VETERINARY GUIDELINES FOR THE HANDLING OF SUMATRAN TIGERS IN CONFLICT SITUATIONS

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FOREWORD

DIRECTOR GENERAL OF FOREST PROTECTION AND NATURE CONSERVATION

Human-tiger conflict has long been one of the key issues in the conservation of tigers in Sumatra. This conflict not only results in the loss or damage of livestock and material goods but in extreme cases can also claim human lives. In the last decade across the island of Sumatra approximately 600 incidents of human-tiger conflict have been recorded. In the areas where these incidents are concentrated, retaliation from the communities affected can result in the capture and killing of the tiger suspected to be responsible for the conflict. Without proper handling, human-tiger conflict reduces vital community support in the efforts to conserve Indonesia's last remaining large cat species in the wild.

This book, "Veterinary Guidelines for the Handling of Sumatran Tigers in Conflict", is the second in a series and is written to complement the first book, "Practical Guidelines to Prevent and Mitigate Human and Tiger Conflict." These books were written following a series of workshops, the first of which, "Workshop on Human-Tiger Conflict Mitigation", was held in Bogor in November 2011. This workshop was attended by experts and field practitioners from each of the 10 provinces of Sumatra, all with experience in human-tiger conflict in their province. This was followed by a training course and workshop for Government approved veterinarians from each province on how to rescue, handle and treat conflict tigers, held at Taman Safari Indonesia in January 2012.

The objective of this book is to provide veterinarians with standardized guidelines for handling Sumatran tigers captured or trapped in conflict situations. This is driven by the need for quick and effective handling of Sumatran tigers in conflict, where the decisions made in the first few hours of the situation can save the tiger's life. The Directorate General of Forest Protection and Nature Conservation, as Indonesia's leading governmental institution working to conserve Indonesian biodiversity, supports the use of this book in our agencies working in tiger conservation. To this end, this book will be widely distributed across Sumatra and will be referred to as the key text for those working on the front line with Sumatran tigers.

Our appreciation and thanks go to all contributing parties: The Zoological Society of London, WCS Indonesia Programme, Taman Safari Indonesia, Forum HarimauKita, Wildlife Vets International, Fauna & Flora International, WWF Indonesia, Veswix, YPHS, Veterinary Department at IPB, FMIPA University of Andalas and PDHI. Thanks also to the UK Department for Environment, Fisheries and Rural Affairs (DEFRA), which funded the workshops, training and publication of the book. May all of our good intentions be blessed by God the Almighty.

Jakarta, October 2012
Director General
Ir. DARORI, MM
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FOREWORD

COMMITTEE OF THE ASSOCIATION OF INDONESIAN VETERINARIANS

First, on behalf of all of the veterinarians assembled in the Indonesian Veterinary Medical Association (PDHI), we would like to express our happiness and appreciation for the publication of the book "Veterinary Guidelines for the Handling of Sumatran Tigers in Conflict."

Data has shown that the number of human-tiger conflicts has escalated every year as a direct consequence of increasing likelihood of human-tiger interaction in the wild. In the past, the absence of proper guidelines has often resulted in cases where the mishandling of a Sumatran tiger has led to their injury or death. With the publication of this book, we expect in the future much improved handling of captured or trapped Sumatran tigers in a conflict situation, minimizing the potential for injuries and deaths related to poor handling.

This book will serve as a main reference text for handling tiger conflict situations. As professionals working on animals'/wild animals' health, veterinarians are often requested to advise and help when a tiger is captured or trapped. This book will be invaluable to those veterinarians, as well as field veterinarians working in close proximity to the remaining wild habitats. It will not only help veterinarians and supporting staff with technical procedures but will also provide clear guidance on the veterinarian's role, affording liability to their decisions.

Indonesia's main legal texts for the professional authority of veterinarians in handling animals are Law No. 18 Year 2009 (*UU no. 18 tahun 2009*) on Animal Husbandry and Health, Law No. 5 Year 1990 (*UU no. 5 tahun 1990*) on Conservation of Natural Resources and Ecosystems, and Government Regulation No. 7 (*PP No. 7*), in particular Chapter 15 on Ex-Situ Management.

As the PDHI committee, we call for veterinarians as well as all parties collaborating with them to handle animals responsibly. In an international forum held in 2004 at Rockefeller University, USA, and annually until 2011, experts in human and animal health unanimously agreed that the greatest challenge we face is posed by emerging infectious diseases (EIDs) and the environmental conditions driving this emergence, with 338 new transmitted diseases appearing of which 60.4% are zoonotic—70% of these zoonotic diseases originated from wild animals. Such challenges must be faced with a multidisciplinary and multi-sectoral approach to establish a healthy ecosystem comprising healthy humans, animals and environment. Furthermore, veterinarians play a key role in working towards "One World One Health" by following 2S and 2A (Safety, Security, Assurance and Animal Welfare).

Finally, we hope that this book will be useful for our national interest as well as the interests of all parties involved in mitigating human-tiger conflict in the field. We very much appreciate all parties who have contributed to the writing of this book.

May God the Almighty bless all the good intentions in the publication of this book. Amen.

Jakarta, October 2012
Head of PB PDHI

Drh. R.D. Wiwiek Bagja

PREFACE

Social and economic developments in Sumatra have brought about negative impacts on the quality and availability of suitable Sumatran tiger habitats. Conflicting interests between humans and the Sumatran tiger are increasingly hard to avoid, resulting in an escalating number of human-tiger conflicts. This situation is worsened by increasing illegal hunting, causing a drop in the availability of tiger prey species and driving tigers to approach human settlements in search of poorly protected domestic cattle as prey.

This book may serve as a guide for veterinarians handling captured/trapped wild Sumatran tigers, which need to be treated differently from those tigers born in captivity. The animal's temperament and stress levels following capture/trapping must be of prime concern when conducting examination and subsequent medical interventions. Quick and appropriate diagnosis to determine the health status of the animal is vital when handling a conflict tiger.

The attending veterinarian must be responsible for the examination and final diagnosis of underlying illnesses and injuries sustained by the tiger and must plan appropriate medical treatment. To minimize the risk to the tiger, veterinarians are required to be professional (accurate, conscientious, skilful), fast and efficient in handling tigers in conflict situations, as time is a key factor in the survival of such tigers, where every minute counts.

This book contains guidance related to all veterinary aspects of dealing with a conflict tiger. It presents a step by step guide, from the moment the animal is found, to handling and anaesthesia, examination techniques, obtaining and handling samples, diagnosis and treatment of the most common health issues, to post treatment recommendations. Also included are guiding principles for euthanasia and diagnostic post-mortem examinations. The main resources drawn upon for this book are the authors' own experiences in handling Sumatran tigers, both in captive and conflict situations, as well as key referenced text.

We would like to express our thanks to Taman Safari Indonesia (TSI), Zoological Society of London (ZSL), Forum HarimauKita (FHK), and Wildlife Conservation Society – Indonesia Program (WCS-IP), as well as other contributors who have provided inputs for the publication of this book. As the veterinary medical profession is ever changing, with new treatments and techniques emerging all the time, we welcome any critique and suggestions to improve this book.

We hope that these guidelines will assist veterinarians, particularly those who serve in Sumatra, on the front line dealing with human-tiger conflict situations. Lastly, we thank God the Almighty for the publication of this book "Veterinary Guidelines for the Handling of Sumatran Tigers in Conflict."

Bogor, 2012

I. INTRODUCTION

The Sumatran tiger population has been decreasing at an alarming rate, as habitat destruction and forest conversion intensifies along with escalating targeted illegal wildlife poaching. The combination of these factors has led to humans and wildlife competing for the same resources. This, in turn, has resulted in mounting human-wild animal conflict, the major driving force behind the illegal killing of wild animals, including Sumatran tigers. Lack of understanding among the general public regarding conservation values and the important role tigers play in the forest ecosystem places tigers in an extremely vulnerable position during a conflict situation.

Veterinarians play a key role in minimizing further risks to the tiger as well as risks to humans from the tiger, handling the situation at all times in accordance with the principles and ethics of animal welfare and conservation. In a conflict situation, the responsibilities and roles of the veterinarian include conducting initial observations when the tiger is first captured, immobilizing it prior to general check up, diagnosing any injuries, ill health or conditions that may impact its release back into the wild, administering the required medical treatments and providing recommendations as to whether the tiger should be released directly into the wild, transported to an ex-situ facility for further treatment, or removed permanently from the wild or euthanized.

II. INITIAL OBSERVATION AND HANDLING OF CONFLICT TIGERS

The approach to handling wild Sumatran tigers in a conflict situation is very different to that used for captive bred Sumatran tigers. The tiger's stress levels following the capture/trapping must be considered at all times when administering medical assistance to the animal. Efficient, diligent and swift evaluation of the tiger's health status is essential when undertaking the preliminary visual observation/examination to diagnose the tiger's condition when first attending the scene. After the initial examination for causes of pain, injury or illnesses, the attending veterinarian must determine the next suitable step to manage the situation, i.e. what first aid treatment is needed, whether further examination is required, as well as the most suitable approach for further handling of the tiger.

A. OBSERVATION

There are four systematic stages to assist the attending veterinarian to write comprehensive documentation and decide what action to take in examining, diagnosing and handling the captured or trapped conflict tiger. These stages serve as guidelines to create thorough records and documentation of the entire handling process: I) preliminary observation examination, II) physical examination, III) diagnosis, and IV) treatment plan.

I. Preliminary observation examination

It is crucial to first collect all the background information available on the conflict situation, in particular as precise information as possible about the duration and conditions in which the tiger has been captured. This information must be placed in chronological order on a time line, as it will support the attending veterinarian in their preliminary observations of the tiger and beyond. At this very early stage, a veterinarian should already be starting to identify the potential physical and psychological conditions the tiger may be experiencing.

A trapped or snared wild Sumatran tiger, particularly if in an open area, will be subject to high levels of stress and will exhibit extreme behaviour as it struggles to free itself, often resulting in the tiger sustaining further injuries. Often as a direct result of the high levels of stress it is subjected to, a distressed wild tiger may experience deterioration in its physical condition. This weakened condition can trigger a secondary infection, or the tiger may succumb to further ill health from an underlying parasite infestation or pre-existing health condition. This will exacerbate the tiger's condition, causing it to deteriorate rapidly.

At this stage, the veterinarian should quickly formulate an idea of both the physical and psychological state of the animal; therefore, Stage 1 preliminary observation of the tiger should comprise:

(i) Behavioural evaluation:

a. Calm; active; depressed; stressed, unconscious/in coma, very weak, aggressive

(ii) Visual/gross evaluation:

b. Injuries and wounds sustained, symptoms, e.g. vomiting, diarrhoea

To aid a rapid and effective preliminary exam, a veterinarian must be able to recognize various different types of tiger behaviour to assist in determining whether the animal is aggressive as the result of experiencing pain or is very weak from exhaustion or potential excessive bleeding/hemorrhage, for example.

This preliminary examination must be conducted in this order to allow for a systematic and effective approach to deciding the next actions to be undertaken in Stage II, such as general examination under general anaesthesia.

II. Physical examination

This is a stage where a veterinarian physically examines the tiger, investigating, measuring and collecting physiological and pathologic data, including samples for laboratory analysis. To minimize any further distress to the tiger, the use of general anaesthesia is necessary to physically examine the tiger as thoroughly as field conditions allow and to stabilize the tiger's condition if treatment needs to be continued elsewhere. Certain attributes of the tiger's physical condition may be assessed prior to performing anaesthesia if the animal is in an observation cage or box trap; these include respiration rate, pupil dilation, and mucosity in the mouth

All physical examinations should include regular measurements of vital signs—respiratory rate, temperature and pulse—as well as determining levels of dehydration (classified as mild, moderate or severe) and, in the case of blood loss, levels of anaemia (classified as mild, moderate or severe).

Where a tiger has an open wound, such as those caused by a metal snare, additional diagnostic samples such as blood, faeces, urine and sputum need to be taken and analysed. See Section III for more detailed instructions.

III. Diagnosis

This third stage assesses the information obtained in Stages I and II. Here, a veterinarian is required to make a diagnosis on the overall condition and health of the tiger as well as the nature and severity of the injuries it has sustained, including the pathophysiology of any open wounds.

Examining the pathophysiology of a wound in the field is vital as continued blood loss, tissue and muscular necrosis, or bacterial infection require immediate attention to be treated effectively, so the medical treatment must be planned accordingly. For example, to diagnose if a tiger is

exhibiting symptoms of necrosis, the preliminary Stage I examination will identify symptoms such as vomiting, nausea, limping, inability to stand up and loss of consciousness, while the physical examination of the wound and measurement of vital signs recording a high temperature indicate a diagnosis of this potentially fatal condition.

IV. Treatment Plan

This final stage involves planning the treatment and subsequent handling of the tiger based on the Stage I & II examinations and Stage III diagnosis. At this stage, further examination may be required to strengthen and refine the diagnosis, determine suitable treatment and administer first aid. An initial prognosis for the tiger may also be determined based on observations and examinations carried out up to this point. For example, in the case of a snared tiger, the prognosis for recovery will depend on how long ago the incident occurred, the scale of injury, and whether any of the injuries sustained may cause temporary or permanent disability.

At this stage, a veterinarian should decide on a short-term (acute) treatment plan (giving fluid therapy, drug therapy, i.e. antibiotics, painkillers), a long-term treatment plan (wound recovery, amputation), and a suitable anaesthesia approach.

B. MANAGING AN EMERGENCY SITUATION

When facing an emergency situation a veterinarian must have the skills to analyse and prioritize the most critical actions. An emergency situation can be characterized by a sudden lowering of the tiger's main body functions to a potentially fatal level. The main physical parameters in catagorizing a situation as an emergency for a tiger are respiratory failure, circulation function/cardiac failure, nervous function failure and hemorrhaging. Quick and appropriate handling of an emergency situation will determine the success of efforts to save the Sumatran tiger.

The following are the guidelines to determine the priority scale for emergency status handling:

1. Most Severe: immediate first aid treatment is required
    (i) A - Airway (Clear from obstructions)
    (ii) B - Breathing (Respiratory arrest)
    (iii) C - Circulation (Cardiopulmonary arrest)
    (iv) D - Deadly bleeding (Rapid arterial or venous hemorrhage)
2. Severe: immediate treatment within a maximum of one (1) hour
    (i) Multiple deep lacerations with hypovolemia

(ii) Severe shock from any cause

(iii) Penetrating wounds of thorax or abdomen

(iv) Head injuries with progressive loss of consciousness

(v) Blunt force trauma with profound shock

(vi) Respiratory distress

(vii) Spinal cord injury with paralysis

3. Serious: treatment should be conducted within a maximum of six (6) hours

(i) Multiple deep lacerations

(ii) Thoracic or abdominal injury with moderate degree shock

(iii) Spinal trauma with suspected neurological trauma

(iv) Massive musculoskeletal injuries

(v) Open fracture of major bones

(vi) Open wounds to joints involving major nerves, tendons and vessels

(vii) Acute and systemic infection

4. Important: handling should be within a maximum of 24 hours

(i) Fracture of the long bones, pelvic without shock

(ii) Luxation and ligament injuries

(iii) Deep laceration puncture wounds

In emergency care, it is essential for the veterinarian to approach the situation in a calm, capable, clinical and comprehensive manner so that the emergency can be handled effectively. In addition to determining and prioritizing the level of emergency care as stipulated above, the veterinarian must also be aware of and recognize potentially life threatening conditions that can cause sudden death. These conditions include:

(i) Anaphylaxis

(ii) Coma and loss of consciousness

(iii) Rapid-acting poisons

(iv) Acute bacteraemia or toxaemia

(ii) ANAESTHESIA AND GENERAL EXAMINATION

The veterinarian is the key point person responsible for performing the anaesthesia and general examination and therefore must understand and bear the responsibility for the execution of the entire anaesthesia process from start to finish, including post-anaesthesia care. This process includes being in control of planning the process, preparing the equipment, executing the procedure and examination, and managing the team directly involved.

A. PREPARATION

For a successful and well executed anaesthesia, preparation is key. Before undertaking the procedure, a well prepared anaesthesia strategic plan must be prepared, where all potential risks and scenarios have been identified and assessed and subsequent plans put in place to deal with them if they should occur. Essential preparations for undertaking a successful anaesthesia include:

(i) A skilled rescue team comprising a veterinarian, paramedic/nurse, animal keeper/supervisor, security guards and assistants
(ii) Careful preparation of equipment and medicines to cover all potential situations that may arise
(iii) Detailed evaluation of the animal subject and their environmental conditions

1. Rescue Team

As part of the planning process prior to anaesthesia, having a skilled rescue team is vital. Prior to the start of the procedure, each person in the team must be assigned responsibilities, e.g. one person responsible for anaesthesia and monitoring, one person for fitting a radio-collar, one person for collecting biological samples and so on.

Everyone involved in the anaesthesia process must be briefed in detail and should have a clear understanding of their specific roles and responsibilities during the procedure. Reconfirm their level of understanding of their roles at least once before the procedure begins. Team members and bystanders not directly involved with the process should be directed to an area away from where the procedure is being carried out.

A rescue team should comprise at least 4 people, namely:

(i) **Team leader (x1)**: The attending veterinarian is the key team member responsible for planning, supervising and carrying out the entire procedure, including treatment and aftercare. They must be proficient in capture/immobilization skills, be in overall charge of any drugs and technical equipment usage, and ultimately bear responsibility for all treatment and procedures administered. If two veterinarians are present, one of them must be allocated the role of team leader from the outset.

(ii) **Handling Assistants (x2)**: ideally one paramedic or nurse and one animal keeper/handler, responsible for carrying and maintaining equipment, monitoring vital signs, taking notes during the procedure, and ensuring the safety of the team during the procedure.

(iii) **Assistant (x1):** to liaise with any other people near the capture/immobilization site to ensure that they do not hinder or disturb the procedure and stay safe.

A good team is a skilled team that is confident, well trained, proficient and adequately equipped, so that personnel are capable and ready to adapt to any situation in the field. Before they attempt to capture/immobilize a tiger, the team should identify and plan for dealing with the potential different field situations that could arise. For example, if the procedure has to be carried out at night, low visibility and increased stress levels for the tiger increase the potential risks to the tiger and the team.

The team must have the most up to date contact details of the relevant authorities or groups to contact in case of an emergency. If there is limited phone network where the capture and/or immobilization is being carried out, a satellite phone or hand-held transceiver radio (walkie-talkie) should be made available.

2. Equipment, drugs and supplies

All equipment, drugs, ancillary supplies and materials must be prepared in advance and be ready and easily accessible during the procedure. Before anaesthesia, the team must make certain that all the equipment that may be used is functional and sterile. After the procedure and treatments, the equipment must be sterilized, cleaned, and stored away properly, with supplies restocked, and medical waste must be dealt with appropriately.

The equipment and drugs required for immobilizing a Sumatran tiger will depend on what the veterinarian has decided is the most suitable approach to use (see tiger capture section) for each individual case. A suggested list of equipment needed to anaesthetize a tiger is outlined in Table 1 as follows:

Table 1. Equipment list for immobilizing a wild tiger

Anaesthesia:

Medetomidine 1%
Ketamine 10%
Xylazine 10%
Zoletil
Atipamizole 0.5%
Midazolam
Diazepam
Yohimbine
Doxapram x 1
Adrenaline x 3
Glycopyrrolate x 1
Atropine sulfate

Other drugs:

Carprofen x 3
Amoxycillin (LA) x 3
Oxytetracycline (LA) x 3
Dexamethasone
Epineprine
Iodine bottle x 1
Injection water (5 ml) x 10
Opthalmic lubricant x 1
Multivitamin injection
Ivermectin injection
Anthelmintic oral
Antibiotic topical ointment
KY Jelly (lubricant gel)
Ringer lactate infusion
Normal saline infusion
Ringer dextrose infusion 5%
Glucose infusion 5%
Alcohol 70%

Blow syringe equipment:

Blow pipe

Blow syringe
Needle syringe + seal
Air pump syringe
Tailpiece stabilizer

Sample collection equipment:

Sterile cotton swabs plain x 5
Sterile cotton swabs with transport medium x 5
Tube plain 3 ml x 10
Tube + EDTA 3 ml x 10
Puncture skin biopsy x 3
Frosted object glass + cover glass
Liquid paraffin
KOH
Alcohol 95%
Plastic container with screw cap 50 ml
Ziplock plastic bags
Transport cool box
Object glass holder
Permanent marker

Physical examination equipment:

Stethoscope
Mercury thermometers x 3
Endotracheal tube no: 16, 18, 20, 22
Mouth props x 4
Laryngoscope
Ophthalmoscope
Pulse oximeter
Pen light
Stomach tube (10 x 16 mm)
Ambu bag
Long forceps x 1
Syringes (5–10 cc) x 10/needles
Catheter IV 18, 22, 24
Infusion set x 2
Infusion set pediatric
Tourniquet
Gloves
Bandage

Cotton wool
Micropore
Support bandage
Clippers – battery operated

Minor surgery equipment:

Vicryl sutures (1) + taper needles x 5
Vicryl sutures (2/0) + round needles x 5
Needle holder
Scissors x 1
Anatomical forceps
Surgical forceps
Artery clamp x 4
Scalpel + blades

Other equipment:

Head torch and batteries x 4
Powerful flash lights and batteries x 4
Sticks x 3
Digital watch x 1
Sheet (3 m x 2 m) x 1
Tarpaulin (3m x 2 m) x 1
Ball of string x 1
Rope x 1
Jungle knives x 3
Penknife x 1
Pliers x 1
Wire cutters x 1
Tape measure x 1
Weighing scale (0–150 kg) x 1
Digital camera x 1
First aid kit x 1
Jerry cans (5 ltr) x 3
Anaesthesia record sheet
Measurement sheet
Physical examination sheet
Plastic bags for rubbish
Stretcher
Box for charges and drug equipment x 1

The team leader (veterinarian) responsible for the anaesthetic procedure must have a comprehensive and up to date knowledge and understanding of the drugs that could potentially be used in this procedure. This expertise must include familiarity with the different choices of anaesthesia, suitable antidotes, as well as associated or related drugs suitable for use as part of a treatment regime. The following drugs (listed in alphabetical order) are the most commonly used for anaesthesia or as part of the anaesthesia procedures for tigers in Indonesia. It should be noted when preparing for the anaesthesia that the antidote dosage must be prepared advance.

a. Adrenaline

A cardiac stimulant that should be used only in an emergency situation when the heart is failing or has stopped. For the most effective treatment, it should be administered by slow intravenous injection. It can also be administered using intramuscular or even subcutaneous injection, though this slows the recovery time and so is less effective in the case of cardiac arrest. Adrenaline comes in 1 ml vials of 1 mg/ml concentration. A dosage of 0.01 mg/kg of weight is recommended, which is equivalent to 0.1ml/10 kg of animal weight.

b. Atipamezole

A highly potent and specific antidote (reversal agent) to medetomidine (see i) and can also be used to reverse the effects of xylazine (see l). Usually administered intramuscularly, but in emergencies can be given intravenously to reverse the effects of these drugs more rapidly. During an emergency situation such as cardiopulmonary arrest, the antidote should be administered intravenously immediately. If the anaesthesia procedure goes accordingly then the antidote may be given intramuscularly when a slow/gradual recovery reaction is desired.

Antisedan® comes in 10 ml vials of 5 mg/ml solution of atipamezole. Recommended dosage falls between 3 to 5 times the total amount of medetomidine administered as the anaesthetic. When used to reverse xylazine, 1 mg atipamezole is given for every 10 mg xylazine used.

c. Atropine

Used to stabilize and increase the heart rate in an emergency situation during an anaesthetic procedure. However, atropine also causes persistent dilation of the pupils, so it is not appropriate for use in tigers that will be released directly back into the wild, as dilation affects an animal's vision. It is appropriate only for tigers that will be moved to a holding facility or for captive animals.

Atropine sulphate can be given intramuscularly, subcutaneously or even by slow intravenous injection at between 0.02 and 0.06 ml/kg of animal weight, equivalent to approximately 0.3 to 1 ml/10 kg of animal weight.

d. Carprofen

A potent anti-inflammatory and analgesic (pain-relieving) drug. Part of the Non Steroid Anti Inflammation Drug (NSAID) family, it counteracts minor swelling and possibly pain experienced by a tiger captured in a snare. If the snare, in particular a steel snare, has caused damage or broken the tiger's skin, carprofen should be administered along with antibiotics.

Rimadyl® contains carprofen at 50 mg/ml. It is administered by subcutaneous or intravenous injection at 4 mg/kg of animal weight, equivalent to approx. 0.8 ml/10 kg of animal weight.

e. Dexamethasone

A steroid with potent anti-inflammatory and anti-allergenic properties. Dexamethasone can also be administered in cases of shock. Because dexamethasone suppresses the body's immune response, whenever it is administered it must be accompanied by antibiotic treatment to prevent bacterial infection.

Dexadresone® is a 2 mg/ml solution of dexamethasone. It is normally administered intramuscularly, although in cases of shock it is administered intravenously for immediate effect. For anti-inflammatory and anti-allergic purposes, dexamethasone dosage should be calculated at 0.1 mg/kg of weight, equivalent to 0.5 ml/10 kg of animal weight. In cases of shock, a much higher dosage of 1 mg/kg weight, equivalent to 5 ml/10kg of animal weight, is recommended.

f. Doxapram

A central nervous system and respiratory stimulant which may have some antagonistic (reversal) action against certain anaesthesia agents, so must be used with care. Its primary use is to stimulate the depth and respiratory frequency in tigers suffering from respiratory depression. However, its effects tend to be short-lived (less than 30 minutes), and it should only be administered after checking that there are no obstructions in the animal's airway which may be restricting respiration.

Dopram-V® is a 20 mg/ml solution of doxapram. For low risk anaesthesia procedures and smaller species, doses of 2 mg to 5 mg/kg of animal weight are administered intravenously to stimulate breathing; this is equivalent to 1 ml to 2.5 ml/10 kg of animal weight. For larger

animals, dosage of 0.5 mg to 1 mg/kg is needed; this is equivalent to 0.25 ml to 0.5 ml/10 kg of animal weight. It is recommended that lower dosages are administered initially to try to re-establish an acceptable breathing pattern, as higher dosages may cause the tiger to come out of the anaesthesia unexpectedly, resulting in a high risk situation for the tiger and the team.

g. Glycopyrrolate

Stabilises and increases heart rate during anaesthetic emergencies and is similar in this respect to atropine. However, unlike atropine, glycopyrrolate does not cause the pupils to dilate, so it is recommended as the emergency drug to use on Sumatran tigers that are intended to be released in the wild directly after the anaesthesia.

Robinul® comes in 3 ml vials containing 0.2 mg/ml solution of glycopyrrolate. The recommended dosage is 0.01 mg/kg animal weight, administered intramuscularly or by slow intravenous injection.

h. Ketamin

A dissociative anaesthetic drug, that causes a chemical separation between the conscious mind and the sensory and motor control mechanisms in the brain. It produces rapid anaesthesia and a trancelike state. The eyes remain open and the swallowing reflex is maintained. When used in isolation, there can be pronounced muscle rigidity, potentially causing an increase in the tiger's body temperature. Common side effects include excessive salivation and seizures (convulsions).

Recovery from ketamine anaesthesia can be prolonged and characterized by ataxia (lack of coordination) which must be taken into consideration for tigers to be released back into the wild. Ketamine works well on many animals and has a wide margin of safety in dosage concentrations.

However, ketamine is best used in combination with a tranquilizer (such as midazolam or diazepam) or sedative (such as medetomidine or xylazine) to overcome the adverse side effects. There is no specific reversal agent for ketamine.

i. Medetominidine

A very potent sedative drug, high doses of medetomidine will tranquilize the tiger, causing a sleep-like state with marked muscular relaxation. Medetomidine should never be used in isolation as animals can be easily roused with minimal stimulation and are capable of direct attack.

Domitor® is a solution of 1 mg/ml of medetomidine. To achieve anaesthetic effect, medetomidine should be used in combination with low doses of ketamine and can be reversed with atipamezole.

j. Midazolam

A tranquilizer that, when used in isolation, produces a calming effect and muscle relaxation without affecting consciousness. As with all tranquilizers, midazolam does not immobilize animals. Midazolam is water soluble and is rapidly absorbed into the muscle.

In field anaesthesia, midazolam can be used to control seizures (convulsions or fits) caused by ketamine or tiletamine. It can be administered either by intramuscular or intravenous routes at a dosage of 0.05 to 0.1 mg/kg weight.

Versed® and Hypnovel® are 5 mg/ml solutions of midazolam. To control seizures, administer a dose of 0.1 ml/10 kg of animal weight intravenously or 0.2 ml/10 kg of animal weight intramuscularly.

k. Tiletamine/Zolazepam

A combination of two drugs – tiletamine and zolazepam – in equal amounts. Tiletamine is chemically related to ketamine, and zolazepam is chemically related to midazolam. Used as an anaesthetic its properties include a rapid induction, minimal depression of breathing and a dose-dependant effect, giving it a wide safety margin of use. The higher the dosage administered the deeper and more prolonged the anaesthesia achieved. It is highly soluble, requiring only a minimal amount of distilled water for reconstitution.

However, disadvantages include prolonged ataxia and unpredictable recovery and lack of a specific reversal agent; furthermore, it does not remain stable for long after being reconstituted with water. Swallowing and gag reflexes are often preserved under anaesthesia with tiletamine/zolazepam, which can make intubation in an emergency situation difficult.

Zoletil® and Telazol® are solutions of tiletamine/zolazepam and are the anaesthetic of choice for bears, small carnivores, primates, rodents and large reptiles. Zoletil® is supplied in packs containing one vial of 500 mg tiletamine/zolazepam powder plus one vial of sterile water. In its powdered form it is extremely stable. Combining the powder and vial of water produces a 100 mg/ml solution. Reduce the amount of water for stronger solutions as desired.

l. Xylazine

A sedative, chemically related to medetomidine although not as potent. It is usually available as a solution of 100 mg/ml or 20 mg/ml. In high doses it can cause severe cardiac and respiratory depression, and even death. Its effects are largely reversible with atipamezole at 1 mg atipamezole to 10 mg xylazine used.

When used in isolation, xylazine may provide sufficient sedation in tigers but only for minor procedures and will require manual restraint. However, animals sedated with xylazine may suddenly come round when stimulated by pain, noise or sudden movements. Therefore it is not recommended as safe to use as the sole drug for handling dangerous species such as tigers and bears.

Low doses of xylazine in combination with ketamine can produce anaesthesia in a wide range of species. In Indonesia this combination is the second choice of preference for veterinarians for inducing anaesthesia in cat species such as tigers and clouded leopards; however, the dosage volumes required are far greater than the medetomidine and ketamine combination.

Rompun® contains 500 mg xylazine powder, to which sterile water is added to produce a 100 mg/ml solution of xylazine. Xylazil® is available in a 50 ml vial in concentrations of either 10% (100 mg/ml) or 2% (20 mg/ml).

3. Environmental Assessment

It is essential that all of the potential environmental hazards in the area where the anaesthesia will be carried out are assessed and, where possible, mitigated. In the majority of cases, the field conditions will be far from ideal, and likely there will be plenty of scope and need for improvisation. It may even be necessary to discuss and plan moving the animal to a more suitable area for examination and treatment once it has been anaesthetized if, for example, there is a river nearby in which the animal could drown or a cliff edge that it could fall off while recovering from after effects of the anaesthesia.

Other factors to consider and plan for before conducting the anaesthesia procedure are weather and temperature. In cold weather, moving a snared tiger out of a prevailing wind may be necessary to reduce any wind chill factor that could contribute to hypothermia. On the contrary, in hot weather, moving the animal to a shady area or making a shade during the anaesthesia procedures should be considered to prevent hyperthermia. Assessment should also include, for example, obstacles that could injure the animal or staff, the slope of the ground, shade, cover pre-prepared in case of heavy rain, and holes and ditches that could trip people working in the area.

4. The condition of the Sumatran tiger

a. Weight estimation

Assessing the condition of a snared or trapped tiger accurately without causing it unnecessary pre-anaesthetic stress is very difficult. The rescue team must possess the ability, using Stage I observations, to accurately estimate the weight of the tiger to calculate the correct amount of anaesthetic drugs required. Estimation should be carried out by two people as quietly and quickly as possible, causing minimum disturbance to the tiger. Under anaesthesia, the tiger should then be weighed to ensure that the correct dosages are being used, and the dosage adjusted accordingly. This information will also be useful to provide guidance to the team for future weight estimations as well as for conservation purposes.

Characteristics to consider when estimating a tiger's weight include:

i. General body condition (large, small; thin, medium, fat; long, short)
ii. Sex (males are generally heavier than females).
iii. Age estimation (hair coat, eyes, teeth)

Male weight range	**Female weight range**
110–140 kg (*average 120 kg)	85–110 kg (*average 90 kg)

Source *Australia Zoo

b. Pre-anaesthetic stress

The rescue team must be aware that a snared or trapped tiger will inevitably experience stress to some degree even without any further disturbance from the outside. So it is important to avoid any further actions that may increase the level of pre-anaesthetic stress. Stressed and anxious animals have high muscle tension, requiring higher anaesthetic doses, which take longer to reach deep anaesthesia status. Such case are prone to more anaesthetic complications and slower recovery.

During the pre-anaesthetic preparation (e.g. weight estimation, dart preparation, on-site discussions and procedures), keep the number of people involved and noise levels to a minimum, avoiding further disturbance to the tiger. Where possible all of the preparations should be made out of sight and hearing and downwind of the animal. People not involved at this stage should stay well back and out of sight until safe anaesthesia is achieved.

A critical period of stress for a snared animal is the period after the animal first detects the person responsible for darting it. Stress levels increase dramatically when an animal detects a

person nearby, and the animal may hurt itself further trying to escape. Thus, animals should be anaesthetized as quickly as possible following initial detection in the snare.

B. INDUCTION OF ANAESTHESIA

During the anaesthesia process, particularly the induction, disturbances such as noise caused by equipment and crowds should be kept to a minimum level. A tiger's hearing is usually the last sense to be lost when undergoing an anaesthetic procedure and the first to return, and therefore, it is especially important to be quiet during induction, recovery, and other periods of light anaesthesia.

1. Choice of Drugs

A veterinarian responsible for anaesthetizing a tiger should elect which drugs to use based on the situation assessment and drug availability. When deciding on the dosage, factors to consider include the objective of the anaesthesia as well as the safety of the tiger and the team.

Recommended drugs for tiger anaesthesia in Indonesia are:

No.	Drug 1 mg/kg	Drug 2 mg/kg
1	Metodimine 0.03–0.05	Ketamine 1–3
2	Xylazine 0.2–0.5	Ketamine 7–8
	Xylazine 2.0–4	Ketamine 2–3
3	Zoletil 3–4	None

2. Administration of Drugs

By far, the best way to administer anaesthetic drugs is by careful injection with syringe and needle into an appropriate muscle. However, as most tigers in a conflict situation cannot be restrained physically and are not safe to approach, remote injection is necessary. This is administered using a blowpipe dart, which is far less traumatic than loud gas powered systems. Excessive trauma on darting is to be avoided not only for humane reasons but also because bruising will delay uptake of anaesthetic drugs at the entry site.

Unnecessary bruising can arise from using needles that are too thick or too long and from darts fired at excessive speeds. Many anaesthetic drugs (and particularly medetomidine) are lipophillic (literally "fat-loving") which means that they will preferentially stay in fatty tissue. Therefore, if

a dart injects its contents into the subcutaneous fat deposits of an animal, the drug will tend to remain there, delaying its absorption into the blood stream. Remote injection using blow syringe potentially causes slow and sometimes incomplete inductions. To prevent this, a sufficiently long dart needle must be used to ensure that the dart penetrates into muscle.

When darting an animal, aim for the large muscle masses present at the front of the upper hind leg or shoulder area. Where possible, avoid the head, chest wall, abdominal wall, lower legs and the genital area. Many tigers will chew a dart if they can get to it, but they rarely swallow the component parts.

If possible, tigers should be darted when standing, as loose skin folds present when sitting or lying down can absorb much of a dart's impact energy, resulting in subcutaneous delivery or even failure to penetrate the skin at all. If a tiger is moving when darted, there is a higher risk of dart deflection and inaccurate placement. In the event of a suspected dart failure or partial drug delivery, wait a full 20 minutes before attempting to administer additional drugs.

No anaesthetic agent works immediately, and during the time between darting and induction animals can lose their balance during the partially anaesthetized stage, which may place them at further risk. The team should anticipate this condition in the pre-anaesthesia planning.

Darting animals is not without hazards. Damage to major nerve trunks, blood vessels and bones is only likely in smaller individuals, where the blow syringe type, velocity or weight is inappropriate. Fortunately, blow syringe ricochets are rare, but the operator must always ensure that no people are within range when firing.

3. Post Injection

The rescue team must establish whether the drugs injected succeed or fail to enter into the tiger's system without disturbing the animal unnecessarily. With the exception of one team member tasked with monitoring the tiger's reaction to the drugs, all members of the rescue team should stay away from the animal to minimize disturbance.

Typically the effects of the drugs should be seen in 10-15 minutes after the injection. Failure to allow such a period may result in partial arousal during the induction leading to a lighter level of anaesthesia than would normally be expected for a given anaesthetic dose rate. If no apparent sedation or anaesthesia has been achieved after 15 minutes, further administration of anaesthesia should be considered. The team should be aware of the possibility of an emergency situation at this stage, such as the development of respiratory problems.

C. MONITORING AND ASSESSMENT OF TIGERS DURING ANAESTHESIA

1. Vital Signs

Monitoring and assessing the vital signs and physiology of a tiger are critical to assess the tiger's health status under anaesthesia. Monitoring of the tiger's condition should ideally begin before the anaesthetic is administered or as soon as it is safe to do so and then continue at regular intervals (to be determined by the veterinarian and depending on the tiger's condition) until the tiger begins to regain consciousness. It is important that the anaesthesia operator observes the impacts of the drugs on body vital functions, such as cardiovascular, respiratory and nervous systems. All monitoring must be recorded throughout the procedure.

By conducting such monitoring, the anaesthesia operator will be able to assess the depth and safety level of the anaesthesia and the appropriate actions according to the anaesthesia planning. The vital signs include:

a. heart rate
b. pulse rate and strength
c. quality and rate of breathing
d. colour of mucus membranes (e.g. lining of mouth)
e. capillary refill time (CRT) (2–3 seconds is normal)
f. body temperature

2. Vital Signs Examination

The easiest way to remember what to check at this stage is to adopt an "ABC" approach.

A. Airway

For safety, a mouth gag should be applied to the tiger before a detailed examination of the mouth is carried out. The simplest design is a section of thick-walled plastic tubing of appropriate length (approx. 5 cm) placed between the upper and lower canine teeth on one side, with the tooth crowns fixed within the tube. The canines of larger species are sufficiently curved to allow the teeth ends to rest in the tube and not the gums where they may cause trauma (see picture for details of use).

Tube gags are only intended for use during full anaesthesia – they may be crushed or split by a semiconscious animal.

To check the airway, the rescue team must:

i. Ensure there is no obstruction in the airway
ii. Clear the mouth of material that could cause an airway obstruction if inhaled, e.g. food, vomit, dirt or even pieces of dart
iii. Check that nothing is pressing on the outside of the neck
iv. Keep the head and neck in as straight a line as possible
v. Check that the larynx and the entrance to the trachea or windpipe is clear, opening the mouth and pulling the tongue forward to examine the larynx using a laryngoscope

B. Breathing

The rescue team should check that breathing is regular and thoracoabdominal. Pay attention to the rate, depth and quality of breaths. Auscultation is conducted to listen for abnormal breathing sounds – snoring, for example, may indicate that there is a partial obstruction to breathing.

C. Circulation

Heart auscultation with a stethoscope is conducted to record the pulse rate and quality. Examination of the mucus membranes should also be performed to check the colour and CRT (Capillary Refill Time).

(iii) ANAESTHETIC COMPLICATIONS AND RESUSCITATION TECHNIQUES

Modern anaesthetic drugs are safe, but emergency situations can and do still arise for a number of reasons. Monitoring of a tiger's vital signs during anaesthesia is key in determining appropriate actions during the anaesthesia procedure. Most monitoring procedures are directed towards assessing the oxygen carrying ability of the blood and the effectiveness of the circulatory system in carrying this blood to and from the tissues. Carried out correctly and with sufficient frequency, appropriate monitoring will avoid a number of anaesthetic-related deaths.

Resuscitation often arises from situations that may not seem to be an immediate emergency, and prevention is always the best approach. In all anaesthetic emergency situations demanding resuscitation, veterinarians must be disciplined and use the ABC approach (see below). When faced with complete respiratory and circulatory failure (cardiopulmonary failure), restoring life is exceedingly difficult. Four types of anaesthetic emergency are detailed below – respiratory failure, cardiac arrest, hyperthermia, and shock.

A. RESPIRATORY FAILURE

This is the most common anaesthesia complication. Respiratory failure (lack of or ineffective breathing) can occur during anaesthesia or in any severely injured, shocked or diseased animal at any time, especially in cases of severe respiratory infections. During anaesthesia, respiratory failure is often caused by the administration of too much anaesthetic agent, which can suppress respiration. It can also be caused by obstruction of the airway or even by severe pain.

Clinical symptoms:

Monitoring of respiration is achieved by observing the depth and rate of breathing, by checking the colour of the mucus membranes, and by ensuring that no obstructions develop within the oral cavity or pharynx.

Signs of impending respiratory failure include a fall in the rate of breathing to less than 50% of normal, a progressive fall in the depth of breathing, and pallor or a blue appearance of the mucus membranes.

Obstruction of the airway in conscious animals may be indicated by violent and frequent attempts by the animal to draw in breath. However, during deep anaesthesia, obstruction can cause inadequate ventilation without the dramatic aspiratory attempts.

Complete respiratory failure in a tiger may be considered to have occurred if there is a lack of breathing for 1 minute, with continued beating of the heart.

Action:

A: Airway:

1. Count the breathing frequency, using a stopwatch.
2. Stop administering anaesthetic drugs, including gaseous agents.
3. Check to make sure that the head is extended straight out from the body to ensure that the airway is not kinked.
4. Check to make sure the throat is not lying across a rock or stick, which may be pressing on the trachea.
5. Check that any radio collar fitted is not too tight.
6. Pull the tongue forward to ensure that it is not lodged against the back of the pharynx, obstructing the larynx.
7. Remove any vomit, mucus, blood clots or foreign materials from the mouth.
8. Where possible, pass an endotracheal tube and inflate the cuff to safeguard the airway.
9. If already fitted, ensure that an endotracheal tube is not blocked or kinked.

B: Breathing (Respiratory)

1. Establish an effective pattern of breathing during anaesthesia.
2. When breathing stops, attach an Ambu bag to the endotracheal tube and begin compressions of the Ambu bag or intermittently through the endotracheal tube (this can be surprisingly effective).
3. In extreme circumstances where no endotracheal tube is fitted, breathing can be established by blowing intermittently with your mouth placed around an animal's nostrils whilst keeping its mouth closed.
4. Whichever method is chosen, one respiratory movement should be established every 5–6 seconds.
5. Intermittent pressure on the chest wall can be used to establish airflow in and out of the lungs but is extremely inefficient for anything more than a couple of minutes. However, if an animal has just stopped breathing, pressing down on and then releasing the chest wall can sometimes trigger spontaneous respiration.

C: Circulation:

Respiratory and circulatory failure often occur together and therefore it is essential to ensure that the animal's heart is still beating and that an effective pulse is present.

D: Drugs:

1. Discontinue anaesthetics, including gaseous anaesthetic agents, such as isoflurane.
2. Where reversible anaesthetic agents have been used, the antidote should be administered. The safety consequences of recovery to consciousness must be considered.
3. Stimulate breathing with intravenous doxapram (Dopram-V) at 2–5 mg/kg for small animals and 0.5–1 mg/kg for large animals. This is equivalent to 1–2.5 mg/10 kg of Dopram-V solution for small animals and 0.25–0.5 ml/10 kg Dopram-V solution for large animals.
4. Pushing on the chest wall sometimes triggers a breath after intravenous doxapram.
5. If there is no effect, repeat the doxapram.
6. If you are unable to administer a dose of doxapram intravenously, the drug can be injected into the muscle of the tongue.

If breathing is re-established and stabilized then the anaesthetic can be continued, but monitor the animal closely and try to lighten the anaesthesia. Close monitoring will be required for a prolonged period following the episode—respiratory failure may recur as the effects of doxapram can be short lived.

B. CARDIAC ARREST

Cardiac arrest is the complete absence of a heartbeat. This is a very serious situation and needs to be corrected within a few minutes. Brain cells are particularly at risk from a lack of oxygen (hypoxia), and irreversible brain damage is likely unless the circulation to the brain is restored within 3 minutes.

Heart failure simply means no effective output from the heart. Therefore the term includes not only complete absence of a heartbeat (cardiac arrest) but also uncoordinated beating of different parts of the heart (such as ventricular fibrillation).

Most anaesthetic drugs have a depressant effect on cardiovascular function, and anaesthetic overdoses are the most common cause of heart failure during anaesthesia. However, some animals that need to be anaesthetized may be very old or sick, with metabolic problems that

cannot be assessed simply by looking at them. Such animals have a high risk of heart failure during anaesthesia.

Symptoms:

1. Absence of previously palpable pulse
2. No heart sound (use stethoscope)
3. Cyanosis (blue coloration) or pallor of mucus membranes
4. These signs are rapidly followed by wide dilatation of pupils, and cessation of breathing or agonal gasping

Action:

Before performing any action, look at watch, set stopwatch. Discontinue administering any anaesthetic, including gaseous agents.

A: Airway

Check that the passage of air into the lung is unobstructed as above.

B: Breathing

Establish and maintain breathing as above

C: Circulation

Apply external cardiac massage, i.e. intermittent pressure on chest wall over the heart - 1 per second. Place head at a lower elevation to the body to assist blood flow to the brain.

D: Drugs:

1. Give intravenous or intra-cardiac adrenaline at 0.01 mg/kg. This is equivalent to 0.1 ml adrenaline injection 1:1000 0.1 ml/10 kg of animal.
2. Repeat adrenaline every 3 – 4 minutes if necessary.
3. If the heart re-starts give glycopyrrolate by slow intravenous injection at 0.01 mg/kg. This is equivalent to 0.5 ml of Robinul®/10 kg of animal.

NB: Restoration of effective cardiovascular function after a cardiac arrest is difficult, and prevention is infinitely better than attempting a cure. A common situation during anaesthesia

where too much anaesthetic has been given is the weakening of pulse strength and slowing of the heart. Timely administration of subcutaneous or very slow intravenous atropine or glycopyrrolate at this point can restore both and prevent heart failure from developing.

C. HYPERTHERMIA

The core body temperature of tigers must be maintained within certain narrow limits to sustain normal metabolic functions. When it rises above these limits, the condition is known as hyperthermia. When it falls below the limits, the condition is known as hypothermia. Both situations are life-threatening. Unanaesthetized animals are able to use a range of temperature-regulating mechanisms to maintain thermal stability – shivering in the cold and panting in the heat are two examples. However, because most anaesthetic drugs interfere with these thermoregulatory mechanisms, the anaesthetized tiger is vulnerable to radical and dangerous changes in its core temperature.

In field operations in Sumatra, hypothermia is extremely unlikely to occur unless at high elevations, but the risk of hyperthermia will always be present. Untreated, hyperthermia can lead to brain damage and death from pulmonary edema. Even in less extreme cases, a prolonged recovery from anaesthesia can be expected.

Hyperthermia can result from high environmental temperatures, exposure to direct sunlight, pre-anaesthetic excitement and convulsions. Very often, several of these factors will operate at the same time in the conditions under which wild tigers will need to be anaesthetized in Sumatra.

For example, a tiger caught in a snare for any length of time on a hot day with no shade or water may become seriously hyperthermic – especially if it is then excited by too much noise or disturbance immediately prior to an anaesthetic. Once under anaesthestic, the tiger will lose the ability to use those thermoregulatory mechanisms available to it while still conscious, causing its temperature to rise rapidly. Therefore, a tiger which is moderately hyperthermic immediately prior to anaesthesia may very rapidly become dangerously overheated shortly after induction unless steps are taken to cool it down, especially on hot, windless days.

Symptoms:

The normal rectal temperature of tigers lies between 37.8 °C and 39.4 °C. As an approximate “rule of thumb”, if a tiger’s body temperature is above 40 °C (104 °F), it must be cooled down.

Action:

1. Move the animal into the shade or create shade over it.

2. Cool the body (especially the abdominal area and feet) with water or alcohol. Alcohol is more effective but short acting. For smaller tigers, i.e. cubs, a cold water compress on the neck area may help.
3. Fan rapidly – use anything to hand to create a breeze close to the wet skin.
4. When the animal is excited/tense, use oxygen to calm it.
5. Control any convulsions with small doses of midazolam (Hypnovel®).

If the procedures above do not bring the animal's temperature down, proceed to the following:

1. Give a cold water enema. Gently insert a soft plastic tube (such as a foal gastric tube) 10 cm into the rectum having lubricated it well with *"K-Y Jelly"* to avoid damaging the lining of the rectum. Introduce cold water into the rectum via a funnel attached to the free end of the tube.
2. Leave water in rectum for 5 minutes, and then drain by lowering the tube.
3. Repeat until 10 liters of water have been put into the rectum. For smaller animals, the maximum water volume is 5 liters.
4. Wait 5 minutes, then recheck the temperature.
5. Repeat enema if temperature does not go back down to the normal range.

   NB: To avoid further increases in body temperature, overheated animals should never be enclosed in a box.

Rectal enema in a captive tiger

D. SHOCK

Shock is a failure of the microcirculation (basically the capillary network) to provide adequate perfusion of the tissues with blood. Thus, cells are deprived of oxygen and nutrients, and waste products are not removed. Local cellular death will eventually occur, which can be followed rapidly by death of the animal.

Various categories of shock can be recognized, but in conflict tigers the most frequent is hypovolemic shock (low volume shock occurs when there is insufficient liquid in the blood vessels to keep capillaries open and functioning). This can be caused, for example, by severe hemorrhaging or dehydration, resulting in the loss of blood, plasma, or just water and electrolytes.

Animals suffering from a lesser degree of fluid or blood loss may only be in mild shock as various adjustments in the body's fluid distribution will have been made to compensate for these losses, maintaining the microcirculation. However, shock is still possible; therefore, such losses should be replaced, as the best way to deal with shock is through prevention.

Dehydration should be suspected if the eyes are sunken, the mucus membranes are dry, and the skin lacks elasticity (not returning to normal position within 2–3 seconds of pulling up a patch of loose skin).

Symptoms:

The symptoms include weak and rapid pulse, pale or cyanotic (bluish) mucus membranes, rapid heartbeat, hyperventilation or shallow sporadic breathing, and cold extremities.

Action:

If the delay in treating shock is too long, damage to cells is irreversible.

1. Correct any obvious cause, for example, stop hemorrhaging. Stop the anaesthesia or give reversal agents.
2. Give intravenous fluids rapidly. The team should have the skills, experience and equipment necessary to give intravenous fluid therapy to tiger.
    a. Ideally, give 10 ml/kg colloidal solution (i.e. plasma substitute) plus 40 ml/kg of crystalloid solution, such as lactated Ringers solution. If dehydration is severe, fluid therapy at <100 ml/kg can be given.
    b. If it is impossible to give fluids intravenously, it is still advantageous to give them subcutaneously, although the effect will be less rapid.

3. Give broad spectrum antibiotics at standard doses.
4. Give high dose dexamethasone at 1 mg/kg intravenously. This is equivalent to Dexadreson® at 5 ml/10 kg of tiger body weight.
5. Provide oxygen if available.
6. Monitor vital signs very closely - especially Capillary Refill Time (CRT) and pulse rate and quality.

(iv) SAMPLE COLLECTION

A. BLOOD AND SERUM SAMPLES

1. Blood Sampling

Blood samples are generally easier to collect if a vein is raised. Use finger pressure over the vein to obstruct blood flow back to the heart. This causes blood to pool in the vein upstream of the obstruction, making the vein more visible and collection of blood easier. In the case of the femoral vein this is not necessary.

Once the vein has been identified and raised, disinfect the site (use liquid to allow for penetration of fur, e.g. surgical spirit), and puncture the vein sharply with an appropriate sized needle attached to a syringe. The bevel of the needle should face the operator. Use short needles for most superficial veins.

The blood should flow easily into the syringe. If it is difficult to withdraw blood or the flow into the syringe is extremely slow, the sample is likely to hemolyse (in other words the excess negative pressure causes red blood cells to lyse and release hemoglobin into the plasma). Hemolysed samples can be identified by a red tinge to the serum once prepared. Hemolysis will affect certain test results adversely.

If withdrawing the blood sample is difficult, try changing the angle of the needle or pulling the needle out slightly. If these manoeuvers do not resolve the problem, re-enter the vein again at a slightly different site, or look for another suitable vein.

Once the sample has been collected, discontinue raising the vein and withdraw the syringe and needle while applying finger pressure over the point of entry. Hold this pressure for a minute. If an artery has accidentally been entered, firm finger pressure should be applied for at least 10 minutes to prevent the formation of a subcutaneous hematoma. Once the sample has been taken, remove the needle from the syringe and dispense the blood carefully into the appropriate tubes without delay.

When storing the blood samples, the followings should be taken into consideration:

(i) Smaller, pink-topped EDTA tubes are used for the collection of blood samples for hematology. Approximately 3–5 ml of blood volume is required for this sample. Spin the blood in the sample tube at number eight direction.

(ii) Red-topped SST tubes are used to collect blood from which serum samples are to be prepared. Approximately 15–20 ml of blood volume is required to collect 4 ml of serum. Rest the blood in the sample tube. Do not shake it.

Store the samples in the drugs cool bag and refrigerate until returning to the lab where the serum can be prepared.

2. Preparation of serum from blood samples

Blood collected into the red-topped SST tubes will clot within 30 minutes. The following are steps to prepare serum from blood samples:

a. Place the liquid phase into conical tubes for centrifugation.
b. Ensure that the centrifuge is balanced.
c. Centrifuge at 2500 rpm for 10 minutes.
d. Using a pipette, remove the clear straw-coloured liquid (serum) without disturbing the red cells at the bottom of the tube.
e. Store serum in screw-topped nylon tubes.
f. Freeze after labeling.

3. Suggested sites for collecting blood samples or giving intravenous injections to tiger:

a. Femoral vein
b. Medial saphenous vein
c. Jugular vein
d. Lateral tail veins

B. HAIR SAMPLES

1. Wear gloves, pluck hair close to roots for DNA.
2. Take samples from different parts of body, especially along the spinal cord.
3. Store samples in plastic envelope with silica desiccant.
4. Label appropriately with species, animal identification, date, and location.
5. Store and transport samples at room temperature.

C. FAECAL SAMPLE

Faecal samples can be analyzed for parasites at a later date after collection into SAF preservation medium. The steps are as follows:

1. Place fresh faeces into a SAF tube until the liquid reaches the red line on the label.
2. As far as possible, using the spoon attached to the tube's screw cap, smash up the faecal mass until homogenous liquid results. This will be difficult in tigers but an attempt should be made.
3. Label and store at room temperature until the sample can be sent to a suitable laboratory.

D. ECTOPARASITE SAMPLES

When possible, collect ectoparasites from immobilized animals by following these steps:

1. With a gloved hand, or using forceps, collect ticks and other ectoparasites from the anaesthetized animal. Check in the ears, inside legs, under tail, between toes, back of neck, nostril.
2. Place ectoparasites in an airtight container containing 70–95% alcohol.
3. Label appropriately with species, animal identification & date, location, location (anatomical).
4. Store and transport samples at room temperature.

(v) RECOMMENDATION FOLLOWING GENERAL EXAMINATION

Having conducted a general examination, the team will give a recommendation with respect to the tiger's immediate future. The recommendations that may be given are as follows:

No.	RECOMMENDATION	CONSIDERATION
1	Should be re-introduced	
	a. Directly	1. A sub-adult or mature tiger in a good health 2. No defects which may decrease ability to survive in the wild 3. A minor defect which has no impact on ability to survive in the wild. (list …)
	b. Under therapy	1. A sub-adult or mature reproductive tiger in less good health 2. No defects which may decrease ability to survive in the wild
2	Should NOT be re-introduced	
	a. Therapy/recovery before transported to ex-situ conservation	1. The tiger has no ability to survive and is suffering a certain disease, and so it is not possible to transport.
	b. To be transported to a captive breeding centre	1. A man-eating tiger 2. A tiger possessing permanent disability affecting significantly its survival ability 3. A juvenile which most probably has no ability to survive
3	Euthanasia	1. A tiger suffering from an unrecoverable disease 2. A tiger is suffering from a severe disease or a serious injury or disability A tiger possessing a particular disease which poses a danger to humans

(vi) TEMPORARY HOLDING FACILITIES

Although it depends on the health condition of a caught tiger, a temporary cage is required for preparation for direct translocation. It is also needed for tigers requiring recovery after medical treatment and for those which are going to be transported to ex-situ conservation or to be euthanized. Advice from veterinarians is important in designing a temporary cage, which requires high standards of sanitation and hygiene. Their advice may involve ensuring that the cage adequately meets the requirements for undertaking medical treatments such as physical observation and therapy to ensure that the caught tiger is well kept under the principles and ethics of animal welfare.

A well designed cage has to meet safety requirements for both the tiger and the keeper. Below are some considerations in making a temporary cage for a tiger:

1. Define the purpose for which the cage will be used, e.g. for sleeping, recovery, or transportation.
2. The keeper should be able to clean the cage, feed the tiger, give therapy, and undertake other activities without disturbing the tiger.
3. Choose a site for placing the cage that is easily accessible but avoids noises and visits from unauthorized people. However, it must be accessible.
4. Materials and size should be determined according to the purpose of the cage.
5. Shelter should be installed to protect the tiger from direct sunlight, wind and rain.
6. Tools to be provided in the cage:
    a. A non-tip drinking bowl that can be easily cleaned and refilled by the keeper should be placed inside the cage.
    b. Enrichment should be provided to prevent boredom and reduce stress.

    It should always be kept in mind that a tiger that has just been caught may be under profound stress; thus, a well-designed cage should provide a safe and comfortable space to minimize stress on the tiger.

(vii) TRANSPORTATION

Some important things to consider when transporting a captured tiger are:

1. In addition to being safe and comfortable, a transport cage must be strongly constructed to ensure that an aggressive and potentially dangerous tiger will be kept inside the cage.

2. Equipment should be prepared in advance, in anticipation of the tiger rampaging or extreme weather changes, e.g. hot, cold or rain, while transporting the animal.

3. A large tarpaulin or forest leaves should be provided to cover the transport cage.

4. Consider carefully the condition of the tiger that is going to be transported:
   a. Age, body size, weight, behaviour (e.g. aggressive, etc.)
   b. Health condition when the tiger is captured
   c. Distance and road condition should be known in advance to estimate travel time and develop a transport plan, including when and where to stop to rest and provide drink for the tiger if necessary.

5. Consider the mode of transportation (land, sea or air transportation). Each mode of transportation has its advantages and disadvantages. Careful consideration must be given to anticipate and plan for all possibilities during travel.

The following should also be considered when transporting a tiger:

1. Transport cage

   a. Ideally, a transport cage should be constructed from right-angle iron frames 5 x 5 cm, with plank or iron walls.
   b. The iron floor pad should be covered by flat and smooth board, without cracks that allow tail or claws out.
   c. There should be vertical sliding doors on the front and rear side of the cage, equipped with padlocks.
   d. Providing ventilation is essential to allow the tiger to breathe with ease.
   e. Accessible drinking water should be provided in the cage.

2. Documents for transporting a tiger

   a. Document of distribution (issued by Ministry of Forestry), comprising:

i. SATS-DN
ii. SATS→ CITES permit or certificate

b. Health Confirmation Letter (*Surat Keterangan Sehat*) issued by Livestock Office for quarantine purposes

Tips for ground transportation:

1. Make sure the vehicle is in good condition and filled with fuel. A long trip may require more than one driver.
2. Depart as soon as the animal is put into the vehicle.
3. Drive the vehicle at constant slow to middle speed. Avoid stopping, braking or changing lanes suddenly.
4. If the weather becomes hot, it is advisable to stop and continue the journey at night or early in the morning. Avoid travelling in the mid-day heat.
5. Avoid halting the journey unnecessarily.
6. If stopping is necessary, it is recommended to do it away from crowds and in a shady place.
7. Feeding is only necessary on a long trip.
8. Taking passengers in transport vehicles is strictly prohibited.
9. Care should be taken that the tiger does not sleep in one position during a long trip.

(viii) EUTHANASIA

The word *euthanasia* is of Greek origin and literally means "good death", implying that death occurs without pain or distress. Following a thorough examination and evaluation of a captured tiger, if the team determines that the animal's life should be ended, the decision to carry out euthanasia may be made. There are a number of possible methods for euthanasia in the field. The following are options to be used if the tiger is under anaesthesia and is to be euthanized:

1. Barbiturate overdose

An intravenous injection of highly concentrated commercial barbiturate solution results in death within minutes. Euthatal is a 200 mg/ml pentobarbital sodium. Use at a dose rate of 150 mg/kg, which is equivalent to 7.5 ml/10 kg. When intravenous injection is not possible, intracardiac or intraperitoneal injection may be considered.

2. Potassium chloride

Intravenous injection of potassium chloride (KCl) affects the electrical activity of the heart, resulting in cardiac arrest. A saturated solution of KCl could be injected intravenously to an anaesthetized tiger. Injection should be quick, as slow injection will not be effective. Administer at least 50 mg/kg KCl (equivalent to 5 gr/100 kg). Potassium chloride is quite cheap and gross overdoses are suggested. Be sure that the tiger is deeply anaesthetized prior to injection, adding more anaesthesia if necessary.

3. Gunshot

In areas where a conflict between human and tiger has occurred, trained armed police should be at hand. A deeply anaesthetized tiger may be euthanized quickly and painlessly by firing a shot into its first cervical vertebrae (i.e. the first vertebrae immediately inferior to the skull). Fire accurately from a very close distance as this will minimize the damage to tissues potentially valuable for necropsy.

4. Embolism

This method is not recommended. It is very difficult to end a tiger's life by intravenous embolism.

5. Exsanguination

Exsanguination (literally means bleeding out) can be used to euthanize an anaesthetized tiger. If this method is employed, it is advisable to sever arteries, particularly carotid arteries on the neck, rather than veins. However, this method is slow and extremely messy.

6. Other intravenous solution

Administering a very high dose of any anaesthetic drug may result in the death of the tiger. However, this is a very expensive option. To euthanize a deeply anaesthetized tiger, intravenous administration of a strong disinfectant solution at 1 ml/kg of body weight should be considered as an option.

7. Restriction of breathing

As an absolute last resort, euthanizing a deeply anaesthetized tiger can be done by restricting its breathing. This can be done by blocking the nostrils and holding the tiger's mouth firmly closed until the heart fails from hypoxia. The tiger's vigorous terminal attempts to breath may be seen, which may be distressing for onlookers and may present some danger to the veterinarian and team.

NB: Tigers euthanized with barbiturates, anaesthetic overdoses or intravenous disinfectant injection must be removed from the field and burned or incinerated so they are not consumed by any other animals.

(ix) NECROPSY TECHNIQUES

It is very important to investigate and document the cause of any illness or death of a tiger. Field necropsy is the most important tool for learning more about how the animal lived and what diseases it might have had. The necropsy should be done as soon as possible after the animal's death. If this is not possible, the carcass should be cooled and refrigerated but should not be frozen. Freezing the carcass will destroy the animal's tissues and make important disease testing impossible.

A. Tools for performing necropsy:

1. A sturdy knife
2. Scissors
3. Forceps
4. Scalpel blades
5. A small hatchet/hacksaw
6. Water to clean off blades, etc.
7. Plastic bags or sample bottles for temporary storage of tissues/organs
8. Branch lopper or bone cutter

B. Paperwork

Complete a field necropsy form for each animal necropsied.

Necropsy procedures:

1. External examination

    a. Document by description and photos all external lesions. Flex the joints, look for injuries, fractures, bruises, etc. Examine mouth, ears, eyes, genitals, anus, footpads, etc.

    b. Document by description and photos the body condition (thin, fat, muscle masses, hair coat, etc.).

2. Internal examination

a. Lay the animal on its side or back. Make a midline incision from the chin to the genitals. Reflect the skin, noting the appearance of the subcutaneous tissues. If the skin is to be saved, it can be totally removed at this time.

b. Make a midline incision through the abdominal muscles, noting the condition of the diaphragm. Once the diaphragm is evaluated, the ribs may be removed using bone cutters. Try not to disturb the internal organs as you are removing the ribs.

c. Methodically examine all the organs and lymph nodes in the abdominal cavity. If you examine and remove the liver and spleen first, it is easier to visualize the other organs. Tissue samples for bacterial and viral cultures should be taken at this point. Methodically examine each organ in the thoracic cavity. Make numerous slices in the spleen, liver, and kidneys, looking for abnormal tissue.

d. Methodically examine all organs in the thoracic cavity. Open the trachea and oesophagus. Make numerous slices in the heart and lungs, looking for abnormal tissue.

e. Samples for histology examinations should be taken at this time. Routine samples for histology include liver, kidney, spleen, lung, heart, intestines, lymph nodes, and any gross lesions present. Samples should not be larger than one centimeter thick and should be placed in 10% formal saline at a ratio of 1:10 tissue to liquid. If the tissues are not preserved at this ratio, they will not fix well and will continue to degenerate.

f. If it is necessary to remove and examine the brain, this should be done last using a hacksaw. Try to remove it whole, but it is very difficult to remove without causing damage.

Digital photography documentation during the necropsy process will be very useful. It will help in necropsy report writing, and the photo files may be used for consultation by email with a qualified pathologist to get a preliminary opinion.

(x) TIGER SAMPLE COLLECTION

As available information on the Sumatran tiger is currently still limited, data collection should be conducted any time a tiger is captured from the wild. To develop Standard Operation Guidelines (*Pedoman Operasi Baku* or POB), tiger data and samples that are needed for a genome resource bank include blood, hair with follicles, skin biopsy for DNA data and spermatozoa or gonad (ovarium or testis) of a dead or euthanized tiger. Sample collection and storage procedures should follow the existing standard, e.g. use tanks with liquid nitrogen for storage.

At present, all facilities for preserving Sumatran tiger DNA samples are available at Sumatran Tiger Captive Breeding Center, Taman Safari Indonesia, Jl. Raya Puncak No. 601, Cisarua, Bogor 16750.

(xi) FIELD HEALTH PROBLEMS

A. STRESS

Mammals have brain structures that enable them to feel fear and suffer from pain, and it is likely that they suffer pain in the same way as humans do. Fear and pain are very strong causes of stress in animals. Pain is usually the effect of injury and trauma.

Stress in tigers can be triggered by the following conditions:

1. Psychological stress
   a. Restraint
   b. Handling
   c. New (novel) experiences

2. Physical stress
   a. Hunger
   b. Thirst
   c. Fatigue
   d. Injury
   e. Thermal extremes

Causes of stress:

1. Unusual noises
2. Unknown places
3. Confusing or inconsistent training or handling
4. People exhibiting strange or unusual behaviour
5. Unpredictable or rough handling
6. Unusual odours
7. Human or animal crowds
8. Staff acting nervous or strange from the tiger's perspective
9. Extreme indoor and outdoor temperatures
10. Inappropriate housing or resting area with no resting/hiding spot, or staff working conditions/systems that keep the tiger awake for 24 hours
11. Territory issue with animal(s) in neighbouring cage(s)
12. Inadequate exercise or mental stimulation
13. Inadequate diet

14. Humans anthropomorphizing animal behaviour, thus causing behavioural problems and increased aggression towards humans
15. Inappropriate or excessive feeding

Signs of stress:

1. Restlessness, distraction, agitation
2. Listlessness, unusual passivity
3. Defensive vocalizations
4. Excessive loss of hair
5. Dilated pupils
6. Biting
7. Uncontrollable urination/defecation

B. WOUND

1. Wound Assessment

a. General assessment

i. Age
ii. General body condition
iii. Health status and presence or absence of other wounds
iv. Wound size and condition
v. Possibility of reintroduction into the forest

b. Wound condition considerations

i. Severity of wound and other finding(s) related to the wound
ii. Wound depth: superficial or profound wound
iii. Wound size: small, medium or large wound
iv. Location of wound: whether or not it is located on bone joint
v. Old or new wound
vi. Clean or contaminated wound
vii. Infected wound: whether or not there is any discharge and/or foul odour

Small wound

i. A small clean wound on healthy tissue requires no action.

ii. A dirty/old/infected small wound on bone joint should be lavaged and debrided to find healthy, living tissue and left to recover by itself or, when necessary, sutured.

Medium wound

i. Lavaging the wound should be enough to treat a superficial medium wound.
ii. If the wound is quite deep, debride the wound to find healthy, living tissues and suture it.
iii. A dirty, infected medium wound on bone joint that increases the possibility of the wound enlarging should be debrided and sutured. Extra suturing may be necessary.

Large clean wound, healthy tissue, not on bone joint

- Debride the tissue and reduce exposure to germs by suturing it. Extra suturing may be necessary.

Clean punctured wound

- Neither a clean punctured wound, not located on bone joint, nor a dirty, infected punctured wound on bone joint should be sutured. They should be lavaged and debrided. Antibiotic administration is required.

Factors preventing wound healing:

- Dehydration
- Bad nutrition status
- Tissue necrosis with blood clot, debris or dirt on the wound, or exposed bone
- Suturing may induce reaction to debris or dirt on the wound. This may be minimized by choosing the right suture.
- Tissue rupture caused by tissue dryness, expanding trauma or inappropriate surgery techniques
- Lack of tissue vascularization
- Inappropriate wound fixation on tissue located on bone joint
- Chronic wound abrasion
- Pathogenic bacterial infection

2. Wound Types

a. Snare wound

i. Observe length and severity of the wound and tissue rupture caused by the snare.

ii. New wound: lesion on skin surface, no swelling. Release snare immediately.
Old wound: intromission of snare into the skin and the muscle tissue. The wound is characterized by muscle or tendon rupture and swelling, weak muscle/tissue, absence of pulse and absence of bleeding. In such a condition, both muscle and tendon will experience tissue necrosis. Treatment for such a wound is by administering wide spectrum antibiotics (cephalosporin gen 3, enroflocxacin 5–10 mg/kg body weight) and analgesic (meloxicam 0.01–0.2 mg/kg body weight). Snares that have been in place for long periods are likely to have caused irreparable damage to soft tissues.

b. Gunshot wound

Gunshot wounds are always considered to be contaminated, and primary closure is generally not recommended. These wounds should be managed as open wounds or by delayed primary closure. After initial assessment and stabilization of the animal, the wound may be explored to evaluate the extent of damage and to determine a plan for repair. If the projectile caused a fracture, the method of repair depends on the location and type of fracture. External fixation or bone plates are common choices for rigid stabilization of the fracture so that the soft tissues may be appropriately managed. Gunshot wounds to the abdomen are an indication for an exploratory laparotomy. Gunshot wounds to the thorax may require a thoracotomy if hemorrhage or pneumothorax cannot be conservatively managed.

c. Abrasion

Abrasion injuries result in loss of skin and a varied amount of deeper tissue. These injuries are a result of a shear force on the skin. If the injury results in a loss of blood supply to the skin (vascularization), necrosis may develop later. Abrasion injuries frequently require marked and repeated debridement to remove necrotic tissues until vascularization is found for development of new tissue. In orthopedic injuries that typically accompany abrasion injuries, final stabilization may be delayed until local infection is under control.

d. Laceration

Uncomplicated simple lacerations are usually managed by complete closure if they are not grossly contaminated. The wound should be thoroughly lavaged and debrided as necessary before closure. If tension is present on the wound edges, it should be relieved by tension-relieving suture techniques, sliding tissue flaps, or grafts. Deep lacerations may be treated according to the same principles, depending on the extent of the injury.

Damage to underlying structures (e.g. muscles, tendons, and blood vessels) must be resolved before closure. If a laceration is grossly contaminated with debris, primary closure of the wound may not be indicated. Contaminated wounds may be closed with drains or treated as open wounds.

e. Contusion
Contusion may cause bruising and swelling on the tissue. It may also cause fractures if it is located on bone area. The severity of a contusion injury depends on how badly the body is hit. Treatments for a contusion depend on the impacts of injuries: bruising, swelling or fracture. Examine the injury methodically to decide on the treatment required.

3. Wound treatment

a. Wound inspection and cleaning

i. Be sure to do things correctly (*lege artis*), keep things clean and sterile.
ii. Check for any myasis infestation.
iii. For small wounds, hair clipping is not required.
iv. For large wounds, apply KY Jelly or clean the skin area with swabs before clipping hair.
v. Clip away hair around the wound prior to surgery/suture.

b. Wound cleansing

i. For simple wound cleansing, use physiological normal saline solution or homemade solution made of 1 teaspoon of salt and 500 ml boiled water.
ii. When wound flushing is necessary, use a 20 ml syringe and an 18G needle to flush the cleansing solution with high pressure.
iii. Avoid scrubbing or using solution that irritates the wound.
iv. Handling a contaminated/infected wound:

- Remove all foreign materials from the wound carefully, using gloves, forceps and swab.
- Wash the wound with clean water.
- Lavage the wound with a large volume of non-irritant antiseptic (0.05% chlorhexidine or 1% povidone iodine).
- Otherwise use a 20 ml syringe and an 18G needle to produce high pressure flushing.

- Avoid using Dettol®, TCP®, Savlon®, peroxide, and alcohol as they have irritating and toxic impacts on tissue, delay the healing process, and are painful to the animals.

c. Surgical debriding

i. Remove all foreign materials and necrotic tissues to help wound recovery.
ii. Surgical debriding aims to remove all necrotic or infected/contaminated tissue.
iii. Surgical debriding is performed until vascularization (blood supply to the skin) is found.
iv. If the wound is contaminated but no infection is found, i.e. treatment is within 6 hours of the injury occurring (golden period), it may be debrided immediately prior to tissue surgery.
v. In the surgery area, use gloves and cleanse area around the wound.
vi. Use a sharp knife.
vii. Handle the tissue carefully, use forceps, and avoid rupturing any tissue.
viii. Skin surface should be maintained in good condition. Use a crooked 20G needle to handle the skin.
ix. Maintain the skin moisture using normal saline solutions during the surgery.
x. Make a cut on the skin around the wound. Avoid excessive cutting.
xi. Debride any blackened unattached muscle surface.
xii. Debride any fat tissue exposed.
xiii. Avoid rupturing nerves.
xiv. Avoid rupturing tendon. Any exposed tendon should be cleansed and put back in the right position. Immobilize any movement.

d. Suture

i. A puncture wound should not be sutured.
ii. A new laceration wound with little surgical debriding may be sutured immediately.
iii. Absorbable sutures should be the choice for handling wounds on wild animals as no further surgery is required to remove the sutures.
iv. When suturing the wound with little skin left, extra caution should be taken not to put too much pressure on the wound.
v. Use a round-shaped needle, the least likely to cause tissue tearing, to suture muscle and deep wounds.
vi. Use a triangle-shaped needle to suture skin.
vii. To minimize pressure on the skin, use staple sutures.
viii. Subcuticular suturing will reduce pressure on the wound and will not break easily when the animal moves a lot.

ix. Cut the tip of suture as short as possible.

e. Following wound observation, delayed wound closure may be necessary in conditions as follow:

i. Badly contaminated wounds with discharge and tissue necrosis that require surgical debriding to find new tissue and vascularization should not be sutured immediately.
ii. Control the wound and infection that follow using oral antibiotic, and apply bandage on the wound. The wound may be sutured in three days.
iii. Control parasites. Ivermectin may be used.

C. FRACTURES AND FISSURES

A fracture is dissolution of bony continuity with or without displacement of the fragments. It is usually accompanied by soft tissue damage of varying degrees, such as torn vessels, bruised muscles, lacerated periosteum, and contused nerves.

1. Diagnosis of fracture

In most instances the clinical signs associated with fracture make diagnosis uncomplicated. However, there are cases that require detailed examination, especially closed fracture cases. Most fracture cases require observation prior to surgical intervention. The following are some of the things to consider while examining an animal with a suspected fracture:

a. Dysfunction

Dysfunction is obvious when a fracture occurs on the extremities. This is most commonly exemplified by lameness. Dysfunctions that are noticeable by clinical symptoms include paralysis with spinal fracture, unconsciousness accompanied by cranial fracture, or masticatory dysfunction with mandibular fracture. Impairment or loss of function is a constant sign of complete fracture and is the result of pain or loss of mechanical support. Only in cases of incomplete or impacted fracture may some weight be borne by the bone. Careful observation will determine the difference between loss of function due to pain alone and that due to inability to bear weight.

b. Pain

Pain over the site of fracture is common. In cases of incomplete fracture this may be the only clinical indication. Direct tenderness can be misleading, since it may be due to a

contusion or other soft tissue damage caused by a blow syringe injection. Indirect tenderness is a more accurate sign of fracture. It is produced by pressure in the long axis of the bone exerted at its two extremities. If there is a break in the continuity of the shaft, such pressure will cause pain at the fracture site that is quite distinct from the pain of injured soft tissue parts. If an animal is examined during the state of local tissue shock, that is, within 20 to 30 minutes after the accident, pain may not be a conspicuous sign.

c. Local trauma

Examination of the area around a fracture may demonstrate swelling, hematoma, contusion, or laceration if the fracture is open. Often, because of extreme swelling, the examiner will be unable to palpate crepitation. Local swelling, although present in many other conditions, is one of the most constant signs of a fracture. Immediately after injury the swelling may be sharply outlined as a result of bleeding from the bone and the soft parts. An indistinctly outlined swelling that occurs later is caused by edematous infiltration. Generally the swelling increases for 24 to 48 hours and then gradually subsides (particularly under treatment). When applying bandages and splints immediately following fracture, it is important to bear in mind that swelling will subside.

d. Abnormalities of positioning

Abnormalities of positioning of an extremity following a trauma usually reflect a fracture. Deformity, a deviation from the normal anatomical structure, may be caused by displacement of the bony framework as in a fracture or dislocation, but it may also be caused by changes in configuration due to a neoplasm. The displacement of bone fragments that produces deformity in a fracture may be angular, longitudinal, or rotational. Longitudinal displacements may cause shortening, referred to as overriding, or may result in separation of the fragments, termed distraction (e.g. fractures of the olecranon). In most cases, the primary displacement is determined by the direction and force of an injury and is maintained and often increased by the contraction of muscles. If in doubt about positioning, comparison with the opposite limb or side of the body part is advised.

e. Crepitus

Crepitus is a sign of fracture that is considered pathognomonic. Bony crepitus is the gritting sensation transmitted to the palpating fingers by the contact of the broken bone ends on each other. There are other forms of crepitus (pseudocrepitus) such as occur in some cases of arthritis—partial luxations of the patella or luxations of the coxofemoral joint. The absence of crepitus does not necessarily indicate the absence of a fracture. The interposition of a piece of soft tissue between the fragments will prevent crepitus. It is

also absent when the ends of the bones are so far apart that they cannot be brought into contact or when they are impacted. Crepitation should be elicited with the utmost precaution because of the danger of causing further damage to bony fragments and surrounding soft tissue. Vigorous palpation, which may turn a routine closed fracture into a contaminated open one, should be avoided.

f. Abnormal mobility

A false point of motion is also pathognomonic. It occurs if there is a complete fracture of the shaft of a long bone; it does not occur in an incomplete or impacted fracture. Mobility near a joint may be difficult to differentiate from normal or abnormal mobility of the joint itself. In order to avoid additional trauma, the same precaution should be taken in eliciting this symptom as in eliciting crepitus.

g. Radiology

Fracture, either a diagnosis or prognosis, should be documented by radiography. At least two views, including the joints above and below the fracture, are needed. Fracture of joints or special anatomical locations may require additional radiographs or special positioning. Radiographs should be read on a well-illuminated flat surface. If questions about anatomical structures exist, the opposite limb or side of the body may be radiographed for comparison. The specific radiographic signs of fracture include: a break in the continuity of a bone, a line of radiolucency when the fragments are distracted, and a line of radiopacity when the fragments are compressed or superimposed.

2. First aid for fracture case:

a. Restrain animal.
b. Gently lay animal on a warm and comfortable surface, such as board, wooden door, tarp, etc., padded with blanket.
c. Make sure the animal is calm.
d. Do not attempt to set the fracture.
e. If a limb is broken, wrap the leg in cotton padding, then wrap with a magazine, rolled newspaper, towel or two sticks. The splint should extend to one joint above the fracture and one joint below. Secure with tape. Make sure the wrap does not constrict blood flow.
f. If the spine, ribs, hip, etc. appear to be injured or broken, gently place the animal on the stretcher and immobilize it if possible.

3. Treatment for fracture case:

a. Primary treatment

i. Prevention of shock due to pain by analgesics
ii. Prevention of further damage due to action to move the animal
iii. Prevention of change of simple fracture to complex fracture due to action to move the animal

b. Secondary treatment

i. Reduction of fractured bone to approximate normal position (reposition). This should be done as soon as possible before numbness and pain, spasm, and swelling, as pain causes muscular spasm.
ii. Animal immobilization to fix the bone. The bone fragments and the joints upper and lower to the fractured bone should be fixed until complete union of the fracture.
iii. Preservation of normal function of muscles, tendon, and joints.

c. Complication in fracture case

i. Necrosis caused by pressure on soft tissue (pressure necrosis), muscular atrophy, and joint stiffness due to pressure of the fractured fragments
ii. Damage of artery, vein or nerves due to movement of splint
iii. Improper repositioning and fixation

D. SHOCK

Shock is characterized by inadequate circulatory provision of oxygen, which causes vital organs and tissues to shut down. It typically occurs when blood pressure falls to a very low level, either from reduced cardiac output or from reduced effective circulating blood volume. As blood pressure falls, the brain and other organs don't get enough blood or oxygen to function, and they begin to fail. Shock can arise from any of a number of causes. It is a life-threatening medical emergency and must be treated early to avoid serious complications and even death.

1. Common signs and symptoms of shock include:

a. Low blood pressure
b. Altered mental state, including reduced alertness and awareness, confusion, and sleepiness
c. Cold, moist skin
d. Weak or rapid pulse
e. Rapid breathing and hyperventilation

f. Decreased urine output
g. In septic shock (from overwhelming blood infection), the symptoms include shaking chills, rapid temperature increase, warm, flushed skin, and rapid pulse.
h. In shock related to heart problems, the symptoms include lung congestion, rapid pulse, heart murmur, and enlarged jugular vein.

2. First aid for shock cases

a. Symptoms: weak pulse, shallow breathing, nervousness, dazed appearance
b. This is often caused by severe injury.
c. Keep the animal restrained, quiet and warm.
d. If the animal is unconscious, keep the head slightly higher than the rest of the body.

3. Types of shock

a. Hypovolemic shock

i. Loss of fluid in the bloodstream occurs after heavy bleeding from an injury or a condition such as bleeding ulcers. Hypovolemic shock can also occur if your body loses too many fluids other than blood, such as the case of severe diarrhoea, vomiting (dehydration) or loss of plasma after serious burns.
ii. Definition: reduced intravascular volume, loss of blood, shock, dehydration >10%
iii. Types: light, moderate, severe. The symptoms may appear similar to shock symptoms
iv. Indication: tachycardia (increased heart rate frequency), weak pulse, change in colour of mucus membrane – pink in light case, pale in medium case and white or murky in severe case.
v. Lowered CRT (capillary refill time)
vi. Depending on the severity of the hypovolemia, tachypnoea may occur. The symptoms are increased respiratory rate, cold extremity and altered animal behaviour.
vii. Clinical symptoms of shock and dehydration are often mixed up. The treatment for both, however, has a similar objective, i.e. to stabilize organ function.
viii. Most critical situations in hypovolemia are cases with extreme external and internal haemorrhage. Comprehensive examination is required.

b. External bleeding

i. The source of the bleed is usually obvious. However, this sometimes may not be the case, particularly when the animal is covered in blood.
ii. Quickly clean blood that covers the animal to find out the source of the blood.

iii. Observe methodically to see whether bleeding is still occurring and whether it is fresh or old, coagulated blood.
iv. Cleanse the wound area carefully.
v. Tourniquet may be used to put pressure on the bleeding. Put it on a higher body part than the bleeding area. Use tourniquet until bleeding stops. Manage time wisely. Cleanse wound area. Check if bleeding is still occurring. Gently release tourniquet.
vi. Time required to put pressure to stop the bleeding is approximately 15–25 minutes, and the maximum is 2 hours. Release the pressure every 25 minutes.
vii. Find and clip or tie the blood vessel where bleeding originates.
viii. Immediately administer infusion liquid.

c. Internal bleeding

i. Internal bleeding is more difficult to observe. Check the abdomen. Internal bleeding within the abdominal cavity can change the percussion sound from hollow to more of a solid, dull type. Carefully insert a long needle to see if blood is present.
ii. Check the thorax. In the case of internal bleeding, heart and lungs will only be vaguely audible.
iii. Internal bleeding is difficult to control. Avoid putting pressure bandage around the abdomen.
iv. When the animal is under anaesthesia, low blood pressure may occur and trigger blood coagulation. Thus, anaesthesia should be monitored closely.
v. Immediately administer liquid infusion.
vi. Treatment: intravenous liquid infusion with high frequency. Insert large catheters at 2 or 3 spots at the same time.
vii. Colloid infusion at 10 ml/kg is suggested to replace the plasma as it remains in the circulation longer than electrolytes alone. It expands the plasma volume by retaining sodium and water in the tissue.
viii. Crystalloid may be administered to fill the interstitial space, soft tissue. It does not expand the plasma volume, although it may initiate circulation volume expansion. It contains water and electrolyte and is only administered at 20% to restore intravascular volume in less than 1 hour.
ix. Lactated Ringers solution is administered at between 40 ml/kg and 100 ml/kg in severe cases.
x. Monitor vital signs: CRT (capillary refill time), heart beat frequency, breathing frequency, pulse frequency and jugular pulse.
xi. Increase breathing quality.
xii. Auscultate lungs to check for any abnormality.

d. Dehydration

i. Definition: loss of body fluids and electrolyte.
ii. Dehydration symptoms are: skin turgor condition (the skin may not be as elastic as normal and sag back into position slowly when it is pinched up into a fold - normally, skin springs right back into place in 2–3 seconds), lack of mucus membrane moisture, and sunken eyes.
iii. Note in percentage: sunken eyes, skin elasticity, and dryness in mucus membrane. Percentage of 6–10% implies that the animal is dehydrated. Treatment: insert 2 large infusion catheters intravenously when possible. Subcutaneous hydration may help.
iv. Crystalloid, which contains water, electrolyte and non-electrolyte, may be administered.
v. Proceed with intravenous infusion, followed by tissue rehydration. This may only be administered at 20% of total intravascular volume after 1 hour. Examples are Lactated Ringer's solution and isotonic liquid.
vi. Do not use sterile water because it is hypotonic and may trigger hemolysis on blood vessels.
vii. Make a calculation as the situation may get more complex and require 24 hours handling.
viii. Further maintenance: 50 ml/kg/24 hours (2 ml/kg/hour) + deficit (dehydration %) + fluid loss
ix. The total amount should be administered intravenously in 24–48 hours or in 4 intakes, if administered subcutaneously
x. For example: a 100 kg tiger is 10% dehydrated. The treatment required is: 50 ml/kg/24 hours = 5000 ml. When dehydration percentage of 10% is added, i.e. 10,000 ml, the total fluid intake to be administered amounts to: 150,000 ml in 24 hours or 625 ml/hour.
xi. Otherwise, a safer calculation of 10 ml/kg/hour should be used.
xii. If the animal does not experience hyperthermia, infusion liquid should be warmed to match body temperature.
xiii. Monitor vital signs: CRT (capillary refill time), heartbeat, respiration, skin turgor and mucus membrane.
xiv. Look for over-hydration symptoms: check pulse at jugular veins. Increase breathing.

e. Septic shock

Septic shock happens if blood vessels become too dilated (distributive shock). If the blood vessels expand too much, they are not able to keep blood circulating to all organs. Septic shock occurs when bacteria invade the bloodstream. Anaphylactic shock, which is a severe allergic reaction, is an example.

4. Shock treatment

The main objectives of shock treatment are to maintain blood pressure and to make sure that the animal's vital organs get enough blood and oxygen to function properly. First aid for shock in tigers includes laying the tiger down with front legs in a higher position than the rest of the body to help the blood flow return to the heart, stopping any bleeding, covering the animal with a coat or blanket to ensure warmth, and performing cardiopulmonary resuscitation (CPR). Administer oxygen, and intravenous fluids. Keep in mind that fear, noise, and cold temperatures all contribute to the tiger's stress level.

The following drugs may be used in shock therapies:

a. Drugs that increase pressure in the arteries and help the heart pump more blood, such as dopamine, dobutamine, and norepinephrine
b. Medications to either dilate or constrict blood vessels (depending on the cause of shock)
c. Antibiotics for septic shock, to confront wide-ranging infection
d. Corticosteroids to reduce the incidence of vasopressor dependent septic shock
e. Thrombolytic therapy (drugs that dissolve clots as they form) may be considered in the case of heart attack or pulmonary embolism
f. Emergency procedure should be conducted simultaneously

E. HYPOTHERMIA

Hypothermia is a condition in which core temperature drops below the required temperature for normal metabolism and body functions, i.e. below rectal body temperature (28 °C), and the body loses its ability to reach normal temperature. In this condition, the animal can only survive with heat provided from outside its body. It is very important to observe and count the pulse, breathing, mental condition and rectal temperature.

The severity of hypothermia will determine the method used to warm the body. Hypothermia can be categorized into: light hypothermia (30–32 °C), moderate hypothermia (22–25 °C), and severe hypothermia (0–8 °C).

There are three techniques to warm the body: passive external, active external and active internal, which should be chosen according to the severity of hypothermia. Hypothermia usually occurs when the body is exposed to cold weather from outside, drugs impact and failure of body mechanism to adjust to temperature outside.

Observation and calculation of key symptoms that follow the condition should be conducted, i.e. pulse (weak or none), breathing (weak or none), mental status (conscious or unconscious), skin (cold or not), and body temperature (normal or low).

1. Handling an animal with hypothermia

An animal with hypothermia should be cared for in a warm environment that prevents further exposure of the animal to cold. Ideally, an animal with hypothermia should be transported to a place where a comprehensive examination may be conducted.

a. Hypothermia examination

Procedures for hypothermia examination:

i. Examine: airway (A), breathing (B), circulation (C), and severity (D). One staff member has to make sure that the animal's airway is open, that the animal is breathing, and that the heart is beating. He has to check the body temperature regularly.
ii. Conduct physical examination: (A) body temperature, (B) consciousness level and neurological status, (C) heart and lungs, (D) possibility of severe trauma. When medical equipment is available, do the following: thoracic x-ray, urine test, complete blood test, oxygen in blood test.

When faced with a tiger with hypothermia, first of all the veterinarian must be sure that the animal is really experiencing hypothermia. Next, the veterinarian should determine the severity of the hypothermia: light, moderate or severe. Finally, re-warming techniques are employed to treat the animal.

b. Re-warming techniques

i. Mild hypothermia: Prevent further heat loss by moving the animal from the floor or ground to a warmer environment, shielding it from the wind, and covering the head and neck. Re-warm the animal with heat packs in areas that lose the most heat.
ii. Moderate hypothermia: Keep the animal in warm conditions, for example by using heat packs, blankets, or warm water compresses. Continue re-warming efforts until normal temperature is achieved.
iii. Severe hypothermia: Animals with severe hypothermia are often mistaken for dead animals because the pulse and heartbeat are faint or may be absent, while breathing is hardly noticeable. In severe cases, care must be taken when re-warming the tiger as this may cause the tiger to go into shock or aggravate injuries.

2. Things to consider:

(i) Refrain from making the prognosis that the animal cannot survive too early. Positive thinking is important.
(ii) Avoid direct application of hot materials or high pressure on the animal's body. Make sure that oxygen and infusion liquid are warmed.
(iii) Medications administered to animals with hypothermia will not provide the expected response. Drugs will not be metabolized normally by the animal's heart and kidneys and instead will accumulate in the body.
(iv) Avoid using Ringer's Lactate liquid infusion as the heart will not metabolize lactate normally.
(v) Avoid administering cold liquid infusion.

F. EMACIATION

Emaciation is a condition where a tiger appears to be weak, with loss of fat and muscles, and has a bony appearance. In wild animals, this condition is caused by disease, malnutrition, dehydration and neglect. Absence of the animal's diet and loss or change of habitat may also cause emaciation in wild animals. Emaciated animals should be rehabilitated by providing nutritious diet, improving conditions and treating dehydration.

G. PARASITES

The following parasites are commonly found in tigers in conflict:

1. Fleas and ticks

Fleas and ticks are blood-sucking ectoparasites that often live on mammals. Some flea and tick species may transmit diseases to cattle which are contagious to humans (zoonosis). The saliva in flea and tick bites can cause toxicosis, and bites can also make the target animal susceptible to secondary bacterial infection, screwworm infestation, anaemia and death. Animals with flea and tick infestation may also transmit diseases such as theileriosis, babesiosis, anaplasmosis and cowdriosis.

Ectoparasites living on cattle are usually from the Argasidae and Ixodiae families. Treatment: ivermectin at 0.04 mg/kg sc, fipronil application.

2. Leeches

Leeches (Annelida: Hirudinea) are predators or parasites that live on land. Characteristics include dark or black colour and strong muscles that suck blood up to the epidermis. Leeches' saliva contains the anticoagulant enzyme hirudin, which prevents blood from coagulating.

3. Endoparasites

a. Dirofilaria immitis

An adult female *Dirofilaria* is approximately 27 cm in length and a male is approximately 17 cm. At the microfilariae stage, it lives in blood vessels and is only about 315 micrometers in size. Microfilariae remain active for 1–3 years and develop to be infectious for approximately 2 weeks in mosquitoes' bodies. Infective larvae migrate to mosquitoes' mouths and are transmitted to animal skin through bite wounds. The larvae grow in tissues under the skin or in subserosal tissues. After 2–4 months, they migrate to the right ventricle of the heart. Clinical symptoms are anorexia, coughing, listlessness, weight loss, fever, breathing difficulties and vomiting.

Diagnosis:
Temporary diagnosis is based on clinical symptoms, the history of the event, and exposure to mosquitoes. The diagnosis may be strengthened and confirmed by the presence of microfilariae of *Dirofilaria immitis* (nucleopore filter test method) or adult *D. immitis* (by routine screening with ELISA) in a blood sample. Treatment is conducted by controversial methods.

b. Phylum Acanthocephala

Phylum Acanthocephala is a small phylum of parasitic worms with head spikes that live mainly in an animal's digestive system. Arthropods act as intermediate hosts that eat the worms' eggs. There is no effective treatment for this worm infection, but benzimidazole is an option to consider.

c. Taeniidae

Tapeworm is an endoparasite of the families Taeniidae (*Echinoccocus spp, Taenia spp*) and Diphyllobotriidae (*Diphyllobothrium latum* and *Spirometra mansonoidae*).

Treatment: suggested medications are Praziquantel at 5 mg/kg/day and Praziquantel at 35 mg/kg/day for the family Diphyllobotriidae. Fenbendazole may be given at 50 mg/kg for three consecutive days for treatment of *Taenia pisiformis*.

d. Phylum Nematoda

Strongyloides, Toxocara, Toxascaris, Ancylostoma, Trichuris, Capillaria

Treatment: levamizole at dosage of 2.5 mg/kg for five consecutive days, fenbendazole at 50 mg/kg for a single dose, ivermectin at 0.2 mg/kg for a single dose, administered subcutaneously.

e. Protozoa

Isospora, amoeba, balantidium. Treatment will not be effective without a controlled environment. Recommended treatment: metronidazole at 10-25 mg/kg PO (by mouth) once a day for 5 days and sulfadimethoxine at 25 mg/kg for a single dose.

H. POISONING

Poison is commonly used in retaliation against tigers in conflict situations, as this is considered an easy way to weaken a tiger, often using prey carcasses laced with poison to attract the tiger. When notified that poisoning has occurred, an appropriate treatment must be given immediately; any delay in treatment can be fatal, with a window of 30 minutes to administer treatment.

1. Management and treatment of poisoning

a. When poisoning signs are found:

   i. Give instruction to save samples that may contain poison—e.g. vomit, faeces or remaining food—in a clean jar.
   ii. If possible, take blood samples (whole blood, EDTA, serum).

b. If possible, identify the poison by sending a specimen to a laboratory for toxicology examination.

c. Delay absorption: remove poison to minimize further absorption.

   i. Ingested poison: give water, milk, activated charcoal, and emetics.
   ii. Injected poison: apply tourniquet and cool pack and immobilize patient.
   iii. Skin or eye contamination: flood with running water for five minutes.

d. Give specific antidote while proceeding with the removal of poison. Maintain vital functions. Give supportive treatment. Electrolyte imbalance may occur after poisoning as the result of vomiting, diarrhoea, sweating, renal malfunction, anorexia, or oesophageal injury. Sodium and chloride administration at 60% of body weight; remaining electrolyte replaced at 20% of body weight. Imperceptible water losses may be calculated as 10 to 15 ml per kg body weight per day depending on environment and body temperature. Water deficits should be replaced by administering water without electrolyte (5% or 10% dextrose intravenous or oral) to supply caloric requirement and reduce tissue catabolism.

   Chemical substances that may cause poisoning in Sumatran tigers include agricultural insecticides for plants, such as chlorobenzene derivative insecticides (for example, amiben, DDT, prolan, chlorobenzilate) and organophosphate insecticides (for example, abate, diazinon, dichlorvos, and guthion).

2. Chlorobenzoate derivative insecticide poisoning

a. Clinical findings:
   The principal manifestations of poisoning with these agents are vomiting, tremors and convulsions.

b. Laboratory findings:

   i. A high urine level of organic chlorine
   ii. In cases of suspected poisoning, analysis of serum or a fat biopsy are useful for diagnosis.

c. Treatment:

   i. Gastric lavage using 2-4 liters of water
   ii. Emesis

      1) Induced emesis by ipecac or apomorphine is possibly more effective than gastric lavage in removing swallowed poisons.
      2) Contraindication: do not produce emesis if the patient has ingested any of the following:

         - Acids or alkalis: emesis increases the likelihood of gastric perforation
         - Kerosene: during vomiting, the patient may aspirate gastric contents
         - Convulsants: vomiting may induce convulsions

      Attempt to resuscitate if breathing is slow

Anti-convulsion administration: Phenobarbital sodium at 1 mg/kg IM (intramuscular injection) with a maximum dose of 5 mg/kg; slow intravenous administration of 10 to 50 mg succinylcholine chloride. Resuscitate if apnoea is suspected; diazepam (Valium) 2–10 mg iv (not effective for all cases of convulsions).

3. Cholinesterase inhibiting pesticide

a. Clinical symptoms:

i. Mild: refusal to feed, headache, weakness, tremor on mouth and eyelids, limpness, muscle pain and blurred vision.
ii. Moderate: nausea, drooling, stomach cramp, shedding tears, vomiting, sweating, low pulse and muscular fasciculation.
iii. Severe: diarrhoea, pinpoint and pupil dilation, breathing difficulty, pulmonary oedema, cyanosis, loss of bowel control, convulsion, coma, and cardiac inhibition.

b. Laboratory findings

i. Laboratory findings are often not supportive.
ii. Cholinesterase in red blood cells and plasma reduction to ≤ 20%. Normal amount 30% to 50% may be used as an indication.
iii. Urine p-nitrophenol may be used as an indication of parathion exposure.

c. Treatment

i. Administer a large dose of atropine at 0.2–2.0 mg/kg, one quart of the dose.
ii. Repeat the process intravenously every 3–4 hours. Atropine administration should be stopped when atropinisation is apparent, with symptoms such as flushed face, dry mouth, pupil dilation and fast pulse.
iii. Administration of drug to activate cholinesterase should be restricted for organic cholinesterase inhibiting phosphate poisoning and should only be given when atropine administration reaches maximum dose. Give 1 g of pralidoxim (Protopam®) in solution of aquades intravenously at a slow pace. Repeat the procedure if breathing does not show improvement within 30 minutes.
iv. Pulmo secretion may be discarded by drainage or catheter suction insertion. Avoid giving morphine, aminophylline, barbiturate, phenothiazines and drugs that suppress breathing.

(xii) HUMAN SAFETY

A. PRINCIPLES OF HUMAN SAFETY

Working with wild animals and powerful drugs comes with risks. There is always the risk of zoonosis, passing on of a pathogen between animal and human or vice versa. Also there is the risk that humans can be injured or harmed during a tiger capture/immobilization process. Risks can be very much reduced with proper planning, preparation, training, and experience. All the team must be made aware of the dangers of the target species. Even the best planned procedures can sometimes go wrong, however, so it is necessary to have a good medical kit and basic first aid training.

In the case of tigers, it is important to be aware of their general behaviour and how they are likely to react in different situations. There are basically two common situations in which you may face a tiger: when a tiger has killed someone in the jungle or when a tiger has strayed into a village. A tiger may be intent on attacking, in which case it may make no noise in its approach and you may not even see it before it is too late, or the tiger may do a mock charge where it growls and stops 2–3 m away from you.

In these circumstances, the following actions may help avoid serious injury or death:

1. Always work as a team. Support one another and be prepared to rescue anyone who is being attacked by the tiger. There is a good chance that 2-3 determined people can fight off a tiger.

2. Always carry a stick, bear spray or gun. A stick can be very useful to beat off a tiger or make yourself look more threatening. Bear spray has been used in Russia to successfully stop a tiger attacking. A gun can be used to scare away the tiger with a blank fire or, as a last resort, to shoot the tiger if human life is being threatened.

3. Never turn your back on a tiger or run away. Tigers will naturally attack animals that are afraid of them and are trying to escape. If you turn your back and run then the tiger may be more likely to attack. If you face the tiger together as a team then the tiger may be less brave and is less likely to attack unless it is cornered, defending its cubs, injured, or defending its food.

4. Make noise and back away slowly. If you have got too close to a tiger and the tiger has charged, then wave your sticks around, hit the sticks on the ground, shout, and back away

slowly until the tiger is at least 50 m away. Then find somewhere safe to re-group and make a new plan.

5. Never surround the tiger. Normally when a tiger comes into a village it is surrounded by villagers who then beat it to death and are also often injured in the process. Surrounding the tiger gives the tiger no option but to attack. When working with tigers always leave an escape route available for the tiger so that it is not forced to attack anyone.

6. Do not make the tiger angry. The more the tiger feels threatened or angry (for example, if people are throwing stones at the tiger) the more likely it is to attack.

7. Make sure that any people who are not in the capture team are away from the tiger. The presence of additional people will make your job more difficult and endanger your team and anyone else within attacking range of the tiger. If you are working in a village then liaise with village leaders to enlist their help in controlling the crowd and keeping them at least 200 m away from the tiger so that you can work safely.

8. Do not panic, but be ready to adapt. Do not shout unnecessarily or visibly lose control of the situation. Keep calm at all times so that you can think clearly and therefore react more quickly to changing situations. If the team leader loses control then the team and everyone else present will lose confidence in the leadership and everyone will do whatever they think is best; this will lead to chaos and increase the danger for everyone. Good leadership, however, does not mean that you cannot take advice or change your plan as you go along.

9. Do not get too close to the tiger unless absolutely necessary. A tiger may stay in the same place until you get close to it and then attack suddenly without much warning. Stay at least 50 m away unless you have to get closer to save someone's life or capture the tiger.

10. Do not force someone to do something that you are not prepared to do yourself. If you are a team leader then you need to lead by example and never make someone else do a dangerous job that you are not prepared to do yourself.

11. Put human safety first. Value your own life and the lives of the team members and other people more highly than the tiger's to help you plan what to do and make quick decisions in dangerous situations.

12. Remember that a human life or a tiger's life is much more important than your job. Never put your life, anyone else's life, or the tiger's life in danger by following orders from your senior officers that you think are wrong. The capture team/immobilization team

should work as a cohesive unit with clear leadership and responsibility for each other's safety.

13. Accidental human exposure to anaesthetic drugs may occur as a result of 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:

a. Always work in pairs in the field, especially when preparing anaesthetic agents.
b. Use gloves and eye protection when loading darts and syringes where possible. Anaesthetic drugs, in both liquid and powdered form, can be absorbed from the mouth, through the eyes, and from cuts on your hands.
c. Treat all capture guns, darts, and syringes as if they were loaded firearms.
d. Use the safety caps on all darts.
e. Store loaded darts and used darts and syringes in non-breakable, leak-proof containers.
f. Dispose of any used needles in a hard container.

B. BASIC FIRST AID FOR HUMANS

In terms of human exposure to it, Zoletil® is a relatively safe drug, but in low doses it may cause excitation, agitated behaviour, and loss of coordination. The person feels no pain and may feel disassociated from their body and mind. In large doses, signs can include coma, respiratory depression, violent behaviour, aggression, and even suicide. Treatment is as follows:

1. Make the person sit down.
2. Remove the dart or syringe.
3. Wash the exposed site with water.
4. If the person appears fine, assess their vital signs.
5. If the person is exhibiting signs of exposure, be certain to maintain the patient's airway.
6. Keep the patient on their side, and maintain normal temperature.
7. Keep the victim calm, and avoid stimulation (lights, horns, sirens, sudden movements, etc.).
8. The victim may be given fruit juice (acidifies urine and helps eliminate the drugs), but be aware of the possibility of vomiting or aspiration.
9. Assist ventilation if necessary.
10. Transport the patient to hospital in a lying down position, on his/her side, with feet slightly raised.

Make all efforts to determine whether any member of staff is allergic to penicillin. If so, they must not be allowed to handle the bottle of Amoxypen LA® or syringes and needles that may

have contained the drug. Serious allergic reactions to penicillin may occur following exposure to very small amounts of the drug.

CLOSING

REFERENCES

CONTACT LIST