
	Left	Right	Left	Right
Canines	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M
Incisors	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M
Premolars and molar	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M	W / D; I / B; S / BL ; M

Body condition	
General body condition	
Old injuries	
New injuries	
Other notes on condition	

APPENDIX 2: ANIMAL IMMOBILISATION DATA SHEET

Date:		Staff name:
Species:	ID:	Age:
Location (GPS):		Sex:
Ambient temperature:		Weight estimate (kg):
Weather:		Actual weight (kg):

Anaesthesia

Time	Drug	Dose		Site (IV/IM/ SC)	Delivery (C/P/N)	Effect (1-5)	Time of effect
		mg	ml				

Site: IV = Intravenous, IM = Intramuscular, SC = Subcutaneous
Delivery: C = Complete, P = Partial, N = Nil
Effect: 0 = no effect, 1 = light sedation, 2 = heavy sedation, 3 = light anaesthesia, 4 = deep anaesthesia, 5 = death

Monitoring vital signs

Time	Body temp.	Heart rate	Resp. Rate	Drugs	Capillary refill time	Notes

Time of first effect e.g. Recumbency:						
Time of recovery e.g. Head up. Standing:						

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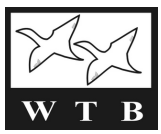
W T B