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PULPY KIDNEY DISEASE IN OREGON LAMBS  
(Infectious Enterotoxemia)

by

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Introduction

For many years the sheep breeders of Curry County have reported heavy losses in their best lambs. These losses have occurred on lush pastures after the lambs are six weeks to two months of age. In this particular county, losses usually begin in early April and end not later than July. Some breeders report losses as high as 25 per cent, although such heavy losses have not been experienced since our investigation started. No popular common name has been given to this disease. Most animals were found dead and so thoroughly devoured by buzzards that nothing characteristic could be detected by the owners, except that death usually occurred rather suddenly. After the investigation started, it was found that in most of the cases examined, the kidneys were dark and very soft; hence the common name "pulpy kidney." This is now the accepted common name among the workers with this disease in England, Australia, and New Zealand.

This disease was first brought to the attention of members of the Department of Veterinary Medicine in 1933, at which time it was believed that some poisonous plant was involved. It was then recognized that the disease was similar to sudden losses occurring on rape pastures in the Willamette Valley. Such losses were in older lambs, but lesions were quite similar. In the Valley, the breeders believed the disease to be hemorrhagic septicemia, and, in spite of unfavorable results, continued to use vaccine for protection against this disease. Efforts to isolate hemorrhagic septicemia organisms, however, met with failure.

During the spring of 1939, typical losses occurred early, not only in Curry County, but in Benton, Douglas, Lane, Linn, Marion, Morrow, and Lake Counties. One typical case occurred in the Station flock.

In 1939, the spring being early, the lambs were on lush pastures at about the same age throughout the state, and typical pulpy kidneys were found in lambs two weeks old. Pulpy kidney disease assumes much more importance when we study the losses and their distribution this past spring. On one farm near the Station, a 12.5 per cent loss was experienced on cultivated pastures, where heretofore with the use of permanent pastures, the disease had apparently not been experienced.

### Cause

Although there may be several unknown contributing factors to this disease, British workers concluded that the rapid growth of the organism, with the elaboration of its toxin or poison in the small intestine under conditions wherein the toxin or poison is rapidly absorbed, accounts for the immediate symptoms and death in lambs. Clostridium perfringens is the name of the organism responsible for the disease.

### Symptoms

Opportunities to study symptoms in lambs dying under natural conditions have not been very great, owing to the suddenness with which lambs die. In those cases that have been studied, the following symptoms have been noted. Weakness, lack of muscular control, frothing at the mouth, convulsions, and evidences of distress. Owners have remarked that lambs seemed to be in extreme pain. In some cases lambs able to stand would stand with head against the fence. In many cases evidences of scouring were noted. Lambs killed by the injection of toxins or intestinal washings died usually in convulsions and in considerable pain.

### Lesions

No doubt the most characteristic lesion is the pulpy condition of the kidney. The kidneys usually show disease, although this is not always present. In well-marked cases, the consistency is much like that of raspberry jam. Dr. E. T. Bell of the University of Minnesota states in a personal communication that this "suggests a gas 'bacillus' infection." Notable also are the lesions of the heart. The sac enclosing the heart often has an excess of fluid, and small hemorrhages are found under the surface covering the heart. The hemorrhages under the lining are usually in the left side. In those cases considered typical, it should be emphasized that the lesions of the heart and kidneys are quite characteristic.

The lining of the fourth stomach is congested and a similar condition is found in the last portion of the small intestine. Intestinal washings from this lamb were very poisonous.

### Prevention

Since sick lambs are seldom seen, preventive medicine becomes necessary. The first efforts to prevent losses were made with the use of hemorrhagic septicemia vaccine. Careful checks were not made with this product, but the sheep breeders reported that it did not stop losses.

Breeders formed the opinion that tapeworms were in some way responsible for losses and began treating the lambs with copper sulphate combined with nicotine sulphate, the so-called cu-nic mixture. Many reported that this treatment stopped losses at least for a time. They also reported that the treatment often resulted in death.

Workers in New Zealand reported that losses stopped following yarding for several hours. This keeping the lambs off feed perhaps had the same effect as

starving lambs before dosing for tapeworms with the copper sulphate-nicotine sulphate mixture. Yarding was tried in Curry County, but did not seem to give results. Breeders reported that it also slowed up the lambs and therefore was objectionable. Yarding has given some results in the Willamette Valley and central Oregon. Trials with an anti-toxin produced in England prevented losses. At present this product is not obtainable because of the war. Commercial laboratories are preparing an anti-toxin, but it will not be available before the middle of the summer. Trials with normal horse serum are now in progress.

### Discussion

Many phases of this disease problem are not satisfactorily understood. Ordinarily, the toxins produced by the organism causing botulism, and by certain staphylococci, are the only ones absorbed from the normal digestive tract, and just what conditions are present to cause the absorption of this toxin are not well understood. British workers were able to kill lambs by feeding them toxins only after slowing up the bowel with drugs. It is quite possible that the high protein-low fiber diet of the lambs on lush pastures produces a similar condition to that produced by the drugs used by the British workers.

Feed no doubt plays a very important part in this disease, as we know that the disease seldom occurs except on lush pasture, seems worse after a rain, and affects mostly the fattest wether lambs. The disease appeared this year on one farm where cultivated pastures were used for the first time. These pastures were produced for the purpose of providing more and better early feed for lambs. Yet with this practice, losses rose to 12 1/2 per cent. That all lambs lost died of pulpy kidney was not proved, but the owner was certain that they all died of the same disease.

In spite of the beliefs of the sheep breeders, we are unable to see how the tapeworm can play a part in causing this disease. This year we saw many cases in which the parasite was not present. Now that Dr. Stunkard has worked out the life cycle of the tapeworm, however, we should be able to prove its importance to the lamb industry of Curry County. Mites, in which the tapeworm spends part of its life, of the same genus as those incriminated by Dr. Stunkard, have been found on the pastures where the disease has existed year after year.

Considering the results obtained in two abdominal operations, they indicate that when a quantity of culture and toxin is introduced directly into the small intestine no injury or absorption of toxin takes place. In order to bring about a diseased effect, the organism, toxin, or both, must in some way produce a localized injury for the portal of absorption of the toxin. The process may depend either on chemical or physical affinity for the tissue cells. While there is no question that a similar condition can be reproduced by intramuscular or intravenous injections, it appears that only under certain conditions the intestinal tract becomes permeable to the toxin. As the problem now stands, one can not reach a decision as to how the toxin of the organism is absorbed from the small intestine.

A method of prevention, if practical, must be low in cost and easily applied. In some areas where losses have occurred year after year, sheep breeders will be willing to pay a high price for anything that will protect their lambs. This is not true where the disease does not appear regularly. Methods of producing a protective substance against Cl. perfringens organisms have not been too successful,

and, therefore, the cost of producing a satisfactory protection against pulpy kidney disease is likely to remain high.

Summary

1. The cause of sudden death losses in Oregon lambs has been found.
2. The cause of these losses is an anaerobic bacterium, Cl. perfringens Type D.
3. This organism is responsible for similar losses in Texas, England, Australia, and New Zealand.
4. Because of sudden death, treatment is not successful.
5. Methods of prevention by the use of antitoxins have been tried and proved successful.
6. Other methods of preventing losses are being tried.