



SUDDEN DEATH OF GESTATING SOWS AND FATTENERS ON A FARROW-TO-FINISH FARM

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valPOR
PRODUÇÃO ANIMAL

JUNE 2019 - FIRST CALL

- 4 **gestating sows** had **suddenly died** in 3 consecutive days
- Workers reported **high-pitched screams** minutes before they found them **lying dead** on their pens



NOVEMBER 2019 - SECOND CALL

- 3 **gestating sows** had **suddenly died** in 3 consecutive days in the same building
- 2 **fattening pigs** (18 weeks-old) from the adjacent fattening rooms were **affected** with **hind-limb paralysis** (both) and **epistaxis and hematemesis** (one of them)

Farm characteristics

- Type: farrow-to-finish farm
- Year of construction: 1981
- Herd size: 380 sows
- Batch system: weekly
- Feed: company owned feed mill
- Genetics: hybrid Largewhite x Landrace (Hypor) x Pietrain (boar)
- Average level of internal and external biosecurity



Vaccination scheme

Agent	Gilts	Gestating sows	Lactating sows	Piglets	Weaners	Fatteners
Aujeszky's disease virus	x	x*			x	x
<i>Bordetella bronchiseptica</i> and <i>Pasteurella multocida</i> (atrophic rhinitis)	x					
<i>Escherichia coli</i> + <i>Clostridium perfringens</i> + <i>Clostridium novyi</i>		x				
<i>Mycoplasma hyopneumoniae</i>	x			x		
Porcine parvovirus + <i>Erysipelothrix rhusiopathiae</i> + <i>Leptospira</i> spp.	x		x			
PRRSV	x	x*			x	
PCV2	x			x		

* Blanket vaccination

Health status

Health status
Oscillating fertility and abortions
PRRSV unstable
Fibrinous polyserositis (<i>Mycoplasma hyorhinis</i> and <i>Glaesserella parasuis</i>)
Slaughter checks: pulmonar cranioventral consolidation (40%); pleurisy (8%); milk spot liver lesions from <i>Ascaris suum</i> (20%)
Average anual mortality (sows): 4%
Average anual mortality (nursery): 3%
Average anual mortality (fattening): 2%

Clinical examination



Sudden death





Cyanosis of vulvae, udders and limbs



Epistaxis and hematemesis



Hind-limb paralysis

Necropsy findings

Date	Type of animal	Lesions
June 2019	Sow (8P)	Cyanosis (udder, vulva) Cystitis
June 2019	Sow (4P)	Cyanosis (limbs, vulva) Splenic abscess
November 2019	Fattener (18W, euthanized)	Paleness Epistaxis Hematemesis Gastric congestion

Problems | Differential diagnoses

Problem	Differential diagnosis
Sudden death	Gastric ulceration
	Hemorrhagic bowel syndrome: <i>Clostridium novyi</i> enterotoxemia and/or intestinal/visceral torsions/gastric dilation
	Acute circulatory failure (fighting/heat stress, others)
	Cystitis-pyelonephritis complex
	Endometritis/uterine torsion
	Bacterial septicemia (erysipelas, others)
	Viral systemic infections (CSF, ASF, others)
	Porcine pleuropneumonia (App)
	Intoxications
	Accidents

Diseases of Swine, 2019

Problems | Differential diagnoses

Problem	Differential diagnosis
Hind-limb paralysis	Bacterial septicemia (streptococcosis, others)
	Neurological viral infections (Teschen disease, AD, others)
	Intoxications
	Nutritional deficiencies
	Accidents

Diseases of Swine, 2019

Diagnostic approach

Intoxications
Salt poisoning
Toxic gases (NH ₃ , H ₂ S, CO)
Selenium toxicosis
Insecticides

Accidents
Fights
Trauma
Ventilation failure
Electrocution/electrical shock

Nutritional deficiencies
Calcium and phosphorus
Copper
Vitamin E or selenium

Diseases of Swine, 2019

Diagnostic methodology
Analysis of the feed and water
Gas measurement
Facilities inspection

Diagnostic approach

- **Drinking water quality: microbiological analysis** → good quality (according to guide of good practices)
 - Bore water
 - Previous results from June 2018: good quality
- **Feed analysis: granulometry, microbiological and mycotoxin analysis**
 - No abnormal values



Immediate treatment and prevention

- **June 2019**

- No treatments due to unspecific clinical signs or recovering animals
- Keep the sows cool

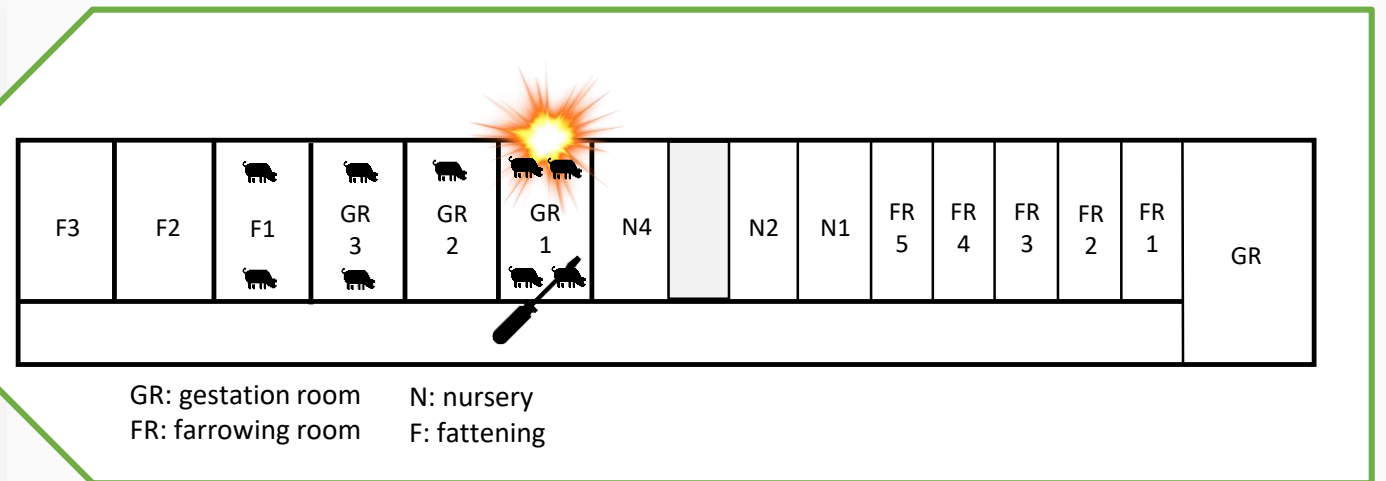
- **November 2019**

- Euthanasia of the 2 affected fatteners
- Control rodenticide use
- **A new development: electrical problems the previous day (circuit breakers switching off).** Revise the electrical system more thoroughly



A previous case from 2018: brodifacum intoxication on a fattening unit

Next step: revising the electrical system



- **June 2019:** 3 death sows GR1 + 1 death sow GR2
- **November 2019:** 1 death sow GR1, 2 death sows GR3, 2 affected fatteners F1

Next step: revising the electrical system

- **A damaged cord directly contacted a metal post connected to the feeding system motor on GR1**
- The flow of current followed the path of the conducting metal in the gestation and fattening rooms
- An electrical surge happened and some sows and fatteners moved frantically in the pens
- Personnel wearing rubber-soled boots were protected (grounded)



Next step: revising the electrical system



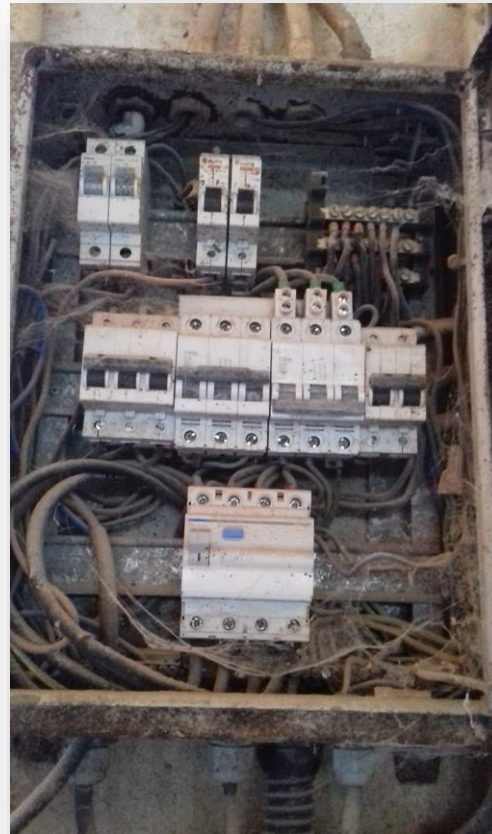
Outcome and follow up

- **On the basis of the history, evidence of electrical problems and occurrence of unspecific lesions, a diagnosis of a likely accidental electrocution was made**
- **No more deaths were registered after the maintenance staff fixed the faulty connection**

Injury or death by accidental electrocution in farm animals

- **Causes:**

- Lightning (outdoor) (Van Alstine and Widmer 2003)
- Faulty electric circuits (Knox et al. 2014; Bildfell et al. 1991; Bildfell et al. 1990)
- Improper use of electrical equipment (Bildfell et al. 1991)



A bad maintenance of the electrical system may lead to accidents

Injury or death by accidental electrocution in farm animals

- Lesions are very variable (low-voltage/short contact versus high-voltage/prolonged contact)
- **External injuries:**
 - No identifiable lesions (Van Alstine and Widmer 2003, Bildfell et al. 1991)
 - **Electrothermal burns** (usually in high-voltage accidents or low-voltage accidents with small contact areas and/or prolonged contact) (Schulze et al. 2016). Singed hairs. Current marks (cattle, pigs) (Viner et al. 2014, revised by Schulze et al. 2016). Burns on the sole of the **hooves** (Sanford et al. 1993).



Current marks, skin, pig. Schulze et al. 2016

Injury or death by accidental electrocution in farm animals

- **Internal lesions:**

- **Signs of acute circulatory failure** (congestion, petechiae and ecchymoses in the trachea, heart and lung, often combined with early rigor or bloating) (Bildfell et al. 1991; Giles and Simmons 1975, revised by Schulze et al. 2016; Mills and Kersting 1966, revised by Schulze et al. 2016)
- Muscular hemorrhages (cattle, pigs) (Gwon Rho 2020; Van Alstine and Widmer 2003; Sanford et al. 1993; Bildfell et al. 1991)
- Central nervous signs (humans) (Price and Cooper 2013, revised by Schulze et al. 2016)
- **Spinal, pelvic or limb fractures** (may be grossly subtle) → careful pelvic and vertebral dissection recommended during necropsy (Van Alstine and Widmer 2003; Sanford et al. 1993; Bildfell et al. 1991)

Injury or death by accidental electrocution in farm animals

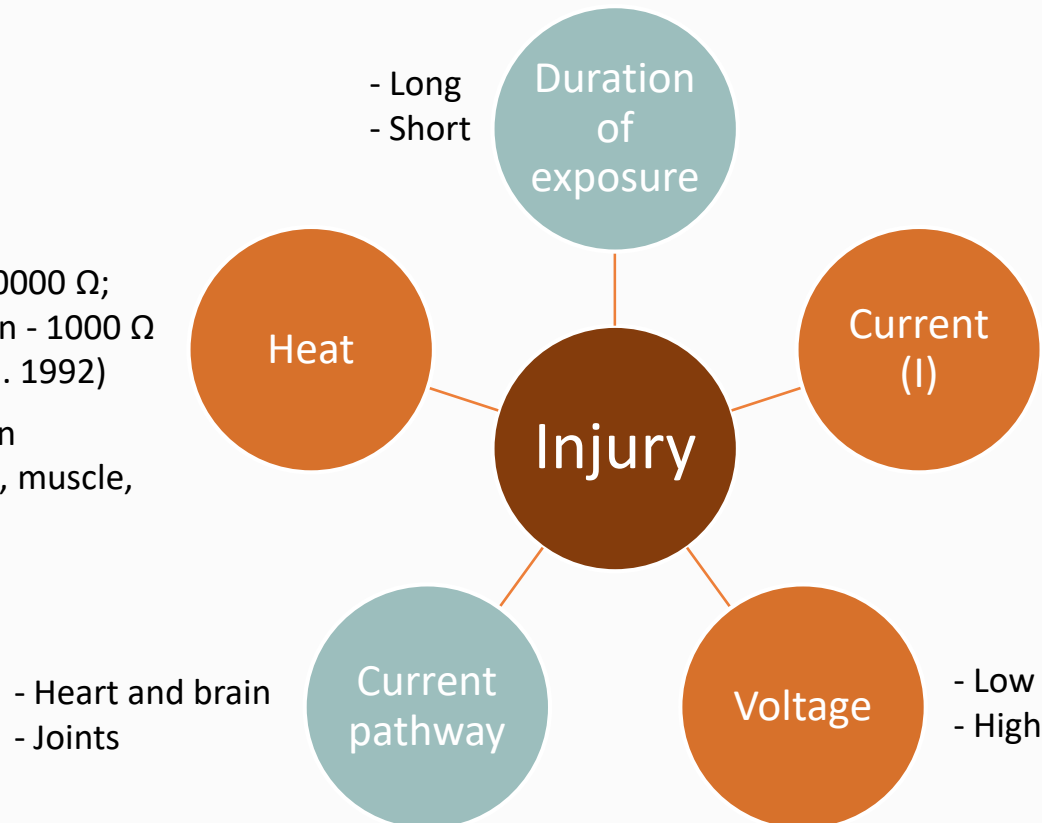
- **Microscopic lesions:**

- No identifiable lesions of CNS, lung, liver, kidney, spleen, muscle, GI tract (Van Alstine and Widmer 2003)
- Perivascular hemorrhages in the brain and spinal cord (pigs) (Sanford et al. 1993, Bildfell et al. 1991)
- Myelomalacia (pigs) (Sanford et al. 1993)
- Severe hemorrhages of internal organs and muscles (cattle) (Gwon Rho 2020)
- Myonecrosis (cattle) (Gwon Rho 2020)

Determining factors for electric injuries

Resistance (Joule's 1st Law):

- Moisture ↓ Ω : dry skin - 250000 Ω ; moist skin - 10000 Ω ; wet skin - 1000 Ω (Knox et al. 2014, Matte et al. 1992)
- ↑ Ω : bone, fat, tendons, skin
- ↓ Ω : blood, nervous tissues, muscle, mucous membranes



Current intensity	Effect
1 mA	Tingling sensation
1-4 mA	Pain
6-22 mA	Inability to let go
16-20 mA	Skeletal muscle tetany
50-100 mA	Ventricular fibrillation
2 A	Asystole
15-30 A	Common household circuit breakers

Schulze et al. 2016

1,3 A - Council Regulation (EC) No. 1099/2009

Ohm's Law: $I = \text{Voltage} / \text{Resistance}$

- Dry skin: $230 \text{ V} / 250000 \Omega = < 1 \text{ mA}$
- Moist skin: $230 \text{ V} / 10000 \Omega = 23 \text{ mA}$
- Wet skin: $230 \text{ V} / 1000 \Omega = 230 \text{ mA}$

- Bodyweight and localization of the animals?

Death usually results from disruption of vital physiologic electric functions and leads to cardiac or respiratory arrest (Schulze et al. 2016)

Conclusions

- Electrocution/electrical shock should be in your list of differential diagnosis whenever there are cases of sudden death or if hind-limb paralysis is observed, especially in **old farms** (obsolete electrical systems and/or insufficient maintenance of the electrical system)
- **Careful investigation** of the **victim** and the **environment** has to be carried out to make a final or most likely diagnosis of electrocution since **morphological lesions tend to be inconsistently present or even absent**
- Never disregard the importance of **rodents** as vectors of disease, but also as important sources of damage to electrical systems

Thank you for your attention!