AXIOM
Veterinary Laboratories Ltd
'The Quality Clinical Pathology Service'

Post Mortem Procedures for large animal species

A post-mortem examination is only part of the process of establishing a diagnosis. It is important to consider all aspects of the case before drawing any conclusions. The following aspects should be considered and although this short information note revolves mainly around post mortem techniques, in the live animal other tests can be used to progress your diagnosis.

-History

-Clinical signs

-Post-Mortem findings

-Interpretation of gross findings

-Selection of tissues/samples for further testing

-Analysis of results and findings

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Diagnosis

Health and Safety

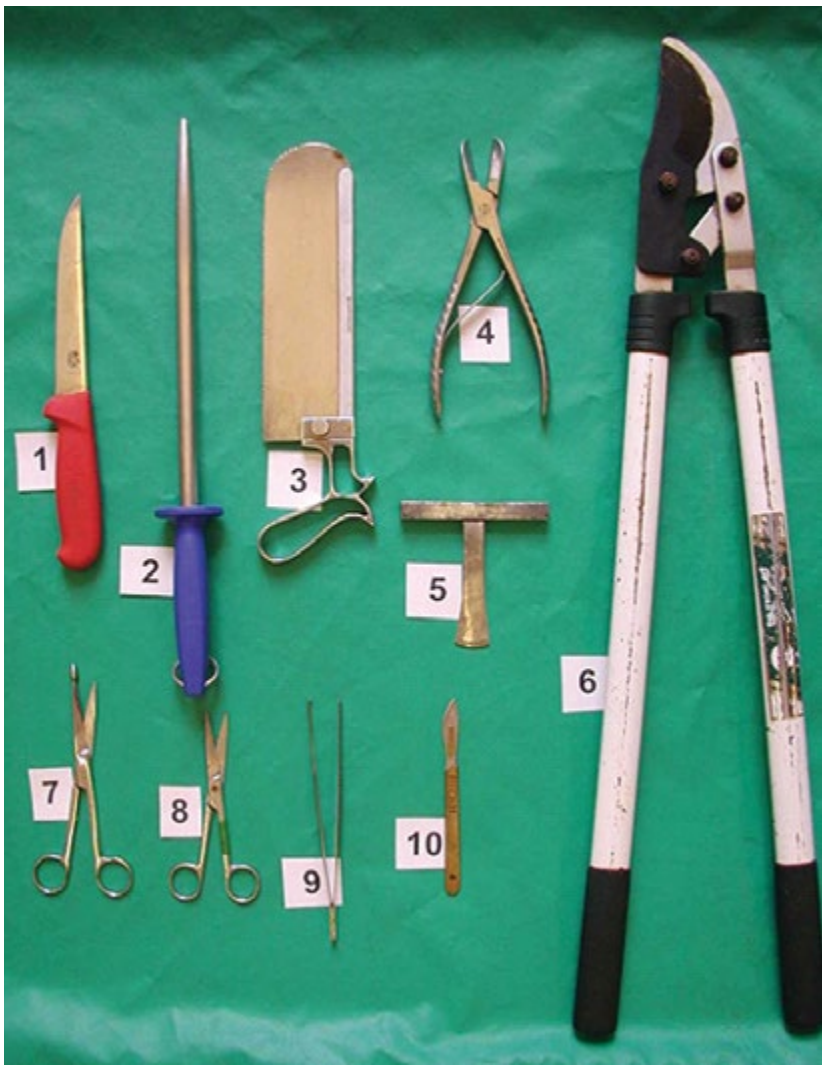
Before embarking on any post mortem whether on farm or in dedicated facilities you should consider the health and safety aspects not only for yourself but also of those who may be assisting or having to deal with the carcass waste.

Personnel protective wear should include suitable gloves, apron or overall, wellington boots, a cut proof glove (to be worn on the non-cutting hand), and a face mask and hard hat if required. This will significantly reduce the likelihood of personnel injury or acquisition of zoonotic infection. Should you be presented with a potential zoonotic disease ensure you are familiar with any procedures that maybe required to reduce infection to yourself and others.

Working in the correct environment and with suitable tools/instruments will make the post mortem easier. Consider what is available to you and always opt for the most suitable facilities.

Post Mortem Instruments

The following photographs provide a guide as to the instruments needed to undertake a full post mortem. They are available through veterinary suppliers (or garden centres for the loppers) and should be dedicated for post mortem work.



1. Post mortem knife (Swann Morton PM40 scalpels are an alternative)
2. Steel (not needed with Swann Morton PM40 scalpels)
3. Saw (in addition a butchers saw is useful for larger species)
4. Bone cutters
5. T piece (for inserting into saw cuts in cranium to apply leverage)
6. Garden Loppers
7. Gut scissors
8. Sharp pointed scissors
9. Rat tooth forceps
10. Scalpel

In many cases the brain can be removed whilst the head is still attached to smaller carcasses but for larger species the head can be removed and either steadied between your knees or placed in a modified vice as shown above. These vices can be made by a competent small engineering firm and wall mounted as illustrated below. They will make the task of brain removal much easier and are a worthwhile investment. A full description of CNS removal is found in our ruminant nervous disease information sheet.

Post Mortem Technique

The following is a descriptive guide to undertaking a full post mortem examination (use in conjunction with University of Edinburgh Prosection DVDs – see 'Further sources of information').

This description is for a full post mortem examination and can be modified for the examination of particular organ systems and situations. Familiarisation with what is normal and what is post mortem change / autolysis is important. This knowledge will only be acquired over time and it goes without saying the more examinations undertaken the greater the range of change you will see.

1 Collect the clinical history.
2 Assess any external findings and note the degree of autolysis. Fix the eyes whole if ocular disease is suspected.
3 Make a midline skin incision from the mandibular symphysis to the inguinal region. Reflect the skin and limbs; disarticulate the hip joints. Examine the navel and subcutaneous tissues. Note overall body condition/fat reserves.
4 Remove the mammary gland and associated lymph nodes.
5 Open the abdominal cavity (along the midline and adjacent to the last ribs) and examine the contents. Pay attention to:
    a) position of viscera
    b) presence/type/volume of any effusion
    c) the external surfaces of viscera
6 Puncture the diaphragm on both sides to check for negative thoracic pressure.
7 Check the patency of the bile duct by gently squeezing the gall bladder.
8 Examine the pancreas in situ.
9 Remove the spleen, pancreas and the alimentary tract (from the gastro-oesophageal junction to the proximal rectum) from the carcase. Consider use of plastic ties around the hollow viscera to reduce risk of contamination.
10 Remove the liver.
11 Using bone shears/saw incise through the ribs approximately one third of the way between the sternum and thoracic vertebrae. Cut close to the sternum at the costosternal junction on the opposite side to the severed ribs taking care not to open the pericardial sac and then reflect the sternum and rib ends. Estimate the volume of any thoracic effusion and note the presence of any adhesions.
12 Split the mandibular symphysis and remove the tongue, trachea, heart and lungs in one piece (pluck).
13 Remove the adrenals.
14 Split the ventral pelvis at the pubic symphysis and remove the urogenital system and rectum as one piece.
15 Open the major limb joints (collect samples if appropriate), examine the principal lymph nodes still attached to the carcase and the major peripheral nerves.
16 Examine a growth plate and bone marrow from one of the long limb bones such as the proximal humerus.
17 Examine the oral cavity, tonsils, teeth, ears (consider fixing whole if middle/inner ear disease is suspected) and salivary glands.
18 Incise the diaphragm and major pelvic, fore/hind limb and masticatory muscles.
19 Remove the brain, spinal cord and pituitary gland.
20 Split the skull (longitudinally and along the mid line) and examine the nasal chambers, pharynx, sinuses and internal/external nares.
21 Examine the removed viscera and associated lymph nodes in a systematic manner.
22 If required place pituitary/thyroid/adrenal glands whole in neutral buffered formalin.
23 Collect appropriate tissues for further examination. Ensure adequate labelling of collected specimens.
24 Record relevant findings

Sample Collection

The post mortem findings combined with previously collected history should inform your sample collection. Organ or specific disease related presentations are dealt with in the individual information sheets but here we deal with the examination and collection of tissues primarily for histological examination particularly when presented with a systemic disease situation.

Heart

Examination of the heart should include the pericardial sac, epi-, endo- and myocardium as well as the chambers and valves. Representative sections of lesions should be collected but as a routine a section of the left and right ventricular free wall and interventricular septum (including papillary muscle) should be collected (see figures 1 to 4).

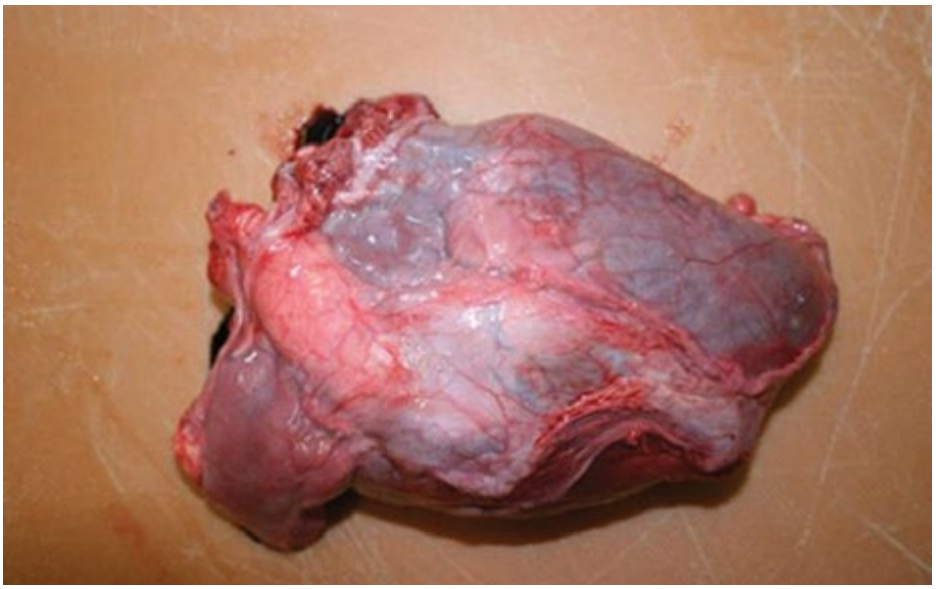


Fig.1. Heart removed from pluck. Note normal shape.

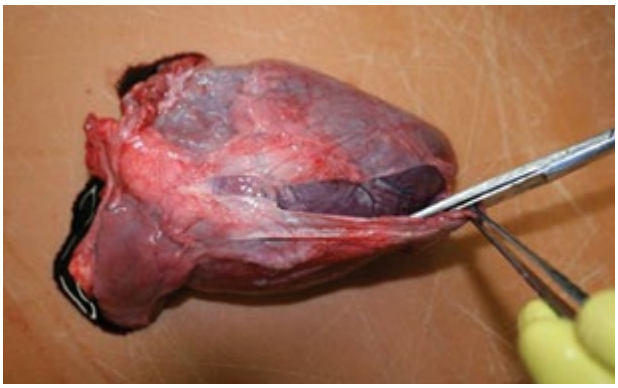


Fig. 2. Opening the pericardial sac. Check for the presence of any effusion or exudate and collect material for culture if required. This can be done prior to removal from the pluck.

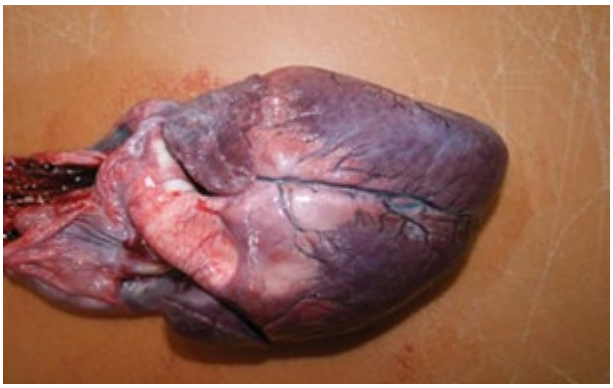


Fig. 3. Pericardial sac removed exposing epicardium/heart and great vessels.

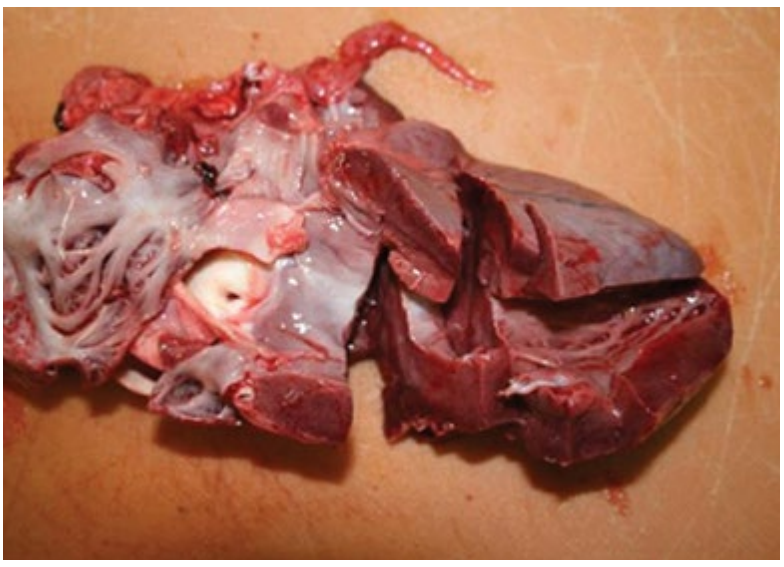


Fig. 4. Open the chambers of the heart assessing chamber size, looking for defects and checking valves. Remove a portion of the left and right ventricular wall and interventricular septum (incision seen here). To open the chambers, cut into the right ventricle and then follow up through the pulmonary valve into the artery lumen. Then cut through the A-V valve opening the right atrium. Turn the heart over and cut into the left ventricle and then cut through the left A-V valve opening the left atrium. The aortic valve can be found under the A-V valve – slide a pair of scissors up cutting the A-V valve and aortic valve opening the aortic lumen.

Lung

Please see Respiratory disease information sheet for information.

Liver

The liver is a large organ and lesions may be diffuse or very localised. Serial sectioning should be performed to identify lesions deep within the parenchyma and major bile ducts squeezed to 'milk out' bile and other contents. Assessment of the gall bladder and its contents should be undertaken. Again focal lesions should be collected and should include the border between affected and non-affected tissue. For more diffuse lesions a representative section of the liver can be collected as shown in figures 5 to 8.

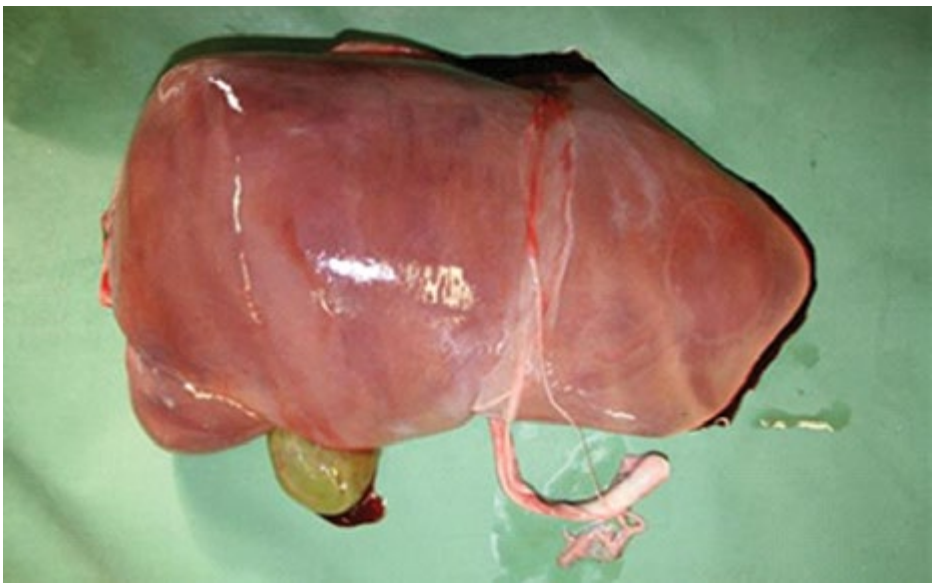


Fig. 5. Normal liver (diaphragmatic surface) with attached umbilical vein/ductus venosus.

Fig. 6. Make a series of incisions to examine the liver parenchyma.

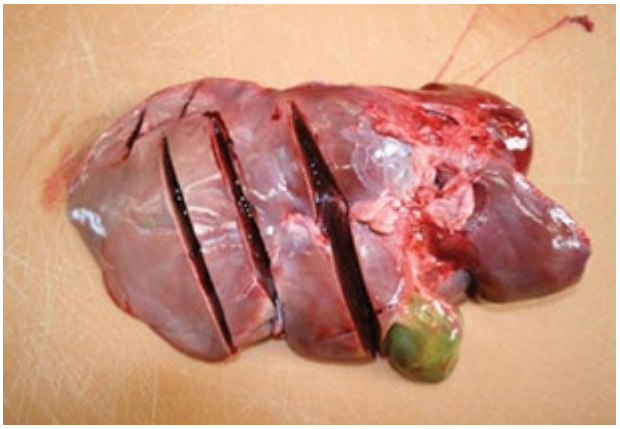


Fig. 7. Visceral surface of liver showing gall bladder. Make similar incisions on this surface, cutting through the major bile ducts (express their contents checking for fluke). Open the gall bladder.

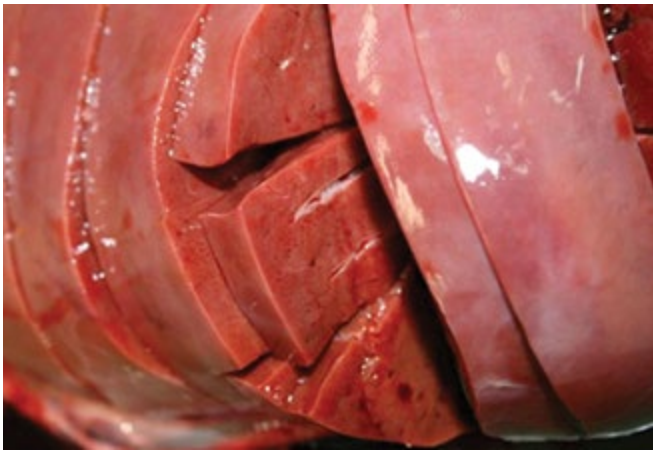


Fig. 8. Take representative portions of liver as shown

Kidney

One of the most important factors in assessing pathology in the kidney is autolysis. This occurs rapidly after death and can be accelerated in some cases by certain toxins (e.g. epsilon toxin in Clostridium perfringens enterotoxaemia type D – Pulpy kidney). It is important to strip the capsule from the renal cortex and examine the kidney surface. Incise the kidney longitudinally and inspect the cortex, medulla and pelvis. When sampling it is best to take a section to include the cortex, medulla and pelvis as each area of the kidney can then be adequately assessed. Figures 9 to 12 illustrate how this is done.

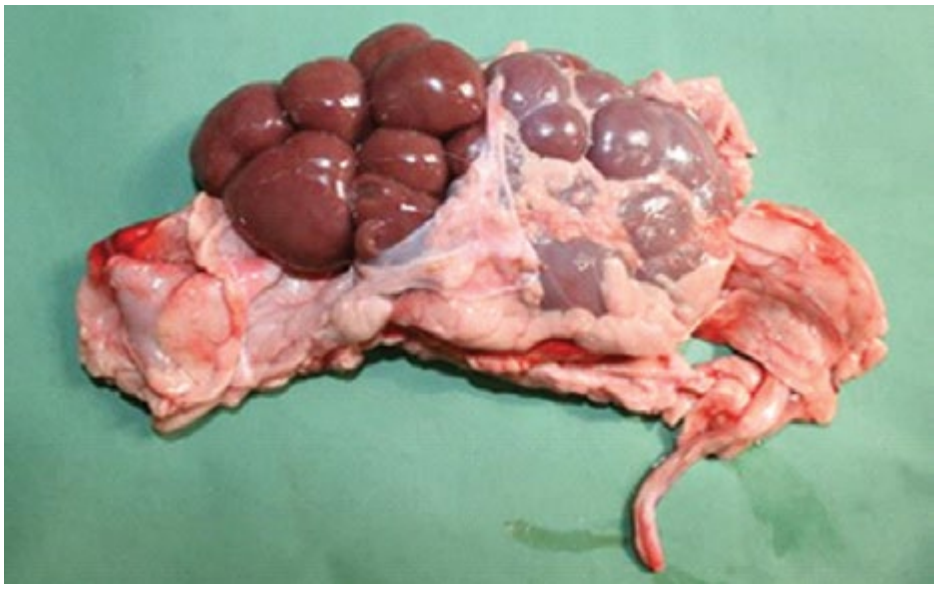


Fig. 9. Bovine kidney. Strip the capsule off to expose the cortical surface.

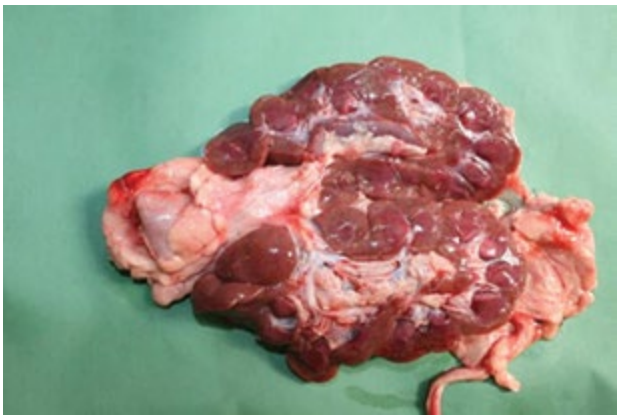


Fig. 10. Sagittally section the kidney exposing the cortex, medulla and pelvis.

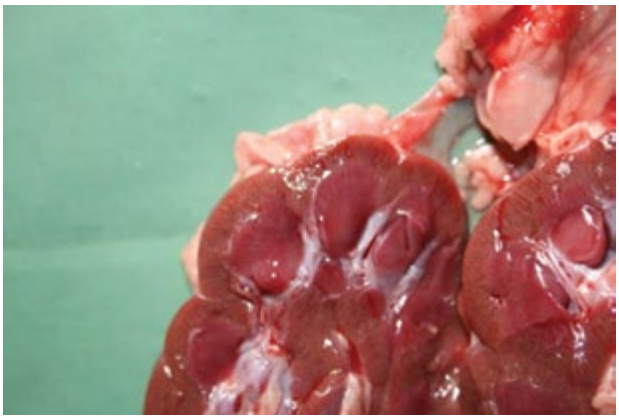


Fig. 11. Assess the cortical and medullary cut surface

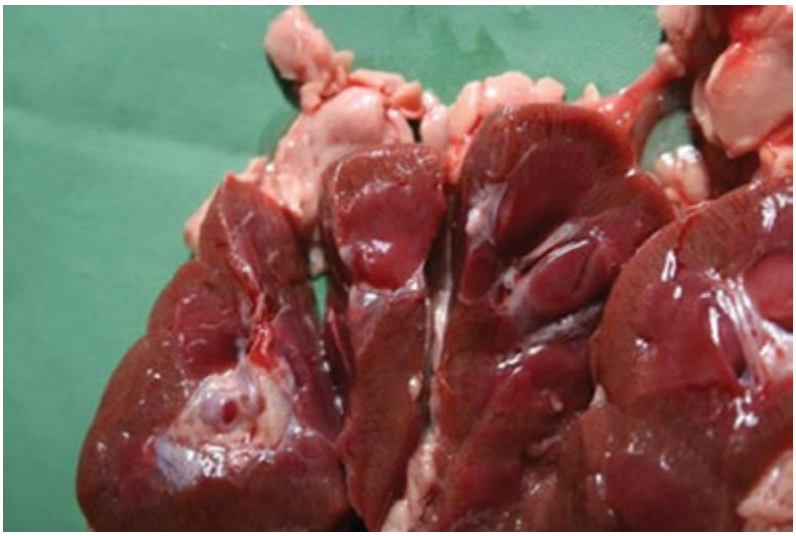


Fig. 12. Remove a section of kidney incising through the cortex, medulla and pelvis.

Spleen

In the majority of cases little splenic pathology is seen but certainly in pigs it is useful to sample to identify lesions associated with PDNS/CSF/ASF etc. In ruminants enlargement occurs in septicaemia and endotoxaemia. Focal lesions are uncommon and a representative portion can be taken for histology (see figures 13 to 14).

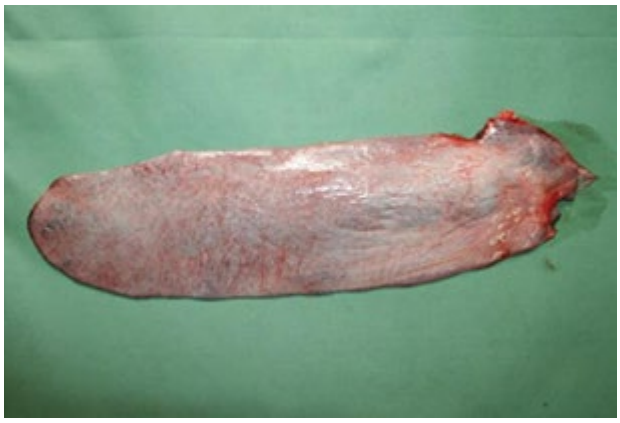


Fig. 13. Normal bovine spleen.

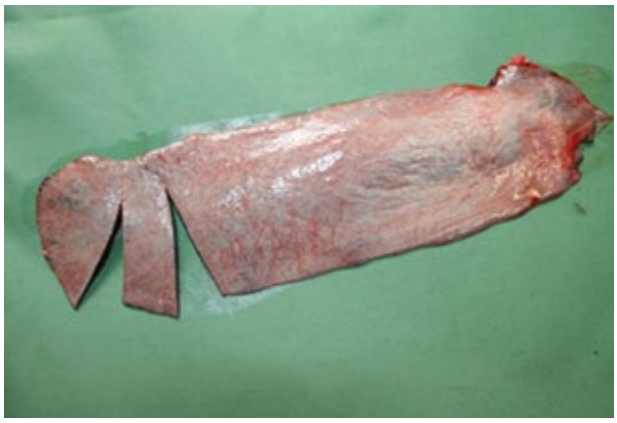


Fig.14. Remove a portion as indicated and place in fixative. A similar sized fresh portion can be retained for bacteriology/virology.

Alimentary tract

The alimentary tract is often examined 'piece-meal' as separate areas are dealt with at different stages of the necropsy. Giving advice on sampling therefore is not straight forward. Oral/pharyngeal lesions should include mucosa, submucosa and subjacent tissues preferably including the area between affected and non-affected tissue.

When examining the 'hollow' parts of the tract it is important to open the viscus and examine the contents.

The oesophagus is usually left with the pluck and opened along its length – any lesions seen can be sampled. The fore-stomachs and abomasal contents should always be examined, with rumen pH assessed if acidosis is suspected (e.g. with pH strips). In cases of plant poisoning the rumen contents may have to be carefully 'sifted' through to identify any fragments. When sampling for histology gently wash off any contents from the mucosa, remove a full thickness portion of the wall and place in fixative.

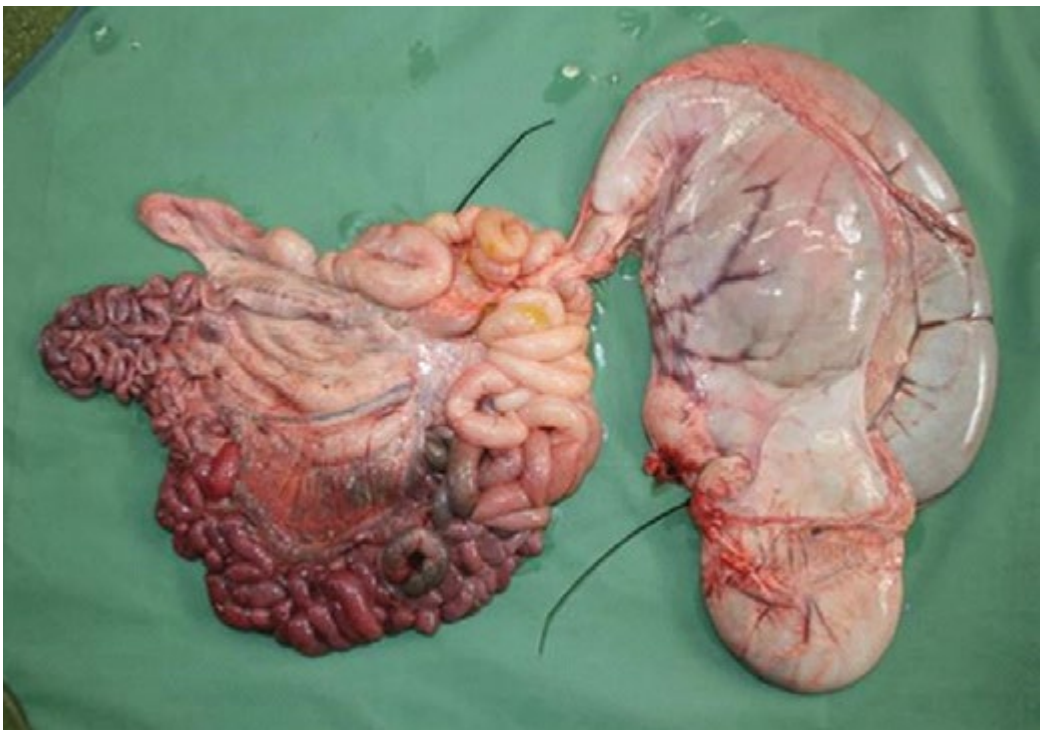


Fig. 15. Abomasum (plus vestigial fore-stomachs) and intestine from a neonatal calf. Note ties placed around oesophagus and rectum before removal from carcass.

The intestine needs to be adequately exposed and is best removed from the carcass and laid on a clean surface as shown in figure 15. It is important to identify the anatomical areas of the intestine, open selected lengths, examine the contents, mucosa and serosa, assess the adjacent mesenteric lymph node and sample appropriately. For histology it is often easier to sample unopened intestine immediately adjacent to any lesion. The photographs illustrate how a length of intestine (ileum) is sampled. If intestinal disease is suspected (whether lesions are present or not) it is worthwhile taking representative lengths from the duodenum/ proximal jejunum, mid and distal jejunum, the ileocaecal junction (including ileum and caecum), the spiral colon and rectum. There is no need to individually identify each length. Gently remove the contents by agitating in water or neutral buffered formalin and then place in clean fixative.

To accurately evaluate intestinal histology samples need to be collected within 15-20 minutes of death. As such identifying and euthanizing a typically affected individual and removing the intestinal tract as soon as possible after death for sampling will yield the best results.

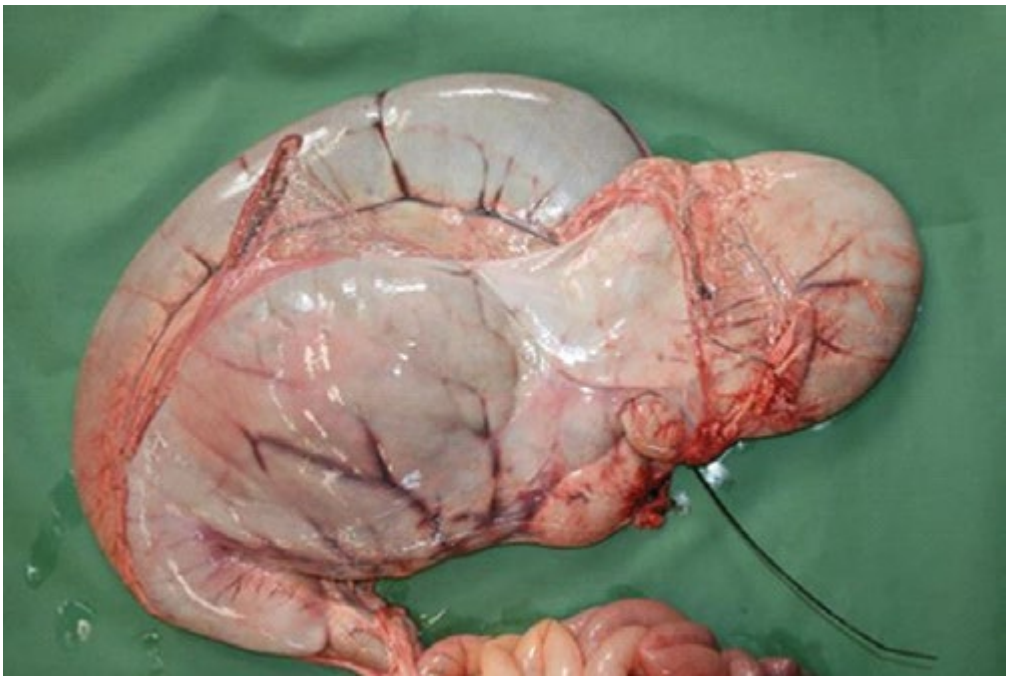


Fig. 16. Normal abomasum/ vestigial fore-stomachs.

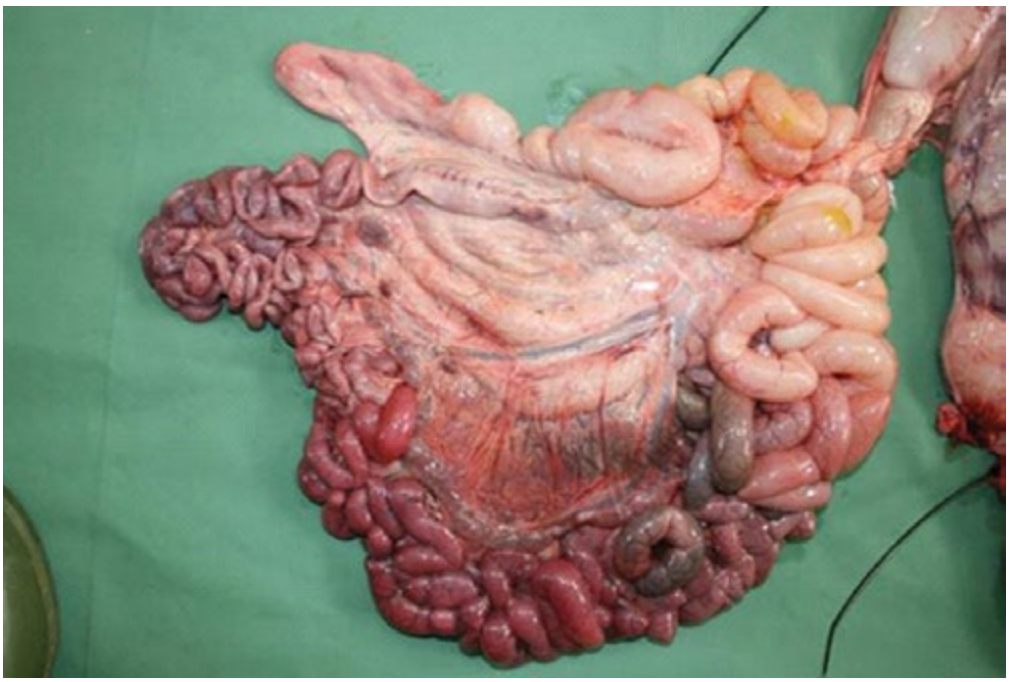


Fig. 17. Intestine with caecum at the top of the photograph clearly showing the pole. The small intestine forms the 'fringe' along the mesentery with the spiral colon in the centre. Use the caecal pole to orientate yourself and identify the ileum.

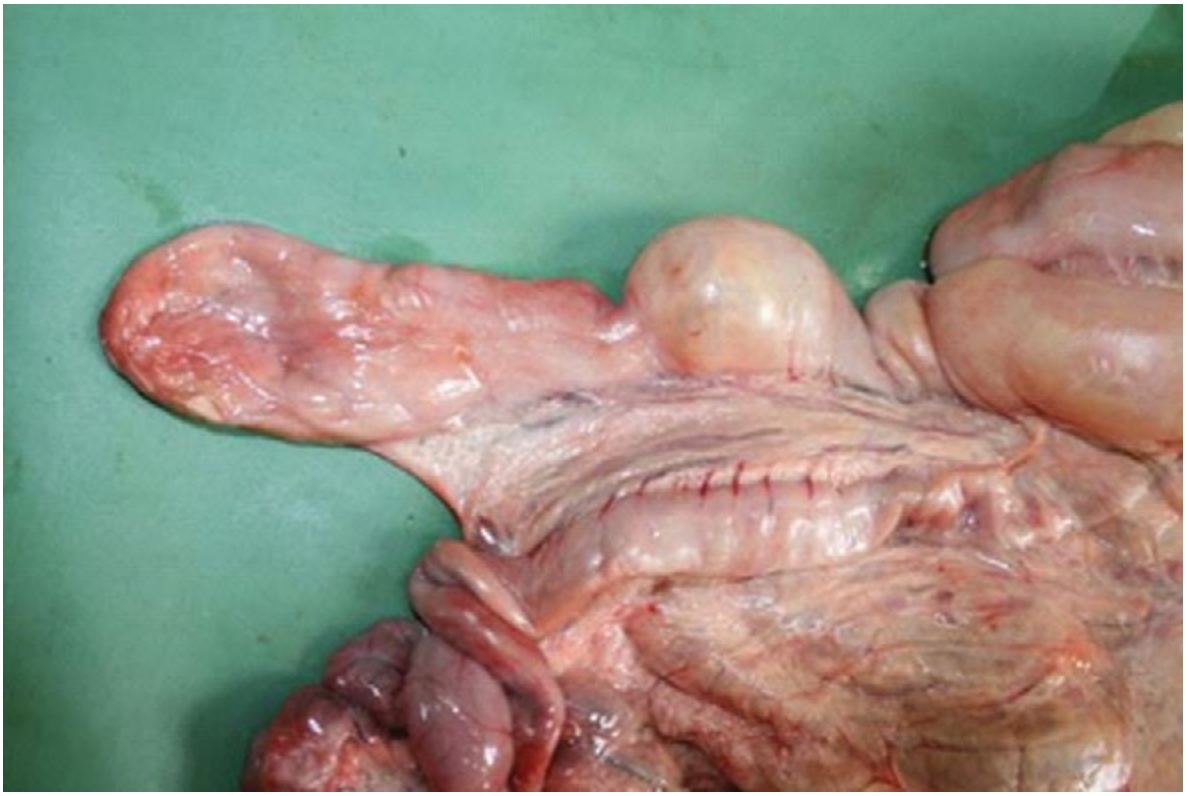


Fig. 18. Caecum with ileum below in the mesentery

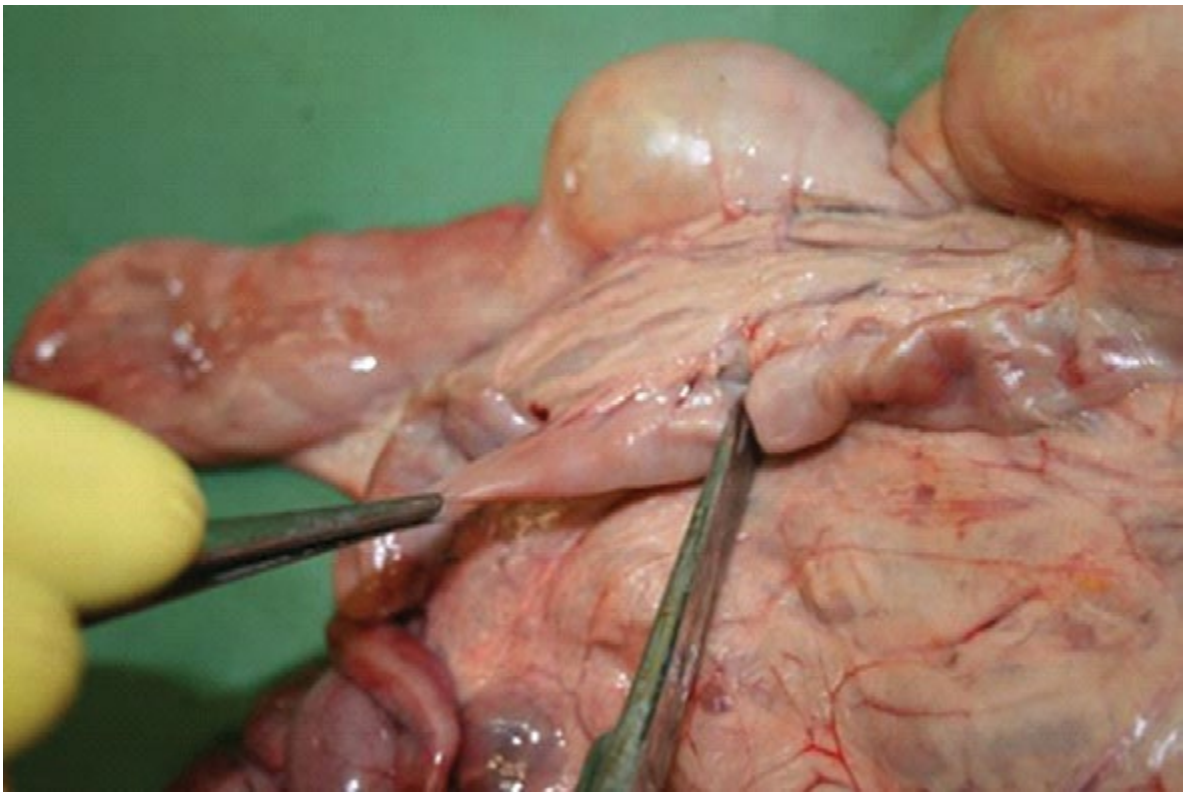


Fig. 19. Removing a length of ileum. Carefully cut the bowel and hold with forceps. Make another incision 2-3 cm distally and remove length.

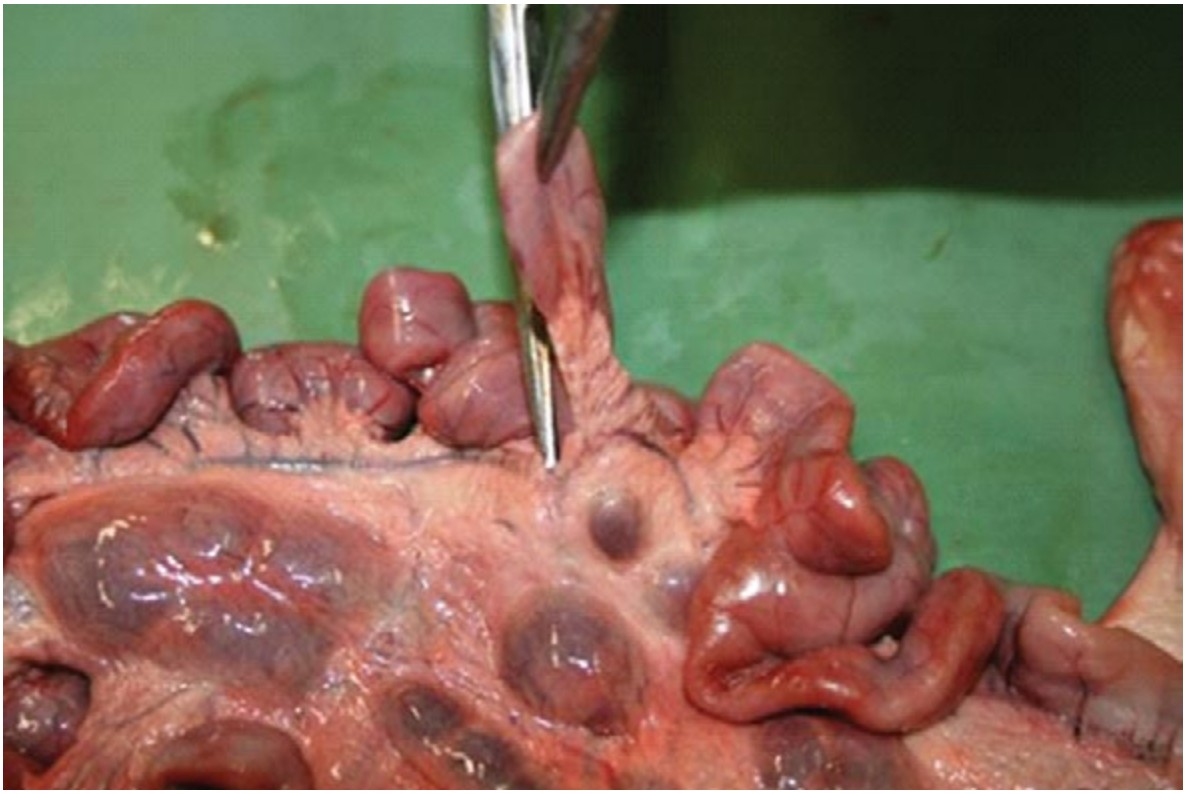


Fig. 20. The same procedure for removing a length of jejunum.

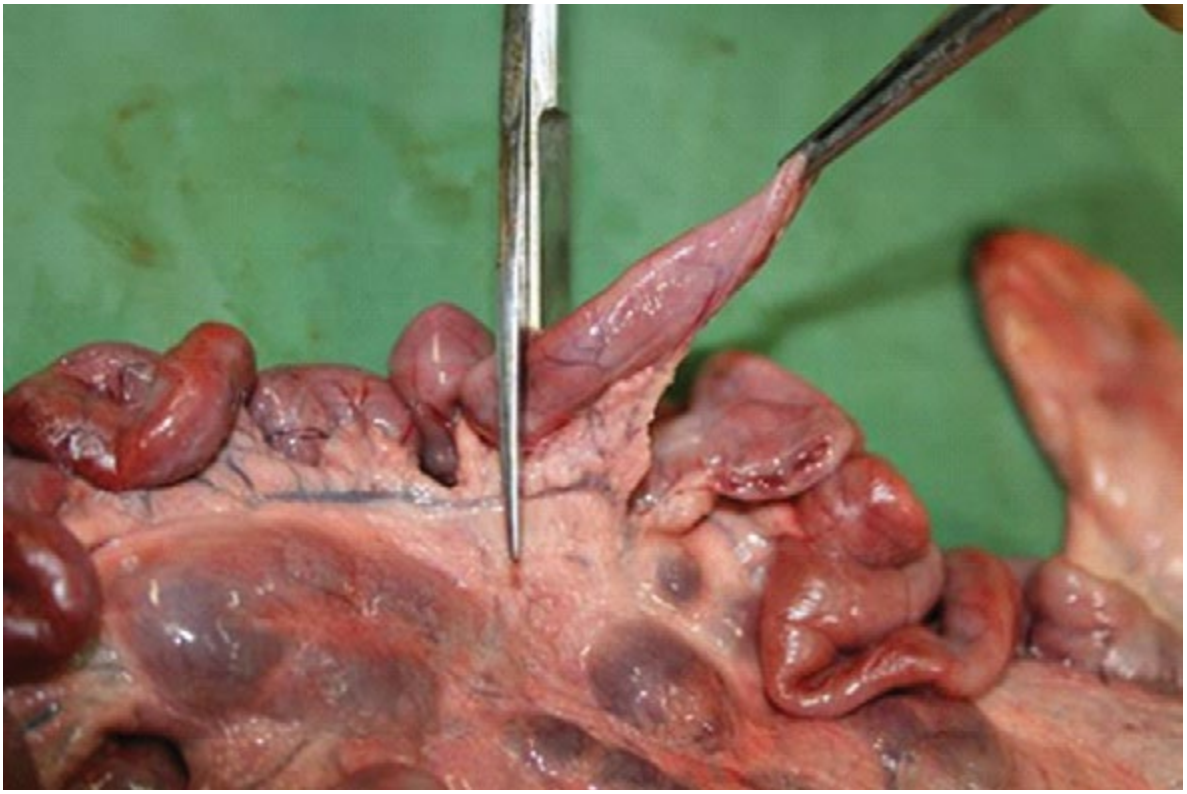


Fig. 21. Removing jejunum. Note mesenteric lymph nodes embedded in mesenteric fat.

CNS

Please see information sheet on CNS disease and sampling and examination of the nervous system.

Please refer to the histopathology information sheet for more information on the collection and fixation of tissues for examination.

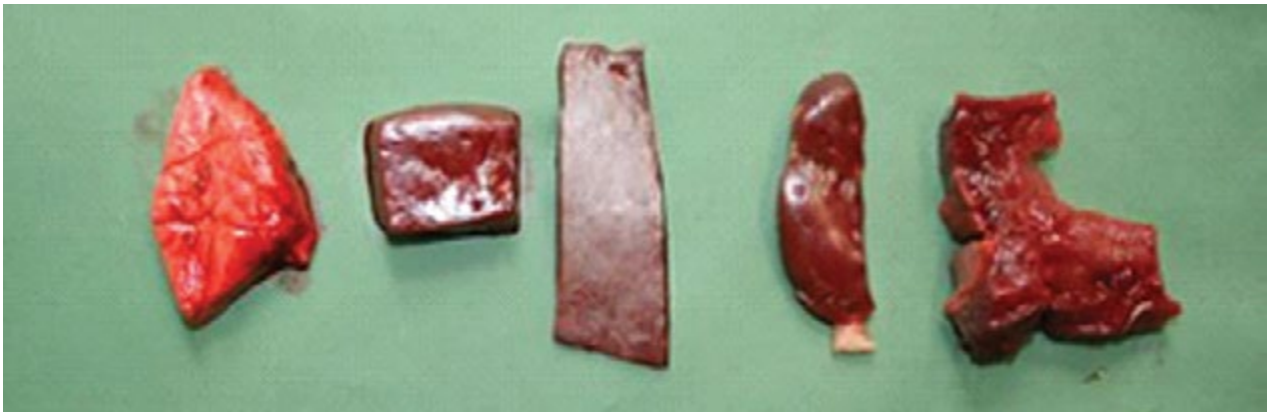


Fig. 22. The main viscera (lung, liver, spleen, kidney and heart) collected for histological examination prior to fixation.

Carcass sampling for other tests

As a routine it is useful to have a 'standard' set of samples that can be collected from each case. These may not all be required to make a diagnosis but it is good practice and should additional testing be required then the material can be accessed without the need to wait for another carcass to become available.

The following can be collected:

- **Fresh liver** – toxicology/bacteriology
- **Fresh spleen** – virology/bacteriology
- **Fresh kidney** – toxicology
- **Fresh lung** (where appropriate) – virology/ bacteriology
- **Colonic contents** – parasitology/ bacteriology/ virology
- **Aqueous humour** (if no ante-mortem blood samples are available) – biochemistry

These samples should be stored in labelled, leak proof containers at 4°C and will be useful for 2-4 weeks after collection. Should tissues need to be kept for longer periods freezing at -20°C is suitable.

Submission to the Laboratory

Once you have undertaken the post mortem re-evaluate your differential diagnoses and consider which tests are most appropriate to establish a diagnosis. Submit the samples to the laboratory once you have consulted the price guide that contains relevant sample requirements.

Please provide a concise history and describe any relevant post mortem findings as this helps the pathologists in establishing a diagnosis. If you wish to submit digital photographs of cases we would be happy to receive these as they often provide additional information on the tissue changes.

Further Sources of Information

There are a number of very good sources of literature, other media and Web based resources available to help improve your knowledge regarding post mortem techniques/procedures and large animal pathology. Some are freely available and others will require some form of subscription/ payment.

Suggested reading/viewing includes:

Farm Animal Practice: Postmortem examination of cattle and sheep. Ian Griffiths In Practice 2005; 27:9 458-465

The necropsy book 4th Edn. King, Dodd and Roth. Available from CL Davis Foundation (www.cldavis.org)

Diagnostic Pathology. Ed. VL Cooper. Veterinary Clinics of North America: Food Animal Practice. 2012, 28, 3.

DVD Prosection guides for cattle, sheep and pigs are available from Edinburgh University. (www.ed.ac.uk/schools-departments/vet/studying/cpd/learning-materials/overview)

The above are useful and demonstrate clearly the technique for necropsy of the species of interest.

Jubb, Kennedy and Palmer's Pathology of Domestic Animals. 5th Edn. Maxie, Saunders Elsevier

Pathologic Basis of Veterinary Disease 5th Edn. McGavin and Zachary, Mosby Elsevier

Post Mortem Procedures

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