In-Transit Losses of Pigs: An Investigation of Hog Heart Health

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Background
The specific cause of death for hogs that die in-transit to a packing plant has rarely been investigated. The increase in shipping mortalities during the summer months is often attributed to heat exhaustion or stress. In Ontario, approximately 0.07% of hogs shipped in a year die during transport to the plant. However it is rarely questioned why so many hogs are able to tolerate the shipping conditions and why only a small percentage cannot.

Research from the authors (KZ, TVD) and other published studies have suggested that heart failure from pre-existing heart lesions may be the specific cause of death of the majority of hog shipping losses. However why the hogs develop these heart lesions is not known. The goal of this project was to examine and characterize market hog heart lesions and investigate if there is a genetic association with hog heart lesions.

The Project: What We Did and What We Found
From May 2012-September 2013, examinations of hogs that died while in transit to one slaughter plant were completed at the Animal Health Laboratory, University of Guelph. The hearts were removed from the carcass and preserved for further examination. For comparison, hearts were also collected from hogs that did not die in transit. Heart weights for hogs that died in transit were compared to the hearts of hogs that did not die in transit. Each heart was examined by one veterinary pathologist (TVD) both visually and microscopically.

Tissue samples from a selection of the hearts were sent to Geneseek Labs Inc. for gene sequencing. These sequence data were analyzed to determine if a common gene or genes could be associated with pigs that die during transport. A second analysis was completed to determine if a common gene or genes could be associated with pigs which had visibly affected hearts regardless of whether or not they died during transit.

- Post mortems were completed on 83 in-transit loss (ITL) hogs and 67 hearts were examined from hogs that did not die in transit. Post mortem findings on ITL hogs indicated cause of death was consistent with heart failure.
- The average total heart weight of hearts from hogs that died in transit was significantly heavier than the average total weight of hearts from the hogs that did not die in transit.
  ITL hearts 442.0 gm ± 66.4gm vs Non-ITL hearts 368.8gm ± 37.9gm (P<0.05)
- Visible enlargement of the heart was more common in the hearts of hogs that died in transit.
  77/83 (93%) of the ITL hearts had visible enlargement (hypertrophy) of the left or right ventricle.
  5/67 (7%) of the non-ITL (hearts from hogs that did not die in transit) had visible enlargement of the left or right ventricle.
Abnormal microscopic lesions were found in the hearts of hogs that died in transit and in those that did not die in transit. 63/83 (76%) of the ITL hearts and 51/67 (76%) of the non-ITL heart had microscopic lesions similar to those seen in Hypertrophic Cardiomyopathy (HCM).

Heart lesions were chronic in nature, i.e. the lesions were developing in the pig’s heart for weeks to months prior to the truck ride to the plant.

38 ITL hearts and 34 non-ITL hearts had samples sent for genetic sequencing and analyses.

Analysis of the gene sequencing data showed over 40 genes possibly associated with a pig dying during transport. Two of these genes are known to cause HCM in humans.

The second analysis of the gene sequencing data compared the genes of hogs with visible heart lesions to those that did not have visible heart lesions. This analysis found fewer genes possibly associated but the statistical associations were stronger with these genes compared to the first analysis.

Heart Lesions to Heart Failure

Heart lesions may cause a heart to not function properly. The heart then has to work harder to maintain normal function. The heart is a muscle. If it has to work harder to function, the heart becomes enlarged. The enlargement of defective hearts resulted in greater heart weights in this study. Compared to most other mammals, a pig’s heart is small in relation to its body size (1). As a result, hearts with compromised function have little reserve capacity to respond to challenges. Therefore if the heart is abnormal, any event that increases a pig’s heart rate (e.g. hot temperatures, fighting, being loaded on a truck) may result in heart failure.

Is There a Genetic Link to Hog Heart Lesions?

The visible and microscopic heart lesions found in the hogs in this study were similar to those observed in a genetic heart disease called Hypertrophy Cardiomyopathy (HCM). HCM has been recognized in people and some breeds of dogs and cats. HCM can result in sudden death in young, apparently healthy individuals. HCM-like lesions in pigs have been previously documented by a research group in Taiwan (2). Based on breeding experiments, the researchers suggested that the heart lesions were inherited (3), however no gene sequencing analyses were completed by the Taiwan research group.

The analyses of the gene sequencing data are very preliminary. A greater number of heart tissue samples will need to be tested to determine the specific gene(s) associated with heart lesions in hogs. If this can be established, it could be possible that the swine industry will be able to proactively address shipping mortalities through genetic selection to eliminate a HCM-like heart lesion gene or genes from the Canadian swine population.

Take Home Messages

- In this study the majority of hogs that died in transit had a pre-existing cardiac abnormality resulting in hogs that were unable to survive standard transport practices.
- The hog heart lesions found in this study were similar to a genetic heart disease of humans, called Hypertrophic Cardiomyopathy (HCM).
Preliminary analyses from this study appear to demonstrate that HCM-like hog heart lesions have a genetic association, but further testing and analyses are needed to identify specific gene(s) involved. The project is continuing to collect samples for more testing.

References


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