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How to . . . investigate sudden death

The investigation of sudden death in farm animals is a relatively common request for large animal vets. If multiple deaths have occurred, or valuable livestock are involved, there can be pressure from the client to come up with a diagnosis and provide a solution very quickly. It is important to take a logical approach to investigation, otherwise key pieces of information may be missed.

Sudden death could be defined as the ‘sudden and unexpected death of an apparently healthy animal’, but as some management systems are quite extensive and levels of stockmanship vary, not all cases will meet this definition. An animal may have shown clinical signs for several hours before it died, but these may have been missed if stock were only inspected once every 24 hours.

Alternatively, an individual may have been separated from the rest of the group and not been seen for two or three days before being found dead; or vague clinical signs may not have been noticed by the farmer before death.

As many sudden death cases will involve insurance claims or litigation, detailed records should be kept from the first point of contact. It is a good idea to establish whether litigation is a possibility, because this may influence how far investigations should go to confirm the diagnosis.

Causes

The causes of sudden death can be categorised and having these broad categories in mind may aid investigation. The areas that should be

considered are trauma/accident, feed-related deaths, infectious disease (bacterial, viral and parasitic) and access to toxins. Some common examples of these are given in Table 1.

Initial approach

There are many possible causes of sudden death and no possibility should be dismissed; for the saying “common things are common” does hold true in many cases. The first – and most crucial – part of the investigation is to take a good history. Knowing the species, age and management system will enable a shortlist of possible causes to be drawn up.

Although farmers may be unwilling to spend time giving a history, clues to the likely cause can become apparent during detailed questioning, which will help the next stage of the investigation. A detailed history will include the following categories.

Age, breed and sex

Are all the dead animals the same age? If animals of all ages are affected, the cause has to be something that is not age-related. This can rule out causes such as nematodiosis in sheep or acute mastitis. If

there is a breed or sex bias, some conditions are raised as possibilities – urolithiasis, for instance, or those linked to pregnancy.

Clinical signs

When were the animals last seen alive and were any clinical signs such as respiratory distress or opisthotonos observed?

Groups

Were all the affected animals in the same group, shed or airspace?

Time-frame

How long had the dead animals been on the farm or in the group? Could it be a disease, such as acute pasteurellosis, caused by the stress of moving; or something they were exposed to after coming into the herd or at market – IBR, for example? (Figure 1).

Bought in

Are only bought-in animals affected? Had they received vaccinations against clostridial diseases or pneumonia? Had they been given the routine herd/flock vaccinations since arrival?

Reproductive status

Were the animals pregnant or had they recently given birth?

Table 1. Causes of sudden death by category

Category	Examples
Traumatic or accidental	Injury from RTA or fighting, lightning, stray electricity, dosing gun
Feed related	Acidosis, bloat, hypomagnesaemia, White muscle disease
Infectious (bacterial, viral or parasitic)	Anthrax, acute pneumonia, clostridial disease, fluke
Toxins	Lead, plants, nitrates, rat poison, acorns

0.75
hours*

*Suggested Personal & Professional Development (PPD)

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Figure 1. Severe tracheitis in a cow with IBR.



Figure 2. Pieris is a common ornamental shrub which is toxic to ruminants.



Figure 3. Rapid autolysis in a cow which died from Blackleg.

The stage of pregnancy or lactation is important, because metabolic diseases, such as milk fever, are much more likely in late pregnancy or early lactation, whereas acute toxic conditions, such as mastitis and metritis, are more common in the periparturient period.

Housing

Have there been any recent changes or building work? If building work has taken place there may be increased risk of access to lead from old putty or paint, or to stray electricity from unfinished or poorly finished work. Poor ventilation increases the risk of acute pneumonia.

Pasture

Have animals safely grazed the pasture in past years? Are there any toxic plants, such as yew, hemlock or oak, nearby? Are there any streams and has there been any dredging which might have exposed hemlock tubers or anthrax spores? Has there been any access to recently fertilized land which may increase the risk of nitrate poisoning? Has anybody tipped garden trimmings or car batteries over the hedge? Cases of plant or lead poisoning have been caused by all such activities.

The type of pasture can be important too – clover-rich leys increase the risk of ruminal bloat; stock on very restricted grazing are more likely to eat toxic plants,

such as bracken; and moving cattle on to fresh grass in the autumn increases the risk of Fog Fever.

Feeding

What are the livestock being fed, by which route, and have there been any recent changes? Certain diseases are linked to the type of feed – for example, acidosis is a common cause of sudden death in lambs soon after concentrate feed has been introduced. Has there been a new batch or type of feed which could be contaminated with bacteria or toxins – silage containing *Listeria monocytogenes*, for example, or toxic plants such as bracken.

Minerals

Which minerals have been fed, by which route, and have there been any changes? Do all stock have access? Has it run out over the last two days? Hypomagnesaemia is a common cause of sudden death in cattle or sheep and cases can occur even when supplementation is provided, especially if intake is optional.

What is the selenium status of the farm? Sudden deaths just after turnout in young calves and lambs could be the consequence of nutritional myopathy.

Water

Have there been any interruptions to the water

supply and do all stock know how to find it? Cases of salt poisoning have occurred after housing in unfamiliar sheds, when stock have failed to find the water supply.

Access

Have any animals escaped and gained access to a feed or chemical store, or gardens where there may be toxic shrubs, such as rhododendron or *Pieris* (Figure 2).

Handling

Have the stock been drenched or dipped recently? Was an experienced operator involved? Blackleg has been reported after handling when dormant spores have been reactivated after bruising during handling.

Vaccinations

Which vaccines are used and when are they given? Do stock receive a proper course and annual boosters? Clostridial diseases are amongst the most common causes of sudden death in ruminants. Although many flocks are vaccinated, on further questioning it may become apparent that the primary course has never been completed so, in effect, they are not protected.

Handling of vaccines – refrigeration, speed of use after broaching vial – is another area which is worth

probing, as mishandling of these products is commonplace.

Parasite control

Which treatments have the stock received and when? Was the correct product used at the right time of year? Using a flukicide that treats only adult fluke infection can lead to deaths from acute fluke at the high risk time of year. Was the correct dose given, and are there likely to be resistance problems if products containing benzimidazoles or triclabendazole were used?

Weather

Bad weather can increase the risk of some diseases, such as hypomagnesaemia; or damage fencing which can allow access to areas where there may be feed stores or toxic products. In cases of lightning strike, it helps to see the animals in situ – under trees, metal fencing or water troughs – and to confirm with the Meteorological Office as to whether lightning was recorded in the area at the estimated time of death.

Freezing weather and access to frozen forage is linked to the clostridial disease, Braxy, in sheep.

Farm history

Any recent disease in the livestock or changes to the management system

Table 2. Items required for post-mortem examination

Items required
protective clothing
gloves (vinyl + cut-proof)
sharp knife or heavy duty scalpel
scalpel handle and blades
saw
sample pots of various sizes
vacutainers + needles
16 gauge needle + syringe
dipsticks for glucose
pH meter
10% formol saline
camera
notepaper + pen
disinfectant.

or personnel may be of importance. The timescale of the losses is another useful line of enquiry. If similar deaths have occurred in previous years under similar circumstances, then recent changes on the farm may not be significant. It is important to keep an open mind.

Anthrax is a notifiable disease in the UK, so if the sudden deaths involve cattle, then the local APHA office should be consulted to ask for authorisation for an anthrax inquiry. It will require a detailed history, including ear tag number, feeding management and calving history, before a decision is made. If the authorisation

is given, the carcass cannot be moved until a negative result is confirmed after examination of a blood smear. If the history has raised any suspicions of any other notifiable disease these should be discussed with APHA before taking any further action.

On arrival on farm

Look at the other stock in the group for signs of ill health. Are there any poisons around? Is there any possible access to feed, lead, chemicals, electricity, toxic plants, pest control substances? If possible, look at the site where the animals were found, particularly if lightning strike was one of the possibilities.

Post-mortem examination

Ideally, thorough post-mortem examinations should be carried out in a veterinary laboratory; but often this is not possible for a variety of reasons, such as distance, transport and time of day, and on-farm post-mortems can provide very useful information and a diagnosis.

In cases of multiple deaths, several carcasses should be examined to check that there is a consistent cause. Choose the freshest ones available, although examination of autolysed carcasses is worthwhile if they are the only option, as sometimes a diagnosis can be reached – haemorrhage caused by

Table 3. Basis of post-mortem examination in sudden death cases

Area of carcass	Items to check
External examination	ID, mucous membranes, wounds, udder Body condition, discharges
Subcutaneous tissues	Degree of hydration, congestion, colour Peripheral lymph nodes
Head and neck	Oral and nasal cavities Pharynx, oesophagus, trachea, brain
Thoracic cavity	Lungs, pericardium, heart, lymph nodes
Abdominal cavity	Liver, kidney, spleen, bladder, lymph nodes, GIT including contents at all levels Urogenital tract
Musculoskeletal system	Joints, muscles (including diaphragm, tongue, intercostals, masseters, heart)

Table 4. Some common causes of sudden death, samples to collect and useful tests

Suspected diagnosis	Sample	Test(s) required
Septicaemia	Fresh liver, lung, spleen, lymph node	Anthrax smear (before PME) Bacterial culture
Clostridial enterotoxaemia	Distal ileal content (5ml) Urine Brain	Clostridial toxins Glucose in urine for pulpy kidney disease Histology
Clostridial myositis	Dark dry lesions in muscle	IFAT or anaerobic culture Histology
White muscle disease	Pale, mineralised muscle Liver	Myocardium +/- skeletal muscle for histology Liver selenium level
Acidosis	Rumen content	pH <4 or 5 (rises with time)
Chemical toxins (e.g. lead poisoning)	Liver/kidney	Fresh liver and kidney for biochemical analysis
Hypomagnesaemia or hypocalcaemia	Aqueous or vitreous humour	Calcium and magnesium levels
Pneumonia	Lung +/- trachea	Culture/PCR/histology
Parasitic gastroenteritis	Abomasal and intestinal contents Faeces	Worm count Worm egg count

trauma, for instance, or acute fluke infection.

If the animals are to be collected by a 'fallen stock' company, check that the firm is happy for the animal to be completely dissected. Usually this is not a problem as long as the viscera can be 'bagged' for easy removal.

If a list of possible differential diagnoses has been drawn up after taking the history, it can be useful to contact the veterinary laboratory to ascertain the best samples to take to confirm the diagnosis. Equipment for taking these should be readily to hand whilst the post-mortem is carried out (Table 2).

The examination should be carried out in good light if at all possible, contemporaneous notes should be made and photographs taken of significant findings. It is good idea to get into the habit of doing a systematic post-mortem so that nothing is missed (Table 3) and a check list of the body systems will ensure all areas are examined.

The examination should start with an external examination. The ear tag number should be recorded and the condition of the animal. Any external injuries should be noted. If there are any wounds, the presence of adjacent haemorrhage and swelling will denote whether the injury took place ante- or post-mortem. The eyes and mucous membranes should be checked for signs of congestion, haemorrhage or dehydration. Note the degree of autolysis too – rapid autolysis is more likely in some causes of sudden death, such as clostridial disease and lightning strike (Figure 3).

A sample of aqueous or vitreous humour can be taken for biochemical analysis for calcium, magnesium or urea levels (Edwards et al, 2009). It is beyond the scope of

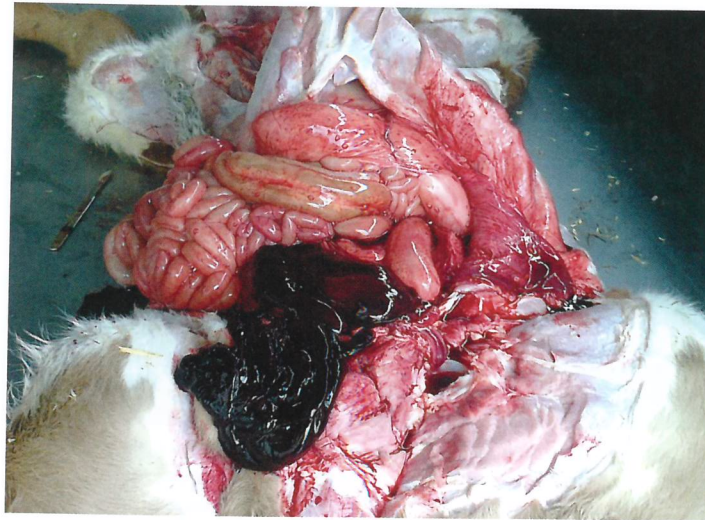


Figure 4. Internal haemorrhage caused by trauma resulted in the death of this young calf.



Figure 5. Acute fascioliasis.

this article to describe in detail a full post-mortem examination – other texts should be consulted for further information (Otter and Davies, 2015).

Gross post-mortem findings can be conclusive in certain types of sudden death (Figures 4 and 5); in other cases samples are required to confirm the diagnosis (Table 4).

Sampling in-contact animals

In cases of suspected nutritional deficiency, samples taken from in-contact animals can sometimes be the fastest way to reach a diagnosis, especially if in-house biochemistry is available. This approach may be useful in cases of hypomagnesaemia, hypocalcaemia, acorn poisoning or nutritional myopathy. However, care must be taken to ensure that the stress of handling does not precipitate more deaths.

Although the task may seem daunting, a logical approach to investigating sudden deaths will lead to a diagnosis in most cases. The history will often give rise to a suspicion of the cause and post-mortem findings and diagnostic tests can confirm this. Preventive actions should be taken, if possible, while

awaiting laboratory results – by removing stock from access to suspect pasture or feed, or providing mineral supplementation, for example. ■

PPD Questions

1. What is the definition of sudden death?
2. List the categories of causes of sudden death used in this article.
3. Name two causes of sudden death which may cause rapid autolysis.
4. Which samples should be taken at post-mortem to test for lead poisoning?

Answers
 1. The sudden and unexpected death of an apparently healthy animal
 2. Trauma/accident, feed-related, infectious, toxin-related
 3. Clostridial disease and lightning strike
 4. Fresh liver and kidney for biochemical tissue analysis

References

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- Otter A and Davies I (2015). Disease features and diagnostic sampling of cattle and sheep postmortem examinations. *In Practice*, 37(6): 293-305.