Swine toxicoses

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Acute toxicoses in swine are not extremely common, but when they do occur, they can affect large numbers of animals. More common are chronic toxicoses caused by mycotoxins, or problems associated with feed-related deficiencies. Last year, in the Toxicology Section of the Animal Disease Diagnostic Laboratory of Purdue University, there were approximately 90 swine-related tests performed. Of these, 95% were liver or serum tests for vitamin E/selenium with 12% being deficient in vitamin E and/or selenium. No samples tested positive for any of the poisons listed in this review.

The purpose of this brief review is not to list every possible poison known to swine and its mechanism of action. Rather, it will present the clinical signs of potential toxicoses and then list poisons which have been reported in the literature to cause those signs in swine in field cases. This will be followed by a brief description of the problem and by methods of diagnosis.

Clinical signs/Causes

Sudden death

Vitamin E/Selenium deficiency

- white muscle disease, severe cardiac and skeletal muscle damage
- relative feed deficiency
- *diagnosis:* history, response to vitamin E/selenium (serum and/or liver vitamin E/Se may be helpful in diagnosis), histology of cardiac and skeletal muscle

Organophosphorus (OP)/Carbamate insecticide

- accidental or malicious incorporation in feed
- application of OP-containing spray to navels of 3- to 6-hour-old pigs
- *diagnosis:* history, detection of OP/carbamate in feed, water, stomach contents, and/or liver. Depression of brain and blood cholinesterase

Iron overdose

- excess administration in young pigs
- *diagnosis:* history, serum and liver iron, histology of liver

Hydrogen sulfide gas (H_2S.)

- pit gas, often associated with agitation
- *diagnosis:* history, high H_2S in air

Carbon monoxide (CO) gas

- furnaces with improper ventilation and/or adjustment in confinement
- *diagnosis:* history, air testing, carboxyhemoglobin

Aflatoxin (mycotoxin)

- possible sudden death with feed contaminated with very high concentrations (up to 2 ppm). Lower concentrations can cause other problems. See below
- *diagnosis:* history, aflatoxin in feed, liver histology

Coal tar pitch

- chewing on tar or tar paper, old clay pigeons
- *diagnosis:* history, liver histology, phenols in tar

Abnormal CNS signs

Organophosphorus/Carbamate insecticide

- salivation, lacrimation, urination, defecation, tremors, seizures, death
- accidental or malicious contamination of feed or water
- *diagnosis:* history, detection of OP/carbamate in feed, water, stomach contents, and/or liver. Depression of brain and blood cholinesterase

Ethylene glycol (antifreeze)

- ataxia/incoordination can be followed by kidney failure, weakness, and death
- antifreeze in radiators or watering systems
- *diagnosis:* history, increased blood urea nitrogen (BUN), kidney histology, glycols in urine

Organic arsenicals (phenylarsonics)

- ataxia, posterior paresis, blindness
- excess in feed, concurrent illness, inadequate water
- *diagnosis:* history, histology of optic and peripheral nerves, arsenic in blood, kidney, and liver

Organochlorine (OC) insecticides

- muscle tremors, hyperexcitability
- excessive use on animals, feed contamination. These are not used now, but are still an occasional source of toxicoses
- *diagnosis:* OC insecticides in feed, body fat, liver, skin

Blue-green algae (neurotoxins)

- tremors/convulsions and death; with or without salivation, lacrimation, urination, and/or defecation
- rapid growth of toxic blue-green algae in pond water
- *diagnosis:* history, detection of blue-green algae and toxin in water

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Water deprivation/salt (sodium) toxicity

- ataxia, convulsions, death
- usually associated with water deprivation
- *diagnosis:* history, sodium in serum and CSF, brain histology (perivascular eosinophillic cuffing)

Selenium toxicity

- paralysis, death
- feed error, possible injection error
- *diagnosis:* history, feed, serum and liver selenium

*Cocklebur (*Xanthium sp.*)*

- weakness, ataxia (associated with liver failure)
- ingestion of young plants
- *diagnosis:* history, liver histology

Furazolidone

- ataxia, hypermetria
- feed errors
- *diagnosis:* history, feed analysis

*Pigweed (*Amaranthus retroflexans*)*

- ataxia (associated with renal failure)
- ingestion of plant
- *diagnosis:* history of consumption, kidney histology, increased BUN

Cassia occidentalis

- ataxia (associated with myopathy)
- ingestion of plants/feed containing plants and seeds
- *diagnosis:* history, histology of cardiac, skeletal, diaphragmatic muscles, plants/seeds in feed

Levamisole

- ataxia, salivation, vomiting
- improper use
- *diagnosis:* history

Hemorrhage

Vitamin K-responsive hemorrhagic pig syndrome

- weaned, 30- to 40-day-old pigs. Severe hemorrhage sometimes associated with castration. Responds to vitamin K treatment
- appears to be feed-related
- *diagnosis:* history, coagulation testing

Anticoagulant rodenticide ingestion

- severe hemorrhage. Accidental or malicious poisoning with rodenticide baits. Swine very sensitive
- *diagnosis:* history, coagulation testing

Aflatoxin

- severe hemorrhage (lack of clotting factors associated with liver damage)
- mycotoxin in feed
- *diagnosis:* history, aflatoxin in feed, liver histology

Gastrointestinal disturbances

Organophosphorus/Carbamate insecticide

- vomiting, diarrhea
- *diagnosis:* history, detection of OP/carbamate in feed, water, stomach contents, and/or liver. Depression of brain and blood cholinesterase

Inorganic arsenic

- vomiting, diarrhea
- accidental or malicious poisoning with old pesticides
- *diagnosis:* history, arsenic in liver, kidney, stomach contents

Vomitoxin (deoxynivalenol)

- vomiting (feed refusal more common)
- mycotoxin in feed
- *diagnosis:* history, feed analysis for vomitoxin

Vitamin D

- vomiting, death
- accidental excess in feed
- *diagnosis:* history; feed, serum, liver analysis for vitamin D; increased serum calcium; histology (widespread calcification with necrosis of kidney and stomach)

Respiratory difficulties

Fumonisins (mycotoxin)

- pulmonary edema
- mycotoxin in feed
- *diagnosis:* history, fumonisins in feed

Ammonia gas

- frequently elevated in confinement facilities
- irritation of respiratory tract, decreased ability to clear lung bacteria
- *diagnosis:* history, air testing

Carbon dioxide (CO_2) gas

- rare respiratory problems
- *diagnosis:* history, air testing

Hydrogen sulfide gas

- rapid breathing, followed by apnea, death
- *diagnosis:* history, high H_2S in air

Ionophore feed additives (monensin, lasalocid, narasin, salinomycin)

- open mouthed breathing (related to cardiomyopathy)
- feeding errors
- *diagnosis:* history, feed analysis, histology of muscle

Paraquat herbicide

- respiratory difficulties (due to pulmonary fibrosis)
- accidental or malicious poisoning
- *diagnosis:* history, feed and urine analysis, histology of lungs

Cottonseed meal (gossypol)

- respiratory difficulties (related to cardiomyopathy)
- excess in feed
- *diagnosis:* history, feed analysis, histology of cardiac, diaphragmatic, and skeletal muscle

Weakness/Depression

Vitamin E/Selenium deficiency

- severe cardiac and skeletal muscle damage may lead to death
- relative feed deficiency
- *diagnosis:* history, response to vitamin E/selenium (serum and/or liver vitamin E/Se may be helpful in diagnosis), histology of muscle

Ionophores (monensin, lasalocid, narasin, salinomycin)

- cardiac and skeletal muscle damage
- *diagnosis:* history, feed analysis, histology of muscle

Blue-green algae hepatotoxin

- severe liver damage may lead to death
- rapid growth of toxic blue-green algae in ponds
- *diagnosis:* history, identification of toxin/blue-green algae in water, histology of liver

Anticoagulant rodenticides

- severe hemorrhage
- *diagnosis:* history, coagulation testing

Pigweed (*Amaranthus retroflexans*)

- severe kidney damage
- *diagnosis:* history of consumption, kidney histology, increased BUN

Ethylene glycol (antifreeze)

- severe kidney damage in second phase of toxicosis
- *diagnosis:* history, increased BUN, kidney histology, glycols in urine

Cottonseed meal (gossypol)

- severe cardiac and skeletal muscle damage
- *diagnosis:* history, feed analysis, histology of cardiac, diaphragmatic, and skeletal muscle

Aflatoxin

- subacute to chronic poisoning causing liver failure
- aflatoxins in feed
- *diagnosis:* history, aflatoxin in feed, liver histology

Cocklebur (*Xanthium sp.*)

- severe liver damage
- *diagnosis:* history, liver histology

Vitamin D

- severe metastatic calcification and kidney damage
- *diagnosis:* history; feed, serum, liver analysis for vitamin D; increased serum calcium; histology (widespread calcification with necrosis of kidney and stomach)

Estrogenic effects/Reproductive problems/Abortion/Teratogens

Zearalenone (mycotoxin)

- estrogenic activity, hormonal changes
- vaginal prolapse, vulvovaginitis, rectal prolapse, signs of estrus in young females. Anestrus in sows. Reduced litter size
- preputial enlargement in males
- *diagnosis:* history, feed analysis for zearalenone

Carbon monoxide gas

- abortion, increase stillborn, decreased growth rate
- *diagnosis:* history, air testing, carboxyhemoglobin

Ergot (mycotoxin)

- agalactia, hormonal disturbances
- feed contaminated with ergot sclerotia
- *diagnosis:* history, feed analyses

Poison hemlock (*Conium maculatum*)

- teratogenic (congenital limb deformities)
- ingestion of plant
- *diagnosis:* history of ingestion and congenital limb deformities

Tobacco (*Nicotiana spp.*)

- teratogenic (congenital limb deformities)
- ingestion of tobacco plants
- *diagnosis:* history of ingestion and congenital limb deformities

Growth depression

Ammonia gas

- respiratory irritation
- *diagnosis:* history, air testing

Carbon dioxide gas

- high concentrations associated with lower production parameters
- *diagnosis:* history, air testing

Carbon monoxide gas

- high concentrations associated with depressed growth
- *diagnosis:* history, air testing, carboxyhemoglobin

Aflatoxin (mycotoxin)

- feed refusal and decreased growth rate
- *diagnosis:* history, aflatoxin in feed, liver histology

Vomitoxin (deoxynivalenol, mycotoxin)

- feed refusal, *occasionally* vomiting
- *diagnosis:* history, feed analysis for vomitoxin

Ergot (mycotoxin)

- reduced weight gain
- *diagnosis:* history, feed analyses

Ochratoxin (mycotoxin)

- reduced growth
- *diagnosis:* history, feed analysis for ochratoxin, kidney histology

Fumonisin (mycotoxin)

- reduced feed consumption
- *diagnosis:* history, fumonisins in feed

Copper

- reduced weight gain
- excess (> 300 ppm) copper in feed
- *diagnosis:* history, feed and liver analysis for copper

Carbadox

- decreased feed consumption and weight gain
- excess (>100 ppm) in feed
- *diagnosis:* history, feed analysis, histology of adrenal gland

Increased urination

Ochratoxin (mycotoxin)

- severe kidney damage
- *diagnosis:* history, feed analysis for ochratoxin, kidney histology

Ethylene glycol (antifreeze)

- severe kidney damage
- *diagnosis:* history, increased BUN, kidney histology, glycols in urine

*Pigweed (***Amaranthus retroflexans***)*

- severe kidney damage
- *diagnosis:* history of consumption, kidney histology, increased BUN

Explosion

Methane

- gas from manure. Non-toxic, high concentrations could cause asphyxiation
- 5% to 15% mixture of methane in air is potentially explosive
- *diagnosis:* history of loud boom, lots of debris

Submission of samples

If a toxicosis is suspected in a **live animal**, samples that can be of value in analysis are:

- whole blood,
- urine,
- vomitus (or gastric contents from lavage), and
- feed.

Clot separator tubes should not be used because the clot separator substance can make some analyses difficult or impossible. Serum should be separated from the clot and frozen. Urine and stomach contents should be frozen. Feed should be thoroughly mixed and a representative sample submitted. With feed analyses it must be remembered that toxins are not usually uniformly distributed. Therefore, care must be taken to gather a thoroughly mixed sample. In addition, it is possible that the feed available for sampling is not the same as that which was originally eaten and caused the toxicosis.

If an unknown poisoning is suspected at **necropsy**, then samples to be collected include:

- liver,
- kidney,
- fat,
- brain,
- stomach contents,
- urine, and
- blood (if available).

With the exception of blood, 100-200 g (¼ to ½ lb) of tissue (or all that is available) should be collected, wrapped in aluminum foil, placed in individually labeled plastic bags, sealed, and frozen. Brains should be cut longitudinally and one half of the brain wrapped, labeled, sealed, frozen, and submitted. Representative samples of tissues should also be fixed in formalin for histological examination.

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