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Lee-Anne graduated from the University of Edinburgh Royal (Dick) School of Veterinary Studies in 2007. Having worked predominantly in farm animal practice for five years, she joined SAC Consulting Veterinary Services in 2013 as a veterinary investigation officer.

In mid-2014, Lee-Anne returned to farm animal practice at Scott Mitchell Associates* in Northumberland, where she is now a partner and has attained Advanced Practitioner status in cattle health and production as well as a Certificate in Advanced Veterinary Practice (Sheep).

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*Suggested Personal & Professional Development (PPD)

POST-MORTEM

Practical approach to post-mortem technique

A post-mortem examination can hold the key information required in the investigation of disease on farm. In some cases, it may be a single animal that has died, and the farmer wants to know why; or it may be part of a larger investigation into a problem that is affecting a group of animals – of which one or more has died or is ill, and the situation warrants euthanasia.

In practice, the examination is often carried out on farm. It can be hard work, a messy affair, and it inevitably carries a cost to it. The farmer needs to be 'on board' with the idea. From a clinical perspective is it necessary or relevant to do a post-mortem examination (PME)? Probably. After all, as Thomas McCrae famously stated... "For everything missed through not knowing, 10 things are missed through not looking".

There may be cases where it is not appropriate to carry out a PME. For example, when anthrax is suspected, if the degree of autolysis is too severe, when the conditions or the environment are not suitable, or the risk of zoonosis is unacceptable. If the case involves litigation or a criminal investigation, a specialist PME at a disease surveillance centre may be a sensible idea.

The equipment required for an on-farm PME includes:

- buckets, warm water, disinfectant, disposable towel
- post-mortem knife (e.g. Swann Morton with disposable PM40 blades)
- tree branch loppers (the type bought from garden centres)
- bone saw (specialist PM saw or a butcher's saw)
- sample pots (preferably with a wide top)
- formalin in which to fix tissues for histopathology
- evacuated blood tubes (plain, EDTA, lithium-heparin)
- 21G vacuum tube needles and mount

- permanent marker to identify samples
- pH meter or litmus paper
- good lighting.

Contemporaneous notes and image capture are needed – because all findings, no matter how small, should be recorded so they are not later forgotten. A camera and voice recording machine satisfy both these requirements; in fact, both functions can be performed by a smartphone in a crimp-top plastic bag or a proprietary waterproof case which is touch screen compatible (as well as cleanable and disinfectable!).

In the absence of voice recording, then a small whiteboard and marker pen could be used – both of which

can be cleansed and disinfected at the end but would need immediate transcription or photographing so as to remain contemporaneous.

The immediate environment needs to be suitable, so that any personnel are safe. Adherence to current Health and Safety at Work and Control of Substances Hazardous to Health (COSHH) legislation is mandatory and may include measures such as wearing cut-resistant gloves covered by arm-length gloves then latex gloves, and the wearing of a disposable gown. The wearing of waterproof trousers and boots that can be disinfected is also appropriate and a hard hat is advisable, perhaps with a visor – or, at least, goggles or safety glasses.

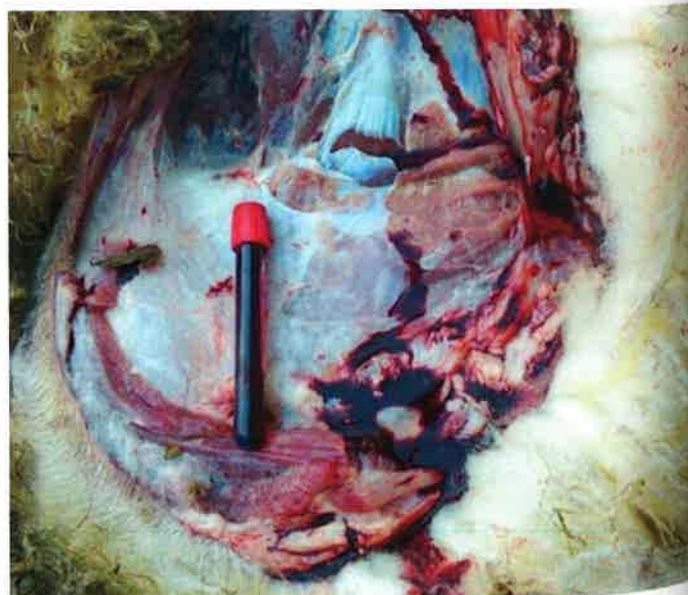


Figure 1. Collection of whole blood from the axillae of a sheep.

To guard against zoonotic infections, the wearing of a mask is necessary. In some cases - such as suspected Q-fever, Mycoplasmosis, brucellosis or louping ill - respiratory apparatus becomes necessary.

Contamination of the wider environment also needs to be considered by checking the drainage from the area. A cleanable work surface - such as a concrete floor or cleanable table - and adequate wash-down and disinfection facilities to permit the area to be disinfected and 'made safe' after use. Drainage into waterways or poor draining land should be assessed and advice sought where deemed necessary. The site where the PME is carried out should not be accessible by livestock.

The method of carcass removal needs to be established. Current Animal By-Product (ABP) legislation is available at www.gov.uk/guidance/animal-by-product-categories-site-approval-hygiene-and-disposal. Is the carcass in an area easily accessible to the fallen stock collector who is to remove it? Do they require the carcass to be stitched back together after the PME?

Before starting a PME, a thorough history of the case is beneficial and should be documented. This will help to formulate a list of possible diagnoses that can be ruled in or out during the PME and sample collection can be targeted with the possible diagnosis in mind.

Once it has been decided that a PME is required, that there is a suitable

environment in which to perform it and that the required equipment is available, then it can commence.

The PME should start by recording the animal's ID, sex, breed, approximate age and weight. Then an external examination should take place and the following points considered:

- the body may need cleaning of excess soiling (indicative of poor husbandry perhaps?)
- faecal staining of the perineum may suggest diarrhoea
- fleece or hair may need removing for closer inspection of the skin
- body condition score
- external parasites
- feet
- dehorning sites
- navel
- udder
- ears - external canal, tagging sites
- eyes - ocular fluid can be tested for beta-hydroxybutyrate (BOHB), urea, calcium and magnesium levels.

While not strictly an external finding, it is at this early, superficial stage of the examination that subcutaneous tissue can be assessed on removal of the skin - jaundice, pallor, haemorrhage, bruising, dehydration and oedema, may all be evident. In cases of *Bibersteinia (Pasteurella) trehalosi* in sheep, petechiation of the subcutaneous tissues of the neck is apparent and ulceration of the oesophagus is also a common finding.

Are any wounds of pre- or post-mortem origin? Pre-mortem wounds are

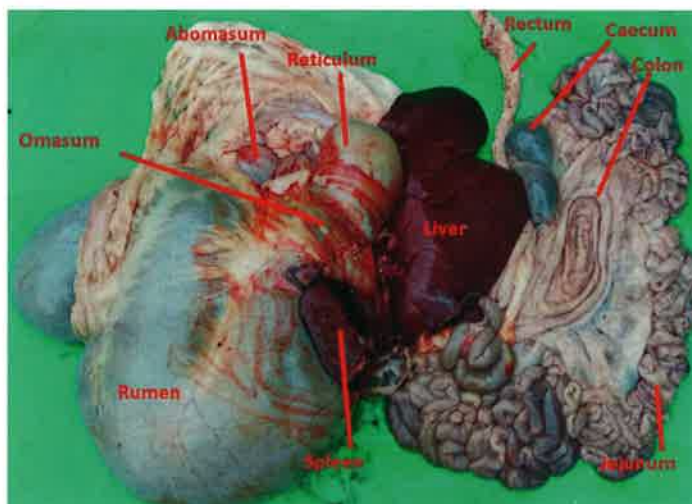


Figure 2. The anatomy of the ovine abdominal viscera.

often associated with inflammation/haemorrhage; post-mortem wounds are not. Examples of wounds include dog bites, sharp injuries, post-mortem scavenging or pre-mortem predation.

In the case of an animal weighing less than 150kg, the carcass can be positioned on its back and the coxo-femoral joints disarticulated to allow splaying of the back legs. The axillae can then be incised and the forelegs also splayed such that the carcass should stay in position. The skin is then reflected from the midline using a skinning knife. The thorax should be examined before the abdominal contents are incised to prevent contamination in the event of samples for bacteriology being required. The thorax can be opened by cutting the ribs on either side of the sternum using the loppers and then excising the sternum.

Carcasses exceeding 150kg can be hung with lifting equipment from a front leg, if it is safe to do so. The skin can then again be reflected from the mid-line and examination of the internal organs may be carried out - once again starting with the thorax.

Blood should be collected from the carcass, if possible,

in a plain (red top) tube. When incising the axillae and the femoral artery adjacent to the coxo-femoral joint, it is a good opportunity to obtain a blood sample from the pooled spilt blood. Many serological tests can be carried out on this sample - BVD antigen, BVD antibody, Johne's serology, MV, louping ill (Figure 1).

The PME should then proceed systematically so that nothing is overlooked.

Head, neck, mouth and oral cavity

Stomatitis and oral ulceration are significant and the size, depth and location in the mouth should be noted. Do they involve the mucocutaneous junctions? The tongue should be examined, looking again for any abrasions, foreign bodies or actinobacillosis. The dentition is best visualised by cutting the commissures of the mouth or, alternatively, splitting the mandibular symphysis.

The laryngopharynx is a common area for dosing injuries and the laryngeal cartilages are the site of foreign body obstructions and laryngeal chondritis. In newborn or stillborn animals, the thyroid may be of interest. An

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Figure 3a & 3b. Brain removal. The classic technique is to saw as shown, approximately 1cm deep, removing the plate of bone and then tipping the brain out – helped by severance of the optic chiasma.

enlarged thyroid gland can be indicative of iodine deficiency; histopathology of a fixed lobe of thyroid is, however, required to confirm this diagnosis. The size of the lymph nodes in this area may point to some local inflammatory response or be part of a generalised lymphadenopathy. The nasal cavity and sinuses should be examined for bots, sinusitis and foreign bodies.

Thorax, including ribs, pleurae and pleural cavity

Ecchymotic haemorrhages can be an indication of sepsis in all species. Along with fibrin deposits, they can be strongly suggestive of pasteurellosis in sheep. It should be noted that the thymus is larger in the younger animal. Bronchial and mediastinal lymph nodes may be enlarged in cases of pneumonia and TB.

Pathology of the heart can involve congenital abnormalities, endocarditis, myocarditis and pericarditis (wire?). A fibrin clot within the pericardium may be suggestive of clostridial disease, such as pulpy kidney. It is important to note the difference between congestion and consolidation of the lungs.

Congestion is more likely in the dependant lobe and blood oozes from the cut surface. Consolidation is a pathological change indicative of pneumonia – the lung tissue is firm, dark and does not float in a bucket of water. Ovine pulmonary adenomatosis (OPA) presents as a confined, relatively demarcated, area of firm lung tissue with a greyish tinge on its cut surface.

Lungworm are visible in cattle and sheep – *Dictyocaulus* spp. are present in the bronchi of cattle, *Muellerius* spp. or *Protostrongylus* spp. in the caudal lobes of sheep. They are all thin white worms, one to three centimetres long

and found in the airways. It is difficult to achieve a diagnosis of bovine respiratory disease from gross pathology alone. Respiratory syncytial virus (RSV) does sometimes present as emphysematous bullae and infectious bovine rhinotracheitis (IBR) as inflammation, ulceration and necrosis of the mucosal lining of the upper respiratory tract. Further testing is usually necessary to reach a definitive diagnosis.

Abdominal cavity and abdominal viscera

On examination of the abdomen, the colour, volume and consistency of the abdominal fluid will indicate ascites, haemorrhage, fibrin or pus. On inspection of the guts, the position, shape, colour, distention, contents (poisonous plants), existence of twists or intussusception or thickening/proliferation or pigmentation should all be considered. **Figure 2** shows the anatomy of the ovine abdominal viscera.

A rumen pH of less than five is suggestive of acidosis – fluid should be squeezed from the rumen contents and its pH measured with a pH meter or litmus paper. The pH of the rumen contents will rise after death. When a normal rumen pH is found in an animal that has been dead for more than a few hours, acidosis should not be ruled out. If histopathology of the gut is required – for example in the case of neonatal scour – then the gut sample must be fresh (within a maximum of six hours after death) otherwise autolysis limits meaningful histopathological examination. The gut should be cut longitudinally and opened out before placing in formalin. A range of gut sections should be fixed – duodenum, jejunum, ileum, caecum and colon.

Fresh, un-fixed sections of liver and kidney can be useful to assess deficiencies and toxicities of various elements

(Table 1). Full universal containers of fresh organ are required as indicated below. These can then be frozen, stored and tested if required.

Musculoskeletal system

Joints should be examined for arthritis, degeneration and synovitis. If multiple joints are affected in bovine cases, then *Mycoplasma bovis* or salmonellosis should be considered. Cultures of synovial fluid are useful to obtain a diagnosis in these situations.

Brain

Histopathology of the brain is required to diagnose a number of neurological diseases. If the carcass is fresh, the removed brain should be allowed to cool before placing it in formalin fixative (Figures 3a & 3b). The meninges should be cut to allow formalin access to the brain tissue itself. The

	Liver	Kidney
Copper	D, T	T
Selenium	D, T	T
Vitamin A	D	-
Vitamin E	D	-
Lead	-	T
Vitamin B ₁₂ (cobalt)	D	

Table 1. Organ samples required to assess macro-mineral status (D = deficiency; T = toxicity)

brain takes at least three to five days to fix. To save on postage costs it is advisable to allow the brain to fix and then drain off the formalin and pack the container with formalin-soaked tissue paper before sealing the container and posting.

Before removing the brain, examine the meninges for opacity, suppuration or excess fluid. Swabs for bacteriology may be required in cases

where meningitis, *Histophilus* (*Haemophilus*) *somnus* encephalitis ('sleeping calves') or listeriosis is suspected. When intra-cranial pressure increases, the cerebellum is often pushed back into the foramen magnum, thereby adopting a triangular shape called 'coning'. ■

Further reading

Edwards G and Foster A (2009). Use of ocular fluids to aid post-mortem diagnosis in cattle and sheep. *In Practice* 31(1): 22-25.

Harwood D (2006). Clostridial diseases in cattle: Part 1. *UK Vet* 11 November.

Harwood D (2007). Clostridial diseases in cattle: Part 2. *UK Vet* 12(2) March.

Otter A and Davies I (2015). Disease features and diagnostic sampling of cattle and sheep post-mortem examinations. *In Practice*, 27: 293-305.

Stevenson H et al (2014). Sudden death in sheep. *In Practice* 36: 409-417.

PPD Questions

- If polyarthritis is identified in a 'bovine' PME examination, what two diseases should be considered?
 - Johne's and BVD
 - BVD and salmonellosis
 - fluke and clostridial disease
 - salmonellosis and *Mycoplasma bovis*.
- What tissue is used to analyse lead levels in a carcass?
 - liver
 - thyroid
 - kidney
 - lung
 - bone marrow.
- For what four things can ocular fluid be tested?
 - calcium, phosphorus, sodium and potassium
 - BOHB, calcium, magnesium and urea
 - urea, bile acids, magnesium and calcium
 - ketones, progesterone, calcium and magnesium.
- Within how many hours after death is it acceptable to submit gut for histopathological examination?
 - six
 - 12
 - 24
 - 48.