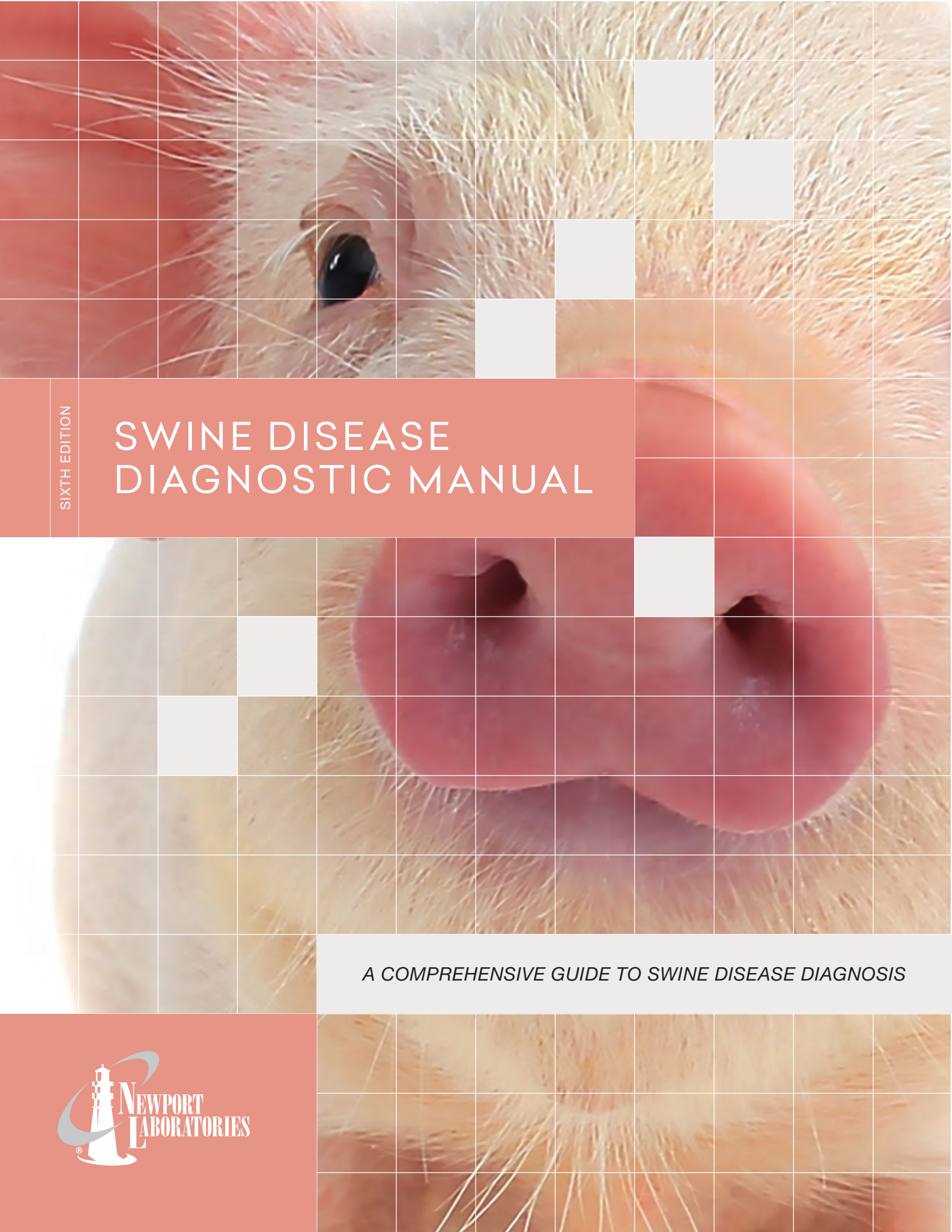

SIXTH EDITION

SWINE DISEASE DIAGNOSTIC MANUAL

A COMPREHENSIVE GUIDE TO SWINE DISEASE DIAGNOSIS

NEWPORT LABORATORIES®

Newport Laboratories is a highly focused, technology-based company dedicated to providing timely, science-based solutions to food-animal disease problems. Our products and services are delivered and supported by a dedicated and experienced sales staff and Veterinary Service team.

800-220-2522 | www.newportlabs.com

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Swine Diagnostic Submission Guide

Disease Suspected	Specimen	Sample Preparation	Laboratory Procedure
Actinobacillus pleuropneumoniae	Lung	Refrigerate	Culture Sensitivity, Serotyping (via PCR)
		10% Formalin	Histopathology
Arthritis	Joint Fluid, Joint Swab, Synovium	Refrigerate	Culture Sensitivity
		10% Formalin	Histopathology
Clostridium perfringens	Duodenum, Jejunum, Ileum, Colon	Refrigerate	Anaerobic Culture Sensitivity, Toxin PCR
		10% Formalin	Histopathology
Clostridioides* (*Clostridium*) *difficile	Duodenum, Jejunum, Ileum, Colon, Fecal Swabs, Colon Content	Refrigerate	Culture, A/B Toxin ELISA, A/B Toxin PCR
***Escherichia coli* (*E. coli*) Colibacillosis Edema Disease**	Duodenum, Jejunum, Ileum, Colon, Brain with Brainstem, Fecal Swabs, Colon Content	Refrigerate	Culture Sensitivity, PCR, Toxin PCR
		10% Formalin	Histopathology
Enteritis (non-specific)	Duodenum, Jejunum, Ileum, Colon, Fecal Swabs, Colon Content	Refrigerate	Culture Sensitivity, Anaerobic Culture/Typing, TGEV PCR, Rotavirus qPCR
		10% Formalin	Histopathology
Erysipelas	Heart, Lymph Node, Liver, Spleen, Synovium, Joint Fluid	Refrigerate	Culture Sensitivity
		10% Formalin	Histopathology
***Glaesserella* (*Haemophilus*) *parasuis* (Glässer's disease – polyserositis)**	Lung, Pleural Fluid, Heart, Pericardial Fluid, Pericardium, Synovium, Joint Fluid	Refrigerate	Culture Sensitivity, qPCR
		10% Formalin	Histopathology, Whole Genome Sequencing
Hemorrhagic Bowel Syndrome (HBS)	Duodenum, Jejunum, Ileum, Colon	Refrigerate	Gross lesions and culture to rule out mimic infections
		10% Formalin	Histopathology
Ileitis (*Lawsonia intracellularis*)	Ileum, Spiral Colon, Cecum, Feces	Refrigerate	PCR
		10% Formalin	Histopathology
Mulberry Heart Disease	Lung, Pericardial Fluid, Heart, Left and Right Ventricles	Refrigerate	Culture to rule out septicemia
		10% Formalin	Histopathology
***Mycoplasma hyorhinis* (Polyarthritis and Polyserositis)**	Lung with Pleura, Pericardium, Pericardial Fluid, Synovium, Joint Fluid	Refrigerate	Culture, Mycoplasma Multiplex PCR
		10% Formalin	Histopathology
***Mycoplasma hyosynoviae* (Polyarthritis)**	Synovium, Joint Fluid	Refrigerate	Mycoplasma Multiplex PCR, Culture
		10% Formalin	Histopathology
***Mycoplasma pneumonia* (*M. hyopneumoniae*)**	Lung	Refrigerate	Culture, Mycoplasma Multiplex PCR
		10% Formalin	Histopathology, PCR
	Serum	Refrigerate	Serology

Swine Diagnostic Submission Guide

Disease Suspected	Specimen	Sample Preparation	Laboratory Procedure
Pasteurella Pneumonia and Rhinitis (*P. multocida*)	Lung, Turbinates If Investigating Rhinitis	10% Formalin	Culture Sensitivity, Serogrouping PCR
		Refrigerate	
Porcine Circovirus Disease (PCV2, PMWS, PDNS)	Lung, Spleen, Liver, Lymph Nodes, Kidney, Ileum, Pancreas, Serum	Refrigerate	Virus Isolation, qPCR
		10% Formalin	Histopathology
Porcine Epidemic Diarrhea (PEDV)	Duodenum, Jejunum, Ileum, Colon, Colon Content or Feces, Fecal Swabs, Serum	Refrigerate	Histopathology, qPCR, VI
		10% Formalin	IHC
Porcine Reproductive & Respiratory Syndrome (PRRS)	Lung	Refrigerate/ Frozen	Virus Isolation, qPCR
		10% Formalin	Histopathology, IHC
	Serum	Refrigerate	Serology, PCR, Virus Isolation, Sequencing
	Blood Swab, Semen	Refrigerate	PCR
Reproductive Diseases/Abortions (Parvo, Lepto, PRRS, etc)	Fetus, Mummies, Stillborns, Weakborns, Serum	Refrigerate	Culture Sensitivity, IgG, PCR, etc.
Rotavirus Enteritis	Duodenum, Jejunum, Ileum, Colon, Colon Content or Feces, Fecal Swabs	Refrigerate	PCR, Virus Isolation Sequencing
		10% Formalin	Histopathology
Salmonella	Duodenum, Jejunum, Ileum, Colon, Liver, Lung, Spleen, Mesenteric Lymph Node, Colon Content or Feces, Fecal Swabs	Refrigerate	Culture Sensitivity, Sequencing to determine serovar
	Duodenum, Jejunum, Ileum, Colon, Liver, Lung	10% Formalin	Histopathology
Streptococcus suis	Brain Including Cerebellum and Brain Stem, Lung, Liver, Spleen, Synovium	Refrigerate	Culture Sensitivity, Whole Genome Sequencing
		10% Formalin	Histopathology
Swine Dysentery (*Brachyspira hyodysenteriae*)	Feces, Cecum, Spiral Colon	Refigerate	Culture Sensitivity
		10% Formalin	Histopathology
Influenza A Virus – Swine (IAV-S)	Trachea, Lung, Nasal Swabs (in Viral Transport Media)	Refrigerate	Virus Isolation, qPCR, Sequencing, HT-SN™
	Lung	10% Formalin	Histopathology (IHC)
	Serum	Refrigerate	Serology (HI/ELISA)
Transmissible Gastroenteritis (TGEV)	Duodenum, Jejunum, Ileum, Colon, Colon Content or Feces, Fecal Swabs, Serum	Refrigerate	Histopathology, qPCR, VI
		10% Formalin	IHC
Gastric Ulcers	Stomach	Refrigerate	Gross Lesions

For bacterial culture, we recommend swabs with transport media to prevent desiccation.
For virus isolation, swabs should be placed into viral transport media; see Sample Submission Guidelines on next page or call the lab for information.

FREE Diagnostic Submission Kits available.

Sample Submission Guidelines

Laboratory test results are directly affected by animal selection, necropsy technique, specimen selection and handling, how well-preserved samples are, and speed of shipment to the laboratory.

The following sections provide an overview and best practices to consider. Newport Laboratories provides diagnostic services in support of the development of custom-made vaccines. Initial, exploratory diagnostic investigations involving tissues and necropsy should be conducted at university laboratories. Isolates can then be forwarded to Newport Laboratories, or specific follow-up diagnostic samples in support of an ongoing investigation can be submitted directly to Newport.

Contact Newport Laboratories at 800-220-2522 or email us at newportlaboratories@vaxxinova.com if you have any questions regarding sample collection or the diagnostic process.

PRE-COLLECTION CONSIDERATIONS

Timing

Populations of pathogens change over time; therefore, diagnostic monitoring should be performed on an ongoing basis. When selecting animals for laboratory analysis, they should be free from antibiotic therapy and in an early or acute disease stage. Pigs that are displaying typical clinical signs and immediately necropsied will yield the most reliable diagnostic data.

Quantity and Volume

Tissue samples should be collected from at least two or three humanely euthanized pigs, ideally in the early stages of disease. Oral fluids, processing fluids, nasal swabs and serum should be collected from appropriate numbers of animals or litters based on the diagnostic test(s) being requested. For more information about specific sample types and appropriate sampling protocols, please contact the Newport Laboratories Customer Service team or continue reading.

Histories

A meaningful history of the disease outbreak and a tentative diagnosis, based upon clinical evaluation and necropsy findings, should be included. This information can help laboratories determine the most appropriate diagnostic tests for your case. It can also help guide follow-up testing that may be required, based on preliminary results.

Sample Submission Guidelines

Method and System of Collection

Selected specimens should be collected using aseptic technique whenever possible to reduce the risk of contamination. Tissue specimens should also be kept separate to avoid cross-contamination. Diagnostic kits are available from Newport Laboratories. Contact the Newport Laboratories Customer Service team for assistance.

Use the appropriate collection method and transport system for the desired specimen type. Details by type are provided in the Collection Considerations section on page 8.

Temperature

It is important that the samples arrive at the lab before they degrade. To help extend viability, as soon as a sample is collected, keep it refrigerated or on ice until and during shipment. Be sure to include enough cold packs for delivery time. For assistance determining this, contact the Newport Laboratories Customer Service team.

Specimen Identification

Clearly identify any sample you wish to submit. All samples should include the following information:

- **Farm ID number**, including site and building, when applicable
- **Animal ID number**
- **Source of material** (i.e., oral fluid, nasal swab, joint fluid, tracheal wash, tissue type, etc.)

Fixative

The selected tissues should be fixed in 10 percent neutral buffered formalin. Use 10 times the volume of the tissues being fixed to ensure good perfusion of the sample and to maintain the tissue architecture. After 24 hours of fixation, excess formalin can be safely poured off, and a smaller formalin volume can be then be used for shipping.

NEUTRAL BUFFERED FORMALIN FORMULAS

37–40% formaldehyde.....100 mL

Distilled water.....900 mL

Sodium phosphate, monobasic monohydrate.....4.0 g

Sodium phosphate, dibasic anhydrous.....6.5 g

Sample Submission Guidelines

COLLECTION CONSIDERATIONS

Fresh Tissues

TARGET:
Collect sample from visible lesions with adjacent normal tissue.

SIZE:
Approximately 2- by 4-inch samples.

TRANSPORT SYSTEM:
Double-bag in Whirl-Pak® bags.

CONSIDERATIONS:

Do not mix swabs, intestines or brains with other tissues in a single bag. Remember to clearly label each bag.

Swabs

Aerobic Culture

TRANSPORT SYSTEM:
Commercial swab.

MEDIA TYPE:
Stuart or Amies recommended to prevent desiccation.

MEDIA VOLUME:
Minimum 1 mL.

CONSIDERATIONS:
Remember to clearly label each swab.

Anaerobic Culture

TRANSPORT SYSTEM:
Port-A-Cul™ (BBL™) or other anaerobic transport system. (The Port-A-Cul tube can be used for anaerobic, facultative and aerobic bacteria.)

CONSIDERATIONS:

For abscesses or exudates, use a capped syringe with the needle removed or a tube with a snug cap.

Nasal Swabs

Bacterial Suspect

TARGET:
Nasal cavity.

TRANSPORT SYSTEM:
Stuart or Amies.

CONSIDERATIONS:

Clean the external nares and internal nostrils with a moist towel to remove common contaminants. Insert the swab into the nasal cavity and rotate. Once sample is collected, return the swab to the accompanying sterile plastic sheath. Crush the ampule at the base of the sheath to release the transport medium.

For bacterial isolation, use bacterial media and avoid using Mycoplasma or viral media, which contain antimicrobials that may inhibit growth of the desired pathogen.

Sample Submission Guidelines

Viral Suspect

TARGET:
Nasal cavity.

TRANSPORT SYSTEM:
Universal Viral Transport Kit (Becton Dickinson #220528) or equivalent.

CONSIDERATIONS:

Prepare the nostrils and sample as described above in the Bacterial Suspect section.

For viral isolation, use Mycoplasma or viral media and avoid using bacterial media. Use of incorrect swab and media may jeopardize the ability to detect or culture the pathogen of interest.

Oral Fluids

Oral fluids can be collected from pens of pigs by hanging a length of clean cotton rope in a way that allows pigs to chew on it, but without contacting areas of excessive feces or other debris. After pigs have sufficiently saturated the rope, the fluid can be squeezed from the rope into a plastic bag and transferred to a sterile screw-/snap-top tube.

Processing Fluids

Processing fluids are collected during castration and tail docking. Tissue should be placed into a clean container lined with a plastic bag and allowed to sit overnight in a refrigerator. The fluid that has collected in the bottom of the bag should then be transferred to a sterile screw-/snap-top tube.

Histopathology

TARGET:
Samples should be taken from multiple sites or types of lesions and should include both normal and diseased tissue, as well as the line of demarcation.

SIZE:
No more than 1 inch thick. Smaller sizes of tissues result in a more rapid and complete penetration of the fixative.

TRANSPORT SYSTEM:
Doubled Whirl-Pak® and 10 percent formalin solution.

CONSIDERATIONS:

Selected tissues should be cut with a sharp knife or scalpel, since the squeezing action of scissors crushes and tears tissues.

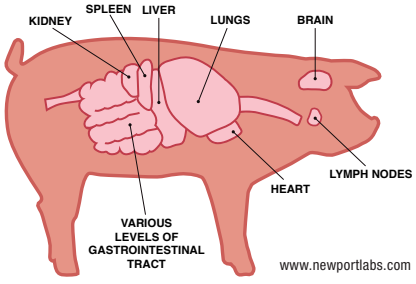
Autolysis and freezing will make samples unsuitable for histopathological evaluation.

For information about how to fix samples and prepare the fixative solution for histopathological analysis, see the Neutral Buffered Formalin Formulas on page 7.

If hollow organs (gut or uterus) retain significant amounts of content, they should be gently flushed with 10 percent formalin — without disturbing the mucosal lining — before being placed in the formalin bag.

CAUTION: Be sure to take proper precautions when handling and disposing of formalin.

Check the recommended samples in the Swine Diagnostic Submission Guide on pages 6–7. If the cause of death is unknown or the clinical syndrome is vague, then submit samples exhibiting gross lesions and sections from all of the following:



Sample Submission Guide

Blood Samples

SIZE:
1–3 mL non-hemolyzed blood, depending on the number of tests.

TRANSPORT SYSTEM:
Sterile tubes (serum separator).

CONSIDERATIONS:

Fill vacutainer tubes three-fourths of the way full, and allow to stand at room temperature for an hour to permit a solid clot to form and retract. Pipette the serum into sterile tubes with snap caps. (3-mL plastic tubes with snap caps, Falcon #2054, are recommended.)

Make sure caps are securely closed to avoid leaking during transit.

Use permanent markers and underline the ID numbers to indicate orientation (e.g., 16 vs. 91).

Do not freeze whole blood or samples with clots.

Contaminated or toxic samples cannot be used in virus isolation tests.

POST-COLLECTION AND SHIPPING CONSIDERATIONS

Diagnostic Shipping Kits and Submission

Newport Labs provides free diagnostic shipping kits for sample submission, which include all necessary forms and shipping materials.

When filling out diagnostic submission forms, remember these key considerations:

- Clearly specify the test(s) being requested.
- Use one form per client site, and identify the sample tubes by different barns or age groups, depending on the test(s) being requested.
- When sending paired sera, distinguish the acute samples from the convalescent samples on the tube and on the form.

To request shipping kits or submission forms email us at newportlaboratories@vaxxinova.com or call us at 800-220-2522.

Sample Submission Guide

Packing Specimens

To avoid leaking in transit, double-bag all samples. Whirl-Pak® bags or equivalent are recommended.

Wrap sample bags and two to four ice packs in absorbent paper (e.g., newspaper).

Place the package into a Styrofoam container.

Completed submission forms should be inserted into a separate bag in case of leakage and clearly attached to the matching specimens.

This is especially important if your package contains specimens from multiple clients and/or sites.

Avoid mixing intestinal samples with other tissues.

If you need more information about shipping samples to Newport Labs, please call us at 800-220-2522.

Mailing

Diagnostic samples should be submitted by the fastest means possible to avoid deterioration of specimens. Next-day or overnight delivery is preferred.

We recommend these reliable services:

- UPS
- FedEx
- Spee-Dee
- U.S. Postal Service as last resort (above services preferred over USPS)

Hours and Contact Information

Newport Labs is open for service from 8:00 a.m. to 5:00 p.m. (CST) Monday through Friday, with the exception of holidays.

Please email us at newportlaboratories@vaxxinova.com or call 800-220-2522 to request a diagnostic shipping kit or submission forms. Visit us online at newportlabs.com for additional infromation.

Our mailing address for diagnostic sample submission and other general inquiries is listed below.

Diagnostic Shipping Address

Newport Laboratories
1524 Prairie Drive
Worthington, MN 56187

Isolate Selection Considerations

Certain pathogen strains are more likely to be associated with disease. Newport Laboratories utilizes the best technology and science, including Whole Genome Sequencing, published literature and collaborative efforts with universities, to select the most relevant isolates for custom-made vaccine creation.

Although the effects in swine are not fully understood, caution should be used when multiple Gram-negative bacteria including, but not limited to, *Escherichia coli, Actinobacillus suis* and/or *Glaesserella parasuis* isolates, are used. Various endotoxins may be concentrated during the manufacturing process, resulting in undesired reactions in sows, pigs or within the bottled vaccine.

General Adjuvant and Manufacturing Considerations

Amplivac™ (formerly TS6)

This is the best all-around adjuvant, particularly for viruses, *Strep. suis* and Mycoplasma custom-made vaccines. Previous Newport Laboratories challenge studies support this. Amplivac can cause mild-to-moderate local injection-site reactions. To minimize the risk of not achieving minimum antigen concentrations and possibly reactions within animals and the bottle of vaccine, a maximum of four isolates should be included in a custom-made vaccine with Amplivac. If more isolates are needed, consult with Newport Laboratories Customer Service.

Trigen™

Trigen is another effective Newport Laboratories adjuvant that is used in specific situations when certain Gram-negative bacteria (such as *Actinobacillus suis*) need to be included in a custom-made vaccine.

Regulatory Considerations

Autogenous biologics (custom-made vaccines) are regulated by USDA-APHIS-CVM in Title 9 CFR 113.113 “Autogenous Biologics,” and more recently, in late 2020, VSM 800.69 “Guidelines for Autogenous Biologics.” These regulations establish that custom-made vaccines are USDA-licensed and manufactured in a USDA-inspected facility according to USDA production, safety and purity guidelines.

Isolate Expirations

Fifteen months from date of first harvest in manufacturing. An isolate can be extended for a total of 60 months from date of isolation for bacterial isolates and 24 months for viral isolates.

Product Expirations

Eighteen months from the date of inactivation in the United States and 12 months in Canada.

Nonadjacent Herd Use

Custom-made vaccines are restricted for use in the herd of origin of the pathogenic isolates.

A nonadjacent form can be developed with your herd veterinarian and approved by a state veterinarian. That form will require the following information:

- List of herds where the vaccine will be used.
- Evidence of epidemiological link between herds.

The Newport Laboratories Customer Service team can help navigate this process.

Canadian Customers

There are established relationships and permits with most Canadian Veterinary Diagnostic Laboratories. Additional paperwork will be needed to satisfy Canadian Food Inspection Agency (CFIA) requirements, which can add some time to the process of developing and shipping a vaccine. The Newport Laboratories Customer Service team is experienced in this process and can help with the communication between the different groups.

Diagnostics

Overall, timelines vary by the diagnostic tests that are requested. In most circumstances, diagnostic work is required prior to beginning vaccine production, which is critical for helping understand which isolates are most appropriate for vaccine development. If this is the first time an isolate is being considered for vaccine production, these diagnostic timeline estimates are in addition to production timelines. Furthermore, consider any other diagnostic timelines from University Veterinary Diagnostic Laboratories that might be part of an initial disease workup. In general, Newport Laboratories' diagnostic capabilities are primarily aimed at providing specific support of vaccine manufacturing, rather than complete diagnostic evaluations.

DIAGNOSTICS

Once samples arrive at Newport Laboratories

Bacteriology

Culture and identification:
2–3 working days

Antibiotic sensitivity:
1–2 working days after bacterial identification

Mycoplasma culture:
7–21 working days

Virus Isolation

IAV-S:
6–10 weeks
High Throughput Serum Neutralization (HTSN):
5 working days after successful virus isolation

PRRSV:
6–8 weeks

Rotavirus A:
8–12 weeks

Whole Genome Sequencing

Culture and identification:
2–3 working days

***S. suis* and *G. parasuis*:**
1–2 weeks
Results generated weekly

Mycoplasma culture:
7–21 working days

Bacterial and Viral PCR Antigen Detection

1–2 days

Clostridium perfringens,* *Pasteurella multocida*, *E. coli* fimbriae,* *Actinobacillus pleuropnuemoniae*, *Glaesserella parasuis*

PCR Typing on Bacterial and Viral Isolates

1–2 days
Samples are batched for efficacy

PRRS, IAV-S, subtype

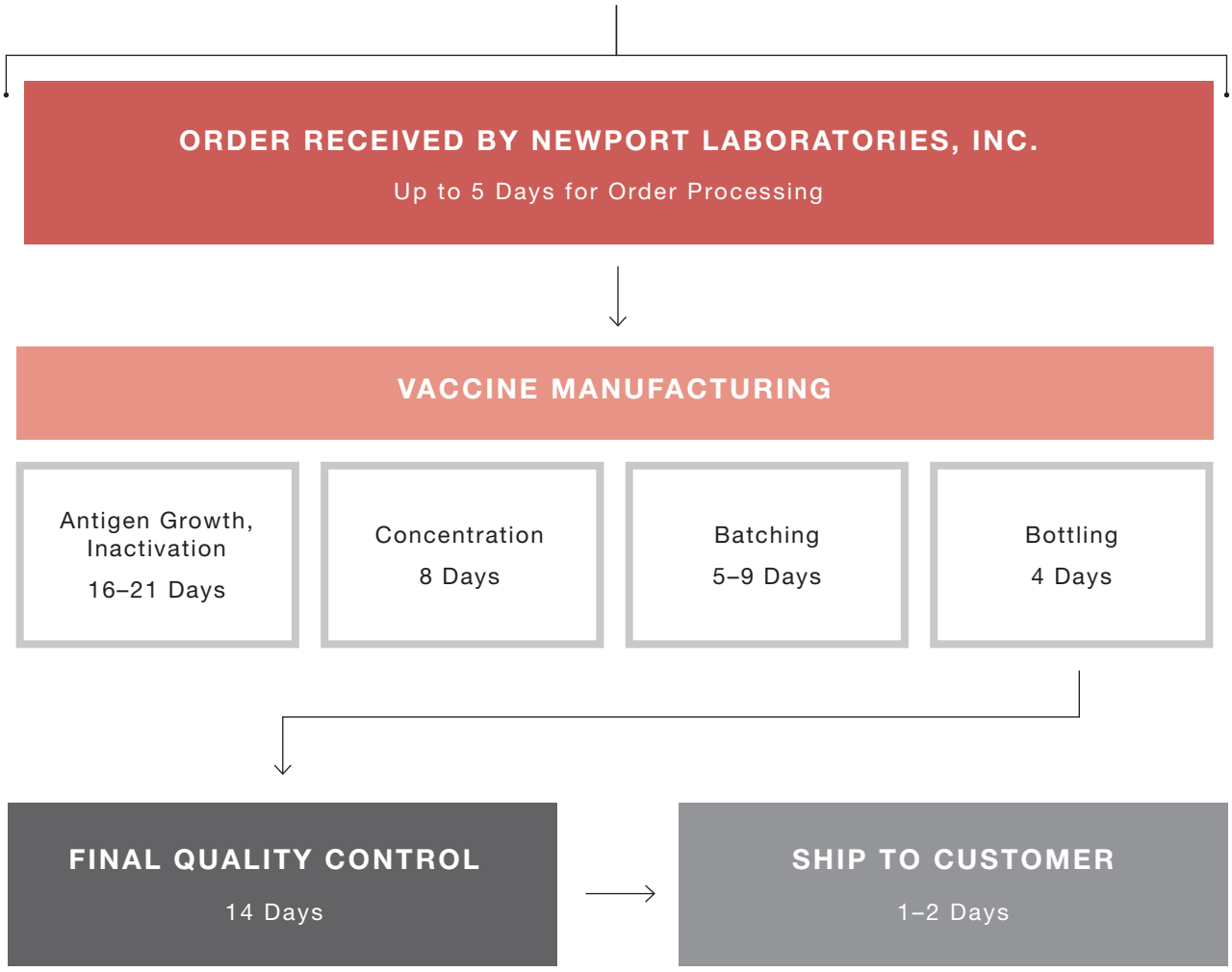
**Anticipated these diagnostics will move into whole genome sequencing in the future.*

Diagnostics

Timelines are broken down to help you understand each step of the process. These timelines start after all diagnostics are complete and specific isolates have been selected for vaccine production. If at any point during the manufacturing process you would like to discuss your vaccine, please contact Newport Laboratories Customer Service.

PRODUCTION

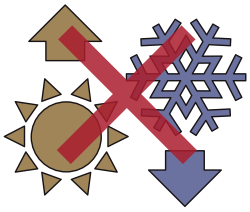
Once isolates arrive at Newport Laboratories



Production time varies according to the organism's growth rate, but bacterial antigens can generally be produced in 6–8 weeks, Mycoplasma antigens in 8–10 weeks, and viral antigens in 10–12 weeks.

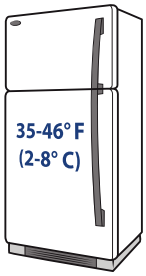
Vaccine Handling

Proper vaccine handling techniques should always be observed with custom-made vaccines. The following best practices are also available in the Newport Laboratories Vaccine Handling Barn Poster, which can be ordered through Newport Laboratories Customer Service and used to help educate barn staff.



Avoid temperature fluctuations during transport and use.

Evite las fluctuaciones de temperatura durante el transporte y el uso.

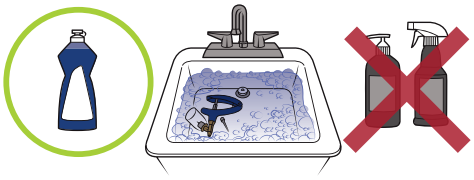


Store in stable, refrigerated conditions at 35–46° F (2–8° C), and minimize the amount of time vaccine bottles spend out of refrigeration.

Almacene el producto en condiciones estables y refrigerado a 35–46° F (2–8° C) y minimice la cantidad de tiempo que pasan los frascos de vacunas fuera de refrigeración.

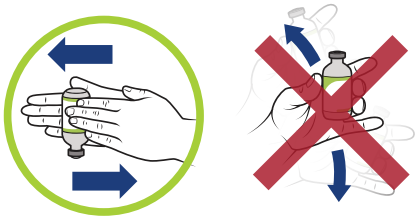
Always wash your hands prior to handling vaccine bottles, preparing syringes, changing out needles and administering vaccines.

Siempre lávese las manos antes de manipular los frascos de vacunas, preparar jeringas, cambiar agujas y administrar vacunas.



Use sterile needles and syringes that have been cleaned using mild detergent and hot water. Do not clean with disinfectants or antibacterial soap.

Use agujas estériles y jeringas que se hayan limpiado con detergente suave y agua caliente. No limpie con desinfectantes o jabones antibacterianos.

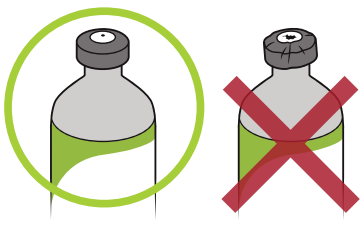


Mix bottles by gently rolling and inverting. Do not shake.

Mezcle el contenido de las botellas girándolas e invirtiéndolas suavemente. No las agite.

Use a fresh needle every time you enter or re-enter a bottle.

Use una aguja nueva cada vez que perfore o vuelva a perforar una botella.

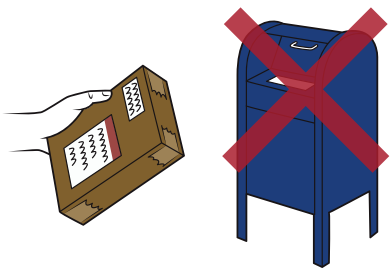


Ensure bottle tops remain clean and undamaged throughout the entire vaccination process.

Asegúrese de que la tapa de la botella permanezca limpia y sin daños durante todo el proceso de vacunación.

Order bottle sizes that minimize bottles being used for multiple days.

Pida botellas del tamaño que minimice la cantidad de botellas que serán usadas durante varios días.



Product returns (especially opened bottles) are not permitted at Newport Laboratories' licensed facility.

No se permiten devoluciones (especialmente de botellas abiertas) en las instalaciones autorizadas de Newport Laboratories.

Vaccine Protocol Considerations

When using Newport Laboratories' custom-made vaccines, there are general vaccination protocol recommendations to consider similar to commercial vaccines. Please contact Newport Laboratories Customer Service to discuss the specifics of your situation, and along with a herd veterinarian, develop your specific plan.

Sows and Gilts

Goal is to maximize maternal-antibody production.

PRE-FARROW
Two doses, three weeks apart, with second dose at least two weeks pre-farrow.

WHOLE-HERD MASS VACCINATION
Two doses, three to four weeks apart.

Pigs

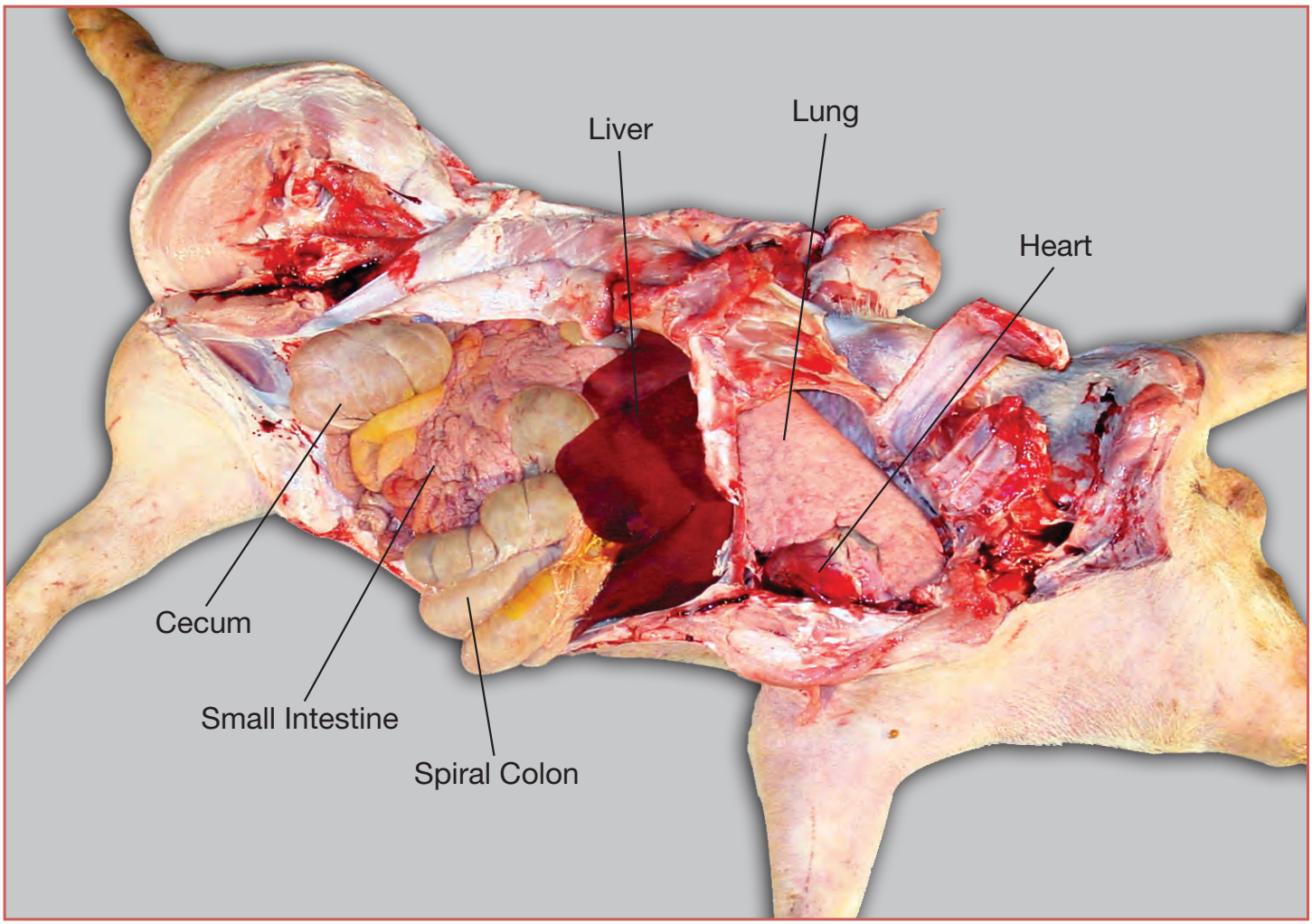
Goal is to maximize individual immunity before maternal-antibody decay.

Two doses prior to weaning, at least 10–14 days apart.

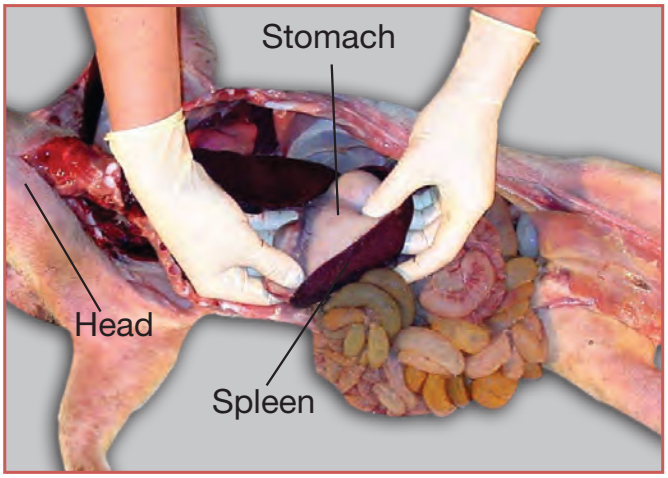
The severity of clinical presentation should be considered when designing the vaccination protocol.

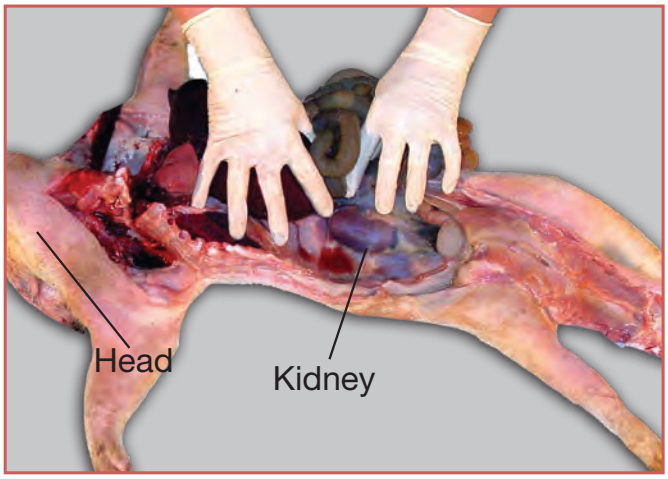
A WHOLE-HERD APPROACH, which includes vaccination of sows and gilts, could be part of an effective control strategy in severe clinical cases.

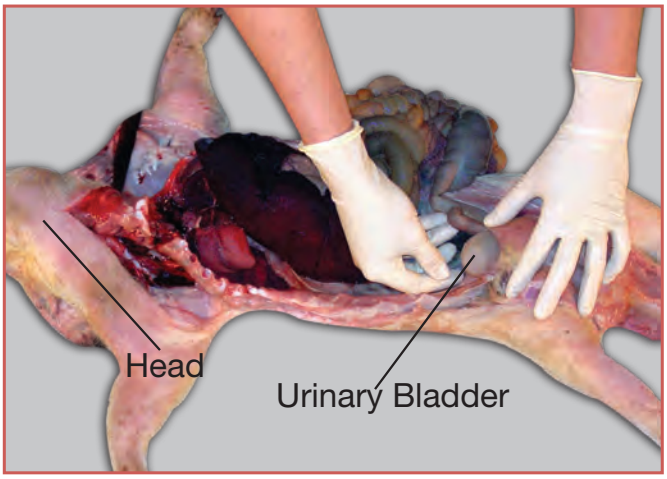
Major Pig Organs



Major Pig Organs

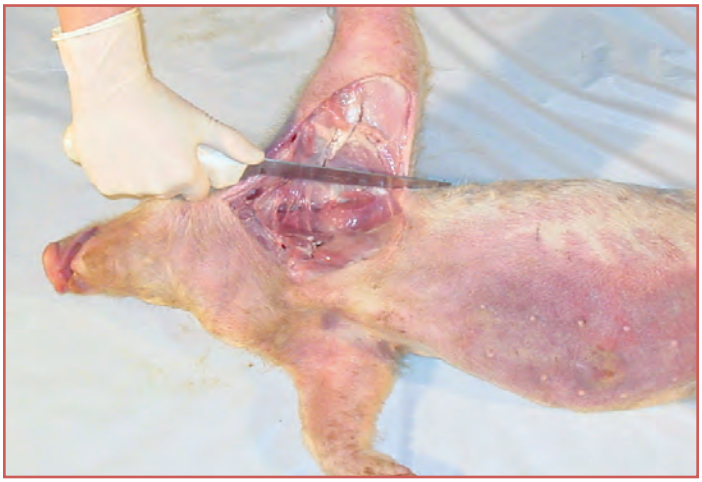




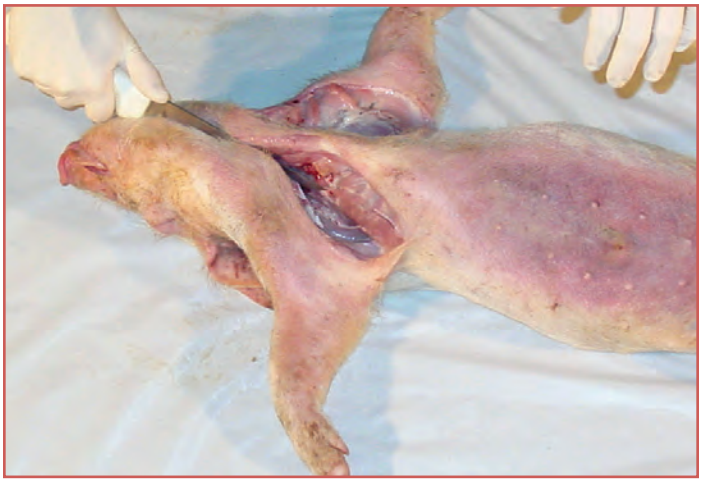


Nursery Pig
Necropsy Instructions

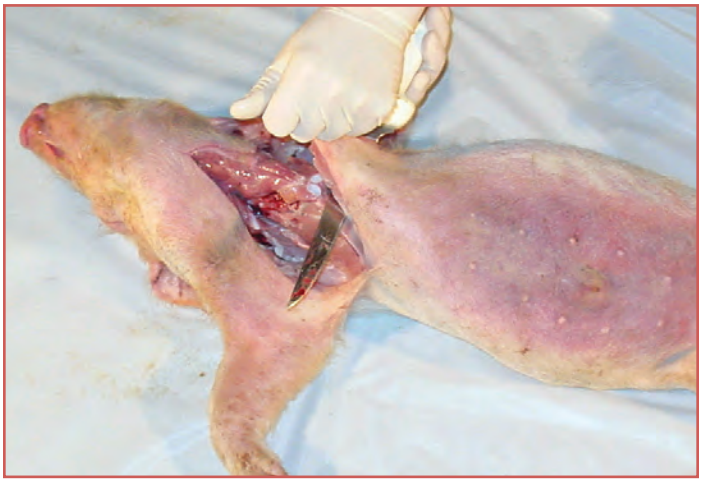
Important: Start with a sharp knife.



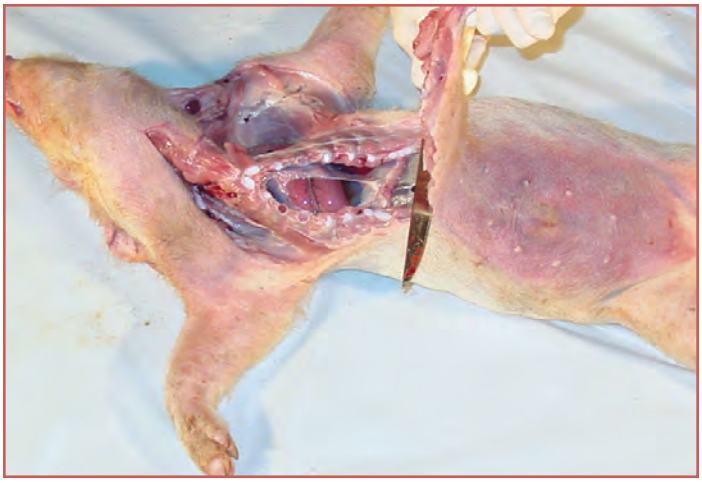
Cut through the axilla to partially separate the front limb from the rib cage. Repeat for other side.



After cutting through the axillae, the pig will lie upright on its back.



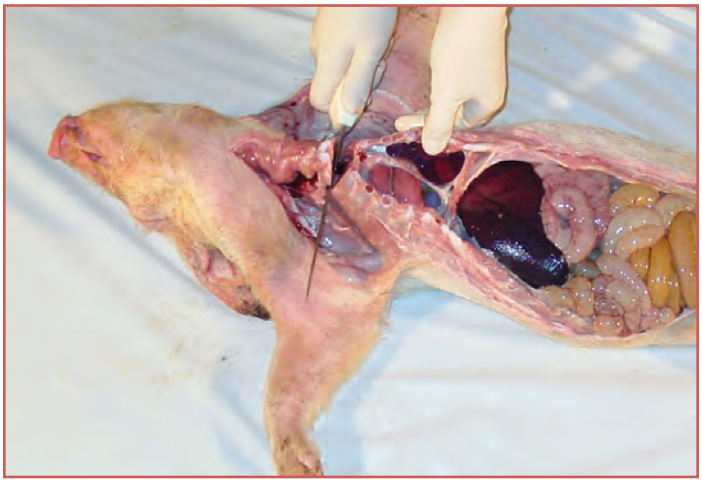
Hook the knife under the cranial sternum. Cut through the cartilage of all the ribs on both sides.



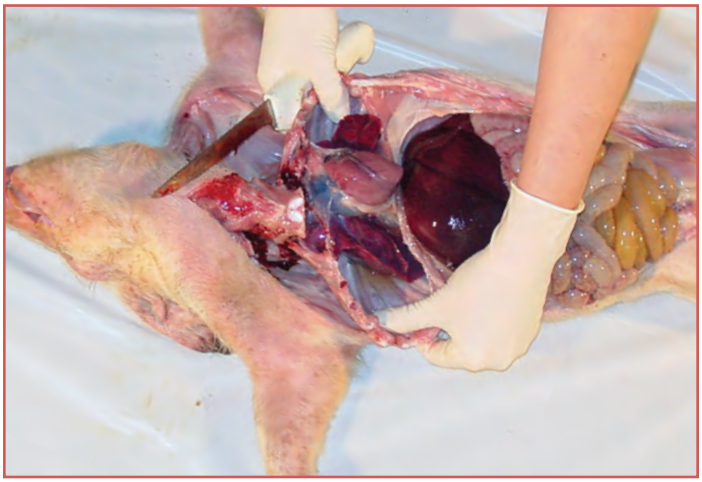
Continue this cut to remove the skin with sternum, and the ventral abdominal wall (belly) of the pig.

Most organs are now visible.

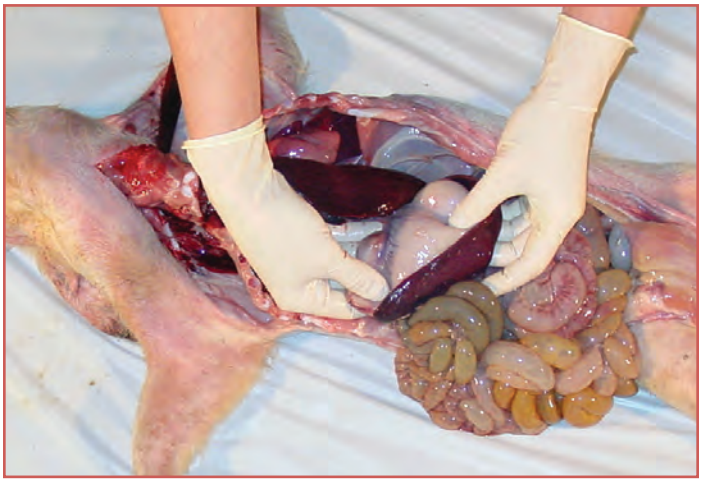
Nursery Pig
Necropsy Instructions



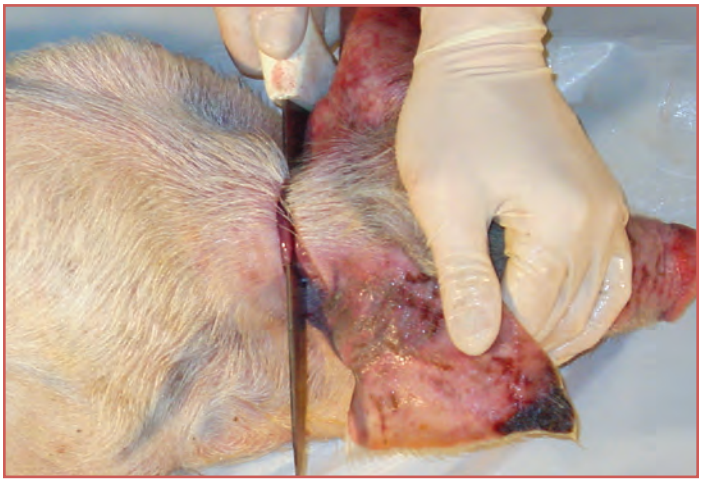
Cut between the ribs below the collarbone.



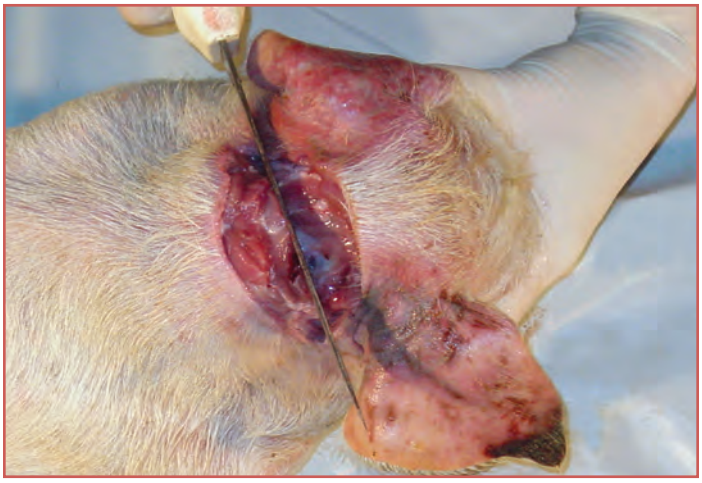
Spread and crack the ribs open.



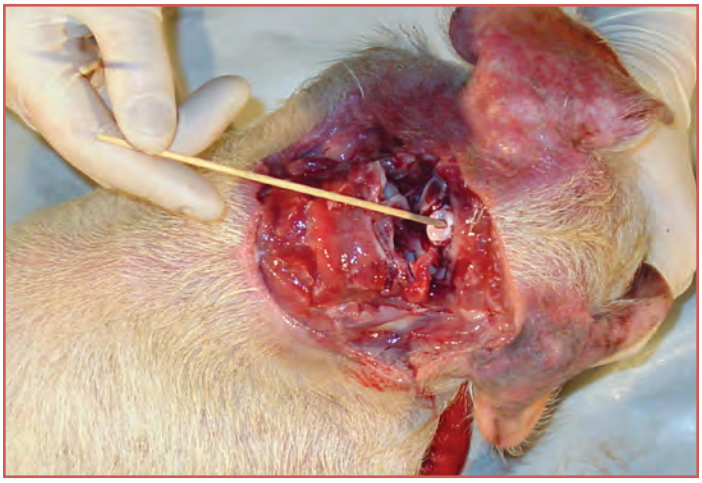
Organs are easily examined.



Brain Swabs: Cut through the skin and muscle behind the ears at the base of the skull.

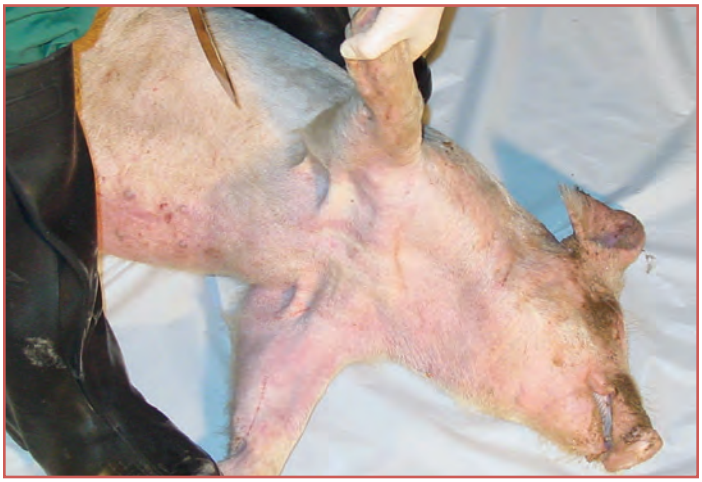


Flex the nose toward the floor and the ears down to open the space between the top vertebra and the skull. This will allow room to cut between them.

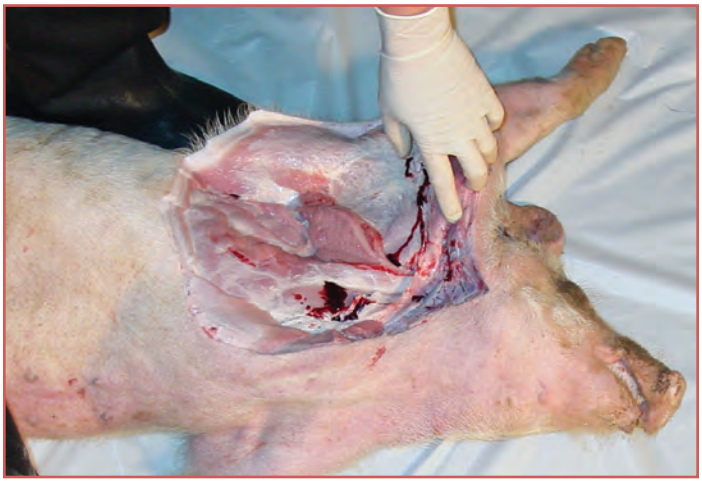


Place a swab on the exposed spinal cord toward the brain. This is an excellent way to test for strep.

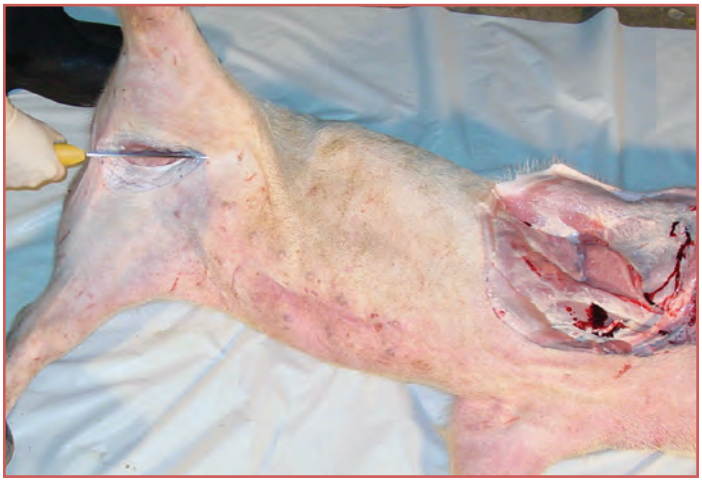
Grower-Finisher
Necropsy Instructions



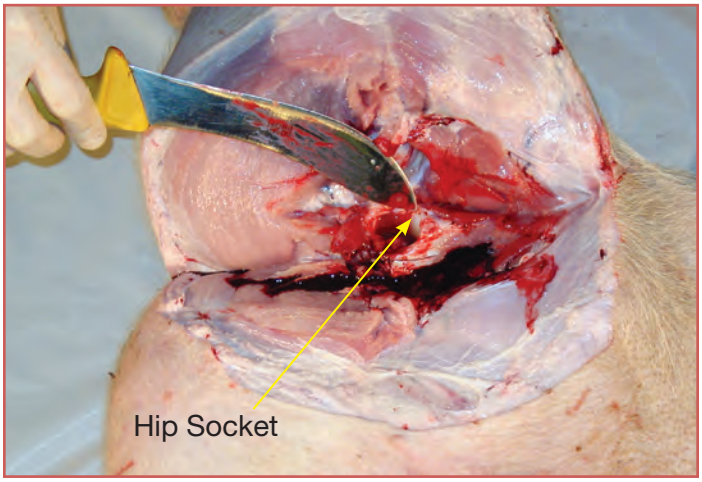
With the pig on its side, hold the lower front limb down with your foot while pulling up on the upper front limb.



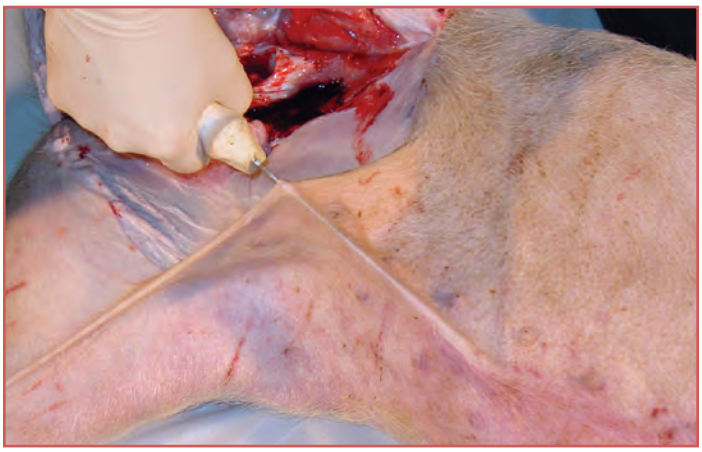
Use the knife to cut through the axilla (armpit) to separate the leg from the rib cage.



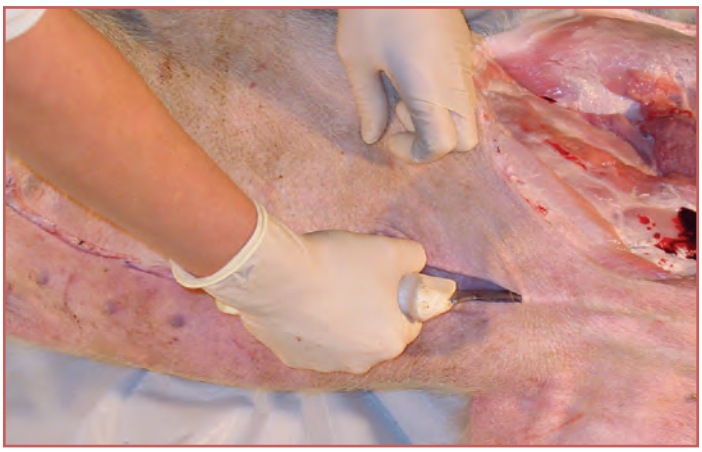
The upper hind limb is cut and laid back likewise.



As you push the hind limb back, up and over the hip by cutting muscle in the area, the hip socket will become exposed. Cut through the socket and continue pushing the limb straight back over the hip.

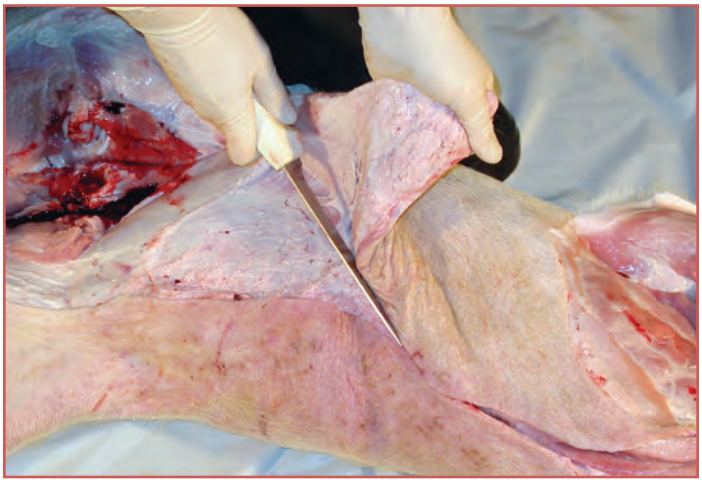


Cut between the skin and body wall, beginning at the pelvis, along the midline all the way to the neck.

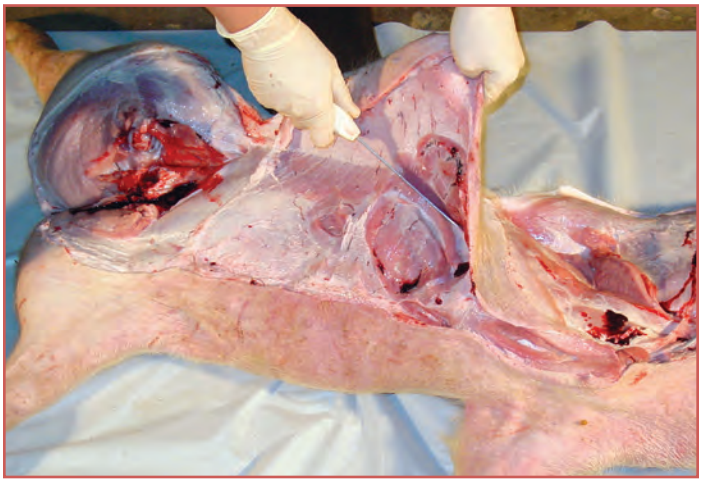


Continue the cut along the ventral midline toward the neck.

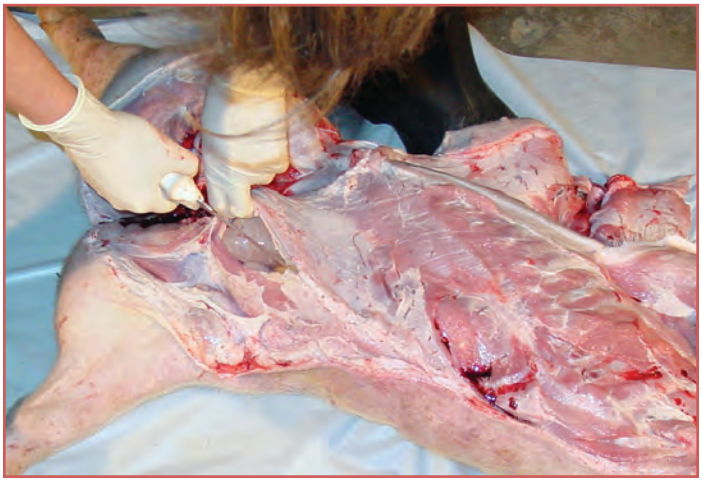
Grower-Finisher
Necropsy Instructions



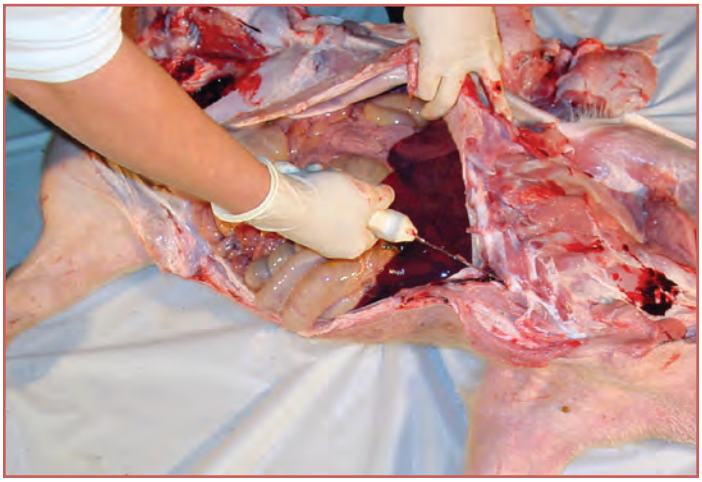
Following the cut just made, dissect the skin away from the body wall, reflecting it over the back.



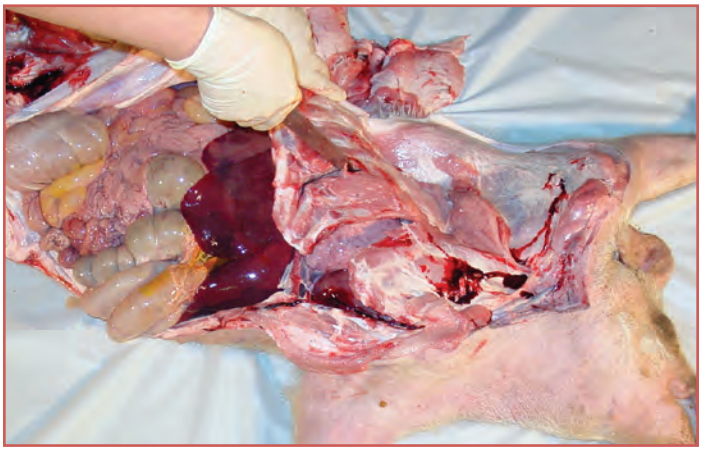
Continuation of previous step. Note that abdominal wall and back muscles are being exposed, but abdomen is not open.



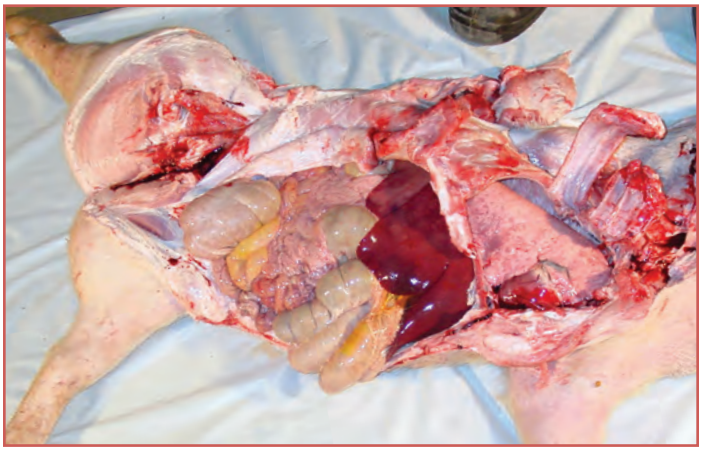
Carefully open the abdomen wall without cutting into intestines or urinary bladder beginning near the pelvic floor and working toward the head along the midline. Reflect abdominal wall over the back.



Puncture the diaphragm near caudal sternum. Cut through cartilage of the sternum all the way to neck.



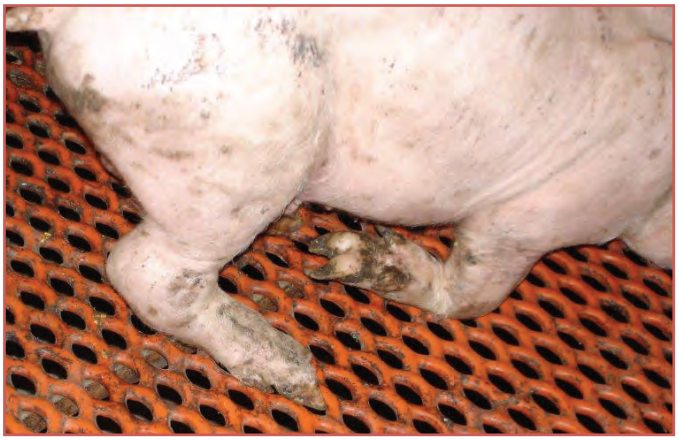
Cut muscles between ribs in pairs; break ribs by pushing one or two at once over the back.



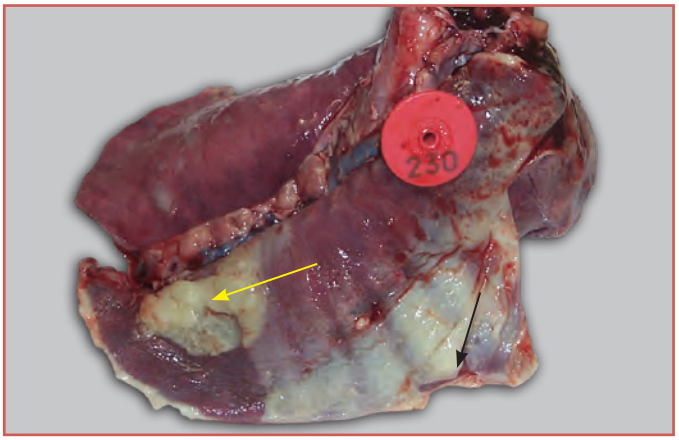
Organs are now exposed for examination.

Glässer's Disease

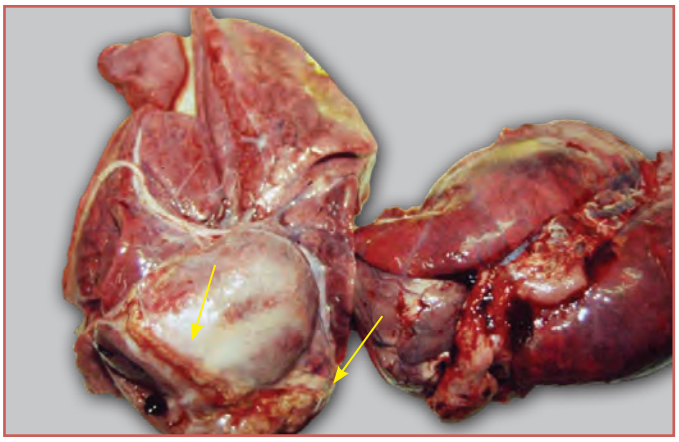
Glaesserella (Haemophilus) parasuis



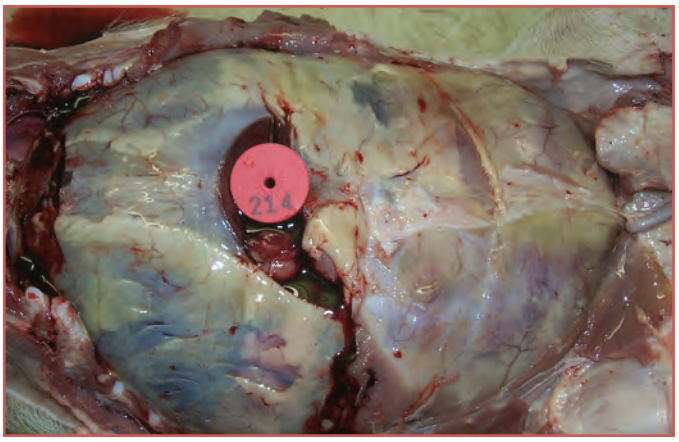
Lame pig



Polyserositis – fibrin-covered lungs



Fibrin on heart



Polyserositis – fibrin-covered abdominal organs

HPS

Tissues to Submit

- Synovium
- Joint Fluid
- Meninges
- Lung with Pleura
- Exudate
- Heart with Pericardium

Diagnostic Tests

- Culture Sensitivity
- Quantitative PCR
- Histopathology
- Whole Genome Sequencing

Clinical Signs and History

- Sudden death.
- A temperature of 104° – 107° F develops, and there is anorexia, depression and occasionally mild rhinitis and dyspnea with coughing.
- Some pigs become lame with painful, warm, swollen joints.
- Chronic arthritis and occasionally meningitis and convulsions may develop.

Stages of Production

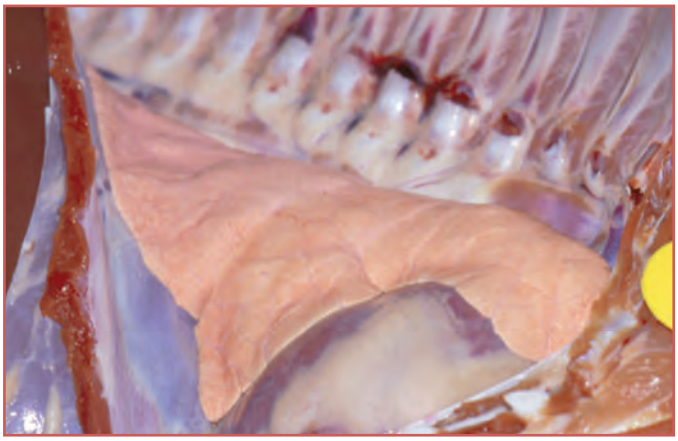
- Nursery
- Grow-Finish

Diagnosis

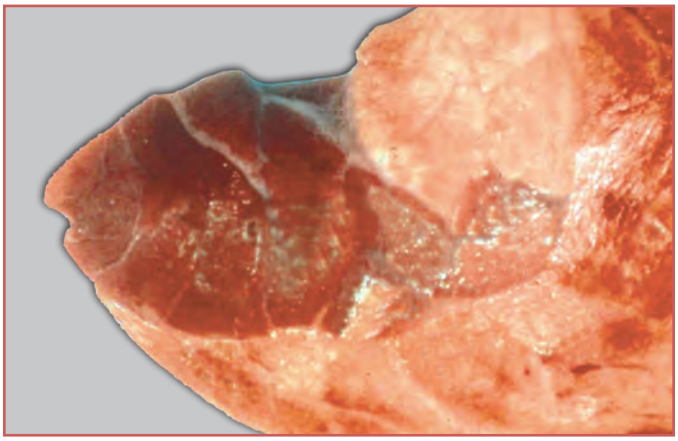
- Based on history, clinical signs and necropsy. Confirmed by culture of the organism from joint fluids, involved tissues, or CSF.
- Polyserositis, polyarthritis and meningitis.

Mycoplasma Pneumonia

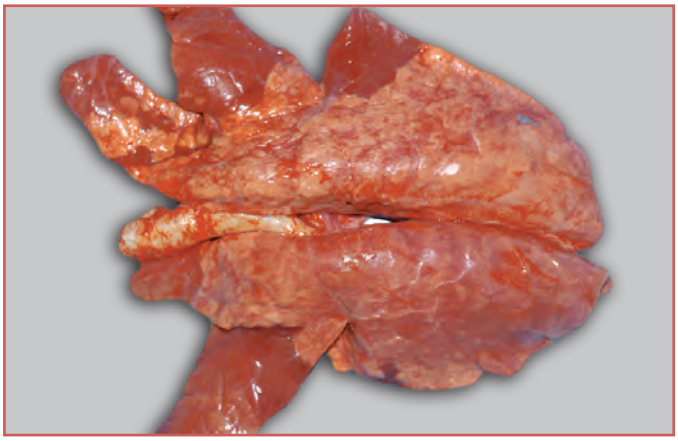
Mycoplasma hyopneumoniae



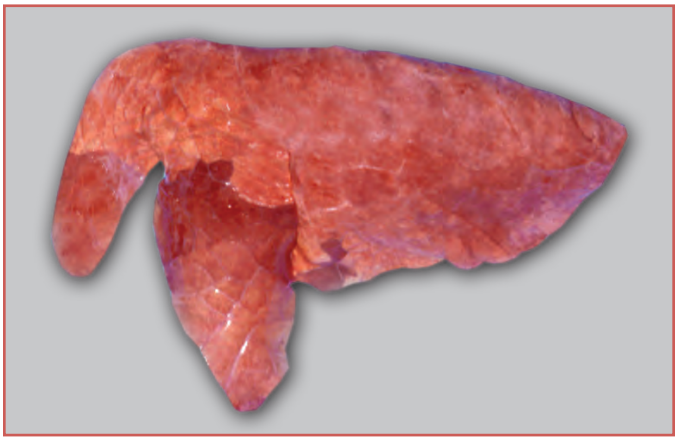
Normal Lung



Purple-tan consolidated lung without pleuritis.



Purple-tan consolidated lung without pleuritis. Note cranioventral involvement.



Purple-tan consolidated lung without pleuritis. Note cranioventral involvement.

Clinical Signs and History

- Coughing is the most common sign and is most obvious when pigs are roused.
- Sporadically, individual pigs or groups develop severe pneumonia.
- Often accompanied with secondary *Pasteurella multocida* or other bacterial infections.

Stages of Production

- Nursery
- Grow-Finish

Diagnosis

- Affected lung tissue is gray or purple, most commonly in the apical and cardiac lobes (cranioventral).
- Lesions are clearly demarcated from normal lung.
- The associated lymph nodes may be enlarged.

Tissues to Submit

- Lung
- Serum

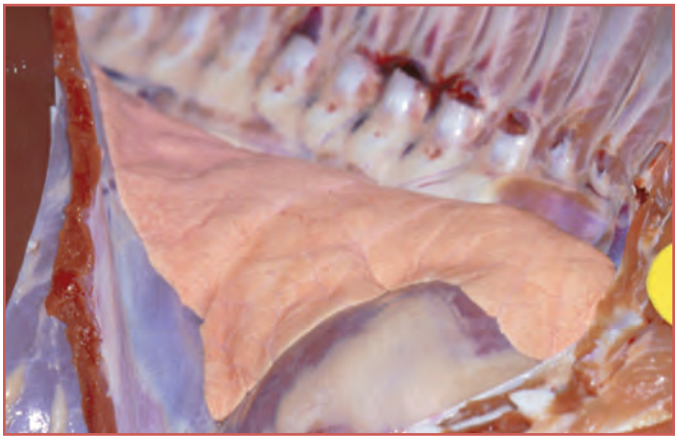
Diagnostic Tests

- Mycoplasma Multiplex PCR
- Mycoplasma Culture
- Quantitative PCR
- Histopathology
- Serology

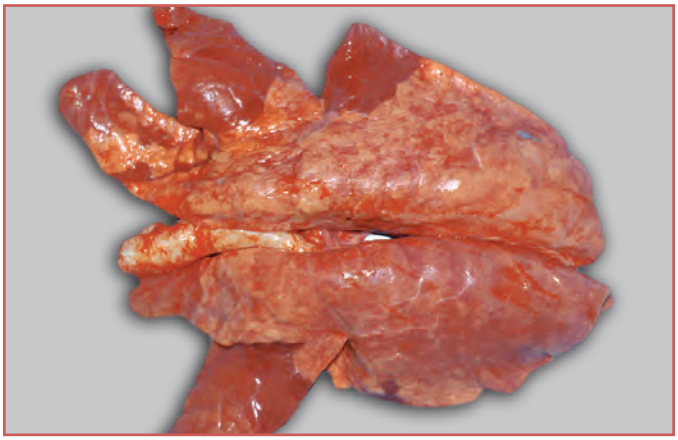
MYCO

Pneumonic Pasteurellosis

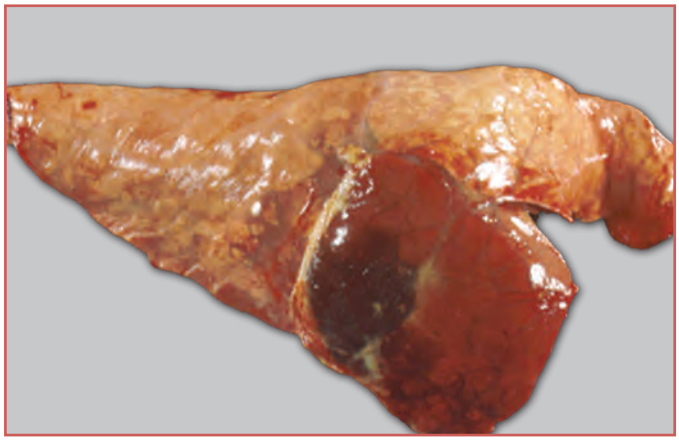
Pasteurella multocida



Normal Lung



Mycoplasma Lung



Mycoplasma and Pasteurella Lung

PASTEURELLA

Tissues to Submit

- Lung

Diagnostic Tests

- Culture
- Serogrouping PCR

Clinical Signs and History

- Respiratory: Cough, rapid breathing (thumping).

Stages of Production

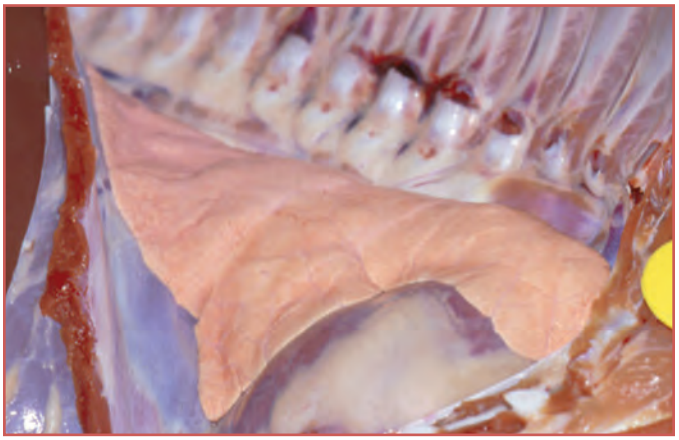
- Nursery
- Grow-Finish

Diagnosis

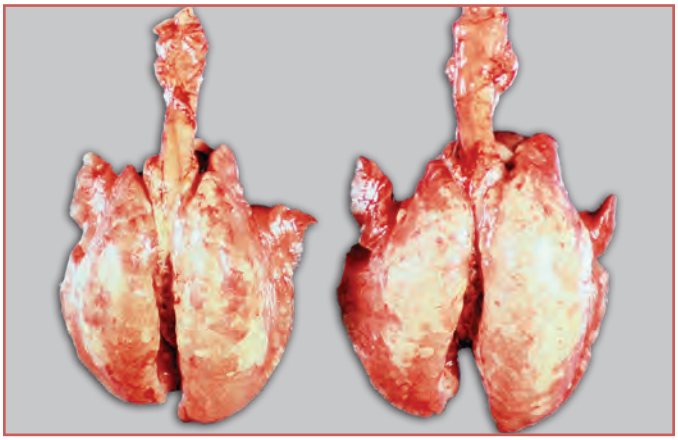
- Diagnosis is based on necropsy findings and culture of *P. multocida* from the lesions.
- Exudative bronchopneumonia, sometimes with pericarditis and pleuritis.

PRRSV

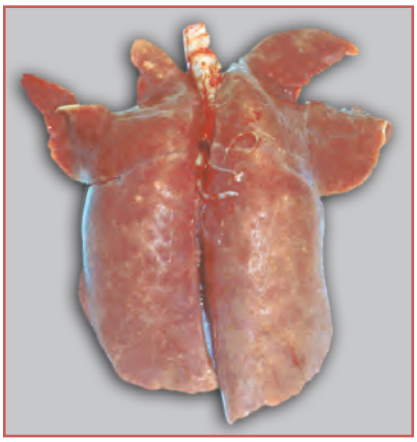
Porcine Reproductive and Respiratory Syndrome



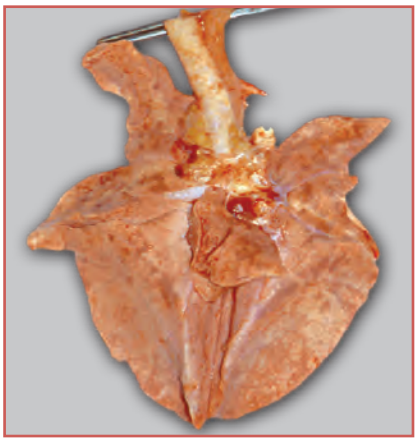
Normal Lung



Lungs stay upright due to diffuse interstitial pneumonia; slightly rubbery but not consolidated.



Lungs stay upright due to diffuse interstitial pneumonia.



Ventral view of PRRSV-infected lung.

Clinical Signs and History

- Respiratory: cough, rapid breathing (thumping), unthrifty pigs.
- Reproductive: late-term abortions after 90 day's gestation with fresh and autolyzed piglets, stillborns, weak live piglets.

Stages of Production

- Gestation
- Farrowing
- Nursery
- Grow-Finish

Diagnosis

- Characteristic lesions and organism identification.
- Diagnosis is based on herd history and virus isolation (VI) or viral antigen testing (PCR or IHC).

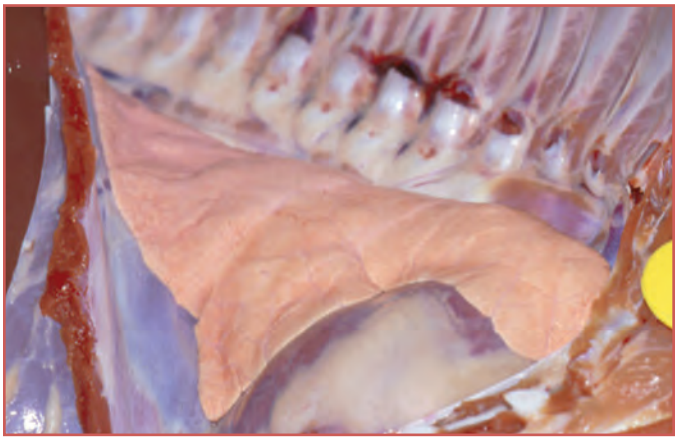
Tissues to Submit

- Lung
- Serum
- Semen

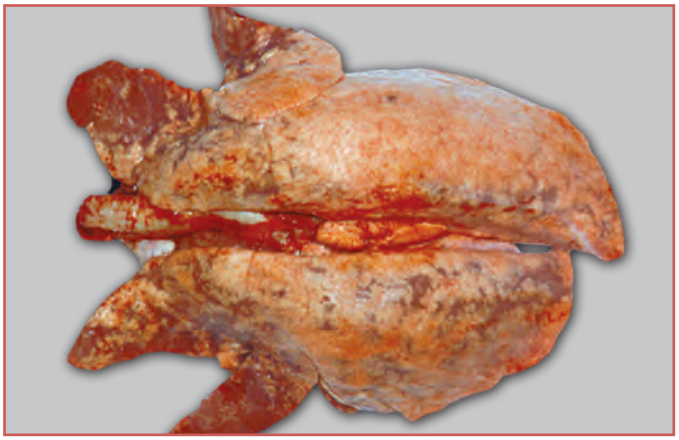
Diagnostic Tests

- Virus Isolation
- Quantitative PCR
- Sequencing
- Histopathology
- IHC
- Serology

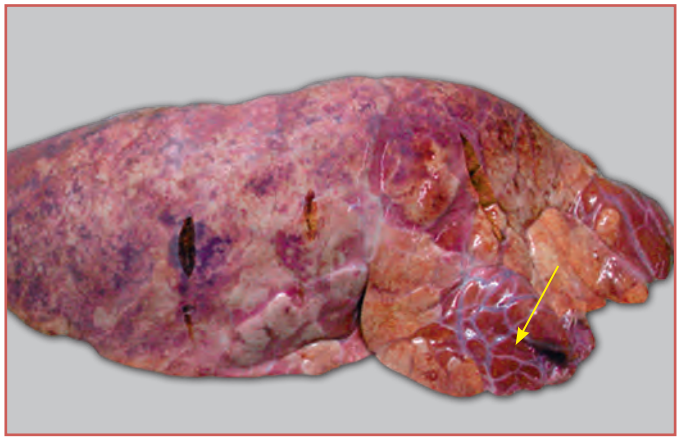
Influenza A Virus – Swine (IAV-S) / Pneumonia



Normal Lung: pink, collapses uniformly, soft upon palpation



Dorsal view of IAV-S pneumonia: Lungs stay upright due to diffuse interstitial pneumonia with patchy red lobules of consolidation; palpates rubbery compared to normal.



IAV-S pneumonia: Diffuse interstitial pneumonia as described above with cranioventral consolidation related to secondary bacterial bronchopneumonia (arrow).

IAV-S

Tissues to Submit

- Lung
- Nasal Swabs
- Serum
- Trachea

Diagnostic Tests

- Virus Isolation
- Quantitative PCR
- Sequencing
- Histopathology
- Serology (HI, ELISA)
- HT-SN™

Clinical Signs and History

- Respiratory: Rapid spread of severe cough throughout the barn, rapid breathing (thumping), depression, fever to 108° F, anorexia, dyspnea, weakness, prostration and a mucous discharge from the eyes and nose.
- Outbreak is characterized by sudden onset and rapid spread through the entire herd, often within one to three days.

Stages of Production

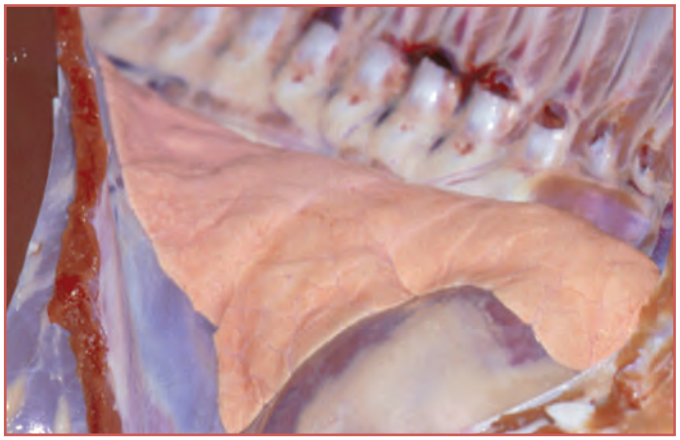
- Farrowing
- Nursery
- Grow-Finish

Diagnosis

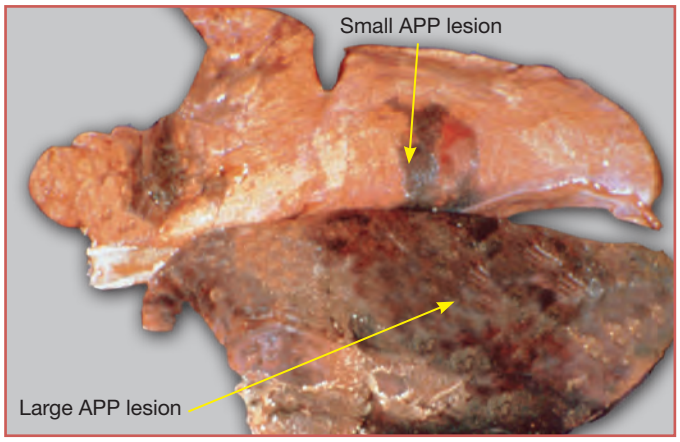
- In uncomplicated infections, lesions are usually confined to the lungs.
- Necrotizing bronchiolitis becomes proliferative in chronic cases; IAV-S is confirmed by IHC or PCR or VI.
- The airways contain a copious mucopurulent exudate, and the bronchial and mediastinal lymph nodes are edematous and enlarged.

Swine Pleuropneumonia

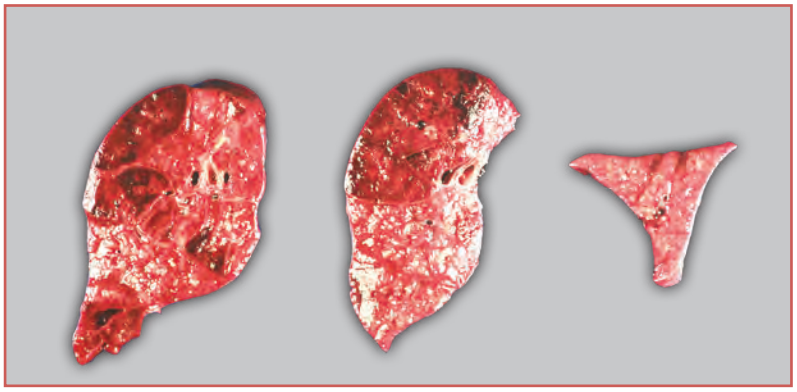
Actinobacillus pleuropneumoniae (APP)



Normal Lung



Hemorrhagic necrotic lung lesions, with pleuritis involving dorsal lung at small lesion. Extensive lobar consolidation in larger lesion.



Cross section of APP lung showing distinct demarcated areas of multi-lobular necrotizing and hemorrhagic pneumonia with pleuritis.

Clinical Signs and History

- Respiratory distress is severe; there is thumping and occasionally open-mouth breathing with a blood-stained frothy nasal and oral discharge, fever, anorexia and reluctance to move.

Stages of Production

- Grow-Finish

Diagnosis

- An explosive disease onset is suggestive.
- The pneumonia is usually bilateral, but often unevenly distributed with unique dorsal and caudal lung lobe involvement.
- The characteristic lesion is a severe fibrinonecrotic and hemorrhagic pneumonia with accompanying fibrinous pleuritis.
- In acute cases, the lesions are sharply delineated, dark consolidated regions that ooze bloody fluid from the cut surface. The involved pleura and inter-lobular septa are thick with exudate.
- The trachea may contain blood-stained froth. Bloody nasal/oral discharge is common.
- In chronic cases, the lesions are more organized and adhesions between the lung and rib cage become fibrous.

Tissues to Submit

- Lung
- Serum

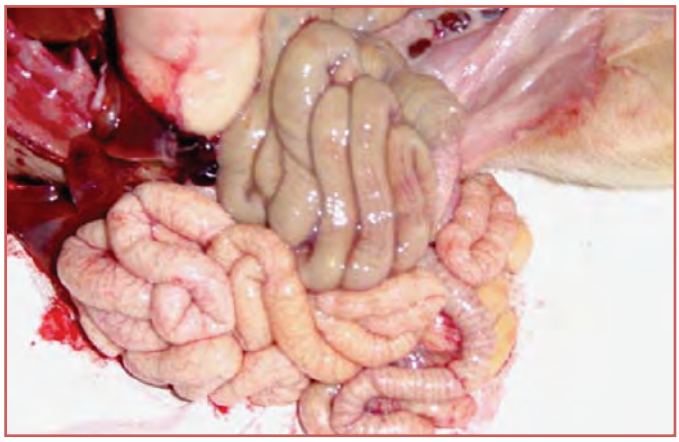
Diagnostic Tests

- Culture
- Histopathology
- Serotyping PCR

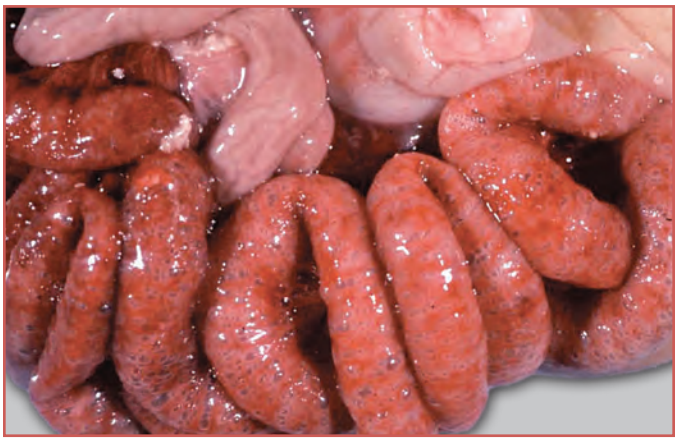
APP

Clostridial Enterocolitis

C. perfringens & C. difficile



Intestinal distension – *C. perfringens* Type A.



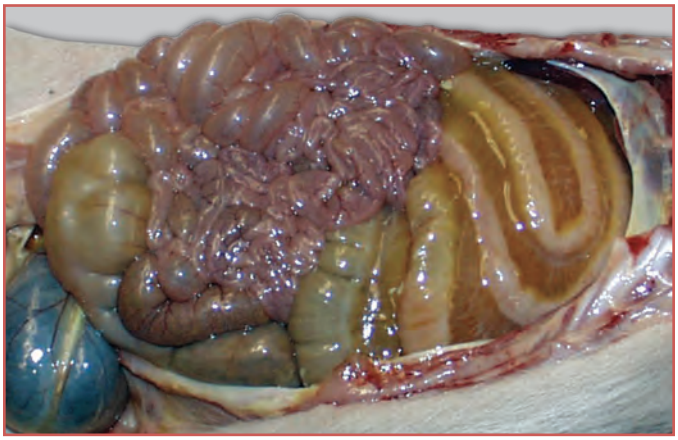
Dark-red intestine, gas bubbles visible beneath the serosa. Lumen will be filled with bloody necrotic content. *C. perfringens* Type C.

Clinical Signs and History

- Diarrhea is the most common sign in enteric clostridial infections.
- Sudden onset of hemorrhagic diarrhea followed by collapse and death is characteristic in piglets 1–3 days old as a result of *Clostridium perfringens* Type C.
- *Clostridium perfringens* Type A and *Clostridioides* (*Clostridium*) *difficile* most frequently cause diarrhea without hemorrhage in pigs 3–15 days of age.

Stages of Production

- Farrowing
- Nursery



Mesocolonic edema – *C. difficile*

CLOSTRIDIUM

Tissues to Submit

- Small Intestine
- Large Intestine
- Colon
- Colon Content
- Fecal Swabs

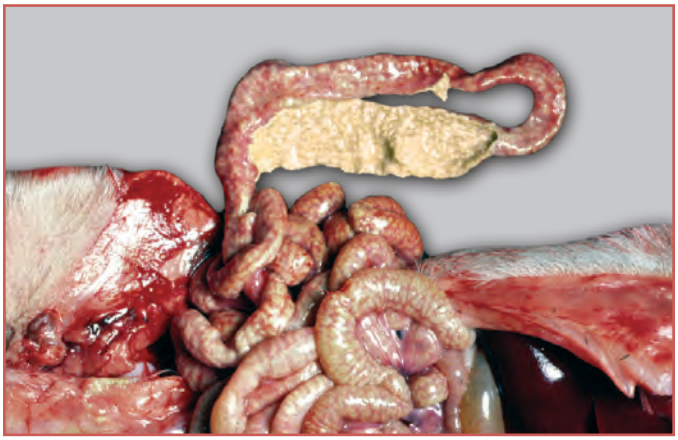
Diagnostic Tests

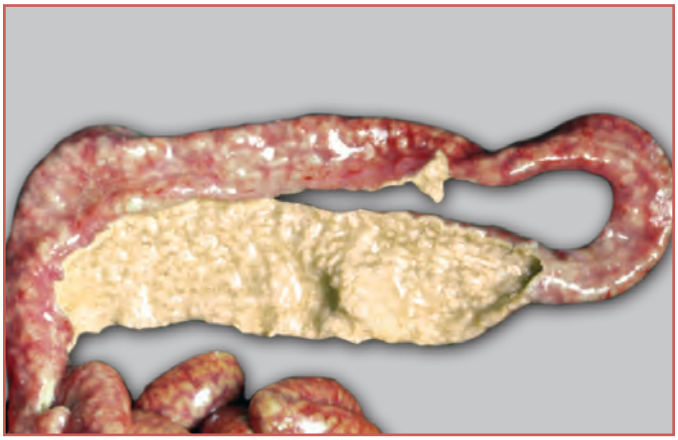
- Culture
- Toxin PCR
- Histopathology
- A/B Toxin ELISA

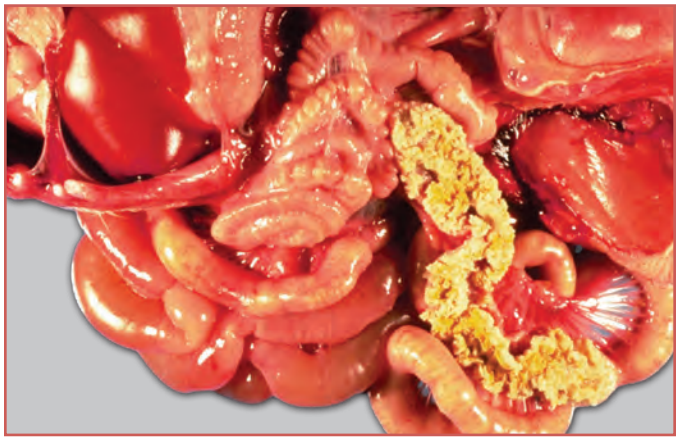
Diagnosis

- Necropsy is usually sufficient to establish the diagnosis of *C. perfringens* Type C in the peracute hemorrhagic form and in the acute form with jejunal emphysema. Histologic observation of villous necrosis with mucosal colonization by numerous large Gram-positive rods is adequate for confirmation.
- Isolation and identification of the organism is necessary to diagnose *C. perfringens* Type A and *C. difficile*.
- ***C. perfringens* Type C** – In acute cases, gas bubbles (gut emphysema) will be visible through the serosa and within the mucosa. The disease is often segmental, and normal areas can be adjacent to severely diseased areas. Important to find and submit specimens from diseased areas.
- ***C. perfringens* Type A** – Lesions are much milder than seen with *C. perfringens* Type C and are similar to those seen with *E. coli*.
- Mesocolonic edema can be seen in *C. difficile* and *C. perfringens* Type A cases.

Coccidiosis







Coccidiosis: note diffuse dull necrotic yellow-tan membrane covering the normally shiny mucosa.

Clinical Signs and History

- Diarrhea in farrowing house caused by *Isospora suis*, usually after 5 days of age. The disease is most intense from 7–14 days of age. Less common in nursery pigs, where it can be associated with *I. suis* or other types of coccidia.
- Clinical signs of coccidiosis are due to destruction of the intestinal epithelium and, frequently, the underlying connective tissue of the mucosa.
- Infection is characterized by a watery or greasy diarrhea, usually yellowish to white and foul smelling. Piglets may appear weak, dehydrated and undersized; weight gains are depressed and sometimes piglets die.

Stages of Production

- Farrowing house disease after 5 days of age; intense between 7–14 days of age.
- Nursery (less common)

Diagnosis

- Diagnosis is by histopathological observation of sporozoites in the diseased mucosa; or by finding sporozoites in mucosal smears via direct microscopic examination.

Tissues to Submit

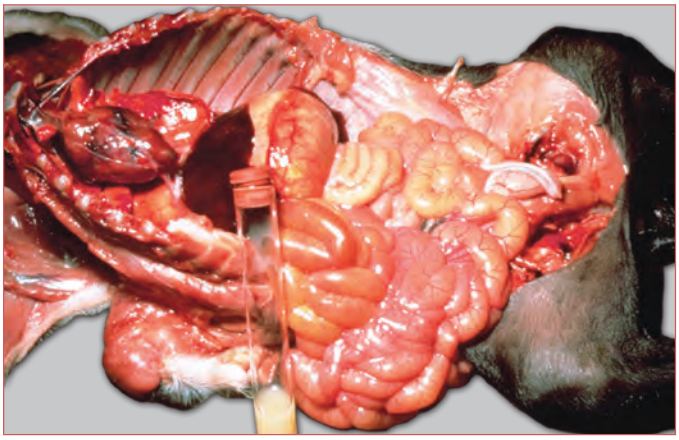
- Small Intestine
- Large Intestine
- Fecal Swab

Diagnostic Tests

- Smear
- Histopathology

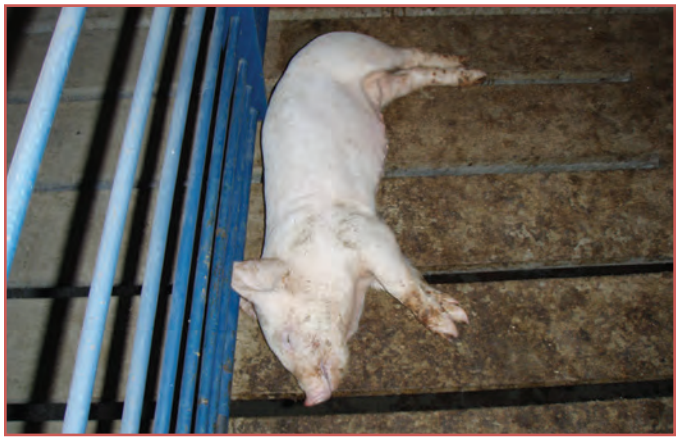
COCCIDIOSIS

Intestinal Colibacillosis and Edema Disease (*E. coli*)



Distension of the intestine with yellowish fluid.

Litter with diarrhea.



Pig down on side, paddling.

E. COLI

Tissues to Submit

- Small Intestine
- Large Intestine
- Fecal Swab
- Brain

Diagnostic Tests

- Culture
- Histopathology
- Toxin PCR
- Pilin PCR
- Adherence Factor PCR

Clinical Signs and History

- Diarrhea
- Sudden Death
- CNS (Edema Disease)

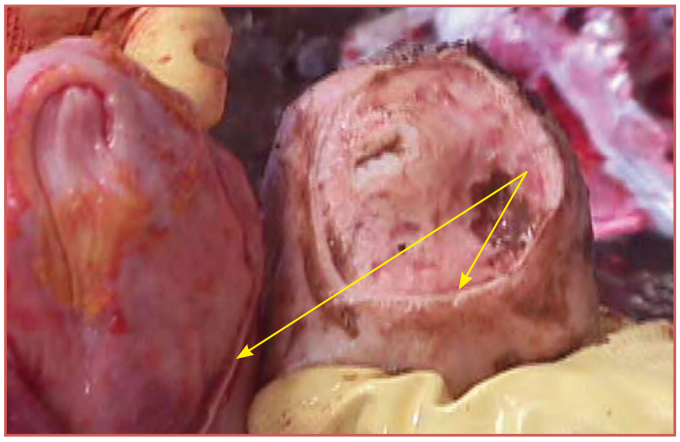
Stages of Production

- Farrowing
- Nursery

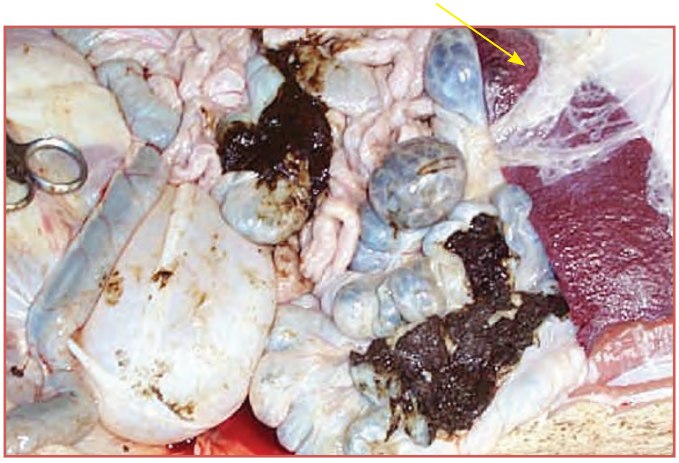
Diagnosis

- Confirmation is based on histologic observation of villous colonization and isolation of pathogenic *E. coli*.
- Dehydration and distension of the small intestine and colon with yellowish, watery to cream-like fluid. Mesenteric lacteals are still white with milk fat, indicating absorption is still normal, but hypersecretion is producing diarrhea.

Gastric Ulcers



Gastric ulcers in two stomachs. Arrows point to ulcer edges.



Gut content in distal small intestine and colon is dark brown (arrow) due to digested blood coming from the gastric ulcers.

Clinical Signs and History

- Sudden death related to gastric bleeding; hematoma (large blood clot) found in stomach.
- In the "chronic" form, hemorrhage results in anorexia, weakness, anemia, and black, tarry feces.

Stages of Production

- Grow-Finish

Diagnosis

- Appearance in a pen of one or two listless, anorexic pigs that show weight loss, anemia and dark feces.
- Sometimes, dyspnea is suggestive of gastric ulceration, as is the sudden death of an apparently healthy pig.
- The typical terminal ulcer lesion is found in the gastric mucosa near the esophageal opening (cardia) in the rectangular area of white, glistening, non-glandular, squamous epithelia.
- In cases of sudden death, the stomach will contain a large hematoma (blood clot) that originates from a chronic bleeding ulcer.

Tissues to Submit

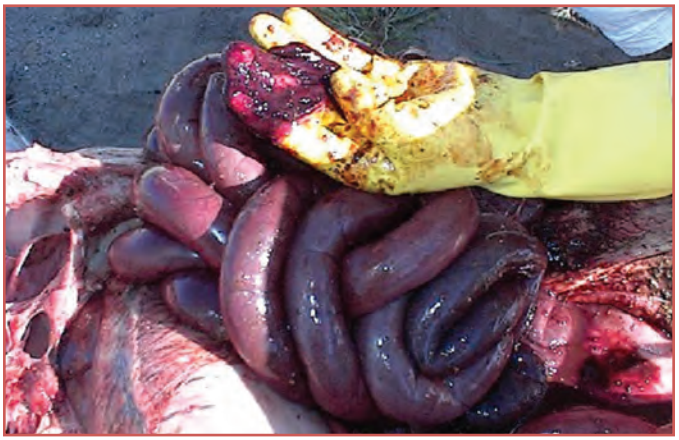
- Stomach

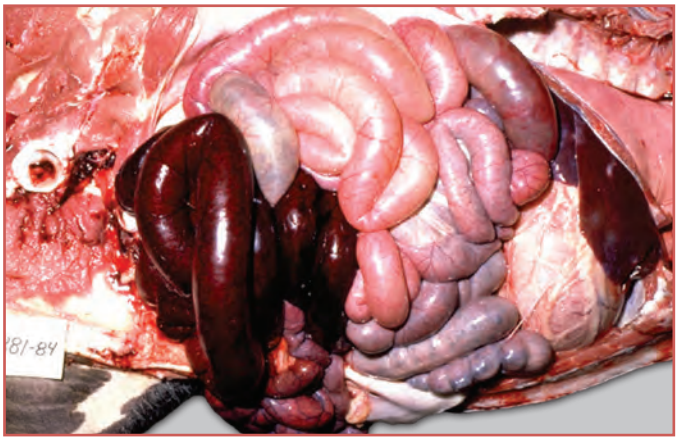
Diagnostic Tests

- Post-mortem Exam

Hemorrhagic Bowel Syndrome – HBS

Mesenteric Torsion of the Small Intestine





Bright-red gas-distended loops of small intestine with bloody content.

HBS

Tissues to Submit

- Small Intestine
- Colon

Diagnostic Tests

- Post-mortem Exam
- Tests to rule out Salmonellosis, Ileitis, and Swine Dysentery

Clinical Signs and History

- Sudden death of 4–6-month-old grow-finish and young breeding pigs.
- Only involves a few animals; not a large outbreak.

Stages of Production

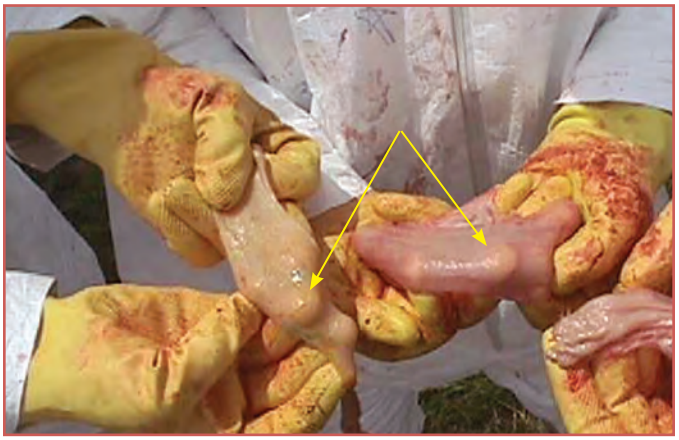
- Grow-Finish

Diagnosis

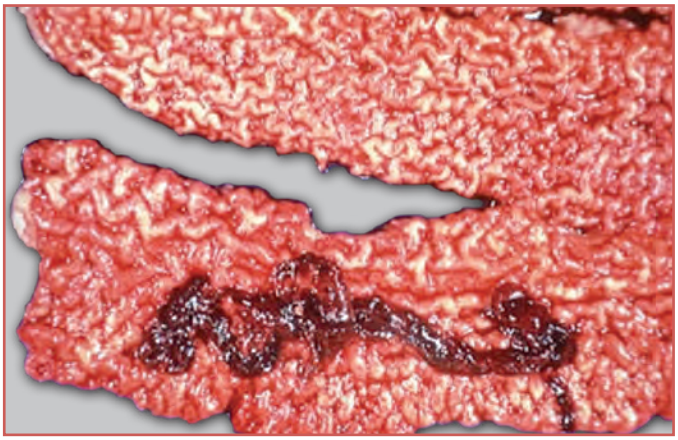
- Sudden death of previously healthy grow-finish pigs and characteristic post-mortem findings.
- Before manipulating the intestines, palpate the mesenteric root (tissue coming down from the lumbar back and supporting the gut mass) for a twist or torsion. When present, this is diagnostic for mesenteric torsion. Smaller lesions may only involve a torsion within the mesentery of a portion of the small intestine.
- The involved gut loops are thin-walled, gas-filled, red due to congestion, and contain bloody fluid.

Ileitis

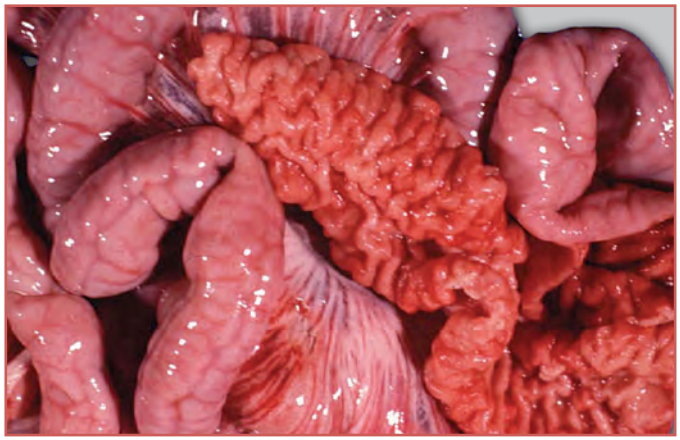
Lawsonia intracellularis



Normal intestine – can see fingers through lining.



Thick hyperplastic ileal mucosa with blood clot in lumen.



Thick hyper-plastic ileal mucosa.

Clinical Signs and History

- Diarrhea
- Ileitis can be either a chronic disease in growing pigs, or an acute hemorrhagic form in market-weight and adult pigs.

Stages of Production

- Grow-Finish

Diagnosis

- Confirmation is based on histologic observation of characteristic proliferation and inflammation of mucosal crypts.
- Lesions may occur anywhere in the lower half of the small intestine, cecum or colon, but are most frequent and obvious in the ileum.
- The wall of the intestine is thickened, and the mesentery may be edematous.

Tissues to Submit

- Ileum
- Feces

Diagnostic Tests

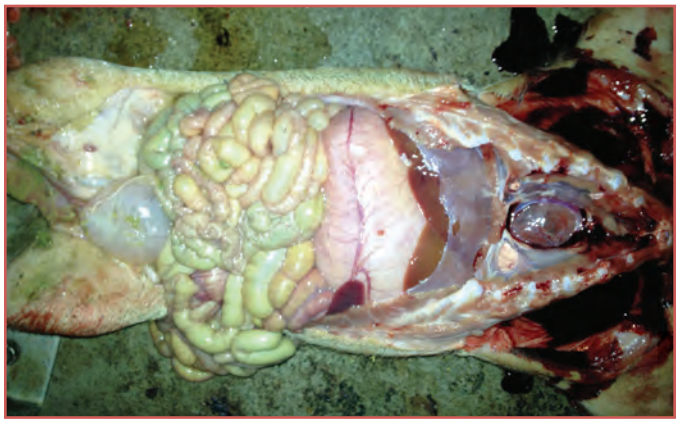
- Histopathology
- PCR

ILEITIS

Porcine Epidemic Diarrhea
PEDv

Gaunt, dehydrated piglets.

Vomiting sow.



Voluminous, fluid-filled intestinal loops.

PEDv

Tissues to Submit
- Small Intestine
- Colon

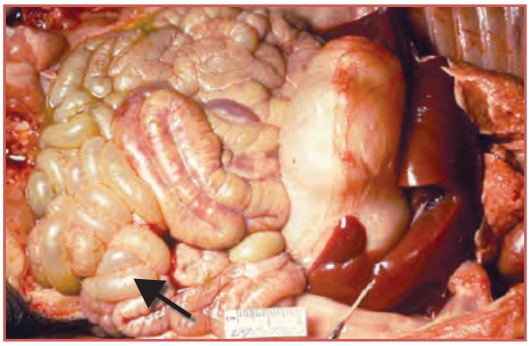
Diagnostic Tests
- PCR

Clinical Signs and History
- The primary clinical sign in outbreaks that occur in previously naïve herds is severe diarrhea in all ages.
- Clinical signs will be essentially identical to those expected with acute TGEv infections.
- Virus is shed in the feces and transmission is via the fecal-oral route.
- The incubation period is 12–24 hours after exposure, with clinically ill pigs shedding virus for 7–10 days.
- Mortality rate in suckling pigs in a naïve herd can be 30–100 percent.

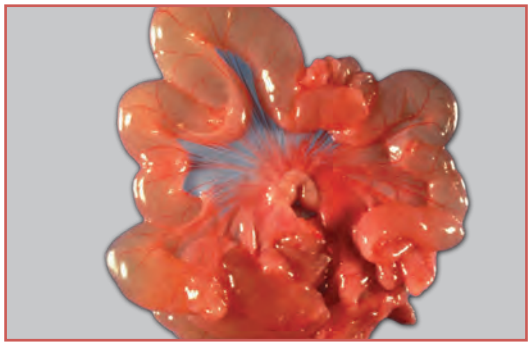
Stages of Production
- Farrowing
- Nursery
- Grow-Finish

Diagnosis
- Clinical signs with severe diarrhea begin explosively in naïve herds, leading to a presumptive diagnosis of TGEv or PEDv.
- PEDv in naïve herds affects animals of all ages.
- The most common sources of infected feces are pigs, trucks, boots, clothing or other fomites.
- Preferred samples for diagnostic testing are live pigs in acute stages of disease, fresh and formalin-fixed small intestine and colon.

Transmissible Gastroenteritis
TGE Virus



Thin-Walled Intestine



Thin-walled, fluid-filled intestines. Mesenteric lacteals do not contain milk fat.

Thin-Walled Intestine

Weak, gaunt piglet covered with malodorous diarrheal fluids.

Clinical Signs and History

- In susceptible herds, vomiting often is the initial sign, followed by profuse watery diarrhea, dehydration and excessive thirst.
- Feces of nursing pigs often contain curds of undigested milk.
- Mortality is nearly 100 percent in piglets < 1 week old, whereas pigs > 1 month old seldom die.
- Gestating sows occasionally abort, and lactating sows often exhibit vomiting, diarrhea and agalactia.
- Diarrhea in surviving nursing piglets continues for five days, but older pigs may be diarrheic for a shorter period.
- Clinically and pathologically mimics PEDv.

Stages of Production

- Farrowing
- Nursery
- Grow-Finish

Diagnosis

- Clinical signs in the epidemic form of TGE usually provide a presumptive diagnosis.
- In the mild endemic form, laboratory procedures are required. Histologic and immunofluorescent examination of the small intestine to demonstrate typical lesions and the presence of TGE viral antigen provide confirmatory evidence.
- Piglets are severely dehydrated and the skin is soiled with liquid feces.
- The stomach usually contains milk curd, but may be empty.
- The small intestine is thin-walled, and the entire intestine contains greenish or yellow watery fluid and clumps of undigested milk.

Tissues to Submit

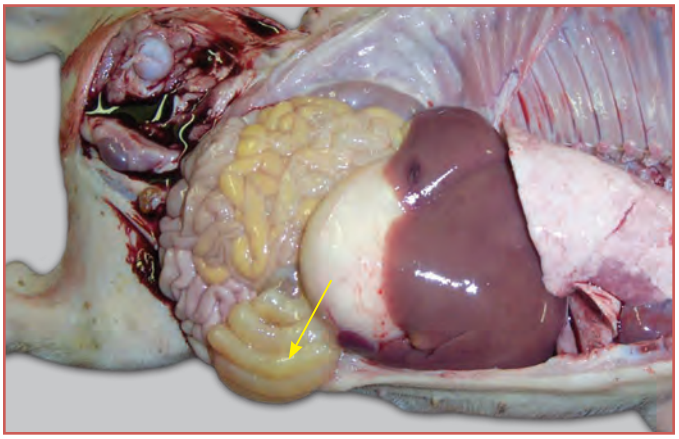
- Small Intestine
- Large Intestine
- Fecal Swab
- Serum

Diagnostic Tests

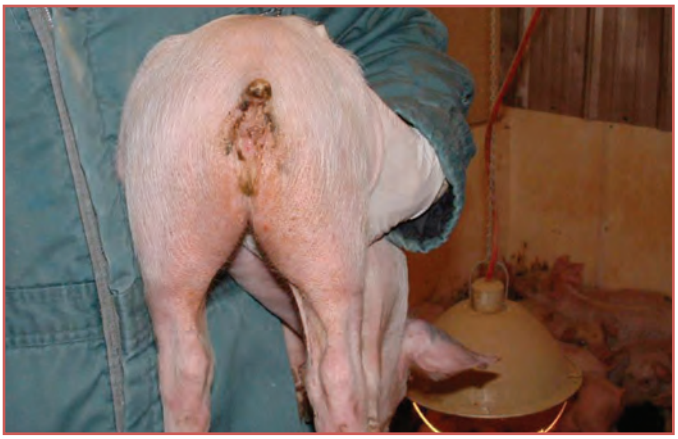
- Histopathology
- PCR

TGE

Rotavirus A
Rotavirus Enteritis



Thin-walled fluid-filled small intestine and spiral colon (arrow).



Evidence of diarrhea around anus of a nursery pig.

ROTA

Tissues to Submit
- Small Intestine
- Large Intestine
- Fecal Swabs

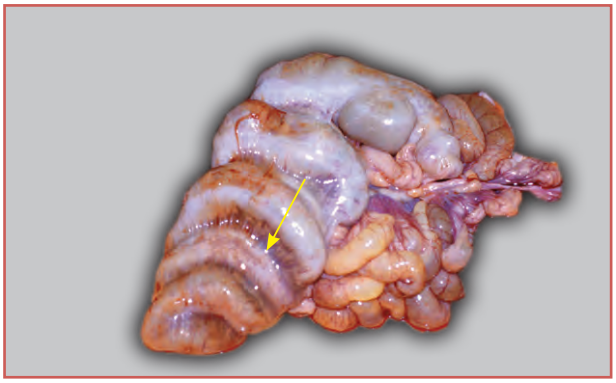
Diagnostic Tests
- PCR
- Virus Isolation
- Histopathology
- Sequencing

Clinical Signs and History
- Diarrhea
- Commonly, the infection is endemic in a herd. Sows have varying levels of antibody in the colostrum and milk, which provides varying degrees of passive protection to nursery pigs.
- Diarrhea often begins in pigs 5 days to 3 weeks old, and is very common immediately after weaning.

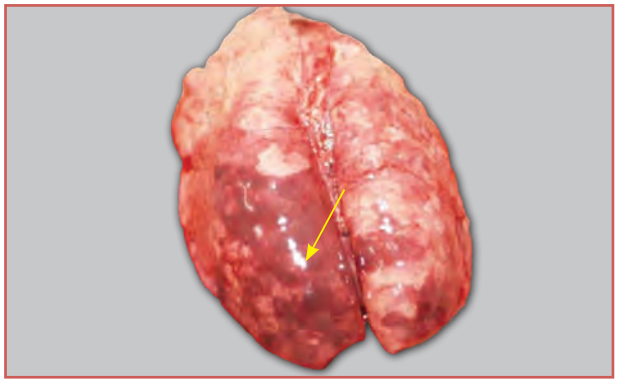
Stages of Production
- Farrowing house and nursery piglets.

Diagnosis
- Laboratory procedures are required for accurate diagnosis.
- The small intestine appears thin-walled, and the cecum and colon contain abundant liquid and usually yellow feces.

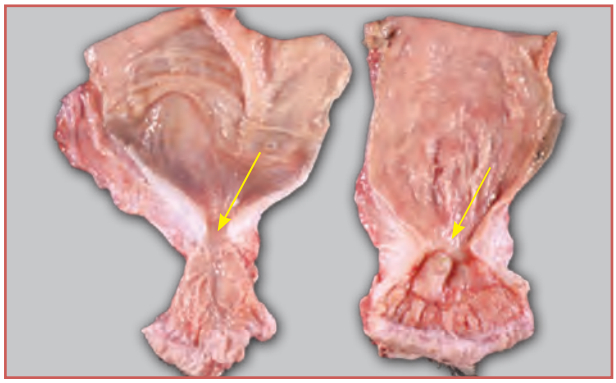
Salmonellosis
Enteritis and Septicemia



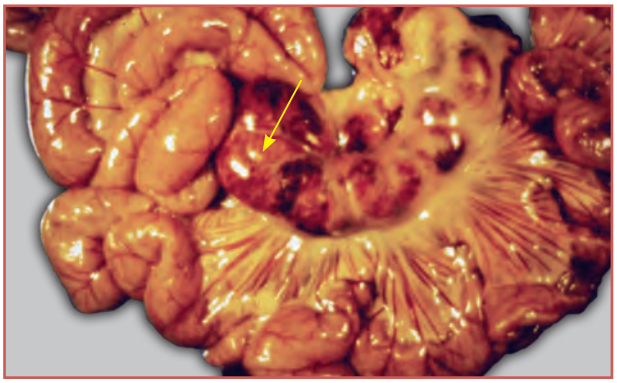
Intestine distended; edematous and thickened wall.



Diffuse interstitial pneumonia with congestion, edema and patchy consolidation (arrow).



Proctitis with rectal stricture.



Swollen lymph nodes.

Clinical Signs and History

- Septicemia is the usual syndrome in pigs up to 6 months of age. Illness is acute, depression is marked, fever (105° – 107° F) is common, and death occurs in 24–48 hours. Nervous signs may occur in pigs; these animals may also suffer from pneumonia. Mortality may reach 100 percent.
- Nursing pigs may develop diarrhea, but usually succumb to generalized septicemia.
- Weaning or grow-finish pigs are febrile, and have liquid feces that may be yellow and contain shreds of necrotic debris.

Stages of Production

- Farrowing
- Nursery
- Grow-Finish

Diagnosis

- Depends on the clinical signs and on the laboratory examination (culture) of feces, tissues from affected animals, feed (including all mineral supplements used), water supplies and feces from wild rodents and birds that may inhabit the premises.
- A dark-red to purple discoloration of the skin is common, especially at the ears and ventral abdomen.
- Also, a swollen spleen, liver and lymph nodes can be seen, as well as rubbery congested hemorrhagic lungs and roughened necrotic intestinal mucosa with ulceration and accumulation of debris.

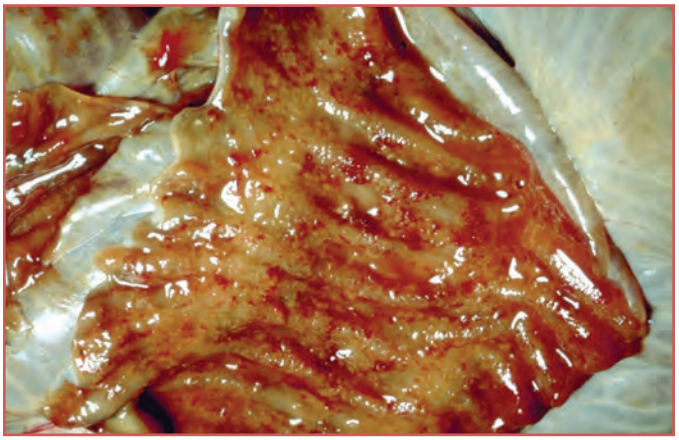
Tissues to Submit

- Small Intestine
- Large Intestine
- Liver
- Lung
- Spleen
- Mesenteric Lymph Nodes

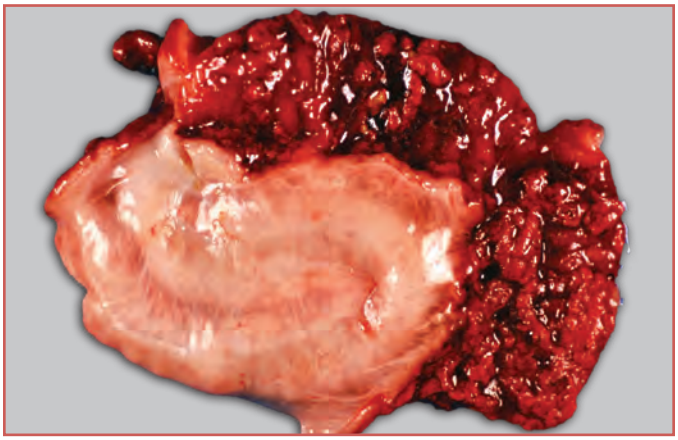
Diagnostic Tests

- Culture
- Histopathology
- Sequencing for Serovar Determination

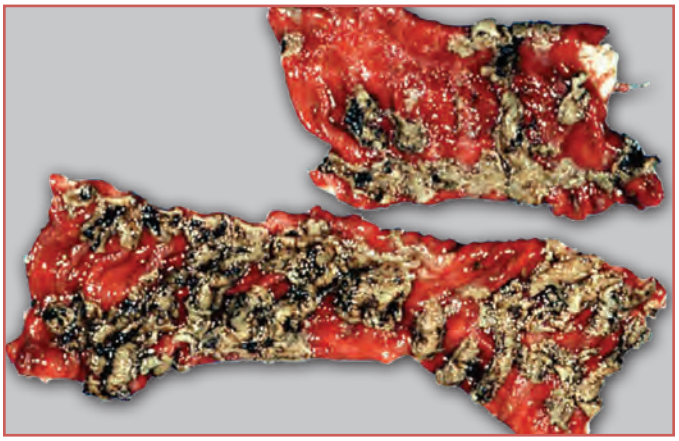
Swine Dysentery
Brachyspira hyodysenteriae



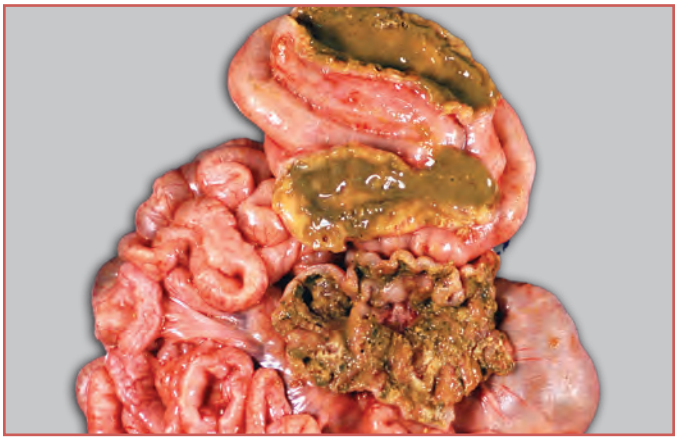
Edematous and hemorrhagic large intestinal mucosa (inner lining).



Thick-walled, hemorrhagic and edematous large intestine.



Fibrinonecrotic debris with dark blood clots on the colon mucosa.



Chronic Swine Dysentery: Less blood, but thickened mucosa covered with adherent yellow-tan necrotic membrane.

SCOURS

Tissues to Submit
- Feces
- Cecum
- Spiral Colon

Diagnostic Tests
- Histopathology

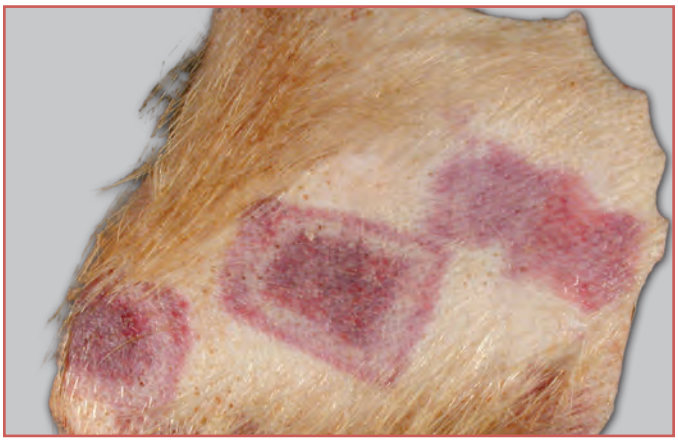
Clinical Signs and History
- Bloody diarrhea, affects large intestine, partial anorexia, soft feces, dehydration, profoundly weak, gaunt and emaciated.

Stages of Production
- Grow-Finish

Diagnosis
- Presumptive diagnosis can be based on necropsy and direct examination of smears prepared on slides from fresh colonic mucosa or feces.

Lesions
- Diffuse superficial lesions, confined to cecum, spiral colon and rectum.

Erysipelas
Erysipelothrix rhusiopathiae



Diamond, square or rhomboid skin lesions (infarcts) associated with Erysipelas.

Clinical Signs and History
- Acute septicemia (the skin [subacute] form), chronic arthritis and vegetative endocarditis may occur together or separately.
- Pigs with acute septicemia may die suddenly without previous signs. This occurs most frequently in finishing pigs weighing 100–200 pounds
- Acutely infected pigs are febrile (104° – 108° F), walk stiffly, and lie on their sternums separately rather than piling in groups. They squeal when handled, and may shift weight from foot to foot when standing.
- Skin discoloration may vary from widespread erythema and purplish discoloration of the ears, snout and abdomen to diamond-square-or rhomboid-shaped skin lesions (infarcts) almost anywhere on the body, particularly the lateral and dorsal areas.

Stages of Production
- Grow-Finish

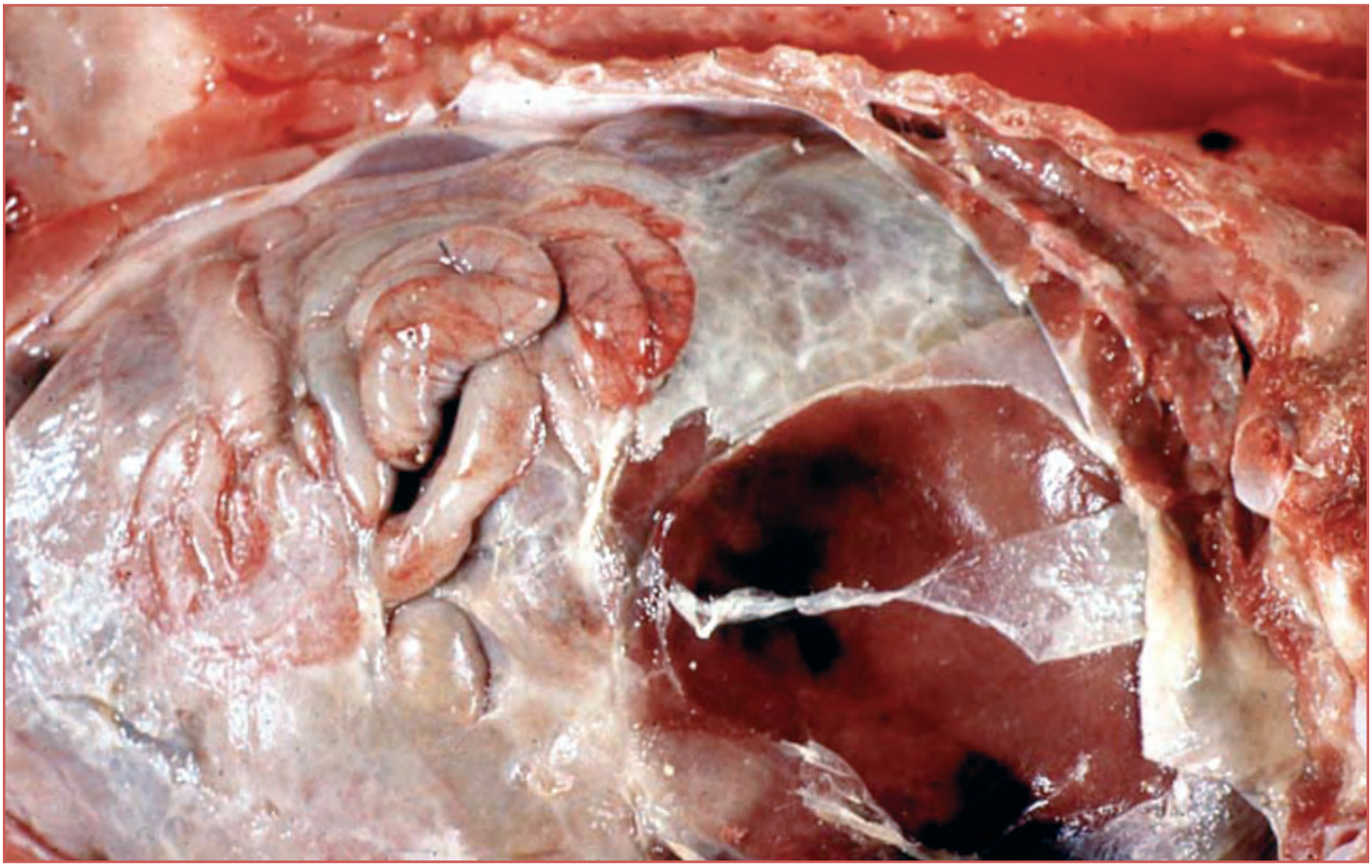
Diagnosis
- Acute Erysipelas is difficult to diagnose in pigs showing only fever, poor appetite and listlessness.
- The typical diamond-shaped skin lesions are highly characteristic when found, but are not always present, and can sometimes be seen with other bacterial septicemias.
- Arthritis and endocarditis are not diagnostic in the live animal because other agents can cause similar syndromes.
- In acute infection, in addition to skin lesions, lymph nodes are usually enlarged and congested, the spleen is noticeably enlarged, and the lungs are edematous and congested.
- Petechiae may be found in the kidneys, heart and occasionally elsewhere.

Tissues to Submit
- Heart
- Lymph Nodes
- Liver
- Spleen
- Joints
- Joint Fluid

Diagnostic Tests
- Culture
- Histopathology

Polyserositis and Polyarthritis

Mycoplasma hyorhinis



Fibrinous peritonitis and polyserositis over intestinal serosa, peritoneum and liver capsule.

HYORHINIS

Tissues to Submit

- Consolidated Lung
- Heart with Pericardium
- Joint Fluid
- Synovium
- Peritoneal Fluid

Diagnostic Tests

- Culture
- Myco Multiplex PCR
- Serology

Clinical Signs and History

- *M. hyorhinis*, *Strep suis H. parasuis* signs are similar because these organisms all can cause polyarthritis and polyserositis.
- *M. hyorhinis* generally occurs in 3- to10-week-old pigs becoming unthrifty, with roughened coat, slight fever, difficult movement, swollen joints and lameness with duration up to 14 days.

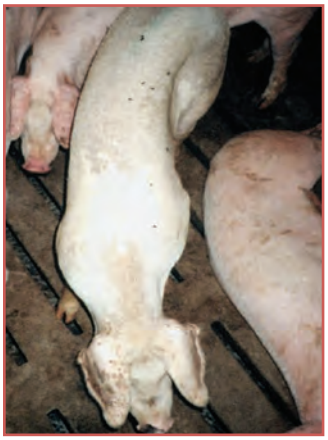
Stages of Production

- Nursery

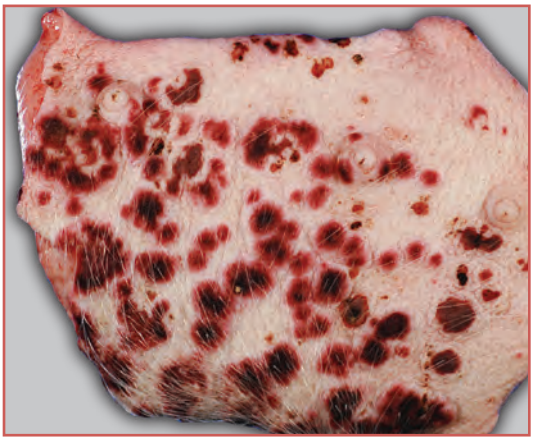
Diagnosis

- Isolation of organism from acute and subacute cases depends on freshly necropsied pigs.
- Polyserositis-affected lungs, pleura, pericardium, epicardium, and peritoneum.

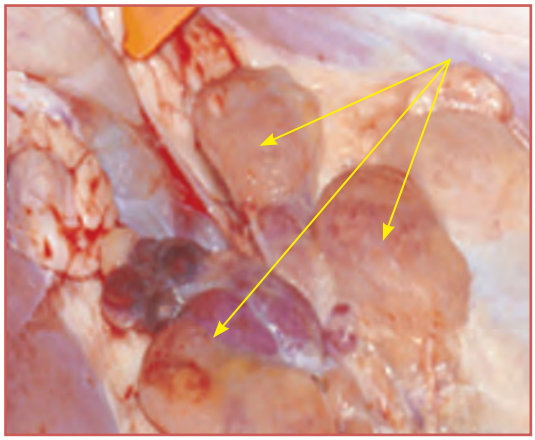
Porcine Circovirus
PCV2 / PMWS / PDNS



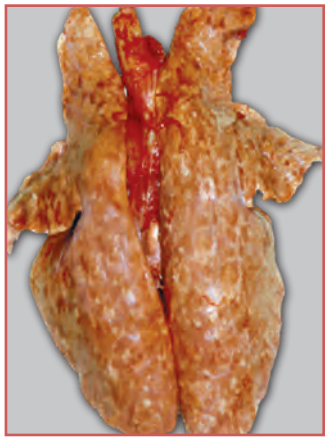
Thin, wasting pig.



Porcine Dermatitis and Nephropathy Syndrome (PDNS) is one manifestation of PCV2 infection. Here the skin shows striking multi-focal hemorrhagic dermatitis from the ventral abdomen.



Enlarged mediastinal lymph nodes.



Lung non-collapsed heavy and firm, or rubbery compatible with diffuse interstitial pneumonia.

Clinical Signs and History

- The most frequent clinical sign is wasting or failure to thrive. In decreasing order of frequency, other signs include dyspnea, enlarged lymph nodes, diarrhea, pallor and jaundice.
- All of the fundamental clinical signs are often not observed in a single pig, but most affected farms will present the majority – if not all – of the signs over a period of time.
- Less common clinical signs include coughing, fever, gastric ulceration, multi-focal hemorrhagic dermatitis and central nervous disorders.

Stages of Production

- Nursery
- Grow-Finish

Diagnosis

- Diagnosis of PCV2 requires that a pig or group of pigs has a specific set of clinical signs and microscopic lesions.

PCV2 Diagnostic Criteria

- Microscopic Lesions: depletion of lymphoid tissues and/or lymphohistiocytic to granulomatous inflammation in any organ (predominantly lung, lymphoid tissue, liver, kidney, intestine, pancreas), or interstitial pneumonia with bronchiolitis.
- PCV2 antigen or genetic material within characteristic lesions;
  - Clinical signs alone are not diagnostic.
  - Gross lesions alone are not diagnostic.
- Role of Co-infections: Field observations and scientific literature suggest that PCV2, although essential for development of PCVAD, may require other factors or agents to induce the full spectrum of clinical signs and lesions associated with advanced PCVAD in conventional pigs:
  - PRRS + PCV2
  - Mycoplasma + IAV-S + PCV2

Tissues to Submit

- Lung
- Spleen
- Lymph Nodes
- Kidney
- Intestine with Peyer's Patches
- Pancreas

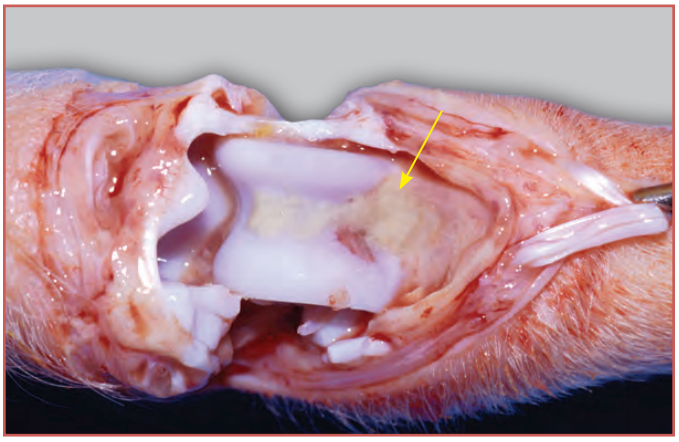
Diagnostic Tests

- Virus Isolation
- Quantitative PCR
- Sequencing
- Histopathology

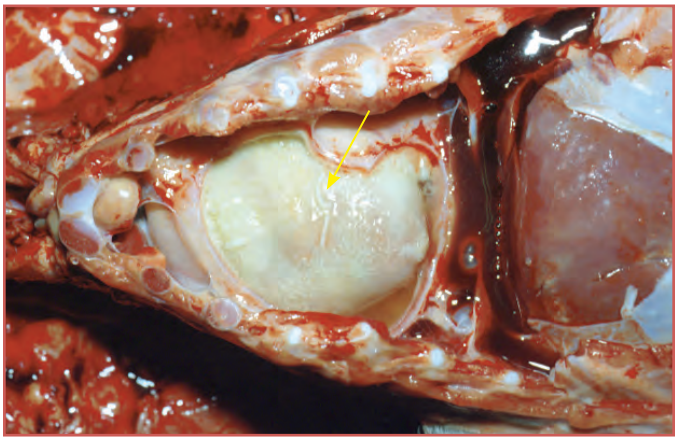
PCV2

Strep

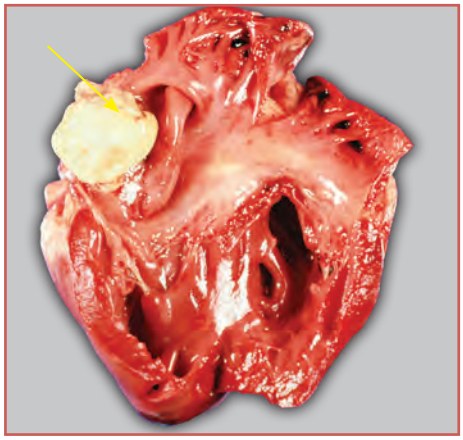
Streptococcus suis



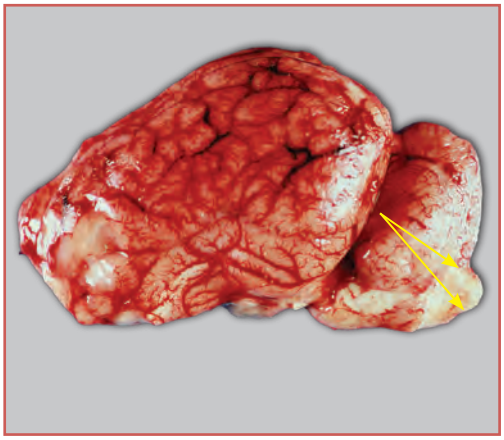
Joint exudate.



Fibrinous lesions on the epicardium (heart surface).



Prominent valvular endocarditis lesion; typical of pigs with bacterial septicemia.



Pus covering cerebellum and brain stem (arrow). Diffuse engorgement of meningeal blood vessels due to hyperemia of septicemia.

Pig down paddling, CNS signs with head tilted back.

STREP

Tissues to Submit

- Brain
- Lung
- Joint
- Liver
- Spleen

Diagnostic Tests

- Culture
- Histopathology
- Whole Genome Sequencing

Clinical Signs and History

- CNS/brain disease; lateral recumbency, paddling, ataxia, head tilt, convulsions, sudden death, arthritis with warm swollen joints, endocarditis (heart).

Stages of Production

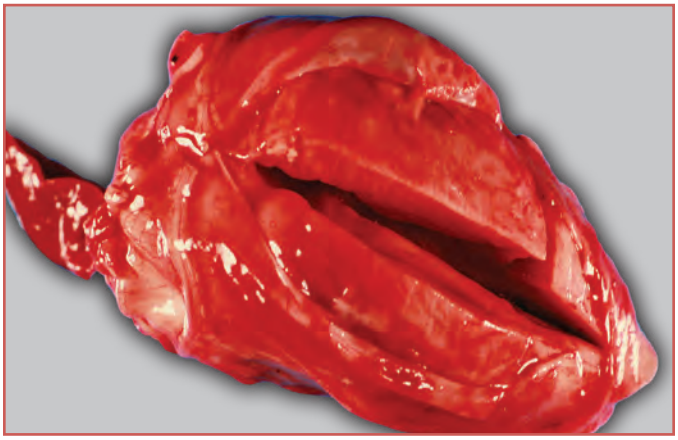
- Farrowing
- Nursery

Diagnosis

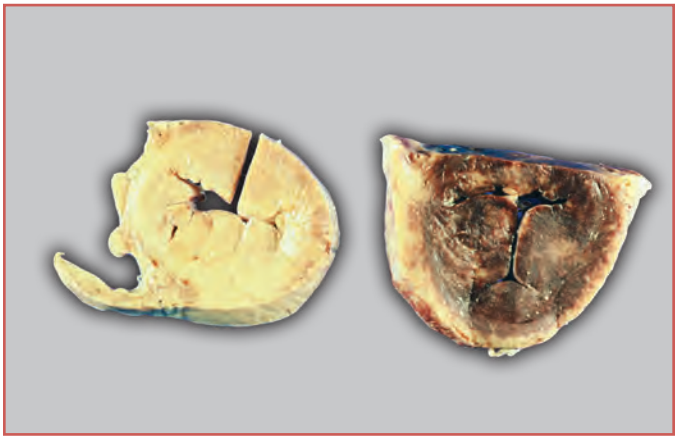
- Definitive diagnosis depends on gross and microscopic lesions and isolation and identification of the organism. The disease can be confused with other streptococcal infections, other bacterial infections (such as Erysipelas, Salmonellosis or acute Glässer's disease), water deprivation or pseudorabies.
- The skin may be reddened in patches. Lymph nodes are often enlarged and congested, and fibrinopurulent polyserositis is common.
- Joint capsules may be thickened and joints may contain excessive clear or cloudy fluid.
- Affected lungs may show varying degrees of diffuse rubbery interstitial change or patchy consolidation due to bronchopneumonia.

Mulberry Heart Disease

Nutritional Cardiomyopathy of Pigs



Fresh heart with multiple prominent hemorrhages on the epicardial surface.



Cross sections of formalin-preserved pig heart. Heart on the left is normal. Heart on the right shows severe diffuse hemorrhage and necrosis of entire left ventricular wall.

Clinical Signs and History

- Sudden death in healthy, rapidly growing piglets and young pigs.
- One or a few pigs in a barn.
- No premonitory signs, but collapse may be precipitated by exercise.

Stages of Production

- Farrowing House or Nursery
- 2–16 weeks old

Diagnosis

- Necropsy reveals pericardial effusion and marked epicardial hemorrhages.
- Cross sections of the ventricles show hemorrhages extend throughout the wall.
- Hemorrhages are not superficial on the epicardium, as seen with bacterial septicemias.
- Histopathological heart lesions are pathognomonic. Send formalin-fixed cross section of ventricles for definitive diagnosis.
- A Vitamin E-/selenium-responsive disease.
- Diets may be low in active form of Vitamin E or selenium (Se).
- Factors that may increase Se demand include low concentrations of dietary protein (especially sulfur-containing amino acids), diets with an excess of selenium-antagonistic compounds, and possibly genetic influences on selenium metabolism.
- Vitamin E demand may increase with diets high in polyunsaturated fatty acids, Vitamin A, mycotoxins or rancid fats.

Tissues to Submit

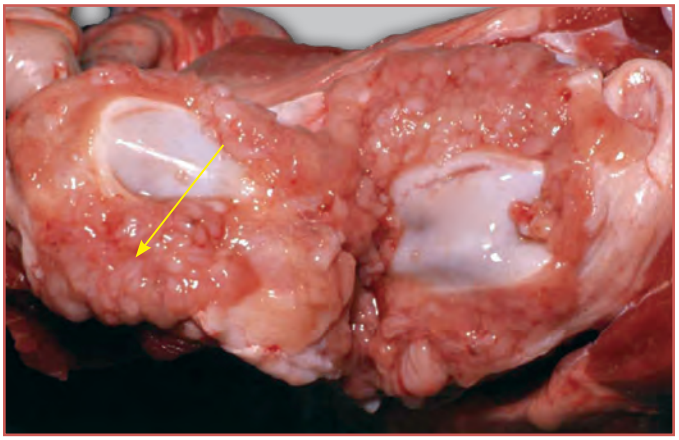
- Fresh Lung and Pericardial Fluid
- Formalin-Fixed Left and Right Ventricles

Diagnostic Tests

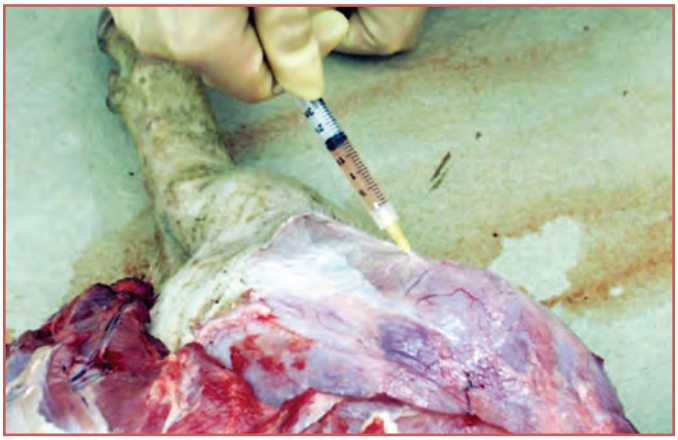
- Culture of Lung and Pericardial Fluid to Rule Out Septicemia
- Histopathology Reveals Diagnostic Lesions

M. hyo Polyarthritis

Mycoplasma hyosynoviae



Proliferative synovitis



Collecting joint fluid.

Dog-sitting pig.

ARTHRITIS

Tissues to Submit

- Joints
- Synovium

Diagnostic Tests

- Myco Multiplex PCR
- Culture

Clinical Signs and History

- Lameness typically occurs at 3–5 months of age, appearing acutely and may occur in more than one leg.
- Slight reduction in appetite, resulting in weight loss.

Stages of Production

- Grow-Finish

Diagnosis

- Infected joints are swollen with edema and hyperemia of synovial membranes.
- On necropsy, lesions are restricted to the joints, especially the stifles.
- Joints contain excess of clear, yellow synovial fluid while surrounding tissues are unaffected.
- Definitive diagnosis is made based on isolation of organism.

Lepto / Parvo / PRRSV

Parvovirus-infected sow litter following abortion. Note mummified fetuses, uneven sizes and post-mortem change indicative of *in utero* death.

One litter from a PRRS virus–associated abortion. Note litter has late- term piglets, at varying stages of *in utero* decomposition, typical of the disease infecting one piglet at a time *in utero*.

Clinical Signs and History

- Abortions, mummies, stillborns, weakborns.
- PPV is the most commonly identified cause of reproductive failure, with associated mummification.
- Lepto can cause abortions occurring two to four weeks before farrowing, and is the most common manifestation of leptospirosis in pigs.

Stages of Production

- Gestation
- Farrowing

Diagnosis

- Porcine parvovirus (PPV) is usually asymptomatic in adults.
- Sows infected with PPV before 70 days of gestation may abort mummified or near-term autolyzed fetuses.
- PRRS causes late-term abortions including fresh and autolyzed pigs, or weakborn piglets.

Tissues to Submit

- Aborted Fetus – two of the freshest
- Mummies – two typical
- Stillborns
- Weakborns
- Sow Serum

REPRODUCTIVE

NOTES:

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