VETERINARY COUNCIL OF INDIA

(Statutory body of Government of India estblished under Indian Veterinary Council Act, 1984)

Continuing Veterinary Education (CVE) Programmes

Training Module
On
Postmortem Examination and Veterolegal Cases

A-Wing, 2nd Floor, August Kranti Bhawan,
Bhikaji Cama Place, New Delhi – 110 066

Training Module developed with inputs from:

1. Dr. R.S. Chauhan, Joint Director, Centre for Animal Disease Research and Diagnosis, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh.
2. Dr. K.S. Prajapati, Professor & Head, Veterinary Pathology, College of Veterinary Science, Anand Agricultural University, Anand, Gujarat.

Published and printed by: The Secretary, Veterinary Council of India, A-Wing, 2nd Floor, August Kranti Bhavan, Bhikaji Cama Place, New Delhi-110066.

Printed at:, ……..

Preface

Consequent upon the decision of the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India to implement the Continuing Veterinary Education (CVE) programmes, an activity of Professional Efficiency Development Scheme, through Veterinary Council of India as its nodal agency in the country, the Council has been implementing these programmes through conducting skill based trainings on identified topics since December, 2007. The primary objective of these trainings is to upgrade the knowledge and skill of the registered Veterinary practitioners aimed at improving quality of Veterinary services through efficient and effective diagnosis of the diseases.

Necropsy of animal carcasses is an important tool in diagnosis of diseases and ultimately their control. It also becomes extremely relevant in addressing vetero-legal cases. Therefore, a veterinarian must have the basic knowledge of the post mortem techniques, recording of lesions, their interpretation, collection of proper sample for laboratory examination, and writing of report.

This Module for a four-day training programme developed and finalized by the experts in the subject emphasizes on the techniques and steps in post mortem examination, gross lesions of important diseases with illustrations, procedures for collection, preservation and despatch of laboratory materials, report writing and the precautions to be followed by the Veterinarians while conducting the post mortem examination.

The contents of this Module are also available on the website www.vci-india.in.

CONTENTS

1. INTRODUCTION

Necropsy of animal carcasses helps in diagnosis of diseases and ultimately their control. It is said *"Necropsy is the message of wisdom from dead to living"*. It includes systemic examination of dead animal, recording of gross pathological lesions, and their correlation with history to make diagnosis of disease. Sometimes, it is difficult to make any conclusive diagnosis merely on the basis of postmortem examinations. In such situation material is to be collected for further laboratory analysis such as histopathology, microbiology, parasitology and toxicology for confirmation of the cause of disease. Necropsy is an integral part of disease investigation. Therefore, veterinarian must have the basic knowledge of postmortem techniques, recording of lesions, interpretation of lesion, collection of proper and best material for laboratory examination. Necropsy is perhaps the sole diagnostic technique available to veterinarian to find out the cause of death of the animals and as it is well known that the control measures for their effectiveness depend upon a correct and reliable diagnosis.

OBJECTIVES

1. To determine the cause of death.
2. To confirm or deny a clinical diagnosis.
3. To obtain samples for laboratory examinations.
4. To satisfy a court order in vetrolegal cases or for insured animal.
5. To diagnose a disease in a herd or a flock to treat rest of the animals with similar clinical signs.
6. To advance scientific knowledge in various areas of research and development.

Post mortem examination should not be performed when

1. The carcass is suspected to have died of anthrax to avoid spore formation (After suspecting the presence of anthrax bacilli in blood smears from ear vein or oozing out unclotted blood.
2. The carcass is completely putrefied with liquefaction of all organs.
3. The carcass is not presented as whole body but in parts.

Precautions

1. Confirm the death of animal by signs like cessation of respiration, heart beat and eye movement. Cooling of body and initiation of rigor mortis.
2. Get the requisition letter from the competent authority particularly needed in vetrolegal/ insured cases.
3. Do not perform postmortem during night under artificial light as colour changes cannot be differentiated which is the base for identifying the lesion. It should be conducted in day light.
4. Obtain complete history of the animal from the owner or the veterinarian treated the case or the police personals.
5. Protect your self with protective wears like apron, gum boots, hand gloss, etc. Remove watch, rings etc.
6. Identify the animal. Note the species, breed, sex, age, colour etc. If age is not available determine the age. Note the identification marks. Measure the length of the animal from point of shoulder to point of hip, height of the animal at the level of shoulder, girth behind the fore limb and in horned animal the distance between the horn tips.

Time of death

Determination of time of death is an important aspect particularly in vetrolegal cases. Usually it is available from the owner or the clinician. Though difficult the approximate time of death can be ascertained by observing following parameters.

1. **Rigor Mortis:** It is the stiffening of muscles after death. By noting the appearance and disappearance of rigor mortis one can find out the approximate time of death. It lasts for 24 hrs. In exhausted and drowning cases it passes off quickly (3 hrs).However, it is quit variable and is best related to body temperature, metabolic activity at the time of death and atmospheric temperature at the site of carcass. Animal with high fever, severe excitement, lightning and drowning show early rigor mortis while moribund and chachectic show delayed rigor mortis. The jaw muscles are first to set up in rigor followed by the eyelids, tail, digits, distal limb muscles and finally the large limb muscles. They relax in a similar sequence. Once rigor has been broken by moving the body or limb it will not return.
    a. Stiffening of head muscles (Jaw, Eye lids)- Occurs within 2-8 hrs. Within 30 min to 3 hrs in summer.

b. Stiffening of head, neck and distal fore limb muscles- Occurs within 12 hrs.

c. Stiffening of hind limb large muscles only and passing away in above muscles- Occurs within 20 hrs.

d. Disappearance of rigor mortis from whole body- 24-30 hrs.

e. Carcass bloated with putrid foul smell- More than 30 hrs.

2. **Algor Mortis:** Means cooling of the carcass after death. It is another useful but not absolute parameter for determination of time of death. However, it helps in identifying freshly dead animals.

3. **Corneal Clouding:** It begins not sooner than 25 hrs after death at least in dogs. Closed eye lids prevent dehydration of cornea and make observation more valid.

Clouding of the lens, rumen mucosal sloughing, blood glucose levels, food digestion in stomach and fly eggs/ larva can also be utilized for the purpose of determination of death. However, they are highly variable parameters.

Description of gross lesions

While performing the postmortem following criteria are evaluated and various terms are used for its description:

- Location of lesions- Organ/ Tissue/ System
- Colour
- Size
- Weight
- Shape
- Consistency and Texture
- Number/ Percent/ Extent
- Content
- Odour
- Surface appearance
- Distribution
  - Organ(s) - Unilateral/ Bilateral
    Focal/ Multifocal
    Locally extensive/ Diffuse
  - Whole Body - Localized
    Generalized
- Time per acute/ Acute/ Subacute/ Chronic/ Chronic active
- Severity: Minimal/ Moderate/ Marked
- Type: Cropous/Haemorrhagic/Purulent/Fibrinous/Fibrinopurulent
- Cause: Bacteria/Viral/Verminous/Protozoal/Mycotic/Toxicity/Traumatic

2. TECHNIQUES OF POST-MORTEM EXAMINATION (NECROPSY)

Bovines

Before dissecting the carcass, possibility of anthrax is to be ruled out first. Blood smears, prepared by pricking the tip of ears are examined by staining with mature polychrome methylene blue stain for this purpose. The body is observed for nutritional status, cadaverous postmortem changes and possible discoloration or anaemia. To detect anaemia the visible mucous membranes are seen, especially the third eye lid (membrane nictitans) by pulling it out with the help of forceps. The carcass is supported on its back and inclined

PM Techniques

- *Place animal on left side (Ruminants) (Fig. 2A).*
- *Place horse on right side and dog on vertebral column (Fig. 3A & 4A).*
- *Make midventral incision with knife from chin to anus.*
- *Surround the prepuce, scrotum/mammary gland.*
- *Remove skin dorsoventrally. Remove skin at face, neck, thorax and abdomen (Fig. 2B & 3B).*
- *Cut the muscles and fascia in between scapula and body; remove fore legs.*
- *Raise hind legs, cut the coxofemoral ligament.*
- *Examine s/c tissue, muscles, superficial lymphnodes- prescapular, prefemoral, supramammary, etc.*
- *Open abdominal cavity by cutting muscles and peritoneum (Fig. 2C, 3C & 4B).*
- *Open thoracic cavity by cutting xiphoid cartilage at sternum; lift ribs and press them to break at joints with vertebral column.*
- *Examine the visceral organs in both cavities:*

Thorax:	*Heart, Lungs, Trachea, Oesophagus, Mediastinal lymphnodes, Diaphragm*
Abdominal cavity:	
Ruminants:	*Rumen, Reticulum, Omasum, Abomasum*
Other animals:	*Stomach*
In all animals:	*Liver, Pancreas, Intestines, Mesenteric lymphnodes, Spleen, Kidneys, Ureter*
Pelvic cavity:	*Urinary bladder, uterus*

towards the left side. The carcass is deskinned leaving the genital organs and udder attached in the normal position. The skin is examined on both sides for any marks and lesions. The hind legs are abducted by cutting through the medial thigh muscles antero-posteriorly close to the pelvic symphysis, opening the hip joints and severing the ligaments. Incision around the udder in female is made to remove it from its attachments. In case of male, the penis along with the prepuce is detached and drawn backward up to the ischial arch. The forelimbs at this stage may also be separated by incising in the axilla close to the chest wall. Do not severe the dorsal attachment and leave the forelimbs partly attached with the body. The scortum is cut to expose the testicles. Incise the tunica vaginalis, draw out the testicles and separate the spermatic cords and leave as such hanging on either side of the abdomen. Make a superficial incision in the linea alba, taking due care for not puncturing the viscera. In cases of excessively tense wall due to bloat etc., a small puncture on the left abdominal wall with the point of knife would allow the escape of gas and relax the wall. Incise from the opening in the linea alba, guided by two fingers up to the xyphoid cartilage and pubic symphysis posteriorly.

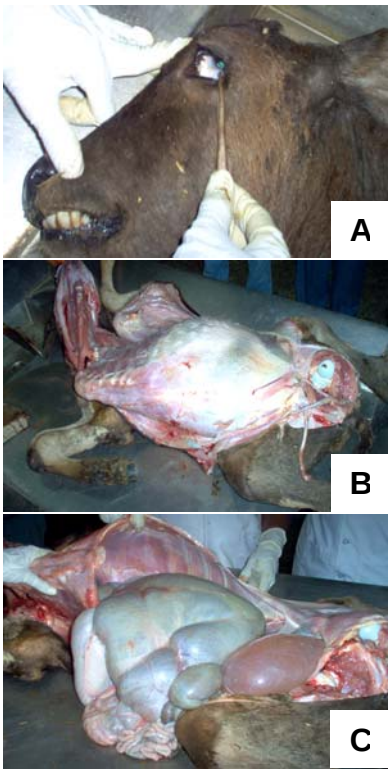


Fig. 1a. A. Examination of eye, B. After removal of skin exposed subcutaneous and muscles, C. Opening of abdominal cavity.

Reflect the abdominal wall along the costal arch on either side and in female along the border of the pubic bones as well. Observe and measure if there is any increased peritoneal fluid or abnormality. Separate if not already done the testicles and spermatic cord from the lateral abdominal wall by incising along the inguinal canal. Examine for the normal position of the viscera and note the changes. Locate and

examine the epiploic foramen for herniation of the loop of intestine (important in case of horses). This is done by inserting two fingers along the caudate lobe of liver, a clear space allowing the two fingers in adult is the epiploic foramen. Remove the omentum from the longitudinal grooves and examine.

Separate the duodenum between two ligatures at the pylorus. Detach rumen possibly by hand from diaphragm and expose the oesophagus. Ligate at two places and cut the oesophagus between ligations. Pull out the rumen with spleen and abomasum on the left side. While doing this, care is taken to separate the pancreas by hand which is to be taken out with liver. Divide duodenum between two ligation at the junction of its second turn with the jejunum. Free the rectum, ligate at two places and incise between these. Remove the whole intestine by cutting the mesenteric roots. Give a small incision in the vena cava near its entrance in diaphragm, and with the help of one finger tear the vena cava through the whole length of the liver. Observe here for any thrombi or abscess in the vena cava. Now remove the liver from its attachment along with pancreas and duodenum in one piece. The kidneys and adrenals are freed and separated from its lateral and anterior side. Cut the renal vessels along the medial border and carefully pull both the kidneys backward, thus freeing the ureters from the abdominal wall. In female the broad ligament of uterus is separated from its insertions on the abdominal wall. In male separate the already drawn penis from the ischial arch. Now the urinary and genital

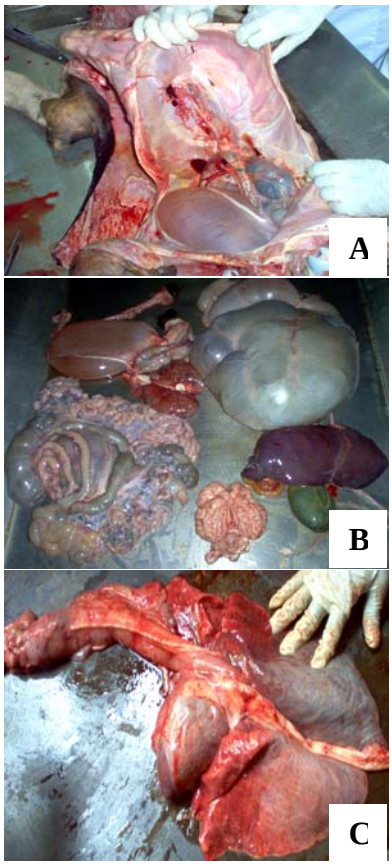


Fig. 1b. A. Exposed thoracic cavity, B. Removal of visceral organs, C. Lungs and trachea.

organs are all free. The floor of the pelvic is first drawn out from anterior to posterior borders through the obturator foramen. Then all the urinogenital organs are gathered in one hand and backward removing simultaneously the attachments by knife. Make an incision around the anus and in the female include the vulva, thus freeing these organs which are safely pulled out.

The diaphragm is taken out by cutting at its insertion at xyphoid cartilage, following on either side along the costal attachment and finally the sub lumbar insertion. Damage to the pericardial sac is avoided. The pericardial sac is separated from the sternum. Any fluid or abnormal contents in the pericardial sac is observed and collected. This can also be done after removing the heart along with the lungs. Separate the trachea and oesophagus in neck region and divide them in the middle. The free end of trachea along with oesophagus is pulled towards the thoracic aperture. This is afforded by making a short transverse incision between the two cartilage rings and inserting the fingers for tight grip. After freeing the trachea up to thoracic inlet, it can be now pushed in the cavity. It is then pulled backward and thoracic organs are separated by cutting through the mediastinum and brachial vessels. The thoracic aorta is removed with these organs and cut through the lumbar region, leaving behind the abdominal aorta.

The structure of oral cavity and neck are then removed. Give an incision on each side of the intermandibular space along the medial border of the mandible as far as the symphysis. The tongue is now drawn out and pushed backward, the incision on either side are also extended backward. The soft palate is cut by incision from each side, forward and medially to meet in the middle line forming a triangular area. The hyoid bones are divided on either side by placing the knife with its edge upward between the thyroid branch of the hyoid bone and larynx. A single jerk is sufficient to separate hyoid bones, provided the knife is in correct position. Now pull the tongue with pharynx, oesophagus and trachea backward along the neck where previous incision was made. The head with the salivary glands intact is severed through the atlanto-occipital joint. The joints are examined by opening from the medial side commencing distally on the limbs. The spinal cord is exposed by sawing through the arch of the vertebrae. It can also be exposed by cutting through edge of the spinal canal slightly off the midline. In order to expose the brain following steps should be followed:

1. Incise the skull on each side beginning at the foramen magnum

and sawing anteriorly the frontal bones and then make transverse incision through the frontal plate just above the eyes (use waste paper for preventing the spill of the contaminated material).

2. Lift the calvaria with bone chisel.
3. Remove brain using sterile instrument. First remove the meninges and tentorium cerebelli with sharp pointed scissors.
4. Cut medulla at the cervical cord, cranial nerves and anterior extension of optic thalami.
5. Lift entire brain on paper/ plastic plate or on large petri dish.

Small Ruminants

The procedure adopted is the same as for large ruminants except the following:

1. The sternum is removed by cutting the ribs at costochondral joints.
2. The neck and thoracic organs are then removed together without cutting the trachea and oesophagus in middle.

Equines

The body of the horse is inclined toward the right side. The rest of the technique is the same as in ruminants except for the abdominal organs. The pelvic flexure of great colon and caecum are reflected ventrally away from the body cavity. Spleen, left kidney, left adrenal and small floating colon are removed in order. Duodenum is then severed behind the root of mesentery where it passes medially from the right side and is separated from the mesentery till the ileocaecal valve is reached. Another method of locating the duodenum is follow the duodenocolic fold mesentery from its colonic attachment near the place where the small and large colons divide, to its duodenal attachment few centimeters posteriorly. Stomach is then removed. Anterior mesenteric artery and its branches supplying the great colon and caecum are examined first by removing the abdominal aorta before separation of the great colon and caecum. Liver, right kidney and right adrenal are subsequently removed. All the thoracic organs are removed together by cutting the trachea and oesophagus at the thoracic inlet.

Canines and Felines

The dog or cat is placed on its back and incision in the skin is given and legs abducted. Abdominal cavity is exposed by a midline

incision along the linea alba from xyphoid cartilage to the pubis and transverse incisions from xyphoid cartilage to dorsal extent of the body cavity along the last rib. Sternal cartilage or ribs are cut through and sternum removed completely to expose the thoracic cavity. The viscera may be removed in piecemeal but *enmasse* removal of all organs from tongue to rectum is equally good if not better, because anatomic relationships are not disturbed and the procedure is quicker. For a hasty examination, Rokitansky procedure, i.e. examination of all organs *in situ* without detaching them by lifting them up, cutting, examining and returning them back to body cavities, is followed. In the piecemeal method intestines from rectum to duodenum, spleen with omentum and liver with pancreas, stomach and duodenum are removed separately.

Swine

The technique is the same as applied for canines except the removal of intestinal tract. The removal of the intestinal tract in this case should begin at the tip of colonic spiral which is made free along with the intestine from the mesentery. Another way is to loosen both forelegs and hind legs and a strip of ventral body wall to expose trachea, esophagus, thorax and abdomen for convenient removal. After post-mortem examination the viscera is returned to the body cavity and ventral flap replaced.

PM Techniques of Poultry

- *Dip the dead bird in antiseptic solution or in water; to avoid feather contamination.*
- *Keep the bird on post-mortem table at vertebral column and look for any lesion or parasite on skin.*
- *Examine the eyes, face and vent.*
- *Remove skin through a cut with knife and with the help of fingers. Expose thymus, trachea, esophagus in neck.*
- *Break the hip joint by lifting the legs. Examine the chest and thigh muscles.*
- *Cut on lateral side of chest muscles. Lift the chest muscle dorsally and break bones at joints with thorax. Cut bones at both sides and remove muscles, bones to expose thorax, abdomen.*
- *Examine different organs.*
- *Cut proventriculus and pull the organs of digestive tract out. Separate liver, spleen, intestines, caecum, proventriculus, gizzard, etc.*
- *Lungs, heart, kidneys, ovary, oviduct, testes can be examined in situ.*
- *Expose bursa just beneath the cloaca.*
- *Cut beak at joint, examine mouth cavity and expose esophagus and trachea.*
- *Remove skin of head and make a square cut on skull to expose brain.*
- *Take a forceps and place in between thigh muscles, remove fascia and expose the sciatic nerve.*
- *Separate each organ, examine them for the presence of lesion.*

Laboratory Animals

Laboratory animals are necropsied either to know the cause of their spontaneous death or to evaluate the results of experimentation by performing complete or line necropsy. There is no single standard procedure. The carcass is invariably soaked in a disinfectant solution and fixed on the board for easy manipulation. At times a direct approach to the visceral organs is made through a midline incision. Brain of laboratory animals often require examination and can easily be removed by either sharp scissors or a pair of bone-forceps.

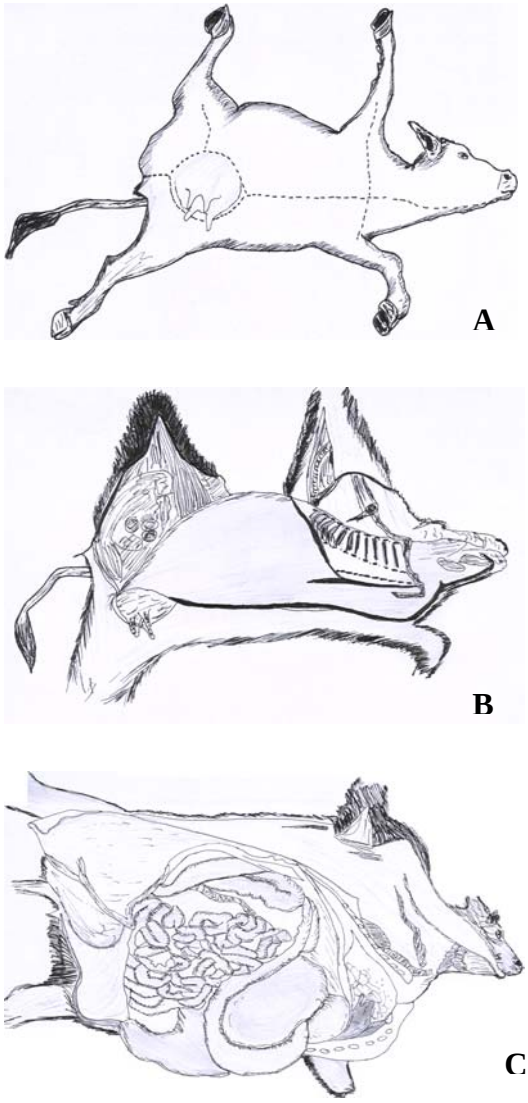


Fig. 2. Diagram showing post-mortem examination of ruminant (A) position of cow and the marking for incision (B) after removal of skin and (C) after exposure of abdominal cavity

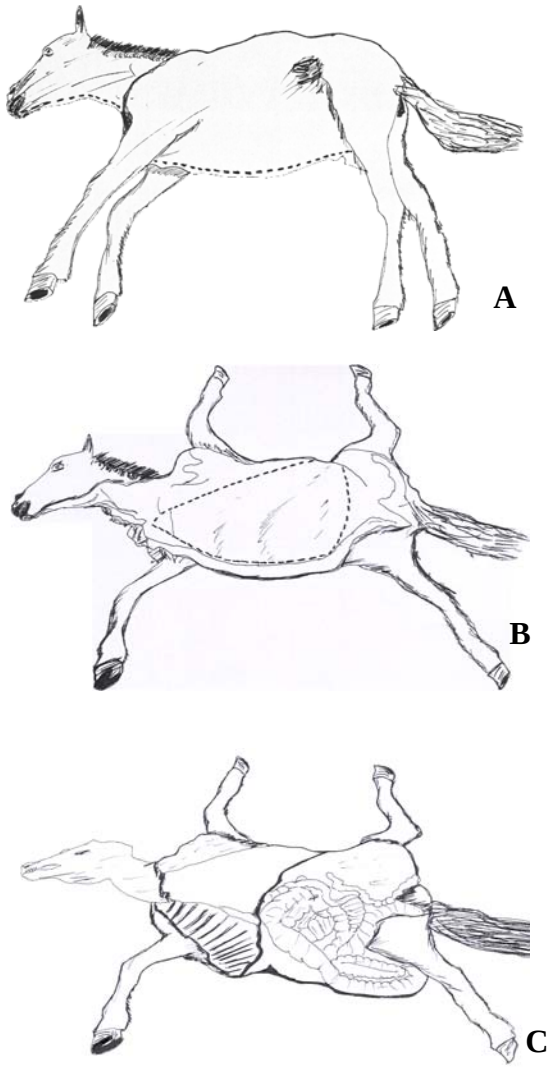


Fig. 3. Diagram showing post-mortem examination of horse (A) position of horse and marking for incision (B) after removal of skin and (C) after exposure of abdominal cavity

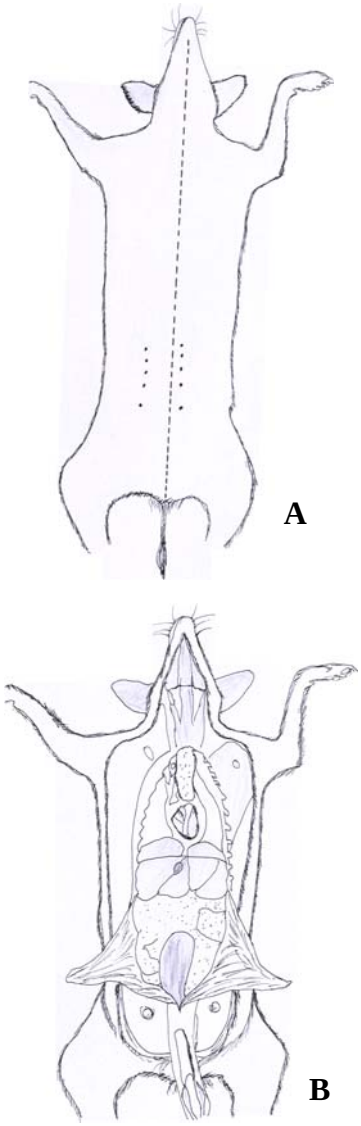


Fig. 4. Diagram showing post-mortem examination of dog (A) position of dog and marking for incision (B) after exposure of thoracic and abdominal cavity

Fig. 5. Position of bird on post mortem table

Fig. 6. External examination for presence of lice, mites & ticks

Fig. 7. External examination of eyes

Fig. 8. Examination of vent

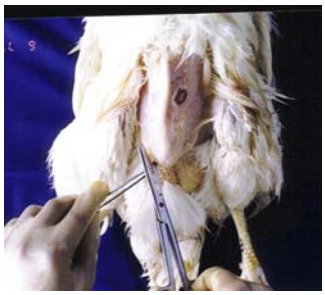


Fig. 9. Removal of skin

Fig. 10. Breaking of hip joint

Fig. 11. Exposure of muscles for examination

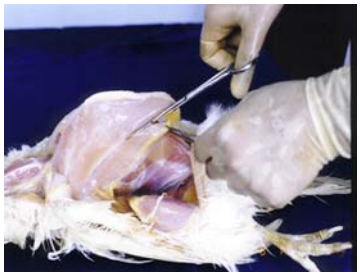


Fig. 12. Removal of breast muscles

Fig. 13. Cutting of olavical bones

Fig. 14. Exposure of internal organs

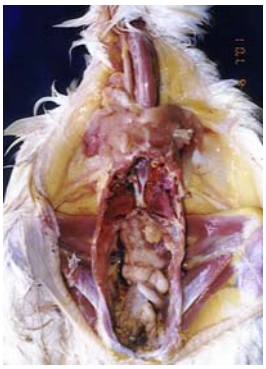


Fig. 15. Kidneys, ovary, oviduct after removal of digestive system and heart

Fig. 16. Examination of mouth cavity

Fig. 17. Examination of intestines including caeca and proventriculus

Fig. 18. Examination of trachea, bronchi and lungs

Fig. 19. Examination of female genital tract

Fig. 20. Examination of testes

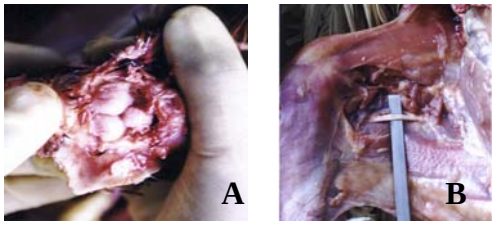


Fig. 21. Examination of nervous system
(A) brain (B) sciatic nerve

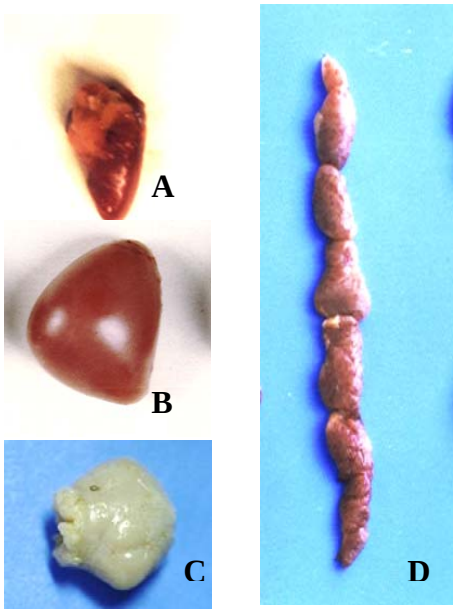


Fig. 22. (A) Heart, (B) Spleen(C) Bursa of Fabricious and (D) Thymus

3. STEPS IN POST-MORTEM EXAMINATION

Post-mortem examination should be conducted only after receiving of a formal request from the owner of animal having details of anamnesis and date and time of death. Without formal written request, one should not do post-mortem examination of animal. The post-mortem record includes the aspects of animal identification, illness, therapeutic and preventive measures adopted and date and time of death. This information provided by the owner or person requesting post-mortem, which helps in post-mortem examination and recording of lesions to make a conclusive diagnosis.

Various steps in post-mortem examination are as under:

1. External examination

Animal should be examined externally before opening the body for the presence of lesions on body surface. Eyes, ear, anus, vulva, mouth, nares etc. should be specifically examined for the presence of blood and any other lesion. If the blood is coming out from natural orifices, it should be examined for the presence of anthrax bacilli and such carcasses must not be opened for post-mortem examination. Following points should be taken into consideration while conducting external examination.

- Trauma, wound, fracture, cuts, etc.
- Fungal infection *e.g.* ringworm
- Parasitic infestation *e.g.* mange, lice, ticks
- Side of animal/ lying down on earth.
- Discharges from openings.
- Burn, ulcers, erosions etc.

2. Subcutaneous tissue and musculature

Examine the subcutaneous tissue and musculature after removal of skin for the presence of lesions such as:

- Congestion, haemorrhage, oedema, nodule, anemia, icterus.
- Fat deposits
- Necrosis on muscles, hardening, calcification.

3. Abdominal and thoracic cavity

Just after opening the carcass, one should observe the presence of any lesion in abdominal and thoracic cavity and following points must be kept in mind.

- Displacement of organs.
- Accumulation of fluid (serus, serosanguinous, blood, pus etc.)
- Fibrinous or fibrous adhesions.
- Parasites
- Abscess, tumor etc.

4. Respiratory system

Organs/tissues to be examined: External nares, nasal passage, larynx, trachea, bronchi, lungs, air sacs (poultry) mediastinal lymphnodes.

Lesions to be observed

- Discharge from external nares.
- Growth (granuloma/polyp) in nasal passage if there is blood mixed nasal discharge.
- *Trachea and Bronchi*- Congestion, haemorrhage, presence of caseous exudate, frothy exudate etc.
- *Lungs*- Congestion, consolidation, nodules, presence of exudate on cut surfaces, oedema, atelectasis, emphysema, haemorrhage, necrosis.
- *Mediastinal lymphnodes*- Oedema, hardening, calcification, congestion, haemorrhage.

5. Cardiovascular system

Organs/tissues to be examined: Heart, aorta, arteries, veins and lymphatics

Lesions to be observed

- Fluid, blood, pus etc. in pericardial sac
- Adhesions, fibrin, fibrosis
- Congestion, haemorrhage, necrotic foci
- Hardening of blood vessel, obstruction, thrombi
- Presence of parasites
- Post-mortem clot/ thrombi.

6. Digestive system

Organs/tissue to be examined: Mouth cavity, esophagus, crop, proventriculus, gizzard (poultry), rumen reticulum, omasum, abomasum (ruminants), stomach, intestine (duodenum, jejunum, ileum, cacum, colon, rectum), cloaca, vent (poultry), anus, liver, pancreas, gall bladder, mesenteric lymphnodes etc.

Lesions to be observed

- Erosions, ulcers, vesicles
- Congestion, haemorrhage, oedema
- Necrosis
- Icterus
- Abscess/pus
- Perforation, needles or hard objects in reticulum.
- Intussusception, torsion, volvulus
- Parasites
- Atrophy, hardening, nodules
- Contents, catarrhal, blood mixed, digested/ undigested feed material, thickening of wall of intestines.
- Cut surface of liver for parasites, lesions in bile duct.

7. Urinary system

Organs/tissue to be examined: Kidneys, ureter, urinary bladder, urethra

Lesions to be observed

- Congestion, haemorrhage, infarction, oedema.
- Necrosis, hardening, nodules
- Deposition of salts, calculi
- Obstruction, pus in pelvis

8. Genital system

Organs/tissue: Female- Ovaries, oviduct, uterus, cervix, vagina. ***Male-*** Testicles, Epididymis, penis, prepuce

Lesions to be observed

- Cysts in ovary
- Congestion, haemorrhage, oedema
- Foetus in uterus, pus, fluid
- Necrosis, overgrowth, nodules
- Atrophy, adhesions, granularity

9. Immune system

Organs/tissue to be examined: Spleen, lymphnodes, bursa and thymus (poultry), bone marrow, Peyer's patches, GALT, RALT.

Lesions to be observed

- Size, shape, atrophy, hardening.
- Oedema, congestion, haemorrhage

10. Nervous system

Organs/tissue to be examined: Brain, spinal cord, nerves, meninges

Lesions to be observed

- Congestion, haemorrhage, hematoma
- Oedema, swelling
- Abscess
- Hypoplasia

11. Miscellaneous observation

- Adhesions in pleural/peritoneal cavity
- Any other left over information pertinent to post-mortem examination/diagnosis

Post-mortem diagnosis

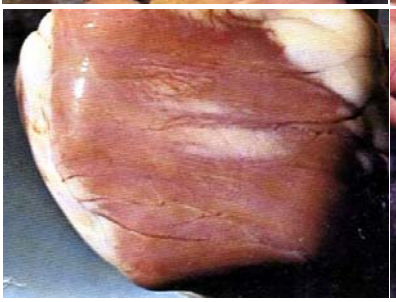
Diagnosis should be made on the basis of above findings which involve any system or organ. The most involved organ based diagnosis should be written with suggestion of etiological factors or etiology based diagnosis.

4. POST-MORTEM LESIONS OF IMPORTANT DISEASES

VIRAL DISEASES OF ANIMALS AND POULTRY

Foot and mouth disease (Picorna virus)

Clinical signs and lesions: Hypersalivation, painful eating, smacking of lips and tongue, gastroenteritis, myocarditis in young animals, ***vesicular lesions*** on oral mucosa i.e. over lips, dorsum of tongue and palate ruminal pillar, skin of coronary band near to the interdigital space; lesions on vulva, teat, udder, and other hairless parts of body; greyish necrotic foci in myocardium ***'Tiger heart'***.



Cow Pox (Orthopox virus)

Clinical signs and lesions: Papule, vesicle, pustule and scab on hairless parts of body like teats, udder.

Pseudocow Pox (Parapox virus)

Clinical signs and lesions: Congestion, papules, vesicles on teat and udder.

Swine Pox (Sui pox virus)

Clinical signs and lesions: Erythema, papule, vesicles, pustules on inner portions of legs.

Buffalo Pox (Buffalo pox virus)

Clinical signs and lesions: Pock lesions (papule, vesicle, pustule, scab) on hairless parts of body, subcutaneous gelatinous edema, haemorrhage from vesicles.

Sheep Pox (Capripox virus)

Clinical signs and lesions: Pock lesions (papule, vesicle, pustule, scab) on hairless parts of body, subcutaneous gelatinous edema, haemorrhage from vesicles.

Goat Pox (Capripox virus)

Clinical signs and lesions: Less severe than sheep pox, skin lesions are smaller.

Fowl Pox (Avipox virus)

Clinical signs and lesions: Pock lesions in the form of small nodules on comb, wattles, and on face, cheese like material on mucosa of tongue, palate and laryngeal orifice, on removal leave the ulceration, coniunctivitis, cheesy material in eyelids.


Infectious canine hepatitis (Adeno virus)

Clinical signs and lesions: Clonic spasms of neck and extremities, paralysis of hindquarters, anaemic mucous membranes, petechiae on mucous membranes, cloudiness of cornea of one eye, albuminurea, neutropenia, lymphopenia followed by lymphocytosis, enlarged liver.

Feline Panleukemia/ feline distemper (Parvo virus)

Clinical signs and lesions: Diphasic fever, ***panleukopenia***, enteritis, dehydration, emaciation mucopurulent exudate in nasal and lacrimal mucosa, haemorrhage at the ileum; mesenteric lymph nodes edematous; bone marrow of longbones becomes greasy, yellowish, white.

Canine parvoviral infection (Parvo virus)

Clinical signs and lesions: Vomiting, diarrhoea, dehydration, fever, leukopenia, necrotizing enteritis myocarditis in pups.

Bluetongue (Orbi virus)

Clinical signs and lesions: High fever, reddening of oral, nasal mucosa, edematous swelling on lips, tongue, ears, face and intermandibullar space, edema and ***cyanosis of tongue***, petechiae on oral and nasal mucosa, lesions on skin of hoof leading to ***pododermatitis***, haemorrhage in tongue.

African horse sickness (Orbi virus)

Clinical signs and lesions: Fever, pulmonary edema, edema of head and neck, lips, eyelids, cheek, tongue and bulging of supraorbital fossa, petechiae on ventral tongue, paralysis of espohagus, hydrothorax edema, hydropericardiun, petechiae on endocardium, foci and myocardial necrosis.

Neonatal calf diarrhoea (Rotavirus)

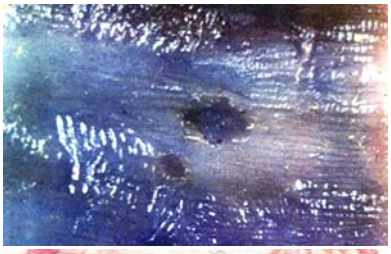
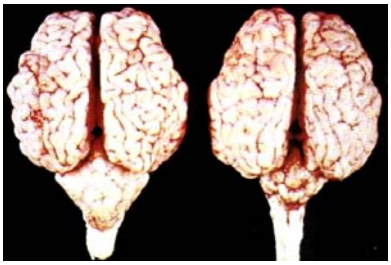
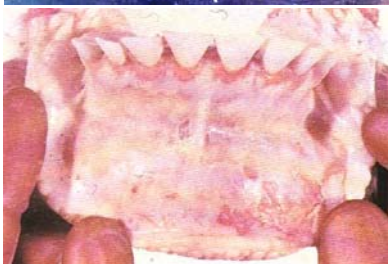
Clinical signs and lesions: Yellowish watery diarrhoea, weakness, dehydration, congestion of intestines, enlargement of mesenteric lymph nodes.

Swine fever/ Hog Cholera (Pestivirus)

Clinical signs and lesions: High fever, leukopenia, lethargyness, grinding of teeth, erythema of skin of abdomen herdling, ***glueing of eyes***, petechiae on kidneys, infarcts in spleen, haemorrhage in lymph nodes, ***button ulcers*** in colon.


Bovine viral diarrhoea Mucosal disease (pesti virus)

Clinical signs and lesions: High fever, diarrhoea, leukopenia, ulcers in mouth, nose, muzzle, small and large intestine leading to zebra strippings congestion of nasal and oral mucosa, conjunctiva; abortions, still birth. In fetus, ulcers in oral cavity, esophagus, abomasum, congenital cerebral hypoplasia, cataract, retinal atrophy.

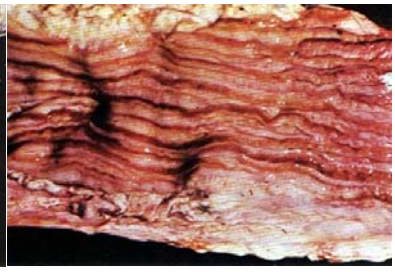
Canine distemper (Morbilli virus)

Clinical signs and lesions: Diphasic fever, coryza, purulent conjunctivitis, bronchitis, bronchopneumonia, vesiculopustular lesions on abdomen, diarrhoea, dehydration, emaciation, blindness, hyperkeratosis of the digital pads, eosinophilic ***intracytoplasmic and intranuclear inclusion bodies*** in nasal mucosa, gastrointestinal tract, in circulating neutrophils and lymphocytes

Rinderpest (Morbilli virus)

Clinical signs and lesions: Fever, nasal and lacrimal discharges, leukopenia, diarrhoea, dysentry, erosions in oral

mucosa. Erosions are shallow, greyish white with red and raw appearing floor, present on inside the lips, gums, cheeks ventral to the tongue, necrosis of lymphocytes in lymph nodes, spleen, Peyer patches of the intestines. ***Intracytoplasmic and intranuclear inclusions*** in the multinucleated giant cells, epithelial cells of the necrosed erosions, hemorrhagic streaks in large intestine simulating "***Zerba markings***".



Bovine ephemeral fever (Rhabdovirus)

Clinical signs and lesions: Fever, mucopurulent nasal discharge, shivering, ***shifting lameness***, vascular engorgement, edema of lymph nodes, hydropericardium, hydrothorax, rhinitis, tracheitis, pulmonary emphysema, tendovaginitis, focal necrosis of muscles, cellulitis, hemosiderosis of spleen and lymph nodes.

Rabies (Lyssa virus)

Clinical signs and lesions: Biting of inanimate objects, furious champing of jaws, hypersalivation, paralysis, perivascular cuffing, neuronophagia in brain stem and hippocampus, eosinophilic ***intracytoplasmic inclusion bodies*** with clear hallo in the nerve cells, these are called ***"Negri bodies"***. On Seller's stain bright red or magenta colour inclusion bodies.

New castle disease/ Ranikhet disease (Paramyxo virus)

Clinical signs and lesions: Respiratory distress, greenish diarrhoea, paralysis of wings, legs, torticollis, ***haemorrhage around the orifice of glands in proventriculus***, haemorrhages at cecocolic junction, edema and lymphocytic infiltration in larynx and trachea; catarrhal inflammation of nasal and conjunctival

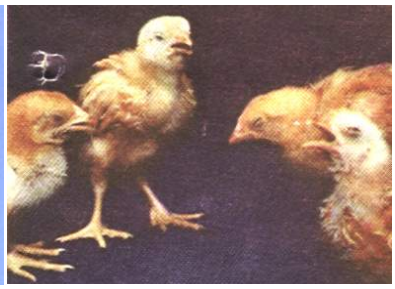
mucosa, interstitial pneumonia, ***in intestines ulcers covered by bran like deposits***, encephalitis, ***pneumo-encephalitis***.


Infectious laryngotracheitis (Herpes virus)

Clinical signs and lesions: Respiratory distress, gasping, rales, coughing, bloody mucous from trachea, lacrimation, drop in egg production, beak soiled, tracheal and laryngeal mucosa covered with bloody tenacious exudate, haemorrhage in trachea, cheesy exudate in larynx.


Infectious bronchitis (Corona virus)

Clinical signs and lesions: Nasal discharge, gasping, rales, coughing lacrimation, swelling of sinus, reduced egg production, mis-shapen eggs, thin shelled eggs, watery yolk, catarrhal tracheitis, air sacs contain fibrinous exudate, yellow caseous material in bronchi specially at the point when enters in lungs, catarrh of nasal passage, kidneys become pale and swollen deposition of urates on kidneys.

Avian encephalomyelitis/ epidemic tremor (Picorna virus)

Clinical signs and lesions: Dullness, disinclination to move, ataxia, ***tremors of head and neck***, bluish colouration of eyes, blindness.

Infectious bursal disease/ Gumboro disease (Birna virus)

Clinical signs and lesions: Ruffled feathers, tremors of head and neck, discharge from eyes, diarrhoea, soild vent, enlarged bursa, haemorrhage and contains gelatinous material, yellow caseous material in atrophied bursa, nephrosis, mottling of kidneys due to urates deposition, intramuscular haemorrhages, congestion and edema of bursa, depletion of lymphoid cells, cellular debris in tubes of kidneys, necrosis of cecal tonsils and thymus.

Avian influenza (Orthomyxo virus)

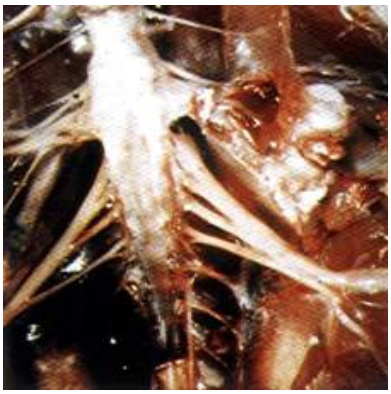
Clinical signs and lesions: ***Cyanosis of comb and wattles, edema of face,*** respiratory distress, reduced egg production, haemorrhage on epicardium, proventriculus, gizzard, necrotic foci on spleen, liver, lungs, kidneys, intestines and pancreas.


Avian leukosis complex (Retro virus)

Clinical signs and lesions: ***White tumours in liver***, spleen, lung, ovary and on other serosal surface; in ***osteopetrosis*** form long bones become thickened.


Marek's disease (Herpes virus)

Clinical signs and lesions: Sudden mortality, inco-ordination of legs, lameness, paralysis of wings, hanging

of wings, torticollis, thickening of nerves, rounding, loss of striations in sciatic nerve, brachial nerve, vagus nerve and mesenteric nerve. Tumours in gonads, liver, spleen, lung, muscle, heart, kidneys proventriculus, intestines.

Avian reovirus infection (Reovirus)

Clinical signs and lesions: *Tenosynovitis:* ***Lameness***, swelling and congestion of synovial sheath of the tendon of hock joints and foot pads, Articular surface of tibia and metatarsal show erosions. *Stunting syndrome:* Poor feathering, poor shank pigmentation, undigested food material in intestines, distention of gall bladder, atrophy of bursa, ***atrophy*** of ***pancreas*** and fibrosis, catarrhal enteritis, ***pasty vent***.

Avian rotavirus infection (Rota virus)

Clinical signs and lesions: Diarrhoea, mortality, dehydration, ***maldigestion***, ***malabsorption***, intestine and ceaca are filled with gases, congestion of intestines, ***cracking of feet*** and digits with dried fecal crusts.

Inclusion body hepatitis (Adenovirus)

Clinical signs and lesions: ***Pale muscles***, and bone marrow, swelling of liver with mottling, haemorrhage atrophy of bursa, petechiae on muscles, paleness and haemorrhage in kidneys, urates in ureters, icterus, ***hydropericardium***.

Adenovirus infection (Adeno virus)

Clinical signs and lesions: Respiratory form: Ruffled feathers, tracheal rales, congestion and consolidation of lungs, Egg drop syndrome: ***Drop in egg production*** (30-40%), depigmented, craked or shell less eggs, diarrhoea.

Chicken anemia agent infection (CAV)

Clinical signs and lesions: Pale, yellowish bone marrow, atrophy of thymus, atrophy of bursa, petechiae on breast muscles and proventriculus, enlargement of liver.

PRION, MYCOPLASMAL, RICKETTSIAL, CHLAMYDIAL, SPIROCHETAL AND BACTERIAL DISEASES OF ANIMALS AND POULTRY

Scrapie (Prion proteins)

Clinical signs and lesions: Intense pruritus, scraping of skin against hard objects, incubation period long 1-5 years, stiffness of forelegs, grinding of teeth, epilepti form seizures.

Bovine spongiform encephalopathy or mad cow disease (Prion proteins)

Clinical signs and lesions: Weight loss, hyperthesia, apprehensive behaviour, unmanagable behaviour of animal.

Contagious caprine pleuropneumonia (CCPP) (*Mycoplasma mycoides* var. capri)

Clinical signs and lesions: Fever, nasal discharge, congestion and consolidation of lungs, ***fibrinopurulent exudate in lungs, pleura***.

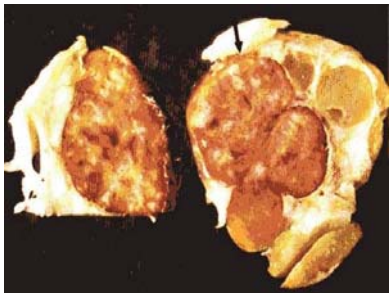
Leptospirosis (*Leptospira* sp)

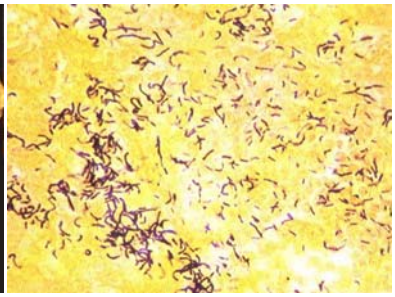
Clinical signs and lesions: Fever, ***icterus***, vomiting, dysentry, albuminuria, dehydration, debility, petechiae of pleura, peritoneum, nasal and oral mucosa, liver, retention of bile due to ***pluging of bile canaliculi***, enlargement of spleen and lymphnodes, haemorrhage on myocardium, muscles of urinary

bladder, gall bladder, lungs, pancreas. *Cattle:* Icterus, edema of liver, petechiae, hemolytic anemia, ***hemoglobinuria***, ***cholangitis***, grayish white focal necrotic lesion of kidneys.

Anthrax (*Bacillus anthracis*)

Clinical signs and lesions: Fever, ***bloody discharges from body orifices***, cyanosis, dyspnoea, subcutaneous edema, enlargement of cervical lymph node, ***spleenomegaly***, haemorrhage in intestines, liver, kidneys.





Tetanus (*Clostridium tetani*)

Clinical signs and lesions: Prolonged spasmodic contractions of muscles, extension of limbs, ***stiffness***, immobilization of affected parts, lock jaw.

Black leg (*Clostridium chauvoei*)

Clinical signs and lesions: ***Crepitant swelling in muscles*** of affected area particularly at thigh, dark brown or dark red colour of incised muscles, gas mixed exudate, sweatish odour; subcutaneous tissues are gelatinous, blood tinged and yellowish. Empty spaces along the muscle fibers, disease common in growing heifers.

Braxy (*Clostridium septicum*)

Clinical signs and lesions: Sudden death, ***edema of abomasal folds***/ wall, haemorrhages in wall of abomasum and small intestines.


Infectious necrotic hepatitis (*Clostridium novyi*)

Clinical signs and lesions: Occurs mainly in sheep, multiple foci of ***necrosis in the liver***, petechiae on epicardium, endocardium, hydropericardium, subcutaneous venous congestion (black disease).

Enterotoxemia

	Clinical signs and lesions	**Collection of material**
(*Clostridium* perfringenes type D)	Petechiae and echymotic haemorrhage beneath the epicardial and endocardial surfaces, intestines, abdominal muscles, hydropericardium, mild catarrhal gastroenterities, distention of gall bladder, ***pulpy kidney***.	Intestinal contents
(*Clostridium perfringenes* type A)	Short course, high mortality in lambs, calves, icterus, hemolytic anemia, ***hemoglobinuria***, hydropericardium enlargement of liver, dark and congested kidneys.	Intestinal contents
(*Clostridium perfringenes* type B)	Prostration, pain, diarrhoea, dysentry, death, haemorrhagic enteritis, ulcers in intestines, petechiae on epicardium, endocardium, hydropericardium.	Intestinal contents
(*Clostridium perfringenes* type C)	Haemorrhagic enteritis, ulceration in intestines, peritonitis, hydroperitoneum.	Intestinal contents

Strangles (*Streptococcus equi*)

Clinical signs and lesions: Fever, edematous swelling of pharyngeal region, dyspnoea, enlargement of submaxillary lymph nodes, abscess in lymph nodes, catarrhal/ purulent rhinitis, lymphadenitis, ***micro abscess in lungs, liver***, kidneys, spleen, brain, empyema in guttural pouch.

Campylobacteteriosis (*Campylobacter fetus*)

Clinical signs and lesions: *Cattle:* Mucopurulent endometritis, infertility, prolonged estrus cycle. *Sheep:* ***Abortions***, edema of placenta, death of fetus, vulvitis, vaginitis.

Swine erysipelas (*Erysiplelothrix rhusiopathiae*)

Clinical signs and lesions: Fever, erythema of skin giving it a "diamond sking appearance" haemorrhage on serous membranes, cutaneous lesions on abdomen in a diamond, rhomboid shape, bright red, purplish or dark bluish in colour, enlargement of joint capsule due to edema, irregular mass of leaves on mitral valve leading to vegetative endocarditis.

Brucellosis (*Brucella sp.*)

Clinical signs and lesions: ***Abortions*** in late gestation, organism localizes in mammary gland/ supra mammary lymph nodes, epididymitis and orchitis in males, sterility in bulls, swelling and induration of scrotum, placenta granular cotyledons, edema of intercotyledonary chorion, yellowish granular necrosis, fetus-edematous, serosanguinous fluid in body cavities, bronchopneumonia,

granulomatous lesions in mammary gland. In pigs, small nodules in uterus, caseous mass in nodules, the nodule may also occur in spleen, liver kidneys, lymph nodes, epididymis, testicles, seminal vesicles, swelling of joints.


Glanders (*Burkholderia mallei*)

Clinical signs and lesions: Copious and persistent catarrhal/ purulent nasal discharge, ulcers in nasal mucosa, chronic cough, ulcers on skin, thickening of superficial lymphatics, abscess in superficial lymph nodes which discharge thick tenacious pus, healed ulcers leaving star shaped scars, granulomatous lesion in lungs, acute purulent bronchopneumonia, granuloma in liver, spleen, Farly.



Salmonellosis (*Salmonella sp.*)

Clinical signs and lesions: Suppurative polyarthritis in foals, abortions in mare during 6-9th month of gestation, placenta edematous, focal haemorrhage, edema and haemorrhages in fetus, gastroenteritis and septicema in cattle, horse, swine, lesions in ileum and colon, congestion, thickening, red/ yellow/ grey exudate in ulcers, haemorrhage, edema, foci of ***necrosis in liver***, petechiae on pleura, peritoneum endocardium, kidneys, meninges, ulcerative proctitis in pigs.

Actinobacillosis (*A. lignieresi*)

Clinical signs and lesions: Enlargement of tongue, lymph nodes of head, neck and thorax. Tongue becomes hard due to fibrous tissue proliferation “wooden tongue”.

Pasteurellosis (*Pasteurella multocida* and *Manhemolytica*)

Clinical signs and lesions: High fever, swelling in neck region extended to the brisket between forelegs, dyspnoea, roaring sound, congestion and consolidation of lungs, abortions in pregnant animals, petechiae on pericardium and other serosal surfaces, congestion of conjunctivae and other mucous membranes, congestion, haemorrhage and oedema in intestines, mesenteric lymphnodes.

Listeriosis (*Listeria monocytogenes*)

Clinical signs and lesions: ***Abortions*** in last quarter of gestation, autolysis of foetus, focal hepatic necrosis, meningitis, encephalitis, abnormal postures, circling movements, presence of ***microabscess in brain***, necrotic foci in liver, spleen, lymph node, myocardium, gastrointestinal tract, and brain.

Actinomycosis (*A. bovis*)

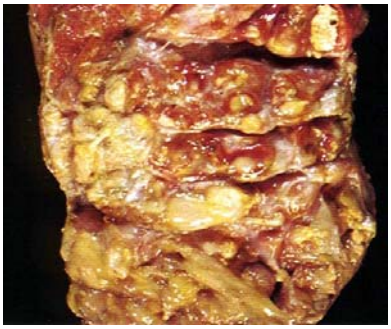
Clinical signs and lesions: Large, irregular enlargement of mandible, maxilla "***lumpy jaw***". Cut surface is white, glistening, abscess yellowish pus having sulfur granules.

Necrobacillosis (*Spherophorus necrophorus*)

Clinical signs and lesions: Necrotic plaques in larynx, pharynx and trachea, "calf diphtheria", necrotic foci in spleen, liver, ulceration in rumen, ulcerative necrotizing stomatitis, enteritis in swine, foot rot/ pododermatitis in cattle, foot rot in sheep, gangrenous dermatitis in foot in horses.

Tuberculosis (*Mycobactetrium* sp.)

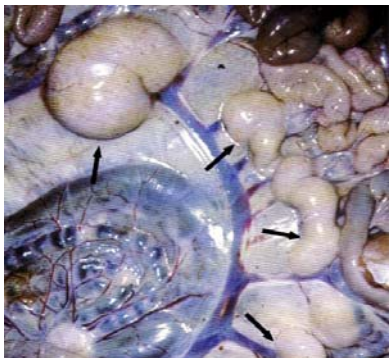
Clinical signs and lesions: Presence of tubercle in lungs, liver, tubercle looks like necrotic foci bulging from surface, white/ grey/ yellow in colour, oncut-caseous dry and solid, calcification in later stage, size of tubercle 1 mm-2 cm. Chronic wasting disease, emaciation, weakness.



Johne's disease (*Mycobacterium paratuberculosis*)

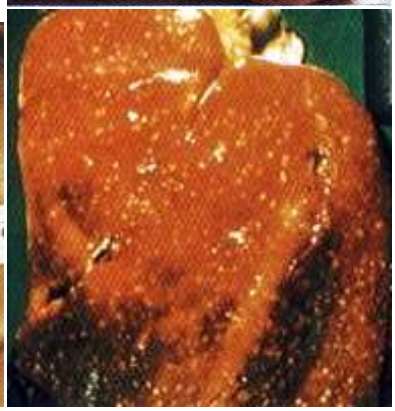
Clinical signs and lesions: ***Chronic diarrhoea***, dehydration, emaciation, hide bound condition, tubercles in mesenteri lymph nodes, small and large intestines and have terminal part of ileum

thickened mucosa, transverse corrugated folds in mucosa of intestines, which remains same on stretching. Granulomatous lesions in liver, spleen, lungs, kidneys, uterus, placenta and lymph nodes.



Fowl cholera (*Pasteurella multocida*)

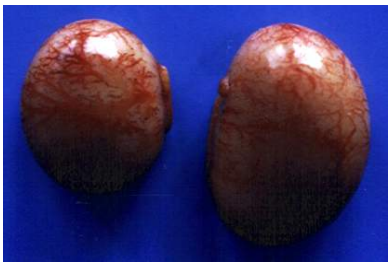
Clinical signs and lesions: *Acute:* Diarrhea, bloody diarrhea, ***cyanotic comb and wattles***, drowsiness, dyspnoea, discharges from beak and nostrils, haemorrhage in intestines, lungs, petechiae on serus membranes, Hemorhage on epicardium, endocardium, and gizzard, enlarged liver. *Chronic:* edema of wattles,



rhinitis, sinusitis, swollen joints, torticollis, caseous necrotic foci on lungs, liver, caseous material in peritoneal cavity.

Salmonellosis (*Salmonella* Gallinarum)

Clinical signs and lesions: Diarrhoea, solid vent, white/ green colour feces, yellowish necrotic foci on liver, lung, heart; enlargement of liver, catarrhal enteritis,yellowish mass in ceaca, discoloured (ova), ***bronze discoloration of liver, necrotic foci in liver***, enlargement of spleen.

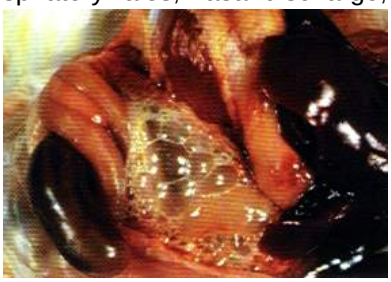


Fowl spirochetosis (*Borrelia anserina*)

Clinical signs and lesions: Cynosis of head, ***greenish diarrhoea***, ruffled feathers, organism in blood, one can detect the presence of spirochete in wet smear; anemia, paralysis, ***spleenomegaly***, haemorrhage in spleen, enlarged liver, white necrotic foci on liver, catarrhal enteritis, fibrinous pericarditis.

Chronic respiratory disease (*M. gallisepticum* and *E. coli*)

Clinical signs and lesions: Respiratory rales, nasal discharge, cough, decreased egg production, poor weight gain, catarrhal exudate in air sacs, trachea, bronchi, lungs, cheesy material in air sacs, thickened tracheal mucosa, focal pneumonia, fibrinous perihepatitis, pleuritis, edema and petechiae in lungs.



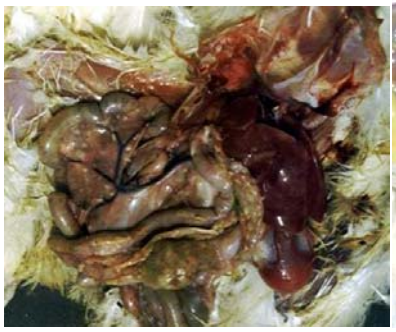
Infectious coryza (*Hemophilus gallinarum*)

Clinical signs and lesions: ***Face swollen*** and edematous, foul smelling nasal discharge, lacrimation, sneezing, coughing, dyspnoea, catarrhal rhinitis, sinusitis, air sacculitis, cheesy exudate in sinuses, nasal passage and conjunctival sac.

Colibacillosis (*E. coli*)

Clinical signs and lesions: *Chicks:* ***Serofibrinous pericarditis***, enlarged liver, bronchopneumonia, tracheitis, distended yolk sac, yolk sac contains foul smelling yellow or curdled/ brown and watery yolk, ***perihepatitis***, adhesions between skin, and abdominal wall/ yolk sac.

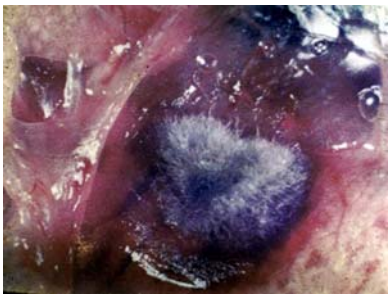
Adults: Peritonitis, salpingo-peritonitis, salpingitis, air sacculitis.



DISEASES CAUSED BY FUNGUS OR THEIR TOXINS

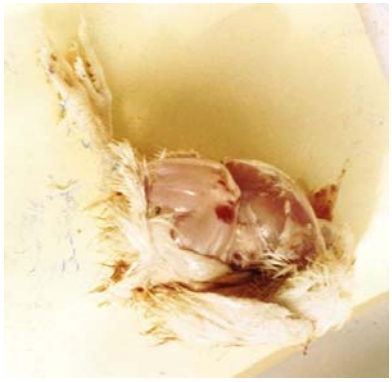
Aspergillosis (*Aspergillus fumigatus*)

Clinical signs and lesions: *Animals:* Placentitis and abortion in cattle, nodular or diffuse consolidation in lungs, a white mouldy growth. *Poultry*: Dyspnoea, depression, emaciation, accumulation of cheesy material under eyelids, pin head size yellowish nodules in lungs, ***air sacs cloudy*** and thickened with yellowish plaques, necrotic foci in liver, spleen, kidneys, proventriculus. Brooder's pneumonia.



Aflatoxicosis (Aflatoxins; produced by *Aspergillus* sp. *Penicillium* sp.)

Clinical signs and lesions: *Dog:* Anorexia, icterus, prostration, blood in feces, vomition, epistaxis, convulsions, toxic hepatitis, proliferation of small bile duct epithelium, necrosis of hepatic cells, edema of gall bladder. *Poultry:* Hepatitis, hepatomegaly, edema of gall bladder, immunosuppression, diarrhoea, loss of weight, mortality, retarded growth, drop in egg production.



Degnala disease (*Fusarium* sp.)

Clinical signs and lesions: Necrosis of tail, ears, extremities, scrotum, gangrene on extremities.

PARASITIC DISEASES

Coccidiosis (*Eimeria* sp.)

Clinical signs and lesions: Bloody diarrhoea, fever, dehydration, emaciation, congestion of intestines, erosions, haemorrhage, thickening of the wall of intestines.

Toxoplasmosis (*Toxoplasma gondii*)

Clinical signs and lesions: Lymphadenopathy, myocarditis, pneumonia, meningoencephalitis, chorioretinitis, lungs resembling pulmonary adenomatosis, enlarged lymphnodes, granulomatous nodules in intestines, focal necrosis in placenta, abortion, granulomatous lesions in fetal brain.

Sarcosporidiosis (*Sarcocystis* sp.)

Clinical signs and lesions: Sarcocysts are found in skeletal muscle or in cardiac muscle, sarcolemma is displaced, no inflammatory reaction, occasionally myositis and muscle necrosis, granulomatous inflammation, in cattle ***eosinophilic myositis***.

Trichomonosis (*Trichnomonas fetus*)

Clinical signs and lesions: Vaginitis in cow, balanitis in bull, endometritis, placentitis, ***early abortions,*** sterility, ***pyometra***.

Trypanosomosis/ Surra (*Trypanosoma evansi*)

Clinical signs and lesions: Intermittent fever, gradual emaciation, parasitemia, serous nasal discharge, patchy alopecia, Petechiae on visceral mucosa, incoordination, edema of limbs prostration, ***icterus***, progressive ***anemia***

Leishmaniasis (*Leismania donovani*)

Clinical signs and lesions: Fever, loss of weight, anemia, cutaneous ulcers, emaciation, enlarged lymph node, spleen, liver, pallor mucous membrane, ulcers in intestines, Leishmania in large macrophages, fibrosis in lymph nodes, In cutaneous forms, nodules on dermis are filled by macrophages, lymphocytes, plasma cells.

Babesiosis (*Babesia bigemina*)

Clinical signs and lesions: *Cattle:* Fever, red colour urine, ***hemoglobinuria***, emaciation, thin and watery red tinged plasma, subcutaneous yellow and edematus (swelling), gastroenteritis, icterus, enlarged spleen, hepatomegaly, distended gall bladder, urinary bladder, contain red urine, hemolytic anemia. *Equines:* Fever, anemia, icterus, weakness, hemoglobinuria, subcutaneous edema, ***erythrophagocytosis***, hyperplasia of lymphoid cells in spleen, bone marrow, liver. Hydropericardium, hydrothorax, ascites.

Theileriosis (*Theileria annulata*)

Clinical signs and lesions: Fever, loss of appetite, cessation of rumination, reduction in milk production, ***enlargement of superficial lymph nodes***, pulmonary edema, emaciation, coma, anemia leucopenia, emphysema, mottled, yellowish liver, white foci on kidneys, congestion of meninges, focal haemorrhage in brain.

Anaplasmosis (*Anaplasma marginale*)

Clinical signs and lesions: *Anemia*, pallor mucous membrane, icterus, spleen and liver enlarged, gall bladder distended, petechiae on pericardium, catarrhal inflammation of intestines, anaplasma organism in the erythrocytes of peripheral blood.

Fascioliasis/ Distomiasis (*Fasciola* sp. *Dicrocoelium* sp.)

Clinical signs and lesions: Chronic diarrhoea, debility, anemia, submandibular edema "***bottle jaw***" pot belly (ascites), thickening of wall of bile duct, hydropericardium.

Amphistomiasis (*Paramphistomum* sp., *Gigantocotyle* sp., *Cotylophoron* sp.)

Clinical signs and lesions: Weakness, emaciation, diarrhoea, pale mucous membrane, submaxillary edema, hypoglycemia, flesh coloured flukes "amphistomes" in rumen, abomasum, duodenum and jejunum, hydropericardium, fat depots are gelatinous, mucosa on intestines becomes thickened, catarhal enteritis.

Schistosomosis (*Schistosoma* sp.)

Clinical signs and lesions: ***Nasal granuloma*** in cattle, minute ulcers in nasal cavity, granulomatous growth in nasal passage causing snoring sound, profuse nasal discharge, pseudotubercles in tissues, parasitic ova in centre and surrounded by macrophages, lymphocytes, giant cells.

Teniasis (Tape worms)

Clinical signs and lesions: Abdominal pain, enteritis, reduced appetite, diarrhoea, emaciation, and irritation, anemia, bloody diarrhoea. Anemia, emaciation and diarrhoea in poultry.

Hydatid disease (*Cysticercus* sp.)

Clinical signs and lesions: Hydatid cysts in muscle, liver, heart, lungs diaphragm in cattle, pigs, sheep and goat.

Ascariasis (*Neoascaris* sp, *Ascaris* sp., *Parascaris* sp., *Toxocara* sp., *Ascaridia* sp.)

Clinical signs and lesions: Catarrhal enteritis, obstruction in intestines, anemia, emaciation, bloody diarrhoea, ***eosinophilia***,

eosinophilic granulomatous lesions in liver, lungs due to migrating larvae.

Strongylosis (*Strongylus* sp.)

Clinical signs and lesions: Diarrhoea, loose foul smelling feces, debility, anemia, edema of lower parts of body, ***thrombosis in anterior mesenteric artery, colic***, petechiae, erosions and thickening of cecal mucosa, catarrhal enteritis, nodules in mucosa and sub-mucosa of cecum.

Ancylostomiosis (Hook worms)

Clinical signs and lesions: Anemia, weakness, shedding of wool, pallor of mucous membrane, pot belly, diarrhoea, ascites, "***bottle jaw***" condition, enteritis, blood tinged intestinal contents.

Parasitic gastritis (Stomach worms)

Clinical signs and lesions: Anemia, diarrhoea, emaciation, edema of dependent parts, pallor mucous membranes, ***chronic catarrhal gastritis***, hydropericardium, hydrothorax, hyperplastic bone marrow.

Trichuriasis (*Trichuris* sp.)

Clinical signs and lesions: Loss of weight, diarrhoea, blood stained feces, anemia-microcytic hypochromic, jaundice.

Mange

Clinical signs and lesions: Intense itching, Red papular eruptions or abrasion wounds in skin, Loss of hairs, Thickening of skin, Loss of shining of skin and hairs, Hyperkeratosis, Scratch wounds.

TOXIC CONDITIONS

Cyanide poisoning

Clinical signs and lesions: Convulsions, froth in mouth, gasping, dilated pupils, diarrhoea, micturition, gastroenteritis, focal necrosis in white and grey matter of brain, bright red colour of blood persists for several hours, sub-epicardial and sub endocardial haemorrhages. Prostration, staggering, muscular tremors, paralysis of hind quarters, albuminuria, hematuria, ulcers in abomasum.

Arsenic poisoning

Clinical signs and lesions: Gastritis, enteritis, haemorrhages in intestines, abdominal pain, vomiting, diarrhoea, incoordination, convulsions, toxic hepatitis.

Mercury poisoning

Clinical signs and lesions: Diarrhoea, hypersalivation, polyuria followed by anuria, muscular tremors, itching on skin, ulcers in stomach, cooked appearance of oral mucosa, nephrosis, hydrothorax, hydropericardium endocardial haemorrhage, perforation in cecum.

Lead toxicity

Clinical signs and lesions: Hypersalivation, grinding of teeth, abdominal pain, diarrhoea, haemorrhage in stomach, intestines, congestion and haemorrhage in kidneys, petechiae on endocardium and epicardium, congestion of meninges. Anemia, ataxia, tremors, blindness, convulsions, laryngeal paralysis leading to roaring respiratory noise.

Zinc phosphide toxicity

Clinical signs and lesions: Abdominal pain, animal lethargic with vomiting and convulsions. Accumulation of gas in stomach, coma, enlargement of heart with dark coloured blood, pulmonary edema, haemorrhage in intestines, congestion of liver, kidneys, endocardial haemorrhage.

Phenol toxicity

Clinical signs and lesions: Depression, shock paralysis, coma, staggering, dilation of pupils, tonic muscular spasms, mucous membrane of oral cavity becomes white, coagulative necrosis of the affected tissues, pneumonia, pleuritis, cirrhosis of liver, gastroenteritis, mucosa of stomach shows coagulative necrosis.

Nitrate/ nitrite

Clinical signs and lesions: Hemolytic anemia, gastroenteritis, depression, cyanosis, dyspnoea, rapid pulse, diarrhoea, convulsions, coma, dark brown colour blood, ***cyanotic mucous membrane***, congestion and haemorrhage in stomach, intestines, serosanguinous pericardial fluid, congestion of liver and kidneys.

Organochlorine pesticides poisoning

Clinical signs and lesions: Nervous hyperexcitability, muscular twitching convulsions, hypersalivation, abnormal postures, grinding of teeth, cyanosis, congestion of liver, lung and kidneys, blood mixed frothy exudate in trachea and bronchi, congestion of meninges, haemorrhage in endocardium and epicardium. Increased cerebrospinal fluid, enteritis, dehydration, depletion of fat deposits.

Organophosphate pesticide poisoning

Clinical signs and lesions: Nausea, abdominal pain, vomiting, diarrhoea, dyspnoea, sweating, muscular twitching, paralysis, convulsions, coma, haemorrhage in heart, lung, gastrointestinal mucosa, pulmonary edema, axonal degeneration, demyelination, degeneration in liver, kidneys, decreased cholinesterase level.

Carbamate pesticide poisoning

Clinical signs and lesions: Hypersalivation, increased respiration lacrimation, urination, diarrrhoea, muscular tremors, constriction of pupil, pallor mucous membranes, nausea, vomiting, ataxia. Tachycardia/ Bradycardia, convulsions, incoordination of legs, hepatic necrosis, depletion of lymphocytes in spleen, lymph nodes haemorrhages and congestion in intestines, kidneys, lungs. Lymphocytic infiltration and congestion of meninges. Hyperglycemia, decreased cholinesterase activity.

Synthetic pyrethroid pesticide poisoning

Clinical signs and lesions: Hyperexcitability, muscular tremors, incoordination, hypersalivation, gastroenteritis, nasal discharge, hyperglycemia, vomiting, convulsions, pallor mucous membrane, abdominal pain, redness of conjunctiva, tongue, lips. Enlargement of liver, axonal edema, degeneration of nerve fibers, depletion of lymphoid tissue in spleen. Immunosuppressive effect.

Phenothiazine toxicity

Clinical signs and lesions: ***Photosensitization***, hemolytic

anemia, jaundice, ***hemoglobinuria***, diarrhoea, colic, corneal ulceration, abortion, prostration, coma, hepatomegaly, spleenomegaly, edema of kidneys, dark coloured urine in urinary bladder, dermatitis.

Thalium toxicity

Clinical signs and lesions: Vomiting, diarrhoea, respiratory distress, conjunctivitis, paralysis of esophagus, erythema, adominal pain, ***ulcers in stomach*** and intestines, lymphopenia, eosinopenia, neutrophilia, shift to left, acanthosis and parakeratosis, intraepithelial abscess, congestion of dermal capillaries, purulent brounchopneumonia, ulceration in esophagus, carrdiac hypertrophy, subendocardial haemorrhage, enlargement of spleen.

Lantana poisoning (*Lantana camera* plant)

Clinical signs and lesions: Edema of face, ear, redness of muzzle, bloody diarrhoea, icterus, haemorrhagic gastroenteritis, subcutaneous edema, epicardial haemorrhage, swollen liver, distended gall bladder, enlarged hepatocytes, vacuolar degeneration in kidney tubular epithelium, hylaine casts, ***bilirubinuria***, uremia.

Ratti poisoning

Clinical signs and lesions: Needle can be seen in skin, profuse swelling and congestion at the site of needle prick, hypersalivation, nasal discharge, clonic convulsions, incoordination of legs, congestion and edema, subcutaneously, Enlargement and edematous lymph nodes, petechiae on endocardium.

Ergot poisoning

Clinical signs and lesions: Incoordination of legs, staggering, hyperexcitability, convulsions, diarrhoea, paralysis, coma, blindness, lameness, gangrene on extremities, ulceration on oral mucosa, stomach, intestine, degeneration of neurons in brain.

Warfarin poisoning

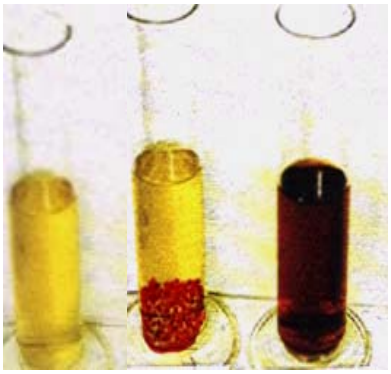
Clinical signs and lesions: Diarrhoea, vomiting, hematoma at joints, stiffness of legs, lameness, cyanosis of mucous membrane, prostration, haemorrhage in intestines, liver, lungs, large quantity of unclotted blood in intestines, pallor of liver, viscera.

Strychnine poisoning

Clinical signs and lesions: Stomach contents, intestinal contents, urine, liver, kidney in ice.

Bracken Fern poisoning

Clinical signs and lesions: Hematuria, Cancer in urinary bladder.



NON-INFECTIOUS DISEASE CONDITIONS

Bloat / Tympany

Tympany is accumulation of gases in rumen due to failure of eructation as a result of obstruction or due to excessive production of gases characterized by distended rumen and dyspnoea. It is also known as bloat.

Etiology

- Choke of esophagus
- Sudden change in animal feed with high content of legumes.
- Excessive lush green fodder

Macroscopic features

- Rumen is distended due to excessive accumulation of gases (CO_2, H_2S, CO)
- Distended rumen compresses diaphragm to hinder respiration.
- Tarry colour blood, pale liver and rupture of diaphragm.
- On rupture of rumen gas comes out (dry tympany).
- The gas is trapped in small bubbles in the ruminal fluid forming foams and is not easily removed. This is known as "***frothy bloat***", which is produced by saponin and water soluble proteins and due to reduction in surface tension in the absence of fatty acids that favours froth formation.

Electrocution and Lightening Stroke

High voltage currents induce tetanic spasms of respiratory muscles and hits the respiratory centre of brain. It also produce flash burns. Lightning causes cyanotic carcass, postmortem bloat, congestion of viscera, tiny haemorrhage and skin damage.

Drowning

Animals died due to drowning and submerged in water, getting water into the lungs causing asphyxia. On postmortem examination wax like changes can be seen in the adipose tissue of the dead body. This change may occur if the dead body remains submerged in water for a few months. Adipocere persists for many years and prevents putrefaction to supervene.

Snake Bite

Snake venom have phospholipase A_2 which causes lytic action on membranes of RBC and platelets. The presence of hyaluronidase, phosphodiesterase and peptidase in snake venom

are responsible for oedema, erythema, haemolytic anemia, swelling of facial/laryngeal tissues, haemoglobinurea, cardiac irregularities, fall in blood pressure, shock and neurotoxicity.

Burns

I degree burns: There is only congestion and injury to the superficial layers of epidermis *e.g.* sun burn on hairless parts or white skinned animal.

II degree burns: Epidermis is destroyed; hair follicles remain intact and provide a nidus for healing of epithelium.

III degree burns: Epidermis and dermis both are destroyed leading to fluid loss, local tissue destruction, laryngeal and pulmonary oedema, renal failure, shock and sepsis. Till 20 hrs of burn, the burn surface remains sterile then bacterial contamination occurs. After 72 hrs millions of bacteria enters in the affected tissue. Bacteria such as staphylococci, streptococci and *Pseudomonas aeruginosa* invade the deeper layers of skin and cause sepsis. There is a state of immunosuppression in severe burns leading to impaired phagocytosis by neutrophils.

Trauma

Traumatic injury occurs due to any force or energy applied on body of animal *e.g.* During control/ restraining, shipping or transport of animal.

Contusions/Bruises: Contusions or bruises arise from rupture of blood vessel with disintegration of extravassated blood.

Abrasions: Abrasions are circumscribed areas where epithelium has been removed by injury and it may indicate the direction of force.

Erosions: Partial loss of surface epithelium on skin or mucosal surface is termed as erosion.

Incised wounds/ cuts: Incised wounds are produced by sharp edged instrument. They are longer than deep.

Stab wound: Stab wounds are deeper than longer produced by sharp edged instrument.

Laceration: Severance of tissue by excessive stretching and is common over bony surfaces or are produced by cut through a dull instrument.

Compression: Compression injury is produced as a result of force applied slowly *e.g*. During parturition.

Blast injury: Force of compression waves against surfaces followed by a wave of reduced pressure. It can rupture muscles/ viscera.

Bullet wound: Hitting at 90° by firearms to produce uniform margins of abrasion. Exit wounds are irregular and lacerated.

Traumatic Reticulitis Pericarditis (TRP)

Reticulitis is the inflammation of reticulum in ruminant animals caused by trauma/perforation by foreign body including sharp object like needles, wires, etc. and characterized by abscess formation, adhesions, peritonitis and pericarditis.

Etiology

- Foreign body- sharp objects like needles, wires etc.

Macroscopic features

- Perforation of reticulum by foreign body.
- Abscessation/ suppuration
- Peritonitis, adhesions of reticulum with diaphragm
- Pericarditis due to foreign body (traumatic reticulo pericarditis).

MISCELLANEOUS CONDITIONS
(Materials for Diagnosis)

	Collection of material
Encephalitis	Cerebrospinal fluid in heparinized vials, half of brain tissue in 10% formol saline, brain tissue in 50% glycerol.
Alkaloids	Liver, stomach contents and brain tissue in ice.
Diarrhoea/ Enteritis	Faecal sample in sterile vial, serum, tissues of intestine, mesenteric lymph nodes in 10% formol saline.
Abortion/ Metritis	Faetal stomach content tide off or in sterile vials, serum of dam after 21 days of abortion, vaginal discharges in sterile conditions, tissues of placenta, foetal liver, stomach, kidney in 10% formol saline.
Mastitis	milk in sterile test tubes from all quarters separately for microbiology and California mastitis test
Pneumonia	Nasal discharge/nasal swabs, lung tissue/pieces in sterile vials, lung tissue and mediastinal lymph node in 10% formol saline.
Dermatitis	Skin scrapings in 10% KOH, skin tissue in 10% formol saline.
Nephritis	Urine sample in sterile vial, kidney tissue in 10% formol saline.

5. WRITING OF POST-MORTEM REPORT

Post-mortem report consists of two parts- A. Post-mortem record, and B. Post-mortem examination as given in the format on next page. The first part *i.e.* post-mortem record is having information related to animal and is supplied by the owner or person requesting post-mortem examination. Actually, it is a part of request form of the case for post-mortem examination. This is necessary for the identification of animal. It should be filled in before conducting post-mortem examination. The proper record will be helpful in establishing accurate diagnosis based on post-mortem examination.

A. POST-MORTEM RECORD

1. **Species:** Here one should write the species of animal such as bovine, porcine, equine, poultry, etc.
2. **Date:** Date of the post-mortem examination.
3. **Case no.:** The serial number of your post-mortem book. It shows cumulatively how many animals are examined by you in necropsy.
4. **Breed:** Mention the breed of animal, if known or supplied in the request form, such as Murrah buffalo, Jersey cattle, etc.
5. **Age/Born:** Age of animal or its date of birth. In case the exact age is not known then mention young, adult or chick, grower, adult in case of poultry.
6. **Sex:** Sex of animal (male or female).
7. **Identification number/mark:** It must be filled with utmost care; the number (tattoo number or brand number) should be the same as on animal. If the identification number is not available/illegible then write the characteristic mark of animal.
8. **Owner:** Here, the name of owner with complete address must be filled clearly. The address should be complete enough so that the report can reach the owner through post also.
9. **Referred by:** In this column, the name of Veterinary Officer/any other officer who referred the case for post-mortem examination should be written. Sometimes owner himself/herself is interested in post-mortem examination of animal; in such case the name of owner should be written.

10. **History of the case:** This includes the clinical illness of animal, duration of illness, epidemiological data, tentative diagnosis, therapeutic and preventive measures adopted. This is very important and information of this column has an important role in making the diagnosis.
11. **Reported date and time of death:** It should have the exact date and time of death of animal. Sometimes, it is difficult to note the exact time then one can write morning, noon, evening, midnight etc. to approximate the timings of death of animal. In some large farms, it is very difficult to record information with regard to each individual animal/bird so here one can write “previous night” as time of death.
12. **Date and time of post-mortem examination:** Pathologist conducting post-mortem examination should write here the exact time and date of the post-mortem examination.

The above information is very important to arrive any conclusive diagnosis. The correct information enhances the specificity of post-mortem diagnosis. Some points might be looking like insignificant but one should not overlook them and write as correct as information he/she can gather from the owner’s request letter/form.

B. POST-MORTEM EXAMINATION

It includes the observations made by the pathologist conducting post-mortem examination. This part of report should be filled in as soon as possible after the post-mortem examination. It is advisable that one should record some points on a small paper or diary during post-mortem examination and fill them in report after the conduct of post-mortem examination.

1. **External appearance:** Record the lesions observed in intact animal before its opening. One should place on record the side of animal lying down, lesions on skin, external parasites, trauma etc.
2. **Subcutaneous tissue and musculature:** The observations made after removal of skin, on subcutaneous tissue and muscle should be included in this column.
3. **General observations after opening the carcass:** It contains the general information or lesions present in abdominal and thoracic cavity such as accumulation of fluid, pus, blood, clot of blood, post-mortem changes such as pseudomelanosis, etc.
4. **Respiratory system:** Record the lesions observed in respiratory system right from external nares, nasal passage, trachea, bronchi and lungs alongwith mediastinal lymphnodes.
5. **Cardiovascular system:** Record the lesions present in heart, aorta, arteries, veins and lymphatics.
6. **Digestive system:** Record the lesions observed in digestive tract from month cavity, esophagus, crop, proventriculus, gizzard (poultry), rumen, reticulum, omasum abomasum (ruminants), stomach, intestines, rectum, anus, cloaca, vent (poultry), liver, pancreas, gall bladder etc.
7. **Urinary system:** Place on record the lesions present on kidneys, ureter and urethra.
8. **Genital system:** Record the lesions present in ovaries, uterus, oviduct, cervix and vagina in females and testes, penis etc. in males. Be careful in recording lesions in this column as it should match with the sex of animal written in post-mortem record section.
9. **Immune system:** Record the lesions present in spleen, bursa, thymus, lymphnodes, respiratory associated lymphoid tissue (RALT), gut associated lymphoid tissue (GALT) etc. Careful recording of lesions in these organs will be helpful in diagnosis.

10. **Nervous system:** Place on record the lesions present in brain, spinal cord and nerves. Most of the pathologists overlook this system and often not taken pain to examine the brain. It should not be done and every effort should be made to examine and place on record the lesions present in this system.
11. **Miscellaneous observations:** Here one can record any missing observation which has not been covered above.
12. **Post-mortem diagnosis:** This is very important. Based on the history and lesions present in different systems, pathologists by using his experience and conscience conclude the diagnosis. He/she may also write suggestions alongwith diagnosis or some points to suggest the diagnosis and/or contain the disease in other animals.
13. **Signature of officer conducting post-mortem:** Each and every report must be signed by the officer doing post-mortem examination. Without signature of competent officer, it has no validity.
14. **Place and date:** The person signing the post-mortem report must also write date and place of post-mortem examination.

POST-MORTEM REPORT
POST-MORTEM RECORD

1. Species: 2. Date: 3. Case No.:

4. Breed: 5. Age/Born: 6. Sex:

7. Identification No.:

8. Owner with address: 9. Referred by:

10. History of the case: 11. Reported date & Time of Death:

12. Date and Time of post-mortem examination:

POST-MORTEM EXAMINATION

1. External appearance
2. Subcutaneous tissue and musculature
3. General observations after opening the carcass
4. Respiratory system
5. Cardiovascular system
6. Digestive system
7. Urinary system
8. Genital system
9. Immune system
10. Nervous system
11. Miscellaneous observations
12. Post-mortem diagnosis

Date:
Place: Signature of officer conducting PM

6. POST-MORTEM CHANGES (NO LESIONS)

Alterations in cells/tissues occur after death of animal. The degree of such alterations and their speed depends upon the environmental temperature, size of animal, species of animal, external insulation and nutritional state of the animal. The postmortem changes occur rapidly in high environmental temperature, large animal, fur/wool bearing and fatty animals.

Autolysis

Autolysis is the digestion of tissue by its own enzymes and is characterized by uniform destruction of cells without any inflammatory reaction. After death, a state of hypoxia occurs leading to decreased ATP. The cell organelles degenerate and the membrane of lysosomes dissolved which releases the lysosomal enzymes in the cell responsible for digestion of cells/tissues. These enzymes cause disintegration of cell components into small granules in the cell. Microscopically, autolysis is characterized by uniform dead cells without any circulatory changes and inflammatory reaction.

Putrefaction

Putrefaction is decomposition of tissue after death by saprophytes leading to production of foul odour. After autolysis the saprophytes invade from external environment into the body, multiply and eventually digest the tissues with their enzymes. The tissue becomes frazile and produces foul odour.

Pseudomelanosis

Pseudomelanosis is greenish or bluish discolouration of tissues/ organs after death. Saprophytes causing putrefaction also produce hydrogen sulfide which chemically reacts with iron portion of hemoglobin to produce iron sulfide. Iron sulfide is a black pigment and produces green, gray or black shades on combination with other tissue pigments.

Rigor mortis

Rigor mortis is the contraction and shortening of muscles after death of animal leading to stiffening and immobilization of body. It occurs 2-4 hrs after death and remains till putrefaction sets in. Rigor mortis begins in cardiac muscles first and then in skeletal muscles of head and neck with a progression towards extremities. It is enhanced by high temperature and increased metabolic activity before death; while it is delayed by starvation, cold and cachexia.

Rigor appears quickly in case animal is died due to strychnine poisoning as a result of depletion of energy source ATP. Muscle fibers shorten due to contraction and remain in contraction in the absence of oxygen, ATP and creatine phosphate. Rigor mortis remains till 20-30 hrs of death, the duration depends on autolysis and putrefaction. It disappears in same order as it appeared from head, neck to extremities. It can be used to determine the length of time after the death of animal.

Algor mortis

Algor mortis is cooling of body. As there is no circulation of blood after death, which maintains the body temperature, body becomes cool after death. However, it takes 2-4 hrs depending on the species, environmental temperature and type of animal.

Livor mortis

Livor mortis is the staining of tissues with hemoglobin after death of animals. It gives pinkish discolouration to the tissues.

Hypostatic congestion

Due to gravitational force, the blood is accumulated in dependent ventral parts of body. It is helpful in establishment of the state of the body at the time of death.

Post-mortem emphysema

It occurs due to decomposition by gas producing organisms including saprophytes. The gas is mainly accumulated in gastrointestinal tract causing rupture of the organ.

Post-mortem clot

It is clotting of blood after death of animal mainly due to excessive release of thrombokinase from dying leucocytes and endothelial cells. It is smooth in consistency and glistening surface with red or yellow in colour. Post-mortem clot is uniform in structure and it does not attach on wall of blood vessel as thrombus does. In anthrax, postmortem clot does not appear. Post-mortem clot in formed in two types: Red or current jelly clot forms when the components of blood are evenly distributed throughout the clot. It occurs due to rapid clotting of blood. The yellow or chicken fat clot occurs when the components of blood are not distributed evenly. The ventral position is red and upper position in yellow due to WBC fibrin and serum. It occurs due to prolonged coagulation time of blood leading to sediment of red blood cells.

Displacement of organs

Displacement of internal organs due to rolling of dead animal. Mainly intestine / stomach and uterus are affected with displacement which can be differentiated from antemortem by absence of passive hyperemia.

Imbibition of bile

Cholebilirubin present in the gall bladder diffuses to the surrounding tissues /organs and stains them with yellow/ greenish pigmentation.

Adipocere

Animals died due to drowning and submerged in water, getting water into the lungs causing asphyxia. On postmortem examination wax like changes can be seen in the adipose tissue of the dead body. This change may occur if the dead body remains submerged in water for a few months. Adipocere persists for many years and prevents putrefaction to supervene.

7. COLLECTION, PRESERVATION AND DISPATCH OF SPECIMENS FOR LABORATORY DIAGNOSIS

Tissue samples are collected from dead or live animals for laboratory examination to confirm the tentative diagnosis.

Purpose

- Diagnosis of disease or for identification of new disease.
- Confirmation of tentative diagnosis.
- Prognosis
- To observe the effect of treatment and give directions for future therapy.

Precautions

- Collect the tissues as early as possible after death of animal.
- Representative tissue/sample should be collected.
- Sharp knife should be used for cutting
- Collect the tissues directly in fixative.
- Size of tissue should not be more than 1 cm for histopathology in 10% formalin (Tissue to formalin ratio should be 1:20).
- Hollow organs should be taken on paper to avoid shrinkage.
- Hard organs like liver, kidneys etc. should be collected along with capsule.

Collection of Specimens for Bacteriological Examination

- Collect the tissues under sterile condition.
- Sterilize knife/ scalpel/ spatula on flame or in boiling water.
- Surface sterilized by hot spatula
- Cut with knife and collect sample from inner tissue.
- Body fluids/blood should be collected in sterilized syringe or in Pasteur pipette.
- Specimens should be collected directly in media (liquid media-nutrient broth, peptone water, tetrathionate broth or even in normal saline solution/phosphate buffer saline).
- Seal, pack and transport the collected material to laboratory in ice/under refrigeration conditions.

BACTERIAL DISEASES

Abscesses

- Swab in sterile conditions/pus in vials
- Collect material from margin of abscess

Actinobacillosis/ Actinomycosis

- Tissues from affected parts in 10% formalin.
- Pus in sterile test tube/from edge of lesion
- Slides from Pus for sulphur granules.

Anthrax

- Blood smear from tip of the ear
- Blood for cultural examination
- Muzzle piece for biological test.
- Mark the specimen as "***Anthrax suspect***"

Black Quarter/Black leg

- Smear from swelling
- Affected muscle piece in ice.

Brucellosis

- Serum after 3 weeks of abortion
- Foetal stomach tied off
- Swabs from uterine discharge
- 5 to 10 ml milk in ice

Glanders

- Smear from discharge
- Lung, liver and spleen in 10% formalin
- Serum

Johne's disease

- Bowel washings in sterile bottle
- Smear from rectal mucosa
- Mesenteric lymphnode in 10% formol saline

Leptospirosis

- Serum 21 days after abortion
- Milk/urine in vials (1 drop of formalin in 20 ml)
- Liver, kidney tissue in 10% formalin

Listeriosis

- Half brain in ice
- Half brain in 10% formalin

Mastitis

- 10 ml milk in sterile vial in ice

Pasteurellosis

- Heart blood
- Lung, spleen and mediastinal lymphnodes in ice.
- Affected tissues in 10% formalin.

Salmonellosis

- Liver, spleen, kidney and intestine tied off in ice.

Strangles

- Smear, swab of pus in ice.

Erysipelas

- Blood
- Spleen, kidney, liver in ice.

Vibriosis/Campylobacteriosis

- Foetal stomach tied off
- Vaginal mucosa in ice.
- In pig, intestine and liver in 10% formalin.

Colibacillosis

- Heart blood in sterile vial.
- Tissues from intestine and lymphnodes in 10% formol saline.

Tuberculosis

- Lungs, mediastinal and bronchial lymphnodes in ice and in 10% formalin.

Collection of Specimens for Virological Examination

- Collect tissue under sterilized condition
- Body fluids/ blood in sterilized syringe or in Pasteur pipette
- Tissues in buffered glycerin
  - PBS pH 7.2- 50%
  - Glycerin- 50%
- Avoid samples in glycerin for sensitive viruses *e.g.* Rinderpest, canine distemper
- Seal and mark the specimen bottle and transport to laboratory.

VIRAL DISEASES

Foot and mouth disease

- Tongue epithelium, vesicular fluid, saliva, pancreas in 50% buffered glycerine
- Serum

Hog cholera/ swine fever

- Serum under refrigeration
- Spleen, liver, kidney in 50% glycerin/ice
- Tissues from intestine, mesenteric lymphnode and half of the brain stem in 10% formol saline.

Infectious Canine Hepatitis

- Several pieces of liver, gall bladder and kidney in 10% formol saline.

Pox

- Scabs in ice and in 10% formol saline.

Rabies

- Intact head should be soaked in 1% carbolic acid.
- Fracture the skull with hammer.
- Remove skin and bones
- Half brain in 10% formalin
- Half brain in 50% neutral glycerin.
- Tissues from cerebellum and hippocampus in Zenkers fluid for

20 hrs, wash in tape water for 24 hr and keep in 80% ethyl alcohol for Negribodies.

Ranikhet disease

- Liver, spleen in 50% neutral glycerin
- Proventriculus, caecal tonsils, brain in 10% formalin
- Brain in ice.

Rotaviral enteritis

- Faecal sample
- Intestinal tissue in 10% formol saline.

Gumboro disease

- Bursa of Fabricious, kidney, muscles in 10% formol saline.
- Bursa, kidney in 50% buffered glycerine.

SYSTEMIC DISEASES

Diarrhoea/Enteritis

- Faecal sample in sterile vial
- Serum
- Tissues of intestine, mesenteric lymphnodes in 10% formol saline.

Abortion/Metritis

- Faetal stomach content tide off or in sterile vials.
- Serum of dam after 21 days of abortion.
- Vaginal discharges in sterile conditions.
- Tissues of placenta, foetal liver, stomach, kidney in 10% formol saline.

Pneumonia

- Nasal discharge/nasal swabs.
- Lung tissue/pieces in sterile vials.
- Lung tissue and mediastinal lymphnode in 10% formol saline.

Dermatitis

- Skin scrapings in 10% KOH.

- Skin tissue in 10% formol saline.

Encephalitis

- Cerebrospinal fluid in heparinised vials.
- Brain tissue in 10% formol saline.
- Brain tissue in 50% glycerol.

Nephritis

- Urine sample in sterile vial.
- Kidney tissue in 10% formol saline.

Collection of Specimens for Toxicological Examination

- Stomach/ intestinal contents
- Liver, kidneys, heart blood
- Urine
- In clean glass jars
- In ice/refrigeration without any preservative
- Seal, label, transport to laboratory.
- In veterolegal cases all specimens must be collected in presence of police.
- Type of poison suspected along with detailed history, signs, lesions/treatment etc. should be written on letter with specimens.

TOXICOSIS/ POISONING

Heavy metal Poisoning

- Hg, Pb, Bi, Ag
- Liver, kidney, stomach content in ice in separate containers.

Alkaloids

- Liver, stomach contents and brain tissue in ice.

Nitrate

- Fodder
- Stomach contents, blood in ice

Strychnine poisoning

- Stomach contents, intestinal contents, urine, liver, kidney in ice.

Hydrocyanic acid

- Plants
- Stomach contents, blood, liver
- Preserved in 1% solution of mercuric chloride.

Pesticides

- Fatty tissue, liver, stomach contents, blood in ice.
- Subcutaneous, omental, mesenteric fat.

Collection of Specimens for Immunological Examination

- Heart blood in syringe/ Pasteur pipette
- CSF/Synovial fluid /peritonial fluid
- Tissues in formol sublimate or in buffered formalin
- Blood/serum/others should be sent to laboratory under refrigeration conditions.
- Add one drop of 1:10000 merthiolate in 5 ml serum as preservative.

DISPATCH OF MATERIAL

Following points must be kept in mind while dispatching the material to laboratory for diagnosis:

1. Describe the clinical signs, lesions, tentative diagnosis and treatment given to animal in your letter. Also mention the type of test you want with your tentative diagnosis.
2. Write correct address on letter as well as on the parcel preferably with pin code, if the material is sent through post.
3. Mark the parcel 'Biological Material', 'Handle with care', 'Glass material', 'Fragile' etc. in order to avoid damage in parcel. Also mark the side to be kept on upper side with arrows.
4. Seal the container so that it should not leak in transit.
5. Try to send the material as soon as after its collection from animal.
6. Keep one copy of cover letter inside the parcel and send another copy by hand or post in a separate cover.
7. Keep adequate material like thermocol etc. in the parcel which will save the material from outside pressures/jerks.
8. Use dry ice, if available otherwise use ice in sealed containers.

8. POST-MORTEM EXAMINATION OF VETEROLEGAL CASES

The post-mortem examination of veterolegal cases is performed as described in pervious sections. However, following points must be kept in mind while doing post-mortem examination and preparing the report.

1. For veterolegal cases, post-mortem request should be signed by a police officer not below the rank of inspector or by magistrate; without which no post-mortem examination should be done.
2. Always collect maximum information on history, date and time of death of animal and treatment given. Use self knowledge and experience to determine the time of death such as rigor morits, autolysis, putrefaction, pseudomelanosis etc.
3. Animal identification including species, breed, age and number or mark must be clearly established before conduct of post-mortem examination. It is specially necessary in insured animals as well as in religiously disputed cases.
4. All the lesions present on skin surface should be clearly defined as laceration, wound, trauma, incision, erosion, vesicle, ulcer and if there is suspected sharp edge wound or bullet injury also state its depth and width (diameter) as the case may be. Also mention the side on which the animal is lying down (ventral portion touching earth).
5. In case of dispute over still birth and calf born alive, a piece of lung should be placed in water. The lung piece will sink in water in case of atelectasis neonatum while it will float if the calf born alive.
6. If the case is suspected for toxic condition/poisoning, try to mention the type of poison in your report. This will help the police authorities to establish/confirm the type of toxin/poison in forensic laboratory.
7. The post-mortem examination of wild animals should be conducted as a special case. One should conduct the post-mortem examination only when DFO or higher officer is making request for post-mortem examination. It should be noted on the report that all the viscera including skin, bones, teeth, etc. are

returned to the person requested for the necropsy and no item should be left behind.

8. Fill the post-mortem report clearly with neat hand writing and in clear language and avoid ambiguity in presentation. Avoid to write general sentences. Be specific to your findings and conclusions. Sign the report with date and must keep a copy of that with you for record and future evidences in the court of law.
9. Post-mortem examination should be conducted in day light. In darkness where the pathologist is not able to recognize the lesions, the post-mortem examination should not be conducted.
10. At the time of post-mortem examination outsiders should not be allowed. To avoid them and wild birds and animals, post-mortem examination should be done in close premises.

9. COLLECTION, PRESERVATION AND DISPATCH OF MATERIAL TO FORENSIC LABORATORY

The collection, preservation and dispatch of different tissues/organs, fluids and viscera should be done as described in section 4. However, in veterolegal cases, these materials should be sent to State Forensic Laboratory under sealed packings.

- In the suspected cases of toxic condition or poisoning, the stomach and intestinal contents should be sent after proper ligation at both the ends and sent it in ice to avoid putrefaction. Besides, samples of blood, liver, spleen and kidneys should be sent in separate container.
- All the materials should be collected in leak proof glass or plastic bottles.
- Tissues for histopathology must be collected in 10% formalin or formol saline, this can be sent to laboratory under normal temperature.
- The materials suspected for toxicity should be sent in ice without adding any preservative.
- The bottles or containers should be sealed and labelled properly indicating the name of owner, identification of animal (number, name, mark etc.), type of tissue collected and preservative used. The examination requested and disease or poisoning suspected should also be written.
- A copy with details of post-mortem report and containing above information should be sent separately under separate cover.
- The address of the forensic laboratory should be clearly written.
- All the containers should be packed with cloth and sealed with sealing wax and should preferably be sent through person in order to avoid any breakage in transit.
- One copy of the forwarding letter should be kept in file for future reference and one copy should accompany the material and one copy should be sent by post. The forwarding letter bearing number and date should have the information about materials sent, type of preservative used, type of examination requested and identification of animals including other details of owner.

10. EQUIPMENTS/ INSTRUMENTS/ MATERIALS REQUIRED

1. Butcher's knife/ PM set
2. Scissors- Straight
3. Scissors- Curved
4. Forceps- Serrated and toothed
5. Scalpel with BP blades
6. Razor with blade
7. Gumboots
8. Apron, face mask, cap, etc.
9. Glooves
10. Soap
11. 10% formalin/ formol saline
12. Petridishes
13. Tissue containers large/ medium/ small size
14. Marker pen
15. Towel
16. Sample container with ice
17. Spirit lamp
18. Match box
19. Test tubes
20. PBS pH 7.2
21. NSS
22. Methylene blue stain
23. Buffered glycerine
24. Syringes/ needles
25. Pasture pipettes with rubber teats
26. Polythene bags
27. Antispetic solution (Dettol/ Savlon)
28. Labels/ Papers
29. Glass slides
30. Parafilm
31. Cello tape
32. Camera for photography of lesions
33. Methanol/ Acetone
34. Swabs

ADDRESSES OF CDDL / RDDLs

Joint Director, CDDL
Centre for Animal Disease Research and Diagnosis (CADRAD),
Indian Veterinary Research Institute, Izatnagar–243 122 (UP)
Phone: 0581-2302188; Fax: 0581-2302188, 2303284
E-mail: jdcadrad@rediffmail.com

Joint Director
RDDL (North Zone), State Disease Diagnostic Laboratory,
Department of Animal Husbandry,
Ladowali Road, Jalandhar–144 001 (Punjab)
Telefax: 0181-2242335
E-mail: rddl_nz@yahoo.com

Joint Director
RDDL (West Zone), Disease Diagnostic Division,
Aundh, Pune – 411 007 (Maharashtra)
Phone: 020-25692135, 25690486; Fax: 020-25691474, 25697962
E-mail: rautmaresunil@yahoo.com

Joint Director
RDDL (East Zone), Deptt. of Veterinary Microbiology,
West Bengal University of Animal & Fish Science,
37, Belgachia Road, Kolkata – 700 037 (West Bengal)
Phone: 033-25563450, 25569234; Fax: 033-25571986 / 25563396
E-mail: sid_nj@indiatimes.com or aich80@rediffmail.com

Joint Director
RDDL (South Zone)
Disease Investigation Division
Institute of Animal health & Veterinary Biologicals (IAHVB),
Hebbal, Bangalore – 560 024 (Karnataka)
Ph: 080-23411502, 23412443; Fax: 080-23412509, 23412367
E-mail: director_iahvb@vsnl.net or byregowda@yahoo.com

Deputy Director
Animal Health Centre, NERDDL
Khanpara, Guwahati-781022 (Assam)
Telefax: 0361-2334177