Document Approval

Prepared by:	Reviewed by:
National Veterinary Hospital Signature ..... Designation..... Date ..... Chief Veterinary officer National Animal Hospital Department of Livestock Ministry of Agriculture & Forest Thimphu Bhutan	Review Committee Signature ..... Designation..... Date ..... Chief Veterinary Officer Animal Health Division Department of Livestock Ministry of Agriculture & Forests Thimphu : Bhutan
	Authorized by: Department of Livestock Signature ..... Designation ..... Date ..... Director General Department of Livestock Ministry of Agriculture & Forests Thimphu : Bhutan

Revision History

Revision	Revision Date	Reason for Revision	Revised by

Table of Contents

1. Purpose

1.1 This SOP describes the procedure for anesthesia of farm animals.

2. Scope

2.1 This SOP covers procedures for induction, intubation and monitoring of patient during anesthesia.

3. Responsibilities

Sl. No.	Official Designation	Responsibilities
1.	Veterinarian	Prescribe the anesthetic drugs as per the animal's body weight. Oversee the anesthetic procedure. Administer anesthetic drugs to the animal.
2.	Paraveterinarian	Administer anesthetic drugs. Monitor the animal during anesthesia.
3.	Animal attendant	Restrain the animal.

4. Definitions

4.1 **AHD:** It refers to Animal Health Division under the Department of Livestock.

4.2 **Animal attendant**: It refers to a person who helps in restraining of animals and ensures the well being of the animals during the treatment procedures.

4.3 **Anesthesia:** It refers to insensitivity to pain, especially as artificially induced by the administration of gases or the injection of drugs before surgical operation.

4.4 **Consent form**: A form signed by the pet owner prior to an anesthetic/ surgical procedure to confirm that he or she agrees to the procedure and is aware of any risks that might be involved. The primary purpose of signing of consent form is to provide evidence that the pet owner gave consent to the procedure in question.

4.5 **DRA:** It refers to Drug Regulatory Authority.

4.6 **DVH:** It refers to Dzongkhag Veterinary Hospital.

4.7 **Effective Date:** It is the date that a document becomes effective for use.

4.8 **Endotracheal tube:** It refers to a catheter that is inserted into the trachea for the primary purpose of establishing and maintaining a patent airway.

4.9 **Extubation:** It is the process of removal of endotracheal tube.

4.10 **Farm Animals:** It refers to animals that are raised for home use or for profit. Farm animals include cattle, yak, sheep, goat, pig and horse.

4.11 **Induction:** It is the process of initiating anesthesia to facilitate intubation.

4.12 **Intubation:** It is the process of placing a tube into the body for medical purposes. Typically, intubation refers to the placement of an endotracheal tube to assist the patient when they are not breathing effectively. The tube is placed into the trachea and connected to an assistive device for breathing.

4.13 **NVH:** It refers to National Veterinary Hospital, Thimphu.

4.14 **Para-veterinarian:** It refers to a person with diploma in Animal Science and is authorized to provide treatment to the animals.

4.15 **Pre-emptic analgesia:** is defined as a treatment that is initiated before surgery in order to prevent the establishment of central sensitization evoked by the incisional and inflammatory injuries occurring during surgery and in the early postoperative period.

4.16 **Procedure:** It refers to SOP.

4.17 **Review Committee:** It refers to a group of people from the department who will review the procedure to see if it should be improved, corrected, or changed.

4.18 **Restrain:** It refers to application of any procedure designed to restrict its movements in order to facilitate examination of patient.

4.19 **SOP:** It refers to Standard Operating Procedure.

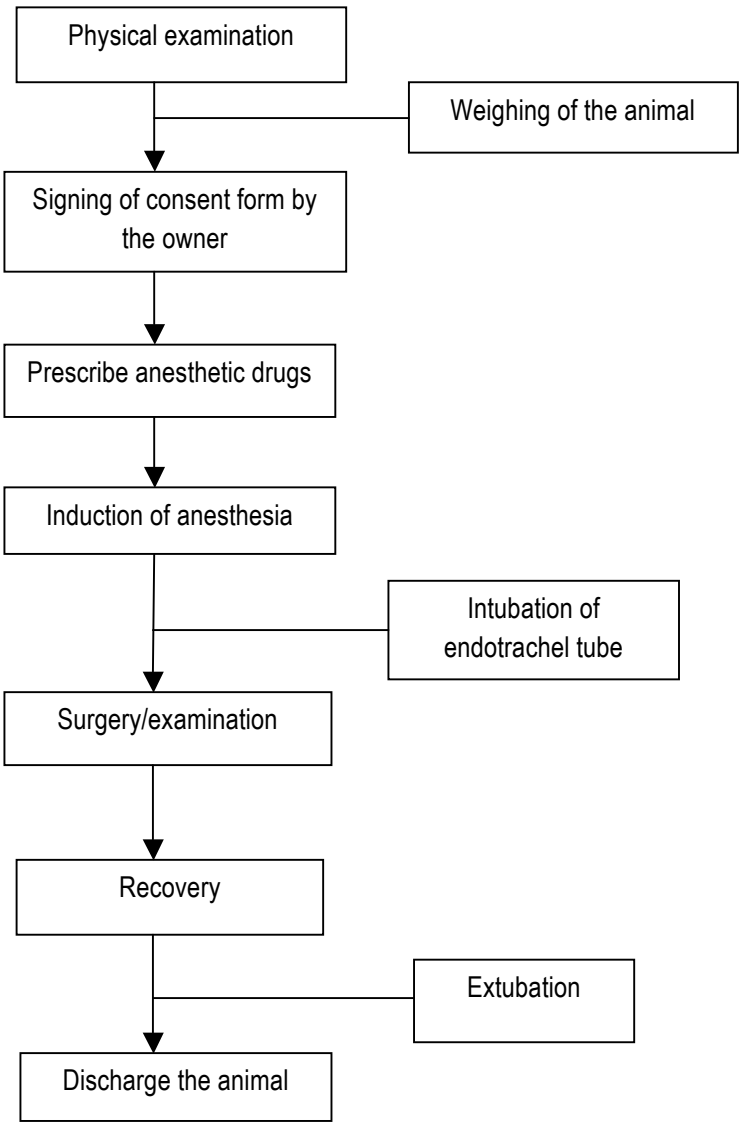
4.20 **Stabilization:** It refers to the action of making the patient stable.

4.21 **Staff:** It refers to veterinarians, para-veterinarians and animal attendants.

4.22 **VHs:** It refers to veterinary hospitals in the country.

4.23 **Veterinarian:** It refers to a person holding a bachelors degree in Veterinary Science and Animal Husbandry and is authorized to practice veterinary medicine.

5. Process Map in Flow Chart



6. Procedure

6.1 All the technical staff involved in administering anesthesia in animal should wear clinical dress (blue) or white lab coat (properly buttoned) with nametag.

6.2 Perform a thorough physical exam.

6.3 Inform about the risk associated with anesthesia and obtain consent from the owner. The consent form should be dully filled and signed by the owner.

6.4 Pre-anesthetic preparation

6.4.1 Small ruminants and calves should be starved for 12 hours and deprived of water for 8 hours.

6.4.2 Adult ruminants should be starved and deprived of water for 12-24 hours.

6.4.3 Adult mature bull should be fasted and deprived of water for 24-36 hours.

6.4.4 Fasting neonates is not recommended for potential risk of hypoglycemia.

6.4.5 Pigs should be fasted for 6-8 hours.

6.4.6 Stabilize animal before surgery in debilitated animals (Gastrointestinal disorders, Dystocia etc).

6.5 Pain management

6.5.1 Follow pre-emptive analgesia by using systemic analgesics (Phenylbutazone or Meloxicam or Paracetamol).

6.6 Induction

6.6.1 Preanaesthetic drugs in cattle: Xylazine and Diazepam, in combination or single. For dose rate of drugs used refer Annexure 1.

6.6.2 In sheep and goats: Xylazine and Diazepam singly. For dose rate of drugs used refer Annexure 2.

6.6.3 In swine: Xylazine, Ketamine and Diazepam. For dose rate of drugs used refer Annexure 3.

**** Goats are more sensitive to Xylazine than sheep.***

**** Xylazine produces marked hypoxemia in sheep, hence it shouldn't be used in respiratory compromised animal or supplementary oxygen should be supplied.***

**** Pigs do not tolerate restraint which posses stress. Therefore IM injection is preferred over IV. Pigs are least sensitive to Xylazine compared to other domestic animals; deep sedation from Xylazine alone is rarely observed.***

6.7 Endotracheal intubation

6.7.1 In cattle and small ruminants

6.7.1.1 Use cuffed endotracheal tube (ET). Cuffed endotracheal tubes provide patent airways and prevent aspiration of saliva and ruminal contents if regurgitation occurs.

6.7.1.2 After induction, place mouth gag.

6.7.1.3 In adult cattle tracheal guide tube is passed down through blind digital

palpation and ET tube is placed over the guide.

6.7.1.4 In sheep, goat and calves visualization of airway is limited due to narrow opening of the mouth. Use long customized laryngeal/ stylet to facilitate intubation.

6.7.1.5 Naso-tracheal intubation can be opted if in case ora-tracheal intubation fails.

6.7.1.6 Following the intubation, correct placement of ET tube can be determined by feeling air coming out of the ET tube in synchrony to the breathing movement of the chest.

6.7.2 In pig.

6.7.2.1 Intubation is not easy in the pig.

6.7.2.2 The shape and size of the head and mouth make the use of a laryngoscope difficult. Laryngeal spasm is easily provoked hence intubation must be carried out under deep general anesthesia or with the aid of muscle relaxant or local anesthetic spray.

6.7.2.3 The size of ET tube when compared to those used in dogs of similar weight is unexpectedly smaller (e.g. 6 mm ID for a 25 kg pig).

6.7.2.4 Use stylet to introduce ET tube. Malleable metal stylet or plastic urinary catheter can be used.

6.7.2.5 Laryngoscopes made for man can be suitable for small pigs, but Rowson laryngoscope may be needed for large pigs to expose the larynx to view.

6.7.2.6 The induced pig is placed in dorsal recumbency with the head and neck extended.

6.7.2.7 The shape of larynx is unique in the pig so that flexing the neck will facilitate when the tube's progress arrested with re-angled tube end.

6.7.2.8 When resistance to the advancement of the ET tube is met, the tube is rotated to 180 degree, which should effectively introduce the tube beyond the ventral floor of the larynx and allow successful completion of the intubation.

6.8 Anesthesia

6.8.1 In cattle anesthesia is maintained by:

6.8.1.1 Method 1: Continuous infusion of 0.2% (2mg/ml) Ketamine. Refer Annexure 4.a.

6.8.1.2 Method 2: Combination of Ketamine and Xylazine. Refer Annexure 4.a.

6.8.1.3 Method 3: Combination of Guaifenesin, Ketamine and Xylazine, referred to as Bovine triple drip can be used for procedures requiring longer duration.

6.8.1.3.1 To mix triple-drip solution combine one liter 5% Guaifenesin (50 mg/ml, final concentration) with 100 mg of Xylazine (0.1 mg/ml, final concentration) and 1 gram of ketamine (1 mg/ml, final concentration).

6.8.1.3.2 Loading dose 0.67-1.1 ml/kg is given as an IV drip "to effect".

6.8.1.3.3 Maintenance CRI to effect (1.5ml/kg/hr for calves and 2ml/kg/hr for adult cattle).

6.8.1.4 Combination of Guaifenesin and ketamine (Double Drip) is given when Xylazine- Ketamine is used for induction (As half life of Xylazine is longer than Ketamine in cattle).

6.8.1.4.1 Combine one liter of 5% Guaifenesin and 1 gram of Ketamine (1mg/ml final concentration).

6.8.1.4.2 1.5-2.2 ml/kg of Double drip combination is given for maintenance anesthesia.

6.8.2 Anesthesia for sheep and goat:

6.8.2.1 In general Xylazine (0.1-0.2 mg/kg IV) and Ketamine (2-3 mg/kg IV) can be used for short-term anesthesia.

6.8.2.2 For Triple drip dose rate refer annexure 4.b

6.8.2.3 In sheep, Ketamine alone (22mg/kg) may cause side effects such as tachycardia, muscle rigidity, and mild salivation during anesthesia and marked ataxia during recovery.

6.8.3 Anesthesia for Pigs

6.8.3.1 Use of Ketamine alone in pigs is not recommended as adverse affects such as muscle termer and exterior rigidity is observed.

6.8.3.2 For use of Ketamine in combination with other drugs refer annexure 4.c.

6.9 Perioperative monitoring

6.9.1 Palpebral reflex, position of eyeball, change in respiratory rate, heart rate and arterial blood pressure are the most useful and reliable indicators of the depth of anesthesia.

6.10 Supportive Fluid Therapy

6.10.1 Supportive fluid therapy is not necessary for healthy animals undergoing short-term surgery.

6.10.2 If the animal is fasted and water is with held for 24 hours or longer prior to anesthesia, a balanced electrolyte solution should be administered.

6.10.3 For healthy animals maintenance fluid during anesthesia is 4-8ml/kg/hr.

6.10.4 To correct hypotension and for compromised animal fluid therapy @ 10-25ml/kg/hr should be given.

6.11 Positioning of animal

6.11.1 Cattle and small ruminants

6.11.1.1 Uneven positioning of the patient can result in neuromyopathy in cattle.

6.11.1.2 Adult cattle should be placed on 10cm thick high density foam pad or locally improvised padding material.

6.11.1.3 For calves and small ruminants 5cm thick high density foam pad or locally improvised padding material.

6.11.1.4 When placed in dorsal recumbency, animal should be balanced squarely

on its back with gluteal muscles bearing equal weight.

6.11.1.5 When placed on lateral recumbency, an automotive inner tube (valve steam pointed down) can be placed under the elbow of the dependent forelimb (refer figure 1).

6.11.1.5.1 The inner tube can be placed under the shoulder (refer figure 2) or through the dependent limb (refer figure 3).

6.11.1.5.2 Duct tape or other non-elastic tape can be placed on the part of the inner tube that is under the shoulder (opposite of valve stem).

6.11.1.5.3 Once the inner tube is in place, pulling the dependent forelimb anteriorly will help to distribute the weight of the thorax on the triceps rather than on humerus.

6.11.1.5.4 Upper fore limb and hind limb should be placed perpendicularly to the floor/ table surface and both uppermost limbs elevated and parallel to the surface. This technique prevents from radial or femoral/ peroneal nerve paralysis. The head and neck should be slightly extended and the head should be slightly lower than the neck, which will allow draining of the saliva and ruminal contents if regurgitation occurs.

6.11.1.6 Apply ophthalmic ointment on the eyes and make sure the dependent eye is closed to minimize risk of corneal ulcer.

6.12 Recovery

6.12.1 They should be placed on sternal recumbency with support during recovery period.

6.12.2 If regurgitation occurred during anesthesia, the oral cavity and pharynx should be lavaged to prevent aspiration.

6.13 Extubation

6.13.1 Ruminants

6.13.1.1 In ruminants the endotracheal tube with the cuff inflated should be left in place till anima regains chewing and coughing reflex.

6.13.1.2 The ET tube should be removed with the cuff inflated.

6.13.2 Pigs

6.13.2.1 Pigs can be placed on lateral or sternal recumbency as long as there is adequate ventilation.

6.13.2.2 Deflate the cuff of the ET tube when swallowing and coughing reflexes return.

7. Related Forms or Work Instructions

7.1 SOP for Surgery of Farm Animals.

7.2 Consent form.

8. References

8.1 SOP on SOP format – Drug Regulatory Authority, Thimphu.
8.2 Farm Animal Anesthesia, Wiley Blackwell.
8.3 Anesthesia in sheep and goat, Polly M. Taylor.
8.4 Ruminant & swine Anesthesia, Lyon Lee (DVM PhD DACVA).

Annexure 1

Drugs	Dose (mg/kg) cattle	Comments
Xylazine	0.015-0.025,IV or IM	Standing sedation
	0.1 IV or 0.2 IM	Recumbency 60 min
	0.66-0.88 IM 2nd dose of 0.52 – 0.53 IM	Capture stray cattle, recumbency in 3-7min Fleeing possible
Xylazine Diazepam	0.12 IV 0.1 IV	Chemical restraint , analgesia Recumbency 30 min Standing in 45-60 min
Xylazine Diazepam	0.05 IV 0.2-0.4 IV	Chemical restraint Recumbency Animal appear awake but cooperative ½ original Ketamine to extend duration

Annexure 2

Drugs	Dose (mg/kg) Sheep and goat	Comments
Diazepam	0.25-0.5 IV slow	Sedation for 30 min

Xylazine	Goats 0.05 – 0.1 IV 0.1 IM	Standing castration, add 1-1.5ml2% lidocaine infiltration to median raphae of scrotum and 2-3ml to each spermatic cored
	Sheep 0.1-0.2 IV 0.2-0.3IM	

Annexure 3

Drugs	Dose (mg/kg) pig	Comments
Xylazine	0.5- 3 IM	Mild sedation
Diazepam	0.5-1 IM	Short duration sedation
Ketamine	20-30 IM	
Diazepam Ketamine	1-2 IM 10-18 IM	Sedation 20-40min
Xylazine Ketamine	4 IM 5-10 IM	Sedation 20-30min

Anesthesia

Annexure 4.a

Drugs	Dose (mg/kg) cattle	Comments
Ketamine	Loading dose: 2 IV	

	CRI: 600ml/hr of 2mg/ml Ketamine in 0.9% NaCl or 5% dextrose solution at a rate of 10ml/min	
Xylazine Diazepam	0.1-0.2 IM 4mg IM	Surgical analgesia for 15-20mins ½ dose Ketamine to extend duration for 10 min
Xylazine Ketamine	0.05-0.1 IM 10-15 IM	Used in calves Anesthesia for 45 minutes Supplemental dose: K 3-5 IM or 1-2 IV
Xylazine Ketamine	0.1-0.2 IM (0.1 mg for >600kg) 2 IV	Preferred combination for adult large ruminants Can be given together as a bolus injection or separately with Ketamine following xylazine. Anesthesia 30 min Top up: Ketamine 0.75-1.25 mg/kg for another 15 minutes.

Annexure 4.b

Drugs	**Dose (mg/kg) goat/sheep**	**Comments**
Xylazine Ketamine	0.1 IV 2.2 IV	Anesthesia 15 minutes
Diazepam	0.5-1 IV	Anesthesia 15-20 minutes

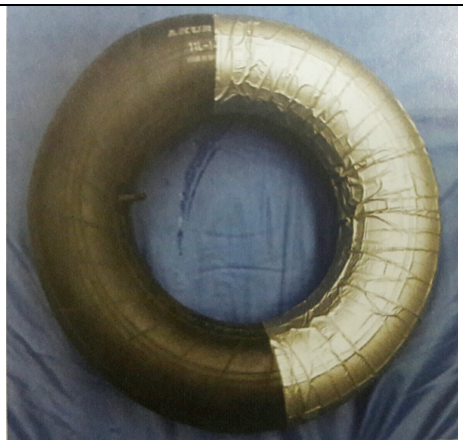
Ketamine	4-7.5 IV	Recumbency 30 minutes
Bovine Triple Drip (GKX): Xylazine (**0.1mg/ml)** Ketamine (1-2mg/ml) in 5% guaifenesin	Induction: 0.65-1.1ml/kg IV Maintenance: 2.2ml/kg/hr IV	Maintenance CRI to effect.

Annexure 4.c

Drugs	**Dose (mg/kg) Pig**	**Comments**
Diazepam Ketamine	1-2 IM 12-20 IM	Duration 20-40 minutes (pigs may still respond to noxious stimuli such as incision of the abdominal wall
Xylazine Ketamine	2.2 IM 20 IM	Anesthesia 20-40 minutes
Swine Triple Drip (GKX): Xylazine (**1mg/ml**) Ketamine (1-2mg/ml) in 5% guaifenesin	Induction: 0.67-1.1ml/kg IV Maintenance: 2.2ml/kg/hr IV	Maintenance CRI to effect.

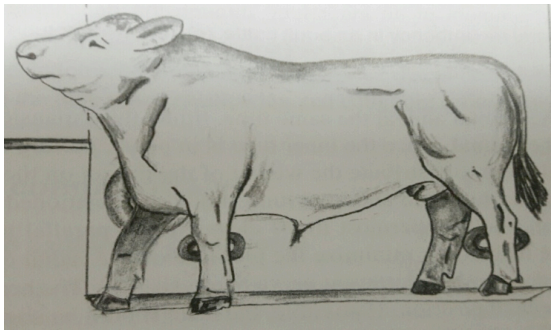
- Pigs may still respond to noxious stimuli such as incision of the abdominal wall while using combination of diazepam-ketamine and xylazine-ketamine.

Figure 1



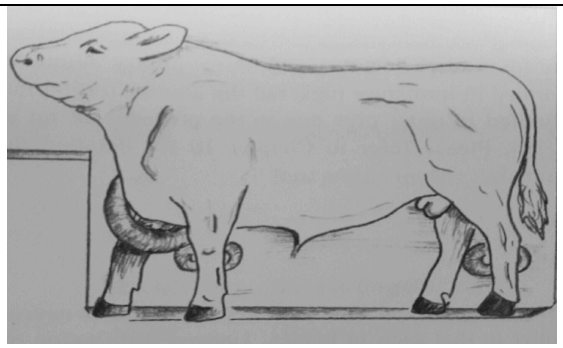
An automobile inner tube (valve stem pointed down), duct tape or other non-elastic tape can be placed on the part of the inner tube (opposite to the valve stem. This prevents from collapsing of the inner tube when placed under the animal at the same time limits the expansion of the inner tube when not under the animal.

Figure 5.b



Placement of the inner tube under the shoulder during lateral recumbency in adult cattle

Figure 5.c



Placement of an inner tube through the dependent forelimb under the shoulder during lateral recumbency in adult catlle.