

# A standardized protocol to investigate sow mortality

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## Summary

This article describes a standardized sow necropsy protocol, including history taking, postmortem techniques, lesion observation, gross organ evaluation, tissue collection and preservation, backfat measurement, and digital imagery.

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**S**ow necropsies can be cumbersome and frustrating, yet very valuable. A consistent, standardized protocol that results in a thorough postmortem examination is essential to creating meaningful data.

A retrospective study of sow mortality revealed the two main causes of death to be

- cardiac failure, and
- torsions or accidents involving abdominal organs.<sup>1</sup>

Christensen reported that among 263 sows submitted to a rendering plant, 36% were euthanized; most of these had locomotor problems.<sup>2</sup> Some postmortem work has also been done to evaluate recumbancy in sows.<sup>3</sup> A mortality target of 2.2% with an interference level of 3% has been suggested for breeding females;<sup>4</sup> however, Straw suggested that more realistic targets are 3% for herds with ≤150 sows, and 5% for herds with >200 sows.<sup>5</sup> In a recent study of 59 herds, the combined death/euthanasia rate was 9%, with 5% from natural deaths and 4% from euthanasia.<sup>6</sup>

Assessing the reasons for death is the first step in understanding the controlling factors that influence sow mortality.<sup>7</sup> In this diagnostic note, a standardized procedure is described for conducting sow necropsies to

elicit comparable data.

## Necessary materials

For the investigation, you'll need:

- reciprocating saw (battery powered),
- knives and sharpeners,
- 36-oz WHIRL-PAK<sup>®</sup> bags,
- latex gloves,
- rainsuits and rubber footwear,
- crowbar and rubber mallet,
- barbiturate euthanasia solution (associated needles and syringes),
- snout snare,
- 10% buffered formalin,
- metric ruler,
- string (for suturing if rendering requires carcass to be intact), and
- digital camera.

## Sow history

The sow's PigCHAMP<sup>®</sup> or PigCarc<sup>™</sup> summary card or other form of history should be obtained from the farm. The following information should be noted and recorded on the standardized necropsy form (Figure 1):

- individual sow identification,
- location,
- parity,
- last significant event (mated/farrowed/weaned),
- clinical history (recumbent, dystocia, off feed, sudden death),
- barn observation and treatments,
- recent reproductive history (farrowing interval, born live, number weaned, lactation length), and
- stage of autolysis.

## Postmortem examination

### External lesion observation

Carefully examine the entire carcass before

beginning the necropsy. All external lesions should be noted on the necropsy form, with special attention to the following:

- digit and hoof lesions,
- swollen joints,
- skin lesions,
- decubital ulcers,
- melena around anus,
- sunken eyes (dehydration),
- external parasites,
- discharges, and
- evidence of trauma.

### Dissection details

Place the carcass in left lateral recumbancy. Abduct the right thoracic limb and incise the axillary region to reflect the limb dorsally. Extend this incision cranially from the ventral midline to the symphysis of the mandible, and extend the incision to the caudal aspect of the skull.

Abduct the right pelvic limb to allow a medial incision over the right coxofemoral joint, exposing the femoral head and the acetabulum. The femoral head and acetabulum should be observed for lesions, including fractures, degenerative changes, osteochondrosis, round ligament rupture, or abnormalities in amount or character of the joint fluid.

Extend the pelvic skin incision cranially on the ventral midline to meet the axillary incision. Reflect the skin on the right side of the ventral midline dorsally to expose the loin. The abdomen should be opened from the brim of the pelvis to the xiphoid process. Make a parallel cut caudal to the last rib to reflect the abdominal musculature. To gain access to the ribs at the spinal-costal joints, excise the external musculature over the dorsal aspect of the ribs, parallel to the spine. Use a reciprocating saw to follow the incision to reflect the rib cage and expose the thoracic cavity. The ribcage is reflected down toward the sternum while cutting the diaphragmatic attachments and then separated by cutting through the costosternal junctions.

To open the cranium, palpate the occipital

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**Figure 1:** Sow mortality diagnostic form

Study ID \_\_\_\_\_

**Farm name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Sow ID:** Farm sow tag \_\_\_\_\_ Other tag \_\_\_\_\_ Tattoo \_\_\_\_\_

**Died/Euthanized** (circle)

**Autolysis:** None/Mild    Moderate    Severe

**Parity:** \_\_\_\_\_

**Location:** \_\_\_\_\_

**Dx comments:** \_\_\_\_\_

**Last significant event and date:**

- Mated \_\_\_\_\_
- Farrowed \_\_\_\_\_
- Weaned \_\_\_\_\_
- Other \_\_\_\_\_

**Suspected cause of death:**

- Down/Musculoskeletal
- Ulcer/GI
- Reproductive
- Respiratory
- Neurologic
- Sudden death
- Other

**Pictures:**

Frame:	View:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Refer to protocol for postmortem examination and tissue collection. ...Note any gross lesions, and sample margin of lesion if noted.

**Tissues for collection:**

- |                                                                                                       |                                                            |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
| <input type="checkbox"/> BF measured at 10th rib _____ (mm)                                           | <input type="checkbox"/> Adrenal gland _____               |
| <input type="checkbox"/> Skin _____                                                                   | <input type="checkbox"/> Kidney _____                      |
| <input type="checkbox"/> Lung _____                                                                   | <input type="checkbox"/> Bladder _____                     |
| <input type="checkbox"/> Left myocardial wall at papillary muscle _____                               | <input type="checkbox"/> Pancreas _____                    |
| <input type="checkbox"/> Heart septum _____                                                           | <input type="checkbox"/> Mesenteric lymph nodes _____      |
| <input type="checkbox"/> Mediastinal lymph nodes _____                                                | <input type="checkbox"/> Ileum _____                       |
| <input type="checkbox"/> Diaphragm (X sect) _____                                                     | <input type="checkbox"/> Longissimus m. (X sect.) _____    |
| <input type="checkbox"/> Liver with bile duct _____                                                   | <input type="checkbox"/> Pectineous m. (X sect.) _____     |
| <input type="checkbox"/> Spleen _____                                                                 | <input type="checkbox"/> Tonsil _____                      |
| <input type="checkbox"/> Uterus _____ Retained pigs? _____                                            | <input type="checkbox"/> Brainstem _____                   |
| <input type="checkbox"/> Ovaries _____                                                                | <input type="checkbox"/> Spiral colon _____                |
| <input type="checkbox"/> Spine                                                                        | <input type="checkbox"/> Other joints and feet in question |
| <input type="checkbox"/> CF joint(s)                                                                  | <input type="checkbox"/> Other _____                       |
| <input type="checkbox"/> Cardia of stomach: <b>Normal / Keratinized / Eroded / Ulcerated</b> (circle) |                                                            |

condyle and cut muscular attachments. Make an incision rostrally from the occipital condyles to the orbits through the skin and underlying musculature. Use a reciprocating saw to make a cut from the occipital bone through the orbit, and continue 2–3 inches beyond. Insert a wedge (crowbar) into the sawcut incision (a hammer may be helpful to achieve proper positioning). Use the wedge to pry off the dorsal cranium, exposing the cerebral hemispheres, brainstem, and cerebellum.

To visualize the tonsil, the tongue, and associated ventral musculature, dissect the tissues free from the mandible. The abdominal, thoracic, and cranial cavities should now be exposed and ready for examination.

### Gross organ examination

Observe each organ for gross abnormalities in size, shape, color, and texture. Note abnormalities on the necropsy form, and collect samples of abnormal tissues. Items for special emphasis are noted below.

#### Brain

Note abnormalities such as hematomas, abscesses, or cloudy meninges. Observe the amount and character of cerebral spinal fluid.

#### Tonsil

Note abnormal texture, necrosis, or abscesses.

#### Thorax

The lungs should be palpated bilaterally to determine tissue consistency and areas of firmness. Note pulmonary adhesions, consolidation, pleuritis, inflammation, abscesses, atelectasis, or other gross pathology. Examine as well the mediastinal lymph nodes.

Open the pericardial sac next to the sternum to evaluate the character and volume of pericardial fluid. Evaluate for the presence of pericarditis and fibrin. Observe the epicardial surface for fibrous attachments or hemorrhage. Incise the heart from base to apex in both ventricular chambers. Evaluate wall thickness, as well as valves and papillary muscles.

#### Abdomen

First observe the entire abdomen and confirm orientation and size of organs. Evaluate

mesenteric, splenic, gastric, or hepatic torsions for degree of rotation if present. Note any adhesions, and the amount and character of any abdominal fluid.

Note the color, orientation, and postmortem change of intestines, as well as the size of mesenteric lymph nodes. Open the various segments of the intestine (duodenum, jejunum, ileum, cecum, spiral colon) to evaluate the contents and mucosal surfaces.

Evaluate the uterus for tone, pregnancy, retained fetuses, or other fluid contents, and open it to observe the mucosa. Note ovarian activity and estrous stage (follicular, luteal, anestrus).

Incise the bladder and note abnormalities in wall thickness, mucosa, and urine character. Follow the ureters to both kidneys, and note the size and any evidence of dilation. Locate adrenal glands at the cranial pole of the kidneys to observe size. Evaluate perirenal fat at this time, since the adrenal glands will be easy to locate if there is little fat present. Observe kidney size, symmetry, and surface. Longitudinally incise the kidneys to evaluate the cut surfaces of cortex, medulla, and renal pelvis.

Observe splenic size, texture, and orientation. Evaluate the color, friability, and size of the liver, as well as associated lymph nodes. The gall bladder should be observed for the presence or absence of bile. Locate and palpate the pancreas. Remove the stomach from the abdomen by incising the esophagus cranial to the liver. Make an incision along the greater curvature to examine the cardia for keratinization, ulceration, erosion, or stricture. Note esophageal thickening and dilation as well.

Palpate the ventral surface of the entire spine to detect abscesses, spondylitis, or signs of injury and trauma.

### Standard tissue collection

Collect a standard set of tissues (Figure 1) in 3 cm × 3 cm (1-inch × 1-inch) pieces from each sow. Immerse tissues in 10% buffered formalin for at least 4 days. The standard ratio is 10 parts formalin to one part tissue,<sup>8</sup> but a ratio of 3–5:1 may be used depending upon amount of tissue and size of the collection bags. After fixation, most of the formalin can be drained prior to shipment to a central location for banking. Leave enough formalin in the bags to keep tissue wet, and ship them to a laboratory. Examine selected cases histologically.

### Backfat measurement

Measure backfat on every sow at the tenth rib, 6 cm (2 1/2 inch) off the midline, and record the measure on the necropsy form.

### Digital imagery

Interesting lesions, obvious gross diagnoses, or normal examples worthy of imagery can be captured using a digital camera. At the end of the visit, all images can be downloaded to a computer, and then transferred to a compact disk to document gross postmortem findings.

### Implications

- A consistent necropsy protocol will result in a thorough postmortem examination, essential for investigating sow mortality. A standard protocol will minimize variation among investigators and examinations.
- It should be simpler to evaluate data collected with a standardized necropsy protocol than a variety of mixed data. Data can be interpreted more meaningfully and the ability to discover trends is enhanced.
- Digital images plus fixed tissue banks offer accurate historic materials should later review be necessary.

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