Electrocution in Swine Production Units

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While on a preceptorship, the practitioner and I were called out to a finishing unit to investigate a possible electrocution of a dozen finisher swine. Electrocution of pigs is a relatively rare occurrence. When electrocution is suspected, it is important to look for diagnostic clues, not only during necropsy, but from the environment as well.

We were called out to a six hundred head finisher. The practitioner was the third veterinarian to be called out to investigate the problem. The first two veterinarians were unsuccessful in reaching a definitive diagnosis. The animals in question were twelve crossbred finisher swine weighing approximately two hundred pounds, located in two different pens. The pigs presented with hind limb paralysis, ventral recumbency, and reluctance to rise. All twelve were bright, alert, and responsive and exhibited normal respiration. There were no dead animals in the two affected pens.

We elected to euthanize one of the pigs showing clinical signs with intravenous administration of 1 milliliter per ten pounds of sodium pentabarbitol.[a] Necropsy revealed very few diagnostic clues. Upon entry into the thoracic cavity, the heart and lungs were normal. There was no evidence of pulmonary edema or petechial hemorrhages on the heart or lungs. The trachea was also normal. Both crura of the diaphragm were normal as well. There were no gross lesions on any of the abdominal organs. However, there was an area of widespread edema encompassing the mesentery of the stomach, pancreas, and spleen. Musculoskeletal evaluation of the rear legs revealed edema between muscle groups of the quadriceps. Although the pig could not walk under his own power, there were no fractures grossly evident on either of the femurs. This type of fracture is sometimes observed when pigs are electrocuted prior to necropsy. The lumbar vertebrae were also found to be normal. Although a pelvic fracture could easily cause the clinical signs observed, the pelvis was not evaluated. Due to the fact that there were no significant gross lesions, tissues were not submitted for histopathology.

After the necropsy was performed, our differential diagnoses included electrocution, heat stroke, and blunt trauma. Our investigation of the environment coupled with the history caused us to rule out both heat stroke and blunt trauma from our differential list. The producer had said that the transformer on the property had stopped working during a thunderstorm that occurred two mornings ago. The weather was cool and damp the entire weekend, which would not support a diagnosis of heat trauma. Blunt trauma could be ruled out in this case due to the fact that there was no disruption to the inside barn structure.

The most interesting finding was the fact that there were two separate pens of pigs affected. They were end pens, both of which had electric motors mounted above the feeders to run a flex-type of feed auger.

Our final diagnosis was a likely pelvic fracture caused by severe muscle contracture during electrocution from lightning. The most likely scenario was that the electric current from lightning traveled from the transformer through the building wiring. The surge of electricity either electrocuted the pigs eating at the feeders or created an arc of electricity from the building wiring, which debilitated the twelve pigs in question.

The course of this injury was very acute and the prognosis in this situation was guarded to poor. Some affected animals can recover, especially if there is no severe skeletal or central nervous system damage. In this particular case, the pigs were not eating and were reluctant to move. We instructed the owner to administer 4 milliliters of dexamethasone per pig along with 10 milliliters of procaine penicillin[b] per head per day for two days. The owner was told to give the injections in the neck muscle and to wait for thirty days before marketing the

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[a] The trade name of sodium pentobarbital used in this situation was Beuthanasia.

[b] The trade name of penicillin used in this case was Procaine Pen G

animals.

Upon reevaluation of the pigs 48 hours later, their conditions were not improving significantly and the pigs were euthanized for humane reasons. The owner of the building had insurance to cover this type of accident. However, the deductible amount far exceeded the value of the pigs affected so the owner did not pursue an insurance settlement in this case.

This case of lightning stroke was eerily similar to a previous report which described a Manitoba farmer's observation of a close lightning strike which resulted in severe damage to the transformer on his property.[1] He then checked his pigs housed in a pole barn and found pigs with stiff rear legs, reluctance to move, and some unable to rise. As in the case reported here, some pigs were observed to favor a dog sitting position. In the Manitoba case, there was extensive hemorrhaging in the pelvic region with grossly evident fractures of the acetabulum, ribs, and transverse processes of the lumbar vetertebrae.[1] In our case, we found no evidence of any fractures or hemorrhage, although we found fairly extensive edema in the mesentery, which was not reported in the Manitoba case.

b The trade name of penicillin used in this case was Procaine Pen G

Another report described similar clinical signs of posterior paralysis of swine.[2] However, this was not a case of lightning, but rather accidental electrical shock. A farmer was welding at one end of his sow barn. The row of crates that he was repairing was empty. However, the farmer accidentally touched the welding rod to a row of crates behind him. Eight sows at the end of the barn immediately collapsed. The referring veterinarian diagnosed posterior paresis, and all eight animals were marketed. Extensive hemorrhage in the rear leg muscles as well as femoral and pelvic fractures were observed at necropsy.

This report also described another case in which dead pigs were found among several pens.[2] Apparently, a gate between the two pens had collapsed breaking a water line and flooding the floor of the barn. A veterinarian called out to the farm diagnosed hydrogen sulfide poisoning and sent four dead pigs to a local diagnostic laboratory. The lab found lesions of pulmonary edema and petechiation of the epicardium and pleura. Although we found some evidence of edema, the pulmonary system was not affected. In this second case, the cause of electrocution was a bare wire from an old thermostat that was grounded to the floor, extending throughout the entire barn.

In yet another report from the literature, three gilts were accidentally electrocuted. After doing chores, a hired hand noticed a breaker switch that was turned off. He flipped it on, heard several pigs squeal, and immediately turned it off. The breaker controlled some broken water heaters and should have stayed turned off until they were repaired. The affected gilts were bright, alert, and responsive, able to remain sternal, and the hind limbs were nonfunctional. All three pigs showed some degree of fractures, either of the lumbar vertebrae, or sacrum.[3]

Finally, a diagnostic laboratory in Canada described similar gross lesions in 1993.4 The 15 pigs affected had a typical

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A Disease Treatment Discovery

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Before 1940 we had no drugs that would specifically kill the bacteria of any disease, and the home remedies did very little good in treating most diseases. By 1940 the first sulfa drug that became available was sulfanilamide, and in my senior year in The College of Veterinary Medicine at Iowa State University I used it in treating infectious diseases in horses. It was used successfully especially in large animals such as horses and cattle. By 1946 I became interested in working out a treatment for swine dysentery that was such a costly disease for swine farmers. About 1936 my father, Clay Orum, had swine dysentery infect his feeder pigs weighing less than a hundred pounds, and like most cases he lost over one-third of the herd, and some of those that did live did not gain weight very well after the outbreak. As a veterinary practitioner I faced the dilemma of not being able to help many farmers that lost such high numbers of hogs from this disease.

Dr. W. B. Holmes owned and operated the Holmes Serum Company, a veterinary supply distributing company in Springfield, Illinois. In July, 1946, he called on me and told me about a new sulfamethazine injectable product he had received that was a fifty percent solution of Sulmet in 500cc bottles. Sulmet is the trade name for one company's sulfamethazine. I did not order any but a day or two later I was called out to a farm near Fountain Green, Illinois. This hog farmer had two hundred 160-175 pound hogs that were infected with the "bloody scours," and several had died. I called Dr. Holmes from Fountain Green and asked him to send me enough of this Sulmet to treat this herd. He said he would deliver the Sulmet to me that night. I asked the farmer to check with a dozen neighbors of his to provide the help of catching these large hogs, placing them in a V trough head down, stomach toward me, so that I could inject the medication into the pig's body cavity. This was the fastest way of getting the drug into the bloodstream within a half hour. True to his word, Dr. Holmes delivered the shipment of Sulmet that night and the next morning at daybreak I started injecting these terribly sick hogs with the injectable sulfa. We worked almost all day, and the poor farmers were exhausted, but by the next morning even the very sickest hogs looked well!

I developed the idea that medication through the drinking water would be best. It would be less stressful on the hogs as well as the humans. I asked Dr. Holmes to see if he could get me a soluble sulfathiazole powder that I could put in the drinking water of the portable water fountains. He called me back and said he could and that the powder was in fifty pound drums. With a little experimenting I found that the best method was dissolving a pound of the sodium sulfathiazole in a gallon jug of water and using a pint of this solution to each thirty gallons of drinking water. In reading an article in our AVMA Research Journal, I found that physicians were experimenting with sodium arsinilate in humans that held some promise in stimulating the faster healing of the epithelium lining of the intestinal tract of humans. I decided to try it in swine since they, of all animals, are most like humans in body tissues. It took some time and study to work out the dosage in the drinking water of hogs, but when I did use the two drugs in combination the results were like a miracle. I used $^1/_4$ pound of arsanilic acid in a one gallon jug of water, and this was used at the rate of one pint per gallon of drinking water. The cost was reasonable and the results were quick. It never changed in the thirty-five years I used them, $8.50 per gallon for the pink and $8 per gallon for the yellow. I used food coloring in the gallon jugs of solutions to differentiate the two:pink for the sulfathiazole sodium and yellow for the sodium arsinilate. I found the sodium sulfathiazole use could be stopped after the first week, and the sodium arsinilate should be used for two weeks. Most small farmers used 60-gallon water fountains and swine would

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drink one gallon or less per pig per day, depending on their size. Dr. Holmes spread the word. I told all the veterinarians in my area. I preached the treatment at our veterinary associations and in publications. It was used in thousands of herds during that time. The number of swine saved would be many times that, and the dollars saved would be astronomical. It was the greatest single achievement of the dollars I saved for my clients in the treatment of specific swine disease during my practice years. I believe strongly in veterinarians sharing their discovery and knowledge with fellow veterinarians. It was shared with hundreds, if not thousands of fellow veterinarians, and it is still used to this day. Other veterinarians found that it worked in respiratory disease, and it is commonly used in swine confinement businesses where respiratory problems are more common that enteric diseases. All important discoveries are not made in well-equipped laboratories although many are and they should be given credit for their great contributions to the livestock industry. But many discoveries are made by the individual veterinary practitioners and this is just one example.◆

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"dog sitting" presentation. Upon necropsy, gross lesions included longitudinal fractures of lumbar vertebrae, massive hemorrhage into the spinal canals, and in one case, total transection of the spinal cord at L5-L6.[4] There were no specific microscopic lesions seen.

In our case, we observed similarities and several differences between the cases referenced. However, there is one common theme which can be inferred. There are few definitive ways of diagnosing lightning stroke in swine regardless of the housing system. That is why it is critical to obtain an accurate and complete history, and to do a thorough physical exam and/or necropsy. More importantly, it is necessary to be a keen observer. Investigation of the animals' environment including feeding, watering, and flooring systems as well as malfunctioning wiring is paramount in arriving at a final diagnosis.◆

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